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The role of economic freedom in the development of international tourism in Asian countries

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Abstract

Purpose — This paper aims to investigate the influence of economic freedom and its components, namely business freedom and trade freedom, on international tourist arrivals in Asian countries. Additionally, it examines the effects of key macroeconomic factors, such as foreign direct investment, exchange rates, political stability, GDP per capita, and inflation, on international tourist arrivals in Asian countries.

Methods — The GMM two-step estimation system is used to analyse data from 25 Asian countries from 1995 to 2020.

Findings — The results show that economic and trade freedom positively influence tourism, while business freedom has a less distinct impact. Inflation positively contributes to tourist arrivals. Exchange rates and political stability show inconclusive effects.

Implications — The study recommends that governments prioritise expanding economic freedom to boost international tourism.

Originality — This is the first study on the impact of economic freedom on developing international tourism in Asian countries.

Keywords: Economic freedom; business freedom; trade freedom; international tourism; Asian countries.

Introduction

Over the recent decades, the tourism industry has experienced robust development, propelled by economic globalisation, and has played a significant role in the economic growth of numerous countries (Bulut et al., 2020; Das & Dirienzo, 2010). The tourism sector offers considerable benefits to many nations, including (i) increased foreign exchange earnings, (ii) poverty reduction, (iii) creation of employment and job opportunities, (iv) significant tax revenues for countries, and (v) development of physical infrastructure and human capital (Tang, 2018). The tourism industry has experienced faster growth than other key industries, such as manufacturing and financial services (Lee, 2015). International tourist arrivals surged from 278 million in 1980 to about 1.5 billion by 2019 (Demir & Gozgor, 2017; World Tourism Organisation (UNWTO), 2020). However, due to the impact of the COVID-19 pandemic and related health policies, international tourist arrivals globally declined sharply in 2020 and 2021, with a recovery commencing in 2022. According to UNWTO statistics (2024), international tourist arrivals globally recovered to approximately 30% in 2021, 66% in 2022, and 88% in 2023 (Figure 1), with tourism revenues estimated at 1.4 trillion USD in 2023. Interestingly, the Asia-Pacific tourism sector, which attracted 361 million international tourist arrivals, accounting for approximately 24% of the global total in

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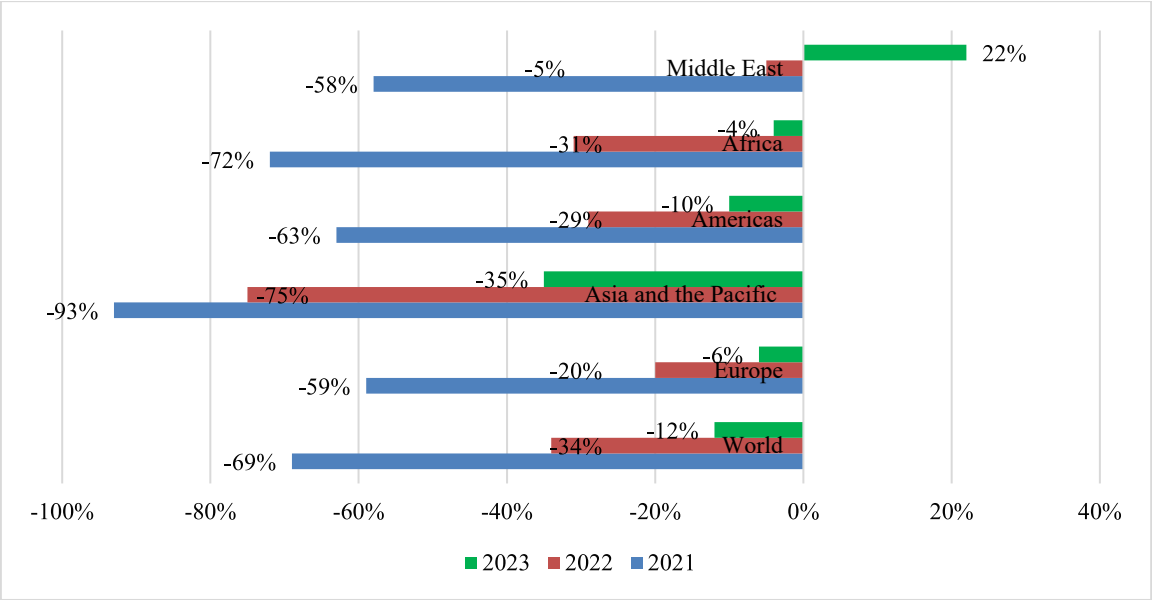
2019, experienced a slower recovery than other regions worldwide. According to the data, in 2021, the number of tourist arrivals recovered to only 7%; in 2022, it recovered to 25%; and by 2023, it reached 65% of the 2019 tourist numbers (Figure 1).



Source: UNWTO (2024).

Figure 1. International Tourist Arrivals (% change over 2019).

Meanwhile, over the past few years, Asia has seen significant economic integration, contributing to global economic growth. According to data Asian Development Bank (ADB) (2022), trade within the Asia-Pacific region peaked over the past 30 years, surpassing global trade growth rates, with 29.6% compared to 27.8% in the first three quarters of 2021. Notably, intra-regional trade among these countries accounted for 58.5% of the total trade in 2020, the highest since 1990. International Monetary Fund (IMF) (2023) reported that economic activity in Asia and the Pacific contributed nearly 70% to global growth in 2023. The driving forces behind this trade growth stem from economic liberalisation. Key initiatives that enhance trade and international investment include the Regional Comprehensive Economic Partnership (RCEP), which accounts for about 30% of global GDP, and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), comprising most Asian member countries and accounting for about 15% of worldwide GDP. This indicates that Asian nations are increasingly economically liberalising (Park et al., 2021).

In this context, is there an impact of economic freedom on tourism in the Asian region? The scope of the literature on tourism economics may be incomplete if the tourism industry is not considered in the context of full economic liberalisation. However, no prior empirical studies have definitively illuminated this area.

Economic freedom, defined as the right of every individual to control their labour and property, is pivotal in a free economy where individuals are free to work, produce, consume, and invest as they choose. This freedom involves a governmental approach that minimises interference in the marketplace, facilitating the free movement of labour, capital, and goods. Essential policies include protecting private property rights, promoting business freedom, and fostering open competition (Miller & Kim, 2013). Contributing to the theoretical framework on the impact of economic integration on tourism development, Cardoso and Ferreira (2000) suggest that economic integration forces countries to become more interdependent, forging stronger connections and diminishing barriers such as physical, technical, and tax obstacles to cross-border trade. Consequently, economic freedom has a clear impact on tourism. Altinay et al. (2002) argue that economic freedom makes promoting tourism more effective. Additionally, economic integration offers a broader market for the tourism industry of these countries. Simultaneously, these nations

can easily leverage their competitive advantages to dominate tourism development. Debates by Stabler et al. (2009), McGrew (2020), Song et al. (2018) and Tribe (2015) also assert that economic liberalisation promotes the flow of capital, trade, and human movement. These three factors have a profound impact on the tourism sector. Furthermore, Gholipour et al. (2014) and Bulut et al. (2020) suggests that if individual freedoms are restricted in a country, people tend to value them more, leading to a higher demand for personal freedom. Consequently, they seek to realise their freedom abroad through travel. This results in more economically liberal countries attracting more international tourists. Additionally, tourists accustomed to living in a free environment tend to vacation in countries with similar levels of freedom.

Despite this, some recent empirical studies investigating the relationship between economic freedom and tourism have shown inconsistent results. Saha et al. (2017) evaluated the role of economic freedom in the tourism development of 110 countries between 1995 and 2012, revealing that a lack of economic freedom could negatively impact tourist experiences. Economic freedom drives a competitive environment in which businesses can offer better services and better serve customers. Additionally, an economically free environment provides a stable legal and monetary system, efficient labour and product markets, and opens opportunities for trade and investment, thereby attracting more tourists. The authors conclude that countries with strong economic freedom, in one way or another, are better at attracting tourists than those without. Satrovic (2019) assessed the relationships among economic freedom, economic growth, and tourism for 100 countries from 2002 to 2015 using the generalised method of moments (GMM) estimation. This study found that economic freedom has a significantly positive impact on tourism. Furthermore, the authors suggest that governments should implement necessary reforms to enhance economic freedom, a crucial factor in attracting international tourists.

Jiang (2022) used dynamic panel data estimation techniques to assess economic freedom's short-term and long-term impacts on global tourism, focusing on the least developed countries. Jiang (2022) examined economic freedom in three aspects: property rights enforcement, regulatory efficiency, and market openness. The study covered 154 countries from 2002 to 2019 and found that the impact of economic freedom on tourism varies across countries. In less developed countries, tourism responds more quickly to improvements in regulatory efficiency. Specifically, more efficient labour markets and stable local prices attract more domestic tourists. Conversely, in developed countries, tourism responds faster to improvements in property rights enforcement. Coban (2021) found a statistically significant, positive relationship between economic freedom and tourism competitiveness, indicating that greater economic freedom significantly boosts tourist attraction. The study surveyed 18 Latin American countries from 2007 to 2019. Similarly, other studies support a positive correlation between economic freedom and tourism development. Lu et al. (2021) used economic freedom as a control variable in their model assessing the impact of preferences under uncertainty on tourism development, finding that economic freedom contributes to industry growth by increasing revenue. Contrary to these viewpoints, Aslan et al. (2020) showed that economic freedom does not always benefit tourism attractions. Their study, spanning 17 Mediterranean countries from 1996 to 2016, found that higher economic freedom negatively affected tourist entries. Aslan et al. (2020) concluded that the role of economic freedom in promoting tourism development requires government policy support; without such support, economic freedom could negatively affect tourism development. Kubickova (2016) investigated how government intervention in the economy affects the development of the tourism industry in seven Central American countries from 1995 to 2007. The study found an inverse relationship between economic freedom and tourism competitiveness, though this relationship was not statistically significant.

Thus, it is evident that the impact of economic freedom on tourism development varies and is not consistent. Previous studies have covered a wide range of countries globally or in various regions, but none have specifically focused on Asia. Therefore, this study aims to provide empirical evidence on the impact of economic freedom on tourism development in Asian countries, with the hope that the findings will offer policymakers and stakeholders valuable insights.

In addition to the crucial factor of economic freedom, the authors assess the impact of foreign direct investment, exchange rate policy, the stability of the political system, per capita income (GDP per capita), and inflation on tourism development. Foreign direct investment (FDI) has been a focus in studies exploring factors influencing tourism development. The eclectic theory of international production by Dunning (2003) suggests that FDI often stimulates infrastructure development and is linked with growth in supply chains and global marketing, thus promoting tourism in recipient countries. Adeola et al. (2020) also consider FDI vital for tourism development, particularly for infrastructure improvements. Numerous studies support a positive relationship between FDI and tourist numbers (Adeola et al., 2020; Fauzel, 2020; Osinubi et al., 2022; Sheng Yin & Hussain, 2021). However, Brohman (1996) highlights FDI's downside in exacerbating income inequality and poverty, potentially deterring international tourists. Other studies also find negative impacts of FDI on tourism development (Clancy, 1999; Oppermann, 1993).

Exchange rates are also commonly used as variables in research models that assess factors influencing tourism. As the exchange rate reflects the strength of one currency against another, its fluctuations affect the purchasing power for goods and services, impacting tourism development (Ming Cheng et al., 2013; Sharma et al., 2022). Most studies support a positive correlation between exchange rates and tourist numbers, as tourists feel more satisfied and willing to spend when their currency has more purchasing power due to the depreciation of the local currency (Adeola et al., 2020; Chang & Mcaleer, 2012; De Vita & Kyaw, 2013; Hwandee & Phumchusri, 2020; Karimi et al., 2015; Karimi et al., 2019; Martins et al., 2017; Meo et al., 2018; Munir & Iftikhar, 2021; Pokharel et al., 2018; Saha et al., 2017; Sharma & Pal, 2020; Yang et al., 2022; Zhang et al., 2009). Tourists pay more attention to exchange rates than to inflation or prices in their destination country (Cheng, 2012). However, studies by Tang et al. (2016) suggest that exchange rate volatility does not significantly impact tourism development. Athari et al. (2021) found that a decline in the exchange rate (local currency appreciation) increased tourist numbers in 76 countries between 1985 and 2018. Agiomirgianakis et al. (2015) found an inverse relationship between exchange rate volatility and tourist numbers in the UK and Sweden from 1990 to 2012, suggesting that exchange rate adjustments are unlikely to attract tourists. Similarly, Surugiu et al. (2011) found an inverse relationship between exchange rates and international tourist numbers in Romania from 1997 to 2008.

Additionally, international tourists are concerned with the political stability of the countries they wish to visit. Most studies agree that political stability in a country enhances and increases tourist numbers. Tourists feel safer and more protected in a secure, non-violent country with a strong government (Saha et al., 2017), and political institution stability plays a crucial role in increasing tourist numbers (Naudé & Saayman, 2005). This positive relationship is supported by other studies (Adeola et al., 2020; Altaf, 2021; Habibi, 2017; Naudé & Saayman, 2005; Saha et al., 2017).

Per capita income is also a factor in tourism development. Most previous research indicates a positive correlation between per capita income and tourism development. Countries with increasing per capita income usually represent a better quality of life, developed infrastructure, and superior tourism services, which are important in tourists' destination decisions (Saha et al., 2017). This argument is supported by many studies (Agiomirgianakis et al., 2015; Altaf, 2021; Hwandee & Phumchusri, 2020; Martins et al., 2017; Muryani et al., 2020; Puah et al., 2019; Saha et al., 2017; Sharma et al., 2022; Yang et al., 2022). However, a few studies, like Fauzel (2020), indicate an inverse relationship between GDP per capita and tourism development.

Lastly, the destination country's inflation rate is also a factor of concern for international tourists. Research on the relationship between inflation and tourism development is inconsistent. High inflation in some countries often indicates a weaker local currency compared to foreign currencies (Dritsakis, 2004; Lim et al., 2008; Nicolau, 2008), allowing international tourists to buy more goods and services. However, Hanafiah and Harun (2010) and Fauzel (2020) argue that even if high inflation increases costs, as long as it remains lower than the tourists' countries of origin, it can still attract international tourists. Some studies support a positive relationship between inflation and tourist numbers (Fauzel, 2020; Muryani et al., 2020; Puah et al., 2019). On the contrary, Gounopoulos et al. (2012) argue that high inflation can pose potential risks to tourists, reducing tourist numbers. Meo et al. (2018) suggest that high inflation increases living and tourism costs,

reducing both domestic and international tourist flows. Athari et al. (2021) found an inverse relationship between inflation and tourism arrivals, as did Barman and Nath (2019) for international tourist numbers in India.

Methods

Data Sources

In this study, the authors collected data for 25 Asian countries from 1995 to 2020. The countries in the sample include Armenia, Bangladesh, China, Cyprus, Georgia, India, Indonesia, Israel, Japan, Jordan, Kazakhstan, Kuwait, Lebanon, Malaysia, Oman, Pakistan, Palestine, Philippines, Qatar, Saudi Arabia, Singapore, Thailand, Turkey, United Arab Emirates, and Vietnam. Data on the Economic Freedom Index, Business Freedom, and Trade Freedom were obtained from The Heritage Foundation. Data for all other variables in the model were collected from the World Bank.

The Model

Based on ideas from several studies, including Yang et al. (2022), Athari et al. (2021), Adeola et al. (2020), Nepal et al. (2019) and Saha et al. (2017), the research team proposes a model to investigate the impact of economic freedom and several key macroeconomic factors on tourist arrivals in Asian countries as follows:

$$lnNOA_{it} = \alpha_0 + \alpha_1 \ln\mathrm{NOA}_{it-1} + \alpha_2 \ln\mathrm{ECOF}_{it} + \alpha_3 \ln\mathrm{FDI}_{it} + \alpha_4 \ln\mathrm{EXG}_{it} + \alpha_5 \ln\mathrm{PS}_{it} + \alpha_6 \ln\mathrm{GDPCG}_{it} + \alpha_7 \ln\mathrm{INF}_{it} + \varepsilon_{it} \quad (1)$$

$$lnNOA_{it} = \beta_0 + \beta_1 \ln\mathrm{NOA}_{it-1} + \beta_2 \ln\mathrm{BUSF}_{it} + \beta_3 \ln\mathrm{FDI}_{it} + \beta_4 \ln\mathrm{EXG}_{it} + \beta_5 \ln\mathrm{PS}_{it} + \beta_6 \ln\mathrm{GDPCG}_{it} + \beta_7 \ln\mathrm{INF}_{it} + \varepsilon_{it} \quad (2)$$

$$lnNOA_{it} = \gamma_0 + \gamma_1 \ln\mathrm{NOA}_{it-1} + \gamma_2 \ln\mathrm{TRAF}_{it} + \gamma_3 \ln\mathrm{FDI}_{it} + \gamma_4 \ln\mathrm{EXG}_{it} + \gamma_5 \ln\mathrm{PS}_{it} + \gamma_6 \ln\mathrm{GDPCG}_{it} + \gamma_7 \ln\mathrm{INF}_{it} + \varepsilon_{it} \quad (3)$$

Table 1 presents more details on the definitions of these variables, their measurement methods, the basis of reference from previous studies, and data collection sources.

Table 1. Definitions, symbols, and data collection sources

Variables	Definition	Symbol	Unit	Source	Reference
Dependent variable					
International tourist arrivals	International tourism, number of arrivals	NOA	Ln	World Bank	Saha et al. (2017); Payne et al. (2023); Osinubi et al. (2022)
Independent variables					
Economic freedom	Economic freedom is the right to control one's labour and property, measured across twelve factors grouped into four categories: Rule of Law, Government Size, Regulatory Efficiency, and Open Markets, with scores ranging from 0 to 100.	ECOF	Ln	The Heritage Foundation	Saha et al. (2017)
Business freedom	The ease of starting, operating, and closing a business, scoring each country, with scores from 0 to 100	BUSF	Ln	The Heritage Foundation	Jiang (2021)
Trade freedom	The absence of tariff and non-tariff barriers that affect imports and exports, with scores from 0 to 100	TRAF	Ln	The Heritage Foundation	Jiang (2021)
Foreign direct investment	Foreign direct investment, net inflows (BoP, current US$)	FDI	Ln	World Bank	Adeola et al. (2020); Fauzel (2020); Osinubi et al. (2022)

Variables	Definition	Symbol	Unit	Source	Reference
Exchange rate	Official exchange rate (LCU per US$, period average)	EXG	Ln	World Bank	Saha et al. (2017); Yang et al. (2022); Adeola et al. (2020)
Political Stability	Political Stability and Absence of Violence or Terrorism, Percentile Rank	PS	Ln	World Bank	Altaf (2021); Adeola et al. (2020); Saha et al. (2017)
GDP per capita growth	GDP per capita growth (annual %)	GDPCG	Ln	World Bank	Altaf (2021); Saha et al. (2017); Yang et al. (2022)
Inflation rate	Inflation, consumer prices (annual %)	INF	Ln	World Bank	Fauzel (2020)

Source: The authors compiled.

The Methodology Estimation

Saha et al. (2017) and Nepal et al. (2019) identified endogeneity issues in the relationship between GDP per capita and the dependent variable. High GDP per capita impacts the number of tourists, and conversely, a large number of tourists contributes to improving GDP per capita. Additionally, Adeola et al. (2020) also suggest a bidirectional relationship between FDI and tourism development. FDI can increase the number of tourist arrivals in countries where it invests. Conversely, international tourism allows potential investors to gather direct information about the investment environment and opportunities in the countries they visit. Furthermore, the authors use a lagged dependent variable as an explanatory variable in the research model. Therefore, the bidirectional interaction between the explanatory and dependent variables will introduce endogeneity bias into the research results. This paper uses the Generalised Method of Moments (GMM) to address endogeneity for model estimation (Arellano & Bond, 1991; Arellano & Bover, 1995; Roodman, 2009). Specifically, the system GMM two-step method is used in this study because of the long sample period from 1995 to 2020, despite the relatively small number of observations due to data gaps in some countries. Instrumental variables include lagged values of the dependent variables, FDI, and GDP per capita. The remaining variables act as exogenous in the model. Additionally, the system GMM two-step method has also been used in previous studies (Athari et al., 2021).

Results and Discussion

Table 2 presents descriptive statistics about the study sample. All variables in the research model have been transformed using the natural logarithm. The research data is panel data and unbalanced, as some observations are incomplete according to World Bank statistics. The statistics indicate that the sample data are normal, with no significant anomalies, and that the difference between the mean and median is not too large. Therefore, the study sample follows a normal distribution and is suitable for model estimation.

Table 2. Descriptive statistics of variables

Variable	Obs	Mean	S.D.	Min	Median	Max
NOA	533	15.1	1.55	9.39	15.21	18.91
ECOF	489	4.15	0.15	3.65	4.17	4.49
BUSF	489	4.20	0.21	3.57	4.24	4.61
TRAF	488	4.28	0.27	2.58	4.36	4.55
FDI	592	0.82	1.48	-7.20	1.04	5.63
EXG	598	2.97	3.01	-1.31	1.98	10.05
PS	528	3.37	0.95	-0.75	3.52	4.6
GDPCG	469	1.23	0.87	-2.42	1.41	2.73
INF	528	1.25	1.15	-4.09	1.34	5.17

Table 3 presents the correlation matrix between the independent variables in the research model. All pairs of coefficients are less than 0.8 (except for the BUSF and ECOF pair), indicating no severe multicollinearity in the research model (Gujarati & Porter, 2009). In the case of BUSF and ECOF, since BUSF is a sub-component of ECOF, it shows a high correlation coefficient with ECOF. The approach taken is that in the regression models, ECOF and its sub-components are not included simultaneously to avoid severe multicollinearity affecting the research results.

Table 3. Correlation matrix of variables

	NOA	ECOF	BUSF	TRAF	FDI	EXG	PS	GDPCG	INF
NOA	1.000								
ECOF	0.066	1.000							
BUSF	0.010	0.819	1.000						
TRAF	-0.028	0.539	0.410	1.000					
FDI	0.085	0.087	0.017	0.069	1.000				
EXG	-0.146	-0.505	-0.435	-0.173	-0.032	1.000			
PS	0.272	0.436	0.424	0.183	0.159	-0.332	1.000		
GDPCG	-0.045	-0.309	-0.316	-0.135	0.227	0.181	-0.039	1	
INF	-0.305	-0.418	-0.332	-0.148	-0.058	0.324	-0.369	0.1409	1

Table 4 presents the research results on the impact of economic freedom and several important macroeconomic factors on international tourist arrivals. Models (1), (2), and (3) correspond to the variables representing economic freedom as economic freedom (ECOF), business freedom (BUSF), and trade freedom (TRAF), respectively.

Table 4. Impact of Economic Freedom and Macroeconomic factors on international tourist arrivals

Variables	Model (1)		Model (2)		Model (3)	
	Coef.	P value	Coef.	P value	Coef.	P value
NOA (lag 1)	0.917***	0.000	0.914***	0.000	0.921***	0.000
ECOF	0.294*	0.076				
BUSF			0.224	0.120		
TRAF					0.069*	0.054
FDI	-0.071**	0.020	-0.071**	0.020	-0.076**	0.011
EXG	0.003	0.604	0.003	0.689	-0.003	0.458
PS	0.012	0.672	0.004	0.905	0.031	0.287
GDPCG	0.069***	0.010	0.071	0.008*	0.070***	0.008
INF	0.022*	0.086	0.022	0.107	0.017*	0.062
Sample period:	1995 - 2020		1995 - 2020		1995 - 2020	
Observations:	226		226		226	
Hansen test (2nd step; p-value)	0.511		0.457		0.630	
AB test AR(1) p value	0.018		0.019		0.017	
AB test AR(2) p value	0.182		0.113		0.127	

Note: Models 1, 2, and 3 correspond to variables representing economic freedom as the economic freedom index (ECOF), business freedom (BUSF), and trade freedom (TRAF), respectively. The models are regressed using the system GMM two-step method; *, **, and *** represent statistical significance levels of 10%, 5%, and 1%, respectively.

The regression results in Table 4 show statistical evidence of a positive impact of economic freedom on the growth of international tourist arrivals. The regression coefficients of ECOF and TRAF in models (1) and (3) are statistically significant at the 10% level, and the regression coefficient of BUSF in model (2), although not statistically significant, is positive. These results imply that economic, trade, and business freedom contribute to increasing international tourist arrivals. This indicates that active participation in multilateral and bilateral trade agreements is

beneficial, and the removal of trade barriers (trade freedom) and ease of establishing and operating new businesses (business freedom) promote economic development and greatly benefit the growth of the tourism industry. From the results of our study, we support the previous arguments that extensive economic freedom contributes to stronger connections between countries (Cardoso & Ferreira, 2000), facilitates more effective tourism promotion by nations, and allows them to leverage competitive advantages to better exploit a broad potential market (Altinay et al., 2002). Countries with economic freedom can positively impact tourist experiences, fostering a competitive environment for better service provision (Saha et al., 2017). Thus, core economic freedoms (including trade and business freedoms) are essential pillars of tourism development in developing countries (McGrew, 2020; Song et al., 2018; Tribe, 2015). These findings are consistent with previous studies and support the positive relationship between economic freedom and tourism development (Coban, 2021; Jiang, 2022; Lu et al., 2021; Saha et al., 2017; Satrovic, 2019). In summary, based on these results, governments may consider relaxing economic restrictions to support the development of international tourism, which is also a channel for attracting foreign currency.

Unlike economic freedom, foreign direct investment negatively affects the increase in international tourist arrivals, as indicated by the negative, statistically significant regression coefficients in all models in Table 4. This suggests that (i) the positive aspects of FDI as theorized by the eclectic theory of international production proposed by Dunning (2003), such as creating a foundation for good infrastructure development and integration in supply chains and international marketing, are not sufficiently convincing, while (ii) the negative aspects of attracting FDI, such as income inequality and poverty that make it less attractive to international tourists (Brohman, 1996) are relatively straightforward. These findings contrast with most previous studies but are similar to Oppermann (1993) and Clancy (1999).

The exchange rate (EXG) does not show of significant impact on international tourist arrivals. This result aligns with Athari et al. (2021) and Tang et al. (2016). Similarly, the factor of political stability (PS) also does not show clear evidence of impact on international tourist arrivals. However, the positive regression coefficients of PS in all models suggest a positive effect of a good political environment on attracting foreign tourists. In other words, tourists feel safer and more protected in countries with high political stability (Saha et al., 2017). This result is somewhat similar to findings from previous studies (Adeola et al., 2020; Altaf, 2021; Habibi, 2017; Naudé & Saayman, 2005; Saha et al., 2017).

GDP per capita growth (GDPCG) shows a positive relationship with international tourist arrivals and is statistically significant. This implies that higher per capita income typically indicates a better quality of life, developed infrastructure, and improved tourism services, thereby attracting more tourists (Saha et al., 2017). The findings of this research are consistent with several previous studies (Agiomirgianakis et al., 2015; Altaf, 2021; Gupta & Solanky, 2022; Hwandee & Phumchusri, 2020; Martins et al., 2017; Muryani et al., 2020; Puah et al., 2019; Saha et al., 2017; Yang et al., 2022).

Finally, the inflation rate (INF) shows evidence of a positive relationship with international tourist arrivals and is statistically significant in models (1) and (3) in Table 4. This indicates that inflation is not always a negative factor for the economy. From the perspective of the tourism industry, inflation attracts more international tourists and contributes to the country's foreign currency earnings. This result implies that inflation can create advantages for foreign tourists when their currency becomes more valuable in a high-inflation country (Dritsakis, 2004; Lim et al., 2008; Nicolau, 2008), stimulating greater spending on tourism services. Additionally, in line with this, when inflation in the countries tourists visit is lower than in their home countries, the decision to spend on tourism remains appropriate (Fauzel, 2020; Hanafiah & Harun, 2010). These findings are consistent with some previous studies (Fauzel, 2020; Muryani et al., 2020; Puah et al., 2019).

Conclusion and policy implications

This study investigates the role of economic freedom and its components, including business and trade freedom, in attracting international tourist arrivals in Asian countries. It also examines

significant macroeconomic factors in its model, including foreign direct investment, exchange rates, political stability, GDP per capita, and inflation. The data sample encompasses 25 Asian countries from 1995 to 2020. The authors employ the two-step GMM system to estimate the research models. The results indicate that economic and trade freedom clearly and positively impact international tourist arrivals. However, while business freedom positively influences international tourist arrivals, its impact is less pronounced. Foreign direct investment is found to negatively affect international tourism development. GDP per capita and inflation positively increase international tourist arrivals, whereas the impacts of exchange rate and political stability are not yet distinct. Based on these findings, the authors suggest that national governments should pay more attention to the role of expanding economic freedom in their strategies for developing international tourism. Furthermore, governments should also reassess the role of foreign direct investment in developing international tourism.

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Islamic bank stability and efficiency: A cross-country analysis

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Abstract

Purpose — The study investigates the impact of the efficiency of Islamic banks on banking stability.

Method — A panel data analysis using the Least Squares Dummy Variable Corrected (LSDVC) method is employed to examine the impact of efficiency on banking stability in Islamic banks. The study has a sample of 54 Islamic banks across eight countries from 2013 to 2021.

Findings — The findings reveal that the efficiency of Islamic banks has a positive and significant effect on banking stability. In addition, financial turmoil has a negative and significant impact on the stability of Islamic banks, but does not significantly affect institutional development. Additionally, financial turmoil can influence how effectively Islamic banks manage their businesses in response to banking stability. The outcomes are robust across various robustness methods.

Implications — The results imply that Islamic bank efficiency plays a pivotal role in banking stability, particularly at higher levels of efficiency. To ensure the stability of Islamic banks, practitioners and regulators of Islamic banks have to achieve and maintain the efficiency of Islamic banks by implementing the required policies and guidelines.

Originality/Value — Previous studies examining the impact of Islamic banks' efficiency on banking stability remain limited. The paper fills a research gap by examining how Islamic bank efficiency affects banking stability, accounting for the effects of financial turmoil and institutional development.

Keywords — Islamic bank, efficiency performance, banking stability, LSDVC, Institutional Development.

Introduction

Even though Islamic banks have been developing significantly (ICD-Refinitiv, 2022), there is ongoing debate within the Islamic banking sector about financial stability. Some studies reveal that Islamic banks conduct the same banking operations as conventional banks (Chong & Liu, 2009). As a result, the risk exposure of Islamic banks is no different from that of their counterparties, particularly in terms of banking stability. On the contrary, studies by Abedifar et al. (2013) document that Islamic banks exhibit different risk exposures because their business models align with the Shariah principles. Hence, the risks faced by Islamic banks are different from those of

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conventional banks. Despite the debate, Islamic banks have faced failures, such as Ihlas Finans House in Turkey in 2001, during a period of financial crisis (Ali, 2007). Therefore, understanding the factors that contribute to banking stability, especially in the case of Islamic banks, is important to this issue.

The studies on Islamic banking stability are voluminous, in which banking efficiency empirically becomes a determinant of the level of stability of the bank. This is because efficiency is a critical indicator of banking financial performance. Several studies regarding banking efficiency and how it impacts banking performance have been conducted previously by Al-Khasawneh et al. (2012) in the Middle East and North African Countries, Ahmad and Luo (2010) in European Countries, Rosman et al. (2014) in the global banking industry, Alqahtani et al. (2017) in Middle East countries, Safiullah and Shamsuddin (2022) conducted in 28 countries, and Asmild et al. (2019) was conducted specifically in Bangladesh.

Apart from that, some studies specifically examine the relationship between the level of efficiency and banking stability, a relationship that has also been explored by previous researchers from various perspectives. For example, Danlami et al. (2022) conducted research on the relationship between banking efficiency and stability in the Organisation of the Islamic Conference (OIC) countries (Miah & Sharmeen, 2015) in Bangladesh, Miah and Uddin (2017), Hidayat et al. (2021), and Alsharif (2021) in Middle Eastern countries, Sakti and Mohamad (2018) in Indonesia, and Saeed and Izzeldin (2016) in Middle Eastern countries and three non-Middle Eastern countries.

The findings of the study show that the level of efficiency reduces the level of stability of Islamic banking (Danlami et al., 2022). This is because of the presence of a "trade-off", where financial efficiency does not give banks sufficient flexibility to manage risk. It increases the risk of bankruptcy in Islamic banking. This is also similar to the findings of Saeed and Izzeldin (2016) and Miah and Uddin (2017), which state that banks with a lower efficiency level have a better level of banking stability. In contrast, Hidayat et al. (2021) recently found that higher the level of banking efficiency is associated with better banking financial performance.

Regarding the influence of bank-specific variables, financial turmoil, and institutional development, previous studies document that size matters for banking stability (Ibrahim & Rizvi, 2017). Bigger Islamic banks tend to be more stable than smaller Islamic banks in terms of asset size. The bigger banks have also been found to be more profitable than the European banks (Terraza, 2015). In contrast, a bigger Islamic bank is more unstable because the bank tends to be more aggressive in financing activities (Aysun, 2016). During the financial turmoil reflected in the COVID-19 pandemic period, some studies highlighted that the banking sector experienced an adverse effect of financial turmoil Demir and Danisman, 2021; Elnahass et al., 2021; Anto et al., 2022; and Fakhrunnas et al., 2021) because it increased the financial risk. Institutional development also affects banking performance, as explained by Albaity et al. (2022) and Nabi and Suliman (2009) within the concept of the institutional theory framework. On the contrary, Shakil et al. (2019) and Azmi et al. (2021) argue that in developing countries, institutional development is hindered by high economic uncertainty and an immature regulatory system.

Given the inconclusive findings, more studies are needed to provide a clearer understanding of the impact of efficiency performance on banking stability. Thus, the study aims to shed light on the effect of efficiency performance on banking stability in Islamic banks. In response to that objective, some questions then arise: (1) Does efficiency performance significantly influence Islamic banking stability? (2) Does the size of Islamic banks matter for efficiency performance on banking stability?, and (3) what is the impact of financial turmoil and institutional development on banking stability concerning the importance of efficiency performance?

The contribution of the study consists of threefold. Firstly, it enriches previous research on the impact of Islamic banks' efficiency performance of Islamic banks on banking performance, as this has already been studied by Al-Khasawneh et al. (2012), Asmild et al. (2019), Alqahtani et al. (2017), and Danlami et al. (2022). Secondly, the study provides a novel perspective on the impact of changes in bank size on banking stability, considering the role of efficiency performance in Islamic banks. Ibrahim and Rizvi (2017) highlighted the role of size in the banking sector to examine whether size matters for Islamic banks. However, according to the recent literature, no

studies have examined the importance of Islamic bank size for efficiency performance in relation to Islamic banking stability. Understanding this relation sheds light on whether possessing a certain level of size benefits efficiency performance or vice versa. Thirdly, the study elaborates on the role of financial turmoil, specifically during the COVID-19 pandemic, and its impact on institutional development and banking stability, considering the role of efficiency performance in Islamic banks.

Furthermore, there are numerous aspects of the study to go over. After the introduction, the first section is the methodology, which explains the data, research model, and analysis strategy. The second section is the results and analysis, ending with the conclusion and recommendation.

Method

To achieve the study's objective, samples are drawn from Islamic banks in eight countries: Saudi Arabia, Malaysia, the United Arab Emirates (UAE), Kuwait, Bahrain, Bangladesh, Turkey, and Indonesia. These countries represent more than 80% of Islamic banking development worldwide (ICD-Refinitiv, 2022). We exclude Islamic banks in Iran because there is a significant difference between Islamic banking concepts and practices in Iran and the rest of the world (Meisamy & Gholipour, 2020). The study period runs from 2013 to 2021, using balanced panel data from Fitch Connect and the World Bank Indicator (WBI). Our sample consists of 54 Islamic Banks across countries. The model of the study is as follows;

$$Bank\ Stability_{it} = a_0 + a_1 EFF_{it} + a_2 Bank_{it-1} + a_3 Macro_{jt} + a_4 Gov_{jt} + a_5 COVID_{jt} + \varepsilon_{ijt} \quad (1)$$

Where i denotes bank-level variables, and t and j denote time- and country-level variables, respectively. In addition, a_0 and ε_{ijt} are the symbols of the constant and error-term for each. In the model, the dependent variable is bank stability, measured by ZSCORE, calculated from the log of $\frac{ROA + ETA}{}$, where ROA is return on total assets, and ETA is equity to total assets (Chiaramonte et al., 2016). A higher score of ZSCORE indicates the bank has more financial stability, and it means the inverse when the bank has a low score of ZSCORE.

In addition, efficiency performance (EFF) is measured as total cost divided by total revenue, with lower scores indicating high efficiency and higher scores indicating low efficiency (Danlami et al., 2022). We use a lagged bank-specific variable (Bank) to address the issue of reverse causality as suggested by Castro (2013). The bank-specific variables consist of CAPLIB, which measures the Islamic bank's capital relative to its liabilities; LOANGR, which explains the Islamic bank's financing growth each year; and ASSET, measured by the log of the Islamic bank's total assets. Furthermore, the macroeconomic variable (Macro) is proxied by the yearly growth of gross domestic product (GDP), while institutional development (GOV) is proxied by the cumulative score of the governance index based on the World Bank indicator. Furthermore, COVID is measured using a dummy variable (1) for the period 2020-2021, while 0 represents other periods.

Furthermore, to answer the importance of Islamic banks' size on banking stability, considering a change in efficiency performance, we follow Ibrahim and Rizvi (2017), Law et al. (2020), and Danlami et al. (2022) to examine the marginal effect of Islamic banks' size due to a change in efficiency performance of Islamic banks. The equation is formulated as follows,

$$\frac{\partial ZSCORE_{it}}{\partial EFF_{it}} = \beta_2 + \alpha ASSET_{it} \quad (2)$$

Where β_2 explains the coefficient of EFF, and α is the coefficient of the interaction variable of EFF and ASSET.

Finally, we use a dynamic panel approach employing the least-squares dummy variable corrected (LSDVC) estimator, as proposed by Nickell (1981) and Bruno (2005). The reasons behind adopting this method are: (1) A correlation exists between the error term and the first lag of ZSCORE, resulting in an endogeneity problem. Hence, the use of fixed or random effect is not appropriate in the model (Ibrahim & Rizvi, 2017). (2) The use of panel dynamics, particularly employing the generalized method of moments (GMM), addresses the issue of the endogeneity

problem. However, in this study, the number of N of the data is considered to be limited. The application of GMM will introduce bias because it requires a large number of data points (Dang et al., 2015; Ibrahim & Rizvi, 2017). (3) LSDVC allows the study to use the model even though the number of data is limited with error correction. In addition, LSDVC addresses endogeneity in small samples (Dang et al., 2015).

Results and Discussion

Table 1 provides a descriptive statistic of the data used in the study. A total of 486 observations are used. The number of Z-Scores indicates that the stability among Islamic banks does not differ significantly, as evidenced by the standard deviation of the data. A higher level of ZSCORE indicates greater banking stability for an Islamic bank. Moreover, the data description from the efficiency performance explains that the mean is 0.568. It shows that the efficiency of Islamic banks can generate roughly twice the total revenue as total cost. A lower EFF score indicates that the Islamic banks are more efficient, and they become less efficient as the score increases.

Table 1. Descriptive Statistic

VARIABLE	OBS.	MEAN	STD. DEV.	MIN	MAX
ZSCORE	486	3.299	0.596	1.689	4.291
EFF	486	0.568	0.181	0.300	0.941
CAPLIB	486	14.1%	7.5%	6.8%	57.4%
LOANGR	486	11.1%	12.5%	-12.7%	44.6%
ASSET	486	12,100	18,700	24.65	166,000
GDPGR	486	3.5%	2.6%	-2.1%	7.1%
GOV	486	-0.024	0.478	-1.120	0.663

Note: ASSET is in USD Million

In addition, Islamic banks' financing growth (LOANGR) is relatively high, with average growth rates in the 2-digit range. It indicates that the bank has aggressive financing activity in the economic. However, at times, financing growth becomes negative due to the adverse effects of the pandemic, which disrupts Islamic banking operations in some countries. In terms of the size of Islamic banks, the standard deviation value remains high, indicating a significant gap in the assets of Islamic banks in the sample. The largest Islamic bank has USD 166,000 million in assets, while the smallest Islamic bank has only USD 24.65 million in total assets. Regarding the correlation analysis, as shown in Table 2, there is a high correlation between ASSET and EFF, with a correlation coefficient of -0.602. Another correlation considered high is between COVID and GDPGR, with a value of -0.516. However, overall correlation scores between the two variables are less than 0.8 or -0.8, indicating that there is no issue of autocorrelation in the research model.

Table 2. Correlation Result

	ZSCORE	EFF	CAPLIB	LOANGR	ASSET	GDPGR	COVID	GOV
ZSCORE	1.000							
EFF	-0.376	1.000						
CAPLIB	0.165	0.081	1.000					
LOANGR	-0.076	-0.121	-0.127	1.000				
ASSET	0.446	-0.602	-0.250	-0.011	1.000			
GDPGR	-0.164	0.159	-0.104	0.090	-0.252	1.000		
COVID	-0.039	-0.076	0.007	-0.115	0.095	-0.516	1.000	
GOV	0.127	-0.173	0.004	-0.132	0.209	-0.147	0.069	1.000

Furthermore, to examine the impact of efficiency performance on banking stability in Islamic banks, several methodologies are utilized. Firstly, we separate the analysis into four equations, each with specific bank-level variables (Model 1), bank-specific and macroeconomic

variables (Model 2), and bank-specific, macroeconomic, and financial turmoil variables (Model 3). Finally, we include all variables in the equation (Model 4). The objective of using different equations is to test the consistency of the results. According to the baseline results, efficiency performance has consistently been negative and significant for banking stability in Islamic banks. It indicates that the bank tends to be more stable when its efficiency performance is high.

For bank-specific variables, LOANGR shows a negative, significant relationship with banking stability. It means that higher financing growth is associated with lower financial stability in Islamic banks. The results are consistent in all four models. Moreover, bank size has a positive and significant impact on the stability of Islamic banks, while financial turmoil during the COVID-19 pandemic reduces the level of banking stability. In contrast, CAPLIB and GOV are insignificant for banking stability, indicating that neither variable affects it econometrically in Islamic banks.

Table 3. Baseline Result

VARIABLE	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
L.ZSCORE	0.74***	0.83***	0.75***	0.76***	0.73***	0.76***	0.77***
	(13.63)	(16.92)	(13.00)	(13.41)	(12.45)	(13.51)	(13.59)
EFF	-0.21**	-0.20**	-0.22**	-0.22**	-1.91**	-0.22**	-0.23**
	(-2.21)	(-2.50)	(-2.23)	(-2.26)	(-2.03)	(-2.24)	(-2.35)
CAPLIB	-0.05	-0.12	-0.02	-0.03	-0.03	-0.03	-0.04
	(-0.19)	(-0.58)	(-0.08)	(-0.13)	(-0.10)	(-0.12)	(-0.16)
LOANGR	-0.25***	-0.30***	-0.32***	-0.32***	-0.31***	-0.32***	-0.32***
	(-3.63)	(-4.89)	(-4.24)	(-4.31)	(-4.01)	(-4.27)	(-4.37)
ASSET	0.02	0.06**	0.07**	0.08**	-0.00	0.08**	0.08**
	(0.75)	(2.13)	(2.17)	(2.32)	(-0.09)	(2.32)	(2.44)
GDPGR		1.27***	0.62	0.67	0.62	0.67	0.71*
		(4.13)	(1.45)	(1.58)	(1.39)	(1.58)	(1.67)
COVID			-0.06***	-0.05**	-0.05**	-0.05**	-0.08
			(-2.68)	(-2.27)	(-2.07)	(-2.26)	(-1.29)
GOV				-0.11	-0.09	-0.13	-0.12
				(-0.86)	(-0.65)	(-0.76)	(-0.95)
EFF*ASSET					0.11*		
					(1.80)		
EFF *GOV						0.04	
						(0.20)	
EFF *COVID							0.05
							(0.48)
No. of Obs.	432	432	432	432	432	432	432
No. of Banks	54	54	54	54	54	54	54

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Secondly, the study examines the relationship between Islamic banks' size (Model 5) and efficiency performance to investigate the impact of bank size on banking stability. The findings in Table 3 show that efficiency performance remains negative and is significantly related to banking stability at the 5% level of significance. A decrease of 1 point in efficiency performance increases banking stability of 1.91 points. The interaction variables between Islamic bank size and efficiency performance are also significant, but in opposite directions at the 10% significance level.

Following the approach of Law et al. (2020), we employ marginal effect measurement to investigate whether the small-big size of Islamic banks has a distinct influence on banking stability, particularly in terms of efficiency performance, as illustrated in Figure 1. At the 95% confidence level of significance, the X line represents the Islamic bank's size across all samples. According to the findings, most Islamic banks exhibit a negative and significant relationship with banking stability. However, when the value of Islamic banks' size is larger, with the X line roughly above 16.5, a positive and significant relationship is observed.

Thirdly, we also consider the impact of financial turmoil, as reflected by COVID-19 (Model 6) and institutional development (Model 7). The study's findings reveal that efficiency performance has a negative and significant relationship with banking stability in both models. However, COVID and GOV fail to moderate the role of efficiency performance in banking stability, as none of the interaction variables is significant.

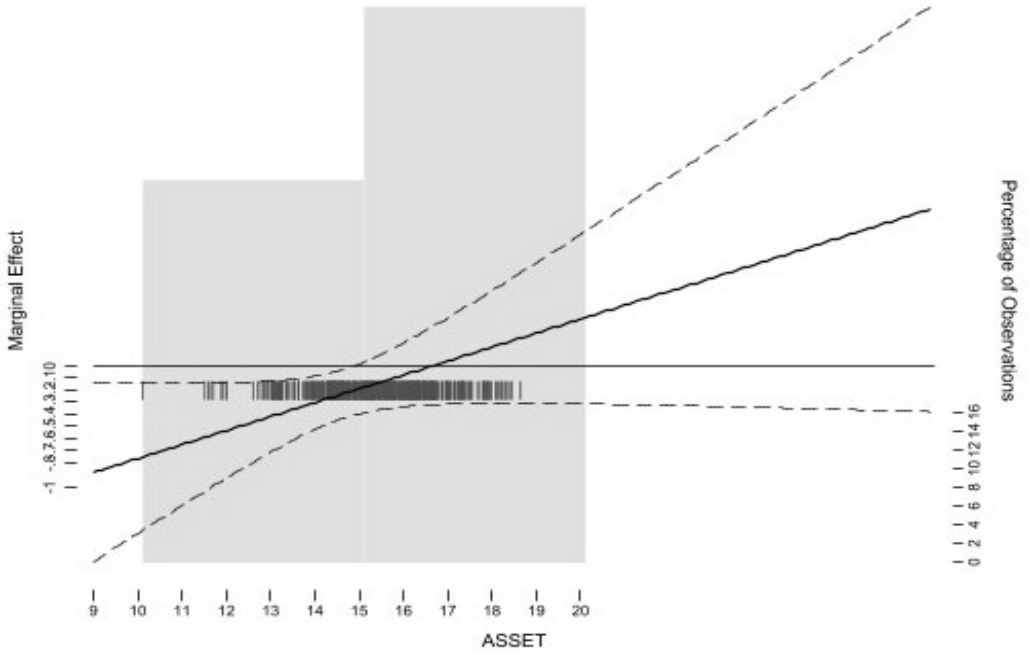

Figure 1. Marginal Effect of Islamic Bank's Size on Efficiency Performance-Banking Stability Nexus

Table 4. Robustness Check

VARIABLE	Model 1	Model 2	Model 3	Model 4	Model 5
L. ZSCORE	0.76***	0.77***	0.79***	0.75***	0.79***
	(9.38)	(9.42)	(9.34)	(9.01)	(9.41)
MGT	-0.21*	-0.21*	-0.21*	-3.43**	-0.22*
	(-1.70)	(-1.77)	(-1.81)	(-2.55)	(-1.81)
CAPLIB	-0.07	-0.11	-0.12	-0.03	-0.12
	(-0.26)	(-0.39)	(-0.41)	(-0.10)	(-0.42)
LOANGR	-0.26***	-0.28***	-0.28***	-0.27***	-0.28***
	(-3.35)	(-3.55)	(-3.65)	(-3.49)	(-3.48)
ASSET	0.09**	0.10**	0.10***	-0.07	0.10***
	(2.32)	(2.47)	(2.64)	(-0.86)	(2.59)
GDPGR		0.62	0.66	0.36	0.67
		(0.99)	(1.08)	(0.59)	(1.09)
GOV			-0.08	-0.03	-0.18
			(-0.61)	(-0.25)	(-0.86)
MGT*ASSET				0.22**	
				(2.42)	
MGT1*GOV					0.16
					(0.65)
No. of Obs.	324	324	324	324	324
No. of Banks	54	54	54	54	54

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Finally, to assess the robustness of the study, we decided to exclude the period of the outbreak (2020-2021) from the sample, reducing the number of observations to 324. We argue that

during financial turmoil, the condition of Islamic banking sectors is dynamic, as mentioned by Rashid and Jabeen (2016), Demir and Danisman (2021), and Fakhrunnas et al. (2022). Therefore, excluding the period of financial turmoil is expected to confirm the analysis and determine whether the result remains consistent when that period of financial turmoil is included in the sample. According to the results of the robustness check shown in Table 4, from model 1 to model 5, efficiency performance has consistently exhibited a negative and significant relationship with banking stability in Islamic banks. The findings confirm the baseline results, indicating robustness.

The above empirical analysis can be developed into several points. Firstly, efficiency performance holds a pivotal role in determining Islamic banking stability. It is found in all models and robustness checks. The finding aligns with Hidayat et al. (2021), who state that efficiency performance is the primary determinant of banking performance. When the bank is more efficient, it can allocate its resources of funds effectively. It also means the bank achieves its objective of financial stability at the banking level by effectively allocating funds to risk management. Additionally, having an efficient and effective allocation of financial resources also directly increases the probability of the bank achieving higher returns, as it spends lower costs on its banking operations. In this case, Islamic banks employ sound management practices that support the future development of the Islamic banking sector worldwide. Efficient performance also indicates that the bank can effectively supervise lending and borrowing activities and properly manage its portfolio.

Secondly, as noted by Terraza (2015), Aysun (2016), and Ibrahim and Rizvi (2017), the size of banks significantly influences performance. The findings of this study reveal that the interaction between efficiency performance and bank size is positively and significantly associated with banking stability. Efficient performance tends to positively influence banking stability, particularly in Islamic banks, when accompanied by an increase in bank size. Following Ibrahim and Rizvi (2017), Law et al. (2020), and Danlami et al. (2022), we examine the marginal effect of size on banking stability when efficiency performance changes. The result is interesting because the size of small- to medium-sized banks tends to better efficiency performance, negatively affecting banking stability. Inversely, the large banks' size has a positive and significant relationship with efficiency performance and banking stability. It indicates that large banks face a trade-off between efficiency and effectiveness. The bank's management can perform efficiently, but it increases the level of banking instability. As a larger bank incurs higher operational costs, for instance, attempting to achieve efficient performance can result of reduced funds allocated to risk management. As a result, the large banks' size probably yields a higher return due to lower costs, but at the expense of greater instability. The finding is supported by Aysun (2016), who also highlights that the size of large banks tends to be associated with greater risk-taking.

Thirdly, the financial turmoil reflected during the COVID-19 pandemic period has a negative and significant relationship with Islamic banking stability. It can be explained that during the outbreak, Islamic banks became relatively unstable due to external financial shocks. The finding aligns with Demir and Danisman (2021), Elnahass et al. (2021), Anto et al. (2022), and Fakhrunnas et al. (2021), who state that the pandemic creates instability in banking performance. However, the financial turmoil fails to moderate the role of efficiency performance in Islamic banking stability. It confirms that the efficiency of Islamic banks performs well during financial turmoil because they can maintain financial stability at the bank level.

Fourth, institutional development does not have a significant influence on Islamic banking stability. Institutional development also fails to moderate the efficiency-performance relationship in Islamic banking. It indicates that institutional development does not matter for Islamic banking stability. The finding can be explained by the arguments of Shakil et al. (2019) and Azmi et al. (2021). They argue that institutional development plays a limited role in creating a financial industry in developing countries due to high uncertainty and a lack of attention to stakeholders, particularly shareholders. Therefore, institutional performance at the management level of the bank has a significant role in the level of stability, regardless of the level of institutional development in developing countries.

Conclusion

The main focus of the study is to examine the impact of efficiency performance on banking stability in Islamic banks. The study reveals that Islamic banks with strong efficiency performance are financially stable. Additionally, the size of Islamic banks matters for the stability of Islamic banks in terms of efficiency performance. High efficiency is found to increase the financial stability of small- to medium-sized Islamic banks, but it has the opposite effect on large Islamic banks. It explains that the role of efficiency performance differs across Islamic banks based of their size and efficiency levels.

Furthermore, financial turmoil has a significant influence on Islamic banking stability. However, it fails to serve as a moderating variable for the relationship between efficiency and banking stability. The insignificant influence of the institutional development variable and its failure to moderate efficiency performance indicate that institutional development does not play a pivotal role in Islamic banking stability.

The findings suggest that Islamic banking institutions must ensure efficient operations to strengthen the level of financial stability within Islamic banks. In addition, for large-sized Islamic banks, efficiency performance must consider the effectiveness of fund allocation, especially in terms of risk-management performance. Indeed, these points should be a concern for financial authorities, who should regulate Islamic banks effectively and efficiently to achieve and maintain financial stability, particularly large Islamic banks that pose a higher risk of systemic instability.

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Is the Romer Hypothesis valid for Newly Industrialized Countries? Evidence from panel ARDL

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Abstract

Purpose — This study investigates the effect of trade openness on inflation, referred to as the Romer hypothesis, for Newly Industrialized Countries (NICs) from 1990 to 2022.

Methods — It uses a panel ARDL method and the Dumitrescu-Hurlin (2012) causality test. Economic growth, credit, and the money supply are included as independent variables in the model.

Findings — The findings reveal no statistically significant long-term and short-term relationships between trade openness and inflation. However, the money supply has a statistically significant positive effect on inflation in the long run, while economic growth and credit have no statistically significant effect. In the short run, money supply and economic growth reduced inflation. According to the Dumitrescu-Hurlin (2012) panel causality test, bidirectional relationships exist between inflation and economic growth, as well as between inflation and the money supply and credit. In contrast, a unidirectional relationship is observed between inflation and trade openness.

Implications — Reducing the external dependency of sectors that rely on imported inputs is necessary to mitigate the adverse effects of trade openness on inflation in Newly Industrialized Countries (NICs). It is crucial to ensure that monetary policy aligns the money supply and credit expansions with real-sector trends.

Originality — This research is pioneering in its focus on testing the Romer hypothesis for Newly Industrialized Countries (NICs).

Keywords — Romer Hypothesis, Trade openness, Panel ARDL, New industrialization countries.

Introduction

One of the critical issues facing economies today is inflation (Girdzijauskas et al., 2022; Doğan, 2023). Excessive inflation, which is desired to be kept within a certain range for economic stability and social welfare, may lead to economic imbalances and social hardships. Persistently high inflation is a crucial factor hindering economic growth and reducing the wealth of low-income groups. Maintaining control over inflation to ensure the sustainability of price stability is a significant macroeconomic goal for countries. The rise of global inflation to historical levels due to

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COVID-19 underscores the significance of combating inflation. Furthermore, these developments have ensured that inflation remains a significant research topic. A review of the literature indicates many studies on the interaction of inflation with various factors, such as economic growth, income distribution, unemployment, current account deficit, and balance of payments (Khan & Hanif, 2020; Uddin & Rahman, 2023; Sintos, 2023; Valogo et al., 2023; Pham & Sala, 2022).

Trade openness is a crucial factor in analyzing inflation. Trade openness indicates the extent to which a country is integrated into foreign trade and often contributes to the improvement of a country's economic performance. Specifically, trade openness increases capital flows, enhances capital formation, and fosters technology transfer and the accumulation of technical knowledge, thereby increasing production levels. Thus, increases in real production lead to higher trade openness, and high trade openness can become a factor that lowers the general price level (Rogoff, 2003). Trade openness primarily alleviates price pressures and reduces inflation by promoting production through increased efficiency, higher foreign investment, better resource allocation, and greater capacity utilization (Binici et al., 2012). However, the effect of increased trade openness on inflation is not always positive. In an economy with high trade openness, imports can have adverse effects on the national economy. Specifically, increases in the prices of imported goods may exert pressure on domestic prices and trigger inflation. Moreover, when a country's trade openness is associated with exchange rate fluctuations, particularly fluctuations in the value of its national currency, it can affect inflation through import prices. Therefore, considering a country's trade openness when analyzing inflation behavior is crucial for understanding inflationary pressures and developing appropriate policy responses.

The nexus between trade openness and inflation is intricate and influenced by many factors, including a country's trade policies, currency value, and trade balance. Consequently, researchers have examined this relationship by considering a variety of variables. The concept of a connection between trade openness and inflation was initially introduced by David Romer in 1993, known as the Romer Hypothesis. According to Romer (1993), there is an inverted linkage between inflation and trade openness. Various studies have supported this negative correlation (Rajagopal, 2007; Terra, 1998). Conversely, other research, including Evans' (2007) study, has identified a positive relationship between inflation and trade openness. These conflicting findings have sparked empirical and theoretical debates, suggesting that the relationship may vary across countries. As a result, this study examines the relationship between trade openness and inflation in newly industrializing countries. These countries are characterized by rapid economic growth, industrialization, and a dynamic trade structure. The significant contributions of this study to the literature are: (i) To our knowledge, this is one of the rare studies empirically examining the Romer Hypothesis in the context of newly industrializing countries and (ii) employing the Panel ARDL method to examine this hypothesis in these nations in the literature, (iii) Another difference from other studies in the literature is that the data set belongs to the period between 1990-2022, which is very important in terms of covering the Covid-19 pandemic period, which had significant effects around the world. (iv) In this sense, it offers a renewed perspective on how inflation is affected by global economic integration. Additionally, this study incorporates country-specific internal variables (such as the degree of financial liberalization and credit) and trade openness.

The present study is organized into five parts. The first part presents the introduction; the second part reviews the literature; the third part provides the theoretical background; the fourth part addresses the dataset and methodology; the fifth part presents the empirical findings and discussion; and the final part concludes with a summary and recommendations.

The Romer hypothesis, posited by economist Paul Romer in 1993, asserts that increased trade openness tends to reduce inflation rates. The general validity and effects of the Romer hypothesis have been debated in the economic literature, yielding different results across countries. Based on their findings, studies on the relationship between trade openness and inflation can be categorized into three groups. Studies in the first group, including Romer (1993), have demonstrated an inverse relationship between trade openness and inflation. Some of these studies include works by Salimifar et al. (2015), Lin et al. (2017), Şimşek & Hepaktan (2019), Atgür (2021), and Yılmaz (2024). For instance, Salimifar et al. (2015) used the ARDL method to explore the trade

openness-inflation relationship in Iran from 1973 to 2010. Both short- and long-term results indicated that trade openness negatively affected inflation, corroborating the Romer hypothesis for Iran. Lin et al. (2017) examined the validity of Romer's hypothesis in Sub-Saharan African countries using Panel 2SLS and OLS methods. The study found a negative relationship between inflation and trade openness, confirming the validity of Romer's hypothesis in these countries. Şimşek & Hepaktan (2019) investigated the validity of Romer's hypothesis for the Turkish economy from 2005 to 2018 using Granger causality and VAR models. Their findings revealed a negative relationship between trade openness and inflation, supporting the hypothesis. Similarly, the relationship between trade openness and inflation in Türkiye was analyzed from 1980 to 2018 using Johansen Cointegration and FMOLS methods. The results showed a long-term relationship among trade openness, inflation, and other variables, with trade openness negatively affecting inflation. Lastly, Yılmaz (2024) demonstrated that, between 1970 and 2021, economic and social globalization had a significant negative impact on inflation in Turkey, whereas political globalization did not have a meaningful effect.

The second group of studies does not support the Romer hypothesis; instead, they identify a positive relationship between trade openness and inflation. Research by Munir & Kiani (2011), Samimi et al. (2012); Sepehrivand & Azizi (2016), Çoban (2020); Nasrat (2020); Bošnjak et al. (2022); Hamidi et al. (2022), Munir et al. (2023), Kaukab & Anggara (2024), indicates this inflationary effect. For example, Munir & Kiani (2011) studied the Pakistani economy and found a positive relationship between trade openness and inflation. Samimi et al. (2012) analyzed developing countries and revealed a positive relationship, indicating that the Romer hypothesis does not hold in these contexts. Sepehrivand & Azizi (2016) examined the impact of trade openness on inflation using the Romer theory, finding that trade openness positively affects inflation. Nasrat (2020) analyzed the relationship between trade openness and inflation in South Asian countries from 1980 to 2016 and found a positive correlation between the two variables. Similarly, Çoban (2020) investigated this relationship for the Next-11 countries using the panel ARDL method. It concluded that there is a significant positive relationship between trade openness and inflation in the short and long term. Bošnjak et al. (2022) explored the relationship between trade openness and inflation in selected European countries from 2000 to 2019 using the Panel GMM methodology. Their findings also showed a positive relationship between trade openness and inflation, contradicting the Romer hypothesis. Hamidi et al. (2022) tested the Romer hypothesis for ASEAN countries using the System GMM and Threshold Panel methods. Their study revealed that trade openness had a positive and significant impact on inflation from 2010 to 2021, further challenging the validity of the Romer hypothesis in these regions. Munir et al. (2023) examined the effects of trade openness on inflation in Pakistan from 1990 to 2021 using cointegration analysis and found a positive long-term relationship between the two variables. Similarly, Kaukab & Anggara (2024) investigated the relationship between commercial investments and inflation in Indonesia from 1985 to 2022 using the ARDL approach and identified a positive long-term correlation.

The studies in the third group contend that trade openness does not significantly impact inflation. For example, Aliyev & Gasimov (2014) explored this relationship in the South Caucasus region, specifically Georgia, Armenia, and Azerbaijan, from 1996 to 2012. Their findings indicated that, except for Georgia, trade openness did not significantly affect inflation levels in these countries. Similarly, Ceyhan et al. (2023) investigated the relationship between trade openness and inflation in MIKTA countries using data from 1960 to 2020. Employing the causality test proposed by Kónya (2006), their panel causality analysis revealed no significant relationship between trade openness and inflation, invalidating the Romer hypothesis for these countries. Nguyen et al. (2023) analyzed the relationship between trade openness and macroeconomic stability in 20 Asian countries from 2011 to 2019 using the ARDL model. They found a positive short-term relationship with macroeconomic stability but no significant relationship with inflation stability.

Methods

This study aims to test the validity of the Romer hypothesis by examining the impact of trade openness on inflation in newly industrialized countries (Brazil, China, India, Indonesia, Malaysia,

Mexico, the Philippines, South Africa, South Korea, Thailand, and Türkiye). Like newly industrialized nations, developing countries typically exhibit high and volatile inflation rates. Additionally, these countries possess dynamic structures regarding their foreign trade potential. For these reasons, newly industrialized countries were selected as the sample for this study. The data set used in the study is shown in Table 1. The period from 1990 to 2022 was selected to represent the widest range of years for which data were available. These variables were sourced from the World Development Indicators (WDI) database.

Table 1. Variables and explanations

Variables	Description	Source
INF	Inflation is measured by the consumer price index	WDI
GDP	Gross domestic product constant 2015 US dollars	WDI
OPEN	The ratio of the sum of exports and imports to gross domestic product	WDI
MONEY	Annual growth rate of broad money supply	WDI
CREDIT	Domestic credit provided by banks to the private sector	WDI

The relationship between inflation and trade openness was examined using the model specified in Equation 3. The model for this study was based on the studies of Munir & Kiani (2011), Nasrat (2020), and Salimifar et al. (2015).

$$INF_{it} = \alpha_0 + \beta_1 GDP_{it} + \beta_2 OPEN_{it} + \beta_3 MONEY_{it} + \beta_4 CREDIT_{it} + \varepsilon_{it} \quad (1)$$

This study employs panel data methods. First, the cross-sectional dependency of the series was tested, as series with cross-sectional dependency require examination using second-generation panel unit root tests. Utilizing first-generation tests without accounting for cross-sectional dependency can lead to erroneous results. For this purpose, the CD_{lm2} cross-sectional dependency test developed by Pesaran (2004) was applied. In the next stage, the stationarity of the series with cross-sectional dependence was examined using the CIPS unit root test developed by Pesaran (2007). It was determined that the series was stationary at different levels, either I(0) or I(1). Therefore, the Panel ARDL approach was adopted. An important feature of the Panel ARDL approach is its ability to examine the relationship between variables in models composed of stationary series at different levels.

To determine the appropriate unit root test, the cross-sectional dependence of the series was assessed using the Pesaran (2004) CD_{lm2} test. This test, asymptotically normally distributed as $T \to \infty$ and $N \to \infty$, provides reliable results. The null hypothesis of the CDlm2 test is that there is no cross-sectional dependence, while the alternative hypothesis is that there of cross-sectional dependence (Pesaran, 2004). The test statistic is calculated using the formula outlined in Equation 2.

$$CD_{lm2} = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \quad (2)$$

Here, T and N represent the time and unit dimensions of the panel series, respectively. As seen in Table 3 below, cross-sectional dependence was found in the series included in the study. Therefore, the CIPS unit root test developed by Pesaran (2007), which considers cross-sectional dependence, was used for the analysis. Pesaran (2007), calculates the test statistic shown in Equation 3 when investigating the stationarity of the series:

$$t_i = (N,T) = \left(\frac{\Delta y_i' \bar{M}_w y_{i-1}}{\bar{\sigma} (y_{i-1}' \bar{M}_w y_{i-1})^{1/2}} \right) \quad (3)$$

With the formula provided in Equation 4, the test statistic for the overall panel is calculated.

$$CIPS(N,T) = \bar{\tau} = \frac{1}{N} \sum_{i=1}^{n} \tau_i(N,T) \quad (4)$$

As shown in Table 4, unit root test results indicated that the variables were stationary at different levels, both at the level and the first difference. In this case, it is not possible to use regression analysis, which can be applied when all variables are stationary at the level, or cointegration analysis tests, which can be applied when all variables are stationary at the same level (I(1) or I(2)). Therefore, to examine the relationship among the variables constituting the model, the Panel ARDL (Autoregressive Distributed Lag) method was utilized, allowing for the investigation of the cointegration relationship between stationary series at both levels and after the first difference.

Pesaran et al. (1999) introduced two different test statistics for two different estimators in the Panel ARDL method: MG (Mean Group) and PMG (Pooled Mean Group). When calculating the test statistic for the MG estimator, there are no restrictions in the ARDL specification. Long-run coefficients are calculated from the averages of unit ARDL predictions obtained through individual ARDL estimations. The main criticism of the MG estimator is that various parameters are not the same across units in the panel. This issue, considered a drawback of the MG estimator, is addressed in the PMG estimator. In the PMG estimator, the long-run coefficients must be identical across countries within the panel. However, in the short run, coefficients, intercepts, and error variances can differ across countries in the panel. The decision on which estimator's values to use is made using the Hausman test (Pesaran et al., 1999).

In the analysis section of this study, the causal relationships among the variables in the model specified in Equation 1 were investigated using the panel causality test introduced by Dumitrescu & Hurlin (2012). The panel causality test by Dumitrescu & Hurlin (2012) examines the null hypothesis of the absence of a Granger causality relationship, using a test statistic calculated from Equation (4). The alternative hypothesis, on the other hand, is formulated as the presence of a Granger causality relationship.

$$W_{N,T}^{HNC} = \frac{1}{T}\sum_{i=1}^{N} W_{i,T} \quad (5)$$

Results and Discussion

This study employed panel data methodology to examine the constructed model. A critical issue is whether to use first- or second-generation panel data methods. Therefore, an investigation was conducted to determine whether the study's variables exhibit cross-sectional dependence.

Table 2 presents basic statistics for all measures, including dependent and independent variables used in the empirical analysis.

Table 2. Description statistics

VARIABLE	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
INF	39.564	5.590	2947.733	-1.401	233.190	367
GDP	11.741	11.651	13.212	10.734	0.47487	367
OPEN	18.761	9.421	2613.497	-296.121	142.854	367
MONEY	52.136	14.320	3280.653	-43.738	267.556	367
CREDIT	60.379	50.338	185.363	11.037	40.3197	367

Source: Authors' calculations

Table 3. Cross-sectional dependence analysis results

Variables	Test CD_{lm2} (Pesaran 2004) t- Statistics
INF	12.920[0.000]***
GDP	8.120[0.000]***
OPEN	5.436[0.000]***
MONEY	6.855[0.000]***
CREDIT	19.340[0.000]***

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

The results regarding cross-sectional dependence are presented in Table 3. According to the results of this study, at the 1% significance level, the null hypothesis that "there is no cross-sectional dependence" is rejected for all variables, and the alternative hypothesis that "there is cross-sectional dependence" is accepted. In other words, all variables exhibit cross-sectional dependence. This outcome indicated that an economic shock in one of the countries in the panel affected the others, demonstrating the interdependence of national economies. Countries are interdependent in terms of economic indicators, a phenomenon parallel to globalization.

The outcomes of the unit root test are presented in Table 4. According to the results of the CIPS unit root tests, the GDP and CREDI variables exhibited unit roots at the level in the stationary model results. In contrast, the other variables were stationary at the level. Furthermore, it was observed that the variables with unit roots at the level become stationary after first differencing. Therefore, it was concluded that the GDP and CREDI variables were integrated of order I(1), indicating they require first differencing to achieve stationarity. In contrast, the INF, OPEN, and MONEY variables were integrated of order I(0), implying they were stationary at the level.

Table 4. CIPS unit root test results

Variables	Level		1. Difference	
	Constant	Constant & Trend	Constant	Constant &Trend
INF	-4.187***	-3.340***	-4.902***	-5.078***
GDP	-1.909	-1.933	-2.743*	-3.146***
OPEN	-3.136***	-3.507***	-5.650***	-5.536***
MONEY	-2.770***	-2.522**	-5.646***	-5.856***
CREDIT	-1.987	-2.512**	-2.867***	-3.038***

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively. Critical value for the Constant model: -2.57 (1%), -2.33 (5%), -2.21 (10%), and Constant and trend model: -3.10 (1%), -2.86 (5%), -2.73 (10%) (Pesaran, 2007).

Table 5. Panel ARDL long and short-run results

Variables	PMG		MG	
	Coefficient [Prob.]	Error Term	Coefficient [Prob.]	Error Term
Long-term coefficients				
GDP	3.548 [0.172]	2.599	15.821 [0.357]	17.185
OPEN	0.006 [0.718]	0.019	-0.362 [0.215]	0.292
MONEY	0.867 [0.000]***	0.027	0.554 [0.000]***	0.133
CREDIT	0.005 [0.904]	0.044	-0.001 [0.996]	0.073
Short-term coefficients				
GDP	-402.766 [0.000]***		-342.252 [0.205]	269.946
OPEN	0.086 [0.192]		0.232 [0.177]	0.172
MONEY	-0.093 [0.048]**		-0.076 [0.215]	0.061
CREDIT	-2.955 [0.223]		-3.306 [0.223]	2.711
EC	-0.492 [0.000]***		-0.756 [0.000]***	0.098
Countries	10			
Observation	37			
Hausman X^2	19.82 [0.005]***			

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

Based on the unit root results, the relationship among the model's variables was investigated using the Panel ARDL method. Table 5 presented the panel ARDL results, encompassing both PMG and MG. The Hausman chi-square statistic displayed at the bottom of the table is crucial. According to the Hausman test results, because the model's slope coefficients were homogeneous, the MG results should be prioritized (Salisu & Isah, 2017). According to the MG results, the MONEY variable exerted a statistically significant positive effect on inflation in the long term.

However, the GDP, OPEN, and CREDIT variables did not demonstrate a statistically significant impact on inflation in the long term. Notably, the coefficients of OPEN and CREDIT were negative, while the coefficient of GDP was positive. The short-term coefficient results showed that the GDP and MONEY variables significantly negatively influenced inflation. Conversely, the OPEN and CREDIT variables did not exhibit a statistically significant effect in the short term. Specifically, the OPEN variable showcased a positive coefficient, whereas the CREDIT variable displayed a negative coefficient.

Table 6 presents the short-term MG results for the countries within the panel. In Brazil, all variables had statistically significant effects on inflation. GDP and CREDI demonstrated negative coefficients, whereas OPEN and MONEY displayed positive coefficients. In the case of China, all variables exerted statistically significant effects on inflation. Except for CREDI, other variables had positive effects. For India, statistical significance was absent for all variables except CREDI, which also exhibited a negative coefficient. In the results for Indonesia, GDP and CREDI variables were statistically significant, with negative coefficients, while the other variables were statistically insignificant. In Mexico and Türkiye, the MONEY and CREDI variables were statistically significant, but they had negative coefficients. In contrast, statistically significant results were not obtained for GDP and OPEN. Statistically significant results could not be obtained for Malaysia, the Philippines, South Africa, and Thailand.

Table 6. Panel ARDL Individual country results

Countries	*D(GDP)*	*D(OPEN)*	*D(MONEY)*	*D(CREDI)*
	Coefficient [Prob.]	Coefficient [Prob.]	Coefficient [Prob.]	Coefficient [Prob.]
Brazil	-2747.027 *** [0.000]	1.439 ** [0.022]	0.254 * [0.058]	-27.630 *** [0.000]
China	13.243 *** [0.004]	1.055 *** [0.005]	0.201 [0.163]	-0.350 *** [0.004]
India	-52.042 [0.120]	-0.155 [0.132]	0.034 [0.814]	-0.618 ** [0.010]
Indonesia	-323.720 *** [0.000]	-0.029 [0.649]	0.073 [0.578]	-0.576 ** [0.039]
Malaysia	7.853 [0.669]	0.001 [0.590]	0.006 [0.695]	-0.038 [0.293]
Mexico	-269.480 [0.106]	-0.008 [0.807]	-0.462 *** [0.000]	-2.006 *** [0.009]
Philippines	-4.236 [0.904]	0.009 [0.491]	-0.050 [0.520]	0.004 [0.984]
South Africa	-44.048 [0.309]	-0.0001 [0.858]	-0.109 [0.120]	-0.168 [0.110]
Thailand	1.187 [0.962]	0.008 [0.250]	-0.076 [0.363]	-0.003 [0.937]
Turkiye	-4.014 [0.960]	0.003 [0.952]	-0.234 *** [0.000]	-1.674 *** [0.000]

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

The results show no statistically significant relationship between trade openness and inflation in newly industrialized countries. These results are similar to those of Aliyev & Gasimov (2014) and Ceyhan et al. (2023). The findings suggest that more dominant factors—such as money supply—play a role in inflation rather than trade openness in these countries. Therefore, it can be argued that no statistically significant relationship was found. According to country-specific results,

a statistically significant and positive relationship between trade openness and inflation was found for Brazil and China, indicating that the Romer hypothesis does not hold. These results are like those of Munir & Kiani (2011) and Samimi et al. (2012). According to the results for Brazil and China, the 'cost-push hypothesis' holds in both countries. This can be explained by the fact that, particularly in China, the level of imports exceeds that of exports, resulting in a trade surplus. Consequently, increased trade openness reduces the quantity of goods and services available for domestic demand through imports. No statistically significant relationship was found between trade openness and inflation in the other countries included in the study.

The effect of GDP on inflation is not statistically significant. However, it is statistically significant for Brazil, China, and Indonesia. While GDP has of positive effect on inflation in China, it is negative in Brazil and Indonesia. These results are similar to those of Ali & Asfaw (2023), Salamai et al. (2022), and Warsame et al. (2023). Gokal & Hanif (2004) emphasized that inflation negatively affects economic growth by increasing costs. Additionally, they noted a positive relationship between GDP and inflation because, under forward supply contracts made by firms, producers are obligated to meet demand even if the prices of goods increase in the future.

Although the money supply has short-term negative effects on inflation, a statistically significant positive relationship has emerged in the long term. In other words, the money supply increases inflation. (Akinbobola, 2012; Ali et al., 2023; Christian, 2023; Van, 2020; Warsame et al., 2023 have produced similar results and stated that the increase in the money supply, which raises inflation, is due to the growth of the money supply exceeding that of the supply of goods and services. In developing countries, particularly under populist approaches, increases in the money supply can be excessive.

The effects of loans on inflation are statistically insignificant in both the short and long term, and the coefficient is negative. Similar to Korkmaz (2015) no significant relationship was found between loans and inflation. The statistical insignificance of the effect of loans on inflation can be explained by the presence of other factors that significantly influence inflation. Additionally, the impact of loans on inflation may vary depending on the type of loan. For example, the effect of consumer loans on inflation may differ from that of investment loans.

Table 7. Results of the pairwise Dumitrescu-Hurlin (2012) panel causality test

Lag (k)	INF=> GDP	GDP=>INF	INF=> OPEN	OPEN=>INF	MONEY=>INF	INF=>MONEY	INF=>CREDI	CREDI=>INF
1	2.539*** [0.003]	2.732*** [0.000]	1.670 [0.225]	14.015*** [0.000]	10.596*** [0.000]	3.764*** [0.001]	3.694*** [0.001]	6.606*** [0.000]
2	4.062*** [0.001]	1.813** [0.069]	3.861** [0.018]	16.200*** [0.000]	22.142*** [0.000]	9.200*** [0.000]	10.765*** [0.000]	6.940*** [0.000]
3	5.939*** [0.003]	4.909* [0.070]	6.673*** [0.000]	16.638*** [0.000]	15.875*** [0.000]	17.565*** [0.000]	18.122*** [0.000]	10.577*** [0.001]

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

Table 7 presents the results of examining the model's variables using a causal approach. The Dumitrescu & Hurlin (2012) method was employed for the panel causality tests in this study. Given the difficulty of selecting an appropriate lag length in the Dumitrescu & Hurlin (2012) causality test and the dataset's annual frequency, causality was investigated for lag lengths of 1, 2, and 3. According to the results, at a lag of 1, a unidirectional causal relationship from trade openness to inflation was identified. In contrast, bidirectional causality relationships between inflation and the other variables were observed. At lag lengths of 2 and 3, bidirectional causality relationships were found between all independent variables and inflation at different statistical significance levels. The causality results are similar to those of Chimobi (2010), Eltejaei & Shoorekchali (2021), and Warsame et al. (2023).

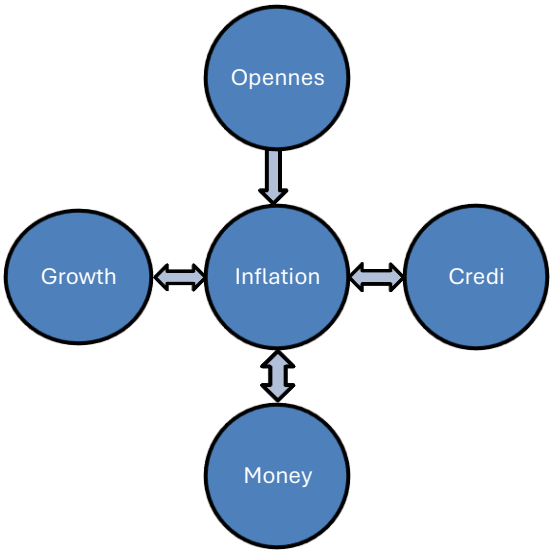

Figure 1. Graphical interpretation of the causality results

Conclusion

Studies examining the relationship between trade openness and inflation have found both positive and negative effects. Recently, economic globalization has often been regarded as an indicator of trade openness; however, traditional measures of trade openness based on international trade remain widely used. Based on traditional trade openness, the validity of the Romer Hypothesis for Newly Industrialized Countries was investigated from 1990 to 2022. According to the results, the Romer Hypothesis is not valid in Newly Industrialized Countries in the short or long term.

Increasing trade can help reduce inflation, but it may not be sufficient on its own. This is because inflation is caused of demand and supply imbalances, cost increases, changes in the money supply, and other factors. Inflation is a significant problem, especially in developing countries like newly industrialized ones. As a result, trade openness can increase as exports rise, driven by higher production, and imports increase. Importing intermediate goods and raw materials, especially for the manufacturing industry, can have an inflationary effect. Therefore, reducing dependence on imported intermediate goods and raw materials used in domestic demand and export-oriented production could positively impact inflation in these countries. It is crucial to ensure that the money supply and credit expansion, i.e., monetary policy, are aligned with real-sector trends. Additionally, monetary and fiscal policies need to be harmonized.

One limitation of this study is the calculation of trade openness based on the total exports and imports. Further research could examine the effects of trade openness on inflation by separately considering imports and exports. Moreover, if the dataset is available monthly or quarterly, the impact of trade openness on inflation can be analyzed at those frequencies. This study is expected to provide a new perspective on prior studies examining the relationship between openness and inflation in NIC countries. However, the study's findings indicate that the exchange rate should be considered to analyze this relationship fully. Based on the results of this study, we aim to develop a model that includes the exchange rate in future studies.

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Skill bias in the labour market: Evidence from Iran

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Abstract

Purpose — Most global economies are dealing with the issue of skill bias. In developing and underdeveloped countries, skill bias poses a problem by preventing the educated from participating in the economy's production function, especially in the long run. This paper expands on the skill-wage relationship and examines it in the case of Iran from 1981 to 2021.

Methods — The application of impulse response analysis from the VECM and Structural VAR models separates the relationship between skill and wages into short-run and long-run effects. The structural wage model was estimated using a structural vector autoregression.

Findings — The results show that skill played a significant role in wage determination for only three periods in the short run, and its effect was neutral in the long run. This means that skill accumulation through advancement in graduate and postgraduate study is unlikely to increase wages in the long run.

Implication — According to the findings, skill bias implies that educational attainment in the Iranian labour market can only improve wages to a minimum extent. This also proves that factors other than education determine wage growth in the economy.

Originality — The skill-wage relationship has not been a focus of studies in the field of education outcomes. Moreover, in the case of Iran, this investigation is novel, and there is a lack of studies on the relationship between compensation and skill.

Keywords — Skill bias, long-run wage model, human capital, bargaining

Introduction

The basic concept of wage-skill determination is captured by the Mincerian earnings function, which establishes a relationship between wages and skills. Jacob Mincer captures this concept in his 1974 study, which provided a strong background for many human capital studies. However, these investigations lack a focus on the assumption of stable effects of skill on wages, which is mostly supported by linear regression estimates of the Mincerian wage equation. Recently, it has been observed that although the number of university-educated individuals is increasing globally, this increase has failed to explain wage variations and has diminished their role in wage bargaining. This problem reflects the skill bias, characterized by high levels of human capital in a society with little power to set the equilibrium nominal wage. This study primarily focuses on the co-integration analysis of wages and the number of skilled workers in both the short- and long-run. It considers the case of Iran to conduct the co-integration analysis and determine how wages respond to

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variations in the number of university-educated workers. Given that the time series is I(1), the study provides sufficient evidence of co-movement between wages and skills of these workers. Although Lazear and Oyer (2007) discussed various types of wage compensation, including non-wage compensation, workers in Iran are mainly compensated through wages. Hence, this study uses wage as a proxy for compensation. Subsequently, the study constructs a long-run relationship between wages and skills. It concludes that skills can determine wages for 2 to 3 periods in the short run and, in longer horizons, the actual wage-skill curve lies below the potential curve. This finding implies that, at the same level of wages, the share of skilled workers in production in actual data is lower than the potential share. This pattern suggests the possibility of skill neutrality, which can lead to the underutilization of resources and the recruitment of low-productivity workers. Therefore, this will diminish the cost of damping skilled labour. According to Klenow and Blis (2000) and Tassaeva (2021), this will hamper economic growth and lead to a lack of equality in technological developments. This issue will then create negative externalities by increasing the social misbehavior of the unemployed. Concerning the long-run wage-skill relationships above, the study uses the vector error correction model (VECM) to solve the actual co-movement equation and estimate skill (which represents the number of workers with a university degree (Cunha et al., 2010; Hutter & Weber, 2021, 2022). The coefficient of skill in the wage model is 2.07, which is approximately equal to the coefficient in the structural vector auto-regression (SVAR) estimated in the subsequent section. To stabilize and filter the model, while accounting for unrelated shocks that prevent the accurate estimation of the coefficient of skill, the study incorporates the exogenous non-accelerating inflation rate of unemployment (NAIRU), estimated using a state-space model solved by the Kalman Filter (Kalman, 2006).

Many studies are dedicated to labour performance and compensation in world economies. Hendricks (2002) found that, in the case of Iran, human capital explains only 31 per cent of the wage difference between Iran and the US. Barro and Lee (2001) conducted a similar investigation for countries with lower revenue than the US. They concluded that higher skill, as measured by educational attainment, reduces earnings per worker by 20 percent in the wealthiest countries and by 40 percent in the poorest.

The primary goal of this study is to examine structural macroeconomic models based on microdata, rooted in the work of Becker (1964), Mincer (1974), Rosen (1976), Jones (2014), and Mankiw et al. (1992). The study highlights that, during the first decade of this century, firms did not adjust their wage structures in response to the accumulation of human capital. As a result, wages were determined by skills only for two to three periods in the short run, implying skill neutrality in the long run. The current study bridges the literature gap by applying the SVAR as a macro-econometric estimation method. The paper employs a specific identification procedure by imposing restrictions consistent with the observed behavior of wages, skills, and NAIRU. Following identification restrictions similar to those proposed by Blanchard and Perotti (2002) and Sims (1999), the model becomes fully identifiable and shows that a 1% increase in NAIRU reduces wages by approximately 10% in Iran.

The study solves the model and finds that the effects of skill shocks on wages last only for two to three periods in the short run. In the long run, skill accumulation, even after seven periods, leads to a decline in wages in the economy. Consequently, wage determination will not take effect from the demography of university-educated workers; therefore, skill is neutral in wage bargaining. This finding from the country case further reinforces the initial analysis of skill-biased labor markets. It suggests that although university attendance is rising in most countries, the share of educated workers may not significantly influence wage determination in the long run.

Methods

By running a unit root test, the study examined whether the model's variables are integrated. All data used in the VECM and structural models, including wages, equilibrium unemployment rates, and educated labour were found to be I(1). This implies that the data follow a light-tailed random walk. Hence, imposing a structural shock in SVAR will decay in the impulse-response function,

which is essential to analyzing structural shocks to wages. These tend to be more short-run than long-run skill effects. Figures 1, 2, and 3 show each variable over time to assess the possibility of changes in the same direction.

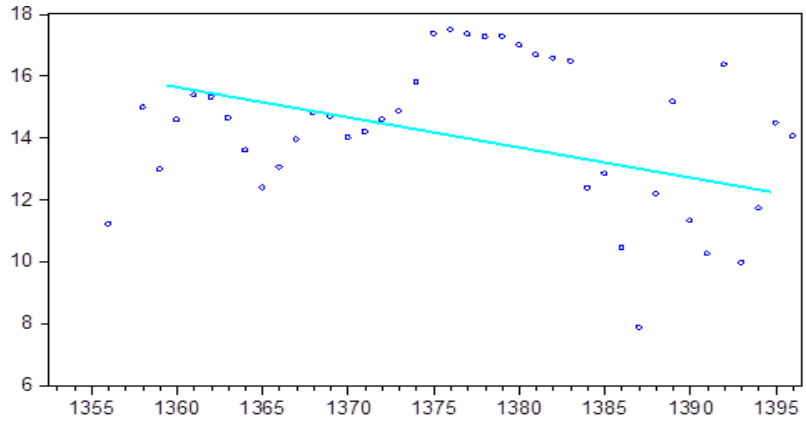

Figure 1. Unemployment in the Equilibrium Rate by Removing Inflationary Pressures

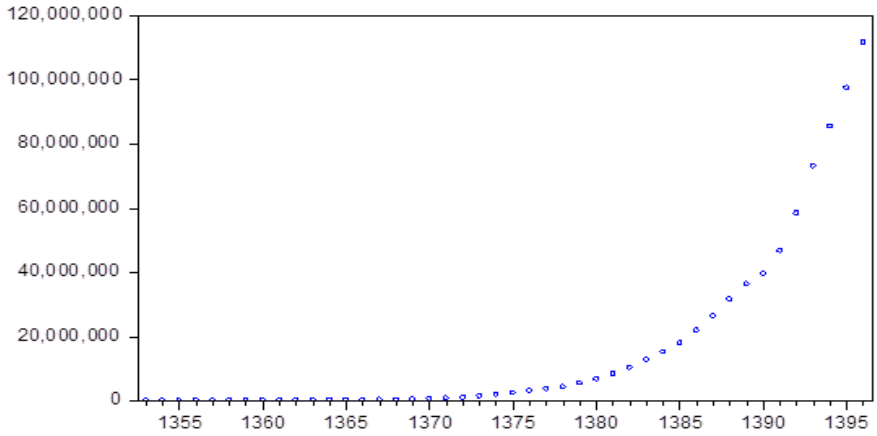

Figure 2. The Average Yearly Wage of All Agents in the Economy, According to Microdata of the National Census

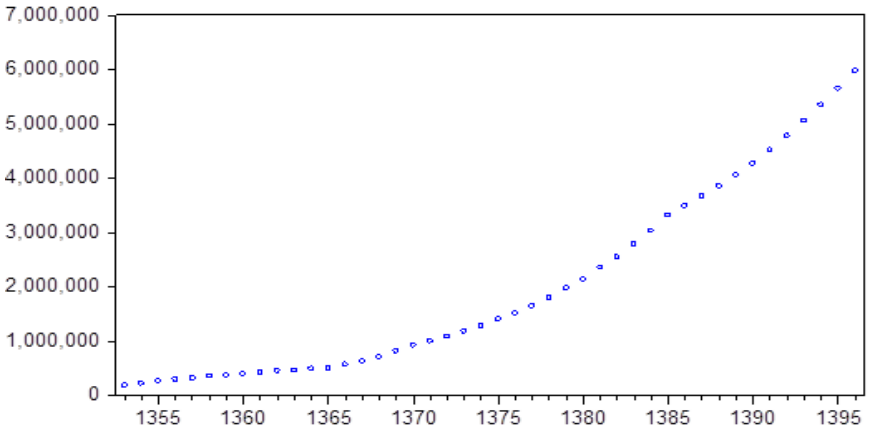

Figure 3. Number of Skilled Workers for the Whole Nation According to Microdata of Sample Firms on Census Data

Annual data analysis reveals paths for wages and skills that are partially similar; however, unemployment fluctuates around a point and exhibits a downward-sloping trend identical to the linear pattern in scatter plots. The co-integration of wage with skill versus unemployment will

produce two strong co-integrating patterns in the data, which tend to decay to a level just as I(0). The weakening of these co-movements can also be triggered by exogenous stimuli, such as changes in working and job-matching arrangements, driven by changes in the economy's skilled labour stock. Jones (2014) highlighted the limitations of standard human capital accounting by applying marginal productivity analysis in a cross-country regression framework, focusing on cross-national variation in human capital. In practice, since the variation of human capital is modest, it appears to contribute negligibly to significant income variations. This study decomposes educated working labour into two parts, based on the significance of the short- and long-run in the structural wage model, constructed and solved using econometric tools. In the long run, the findings suggest that wages tend to be skill-neutral. This outcome reflects inefficiencies in the hiring process and labour-matching mechanisms, which are often hindered by weak institutional frameworks in developing countries.

Furthermore, the prevalence of a low-skilled workforce limits the potential contribution of the educated population. As of 2016, only 18/7 percent of high school graduates attained a bachelor's or higher university degree. This implies that any co-movement between wages and skills is not sustained in the long run and will decay in level.

Figures 2 and 3 illustrate changes in wages associated with a specific characteristic of each year: the proportion of workers who attended school for 2 or more years. This may reflect a labour-market bias, of which years of schooling are associated with short-term wage changes. In contrast, the impact of university education on wages appears unstable over the same period. Hendricks (2002) explained that human capital accounted for only 31 per cent of the wage difference in the US, as measured by the ratio of wages to the US wage. The coefficients for other countries are as follows: Iraq: 32.3; Venezuela: 47.4; Turkey: 23.5; and Thailand: 18.4. The coefficients for higher-income countries include Austria 72.6, Belgium 86.3, and France 82.6. Barro and Lee (2000) investigated the same condition for all source countries and found that educational attainment in countries' global data is lower than that in the US. This effect reduces earnings per worker by 20 percent for the wealthiest countries and by 40 percent for the poorest countries. The study investigated skill neutrality using Iran's microdata. It decomposed the time horizon into short- and long-run structural models, accounting for Iran's unique economic features, and ran an SVAR to estimate them. Subsequently, this study regresses wages on years of schooling. The model explains a substantial share of wage variation, with the schooling coefficient statistically significant at the 1% level and an adjusted R-squared of 99.3%. This further supports the assumption that other factors may undermine the impact of skills, rendering wages skill-neutral in the long run. The study investigates whether wages remain unresponsive to skill when short- and long-run co-movements are disentangled, thereby assessing the empirical validity of skill neutrality in the labour market. It used the features of two macro-econometric tools—VECM and restricted SVAR—to distinguish between the long and short horizons and probe whether the long-term bias is due to the economy's structure.

Model Specification

Generalization of the wage and skill relationship

Co-integration based on the VECM model needs to be specified to investigate wage and human capital co-movements. Herrendorf and Schoellman (2018), Hutter and Weber (2021), and Klenow and Blais (2000) assumed that the logarithm of average years of schooling indicates skill affecting the logarithm of wage in Equation 1. To upgrade the indicator and make it suitable for the current job market and the production functions of firms with advanced technology, I used the number of workers with a specified contract period and university degrees as measures of their skill levels.

$$\text{Log(Wage)} = \alpha \text{Log(schooling)} + \varepsilon \quad (1)$$

Equation 1 implies that when an economy is at equilibrium, there is a balance between demand and supply. Additionally, the equation states that the returns to human capital from an additional year of education are equal to the rate of change of the logarithm of schooling, also known as wage returns (Mincer returns). The pace of technological advancements and the

complexity of production processes require us to consider precise variables as proxies for human capital. According to Holmstrom (2017), the number of university-educated workers reflects the productive labour supplied by each individual, who is compensated through wages. Consequently, the co-movement between wages and worker performance is modeled through a generic principal-agent framework.

Examining the long-run relationship between wages and human capital is essential. Firms may be reluctant to alter production processes, increase the hiring of educated workers, or respond flexibly to economic shocks affecting wages, human capital, and unemployment. The wage and skill relationship can be inferred by the co-integration coefficient of wage and human capital being I(1). This implies that the long-run relationship between fluctuations in human capital and wages is neutral. Error correction can be achieved in two ways by assuming a linear long-run relationship. In the first method, error correction can be achieved by adjusting human capital. (Figure 4).

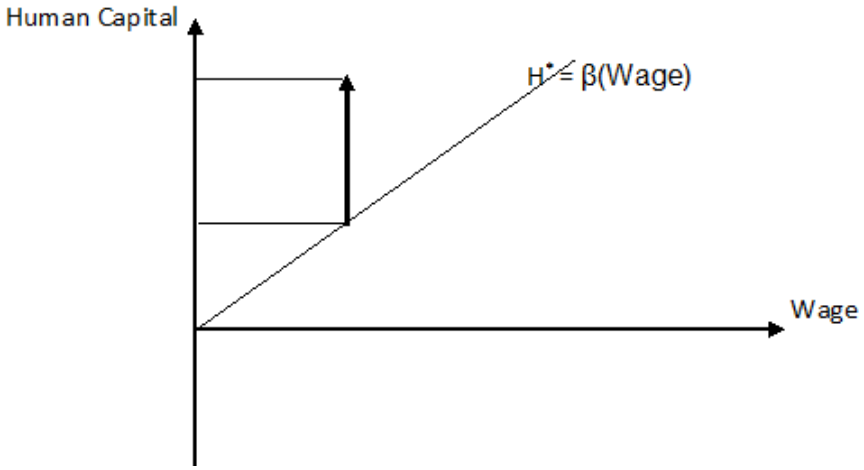

Figure 4. Long-run Relationship of Human Capital, Wage, and NAIRU by the Suppression of Inflationary

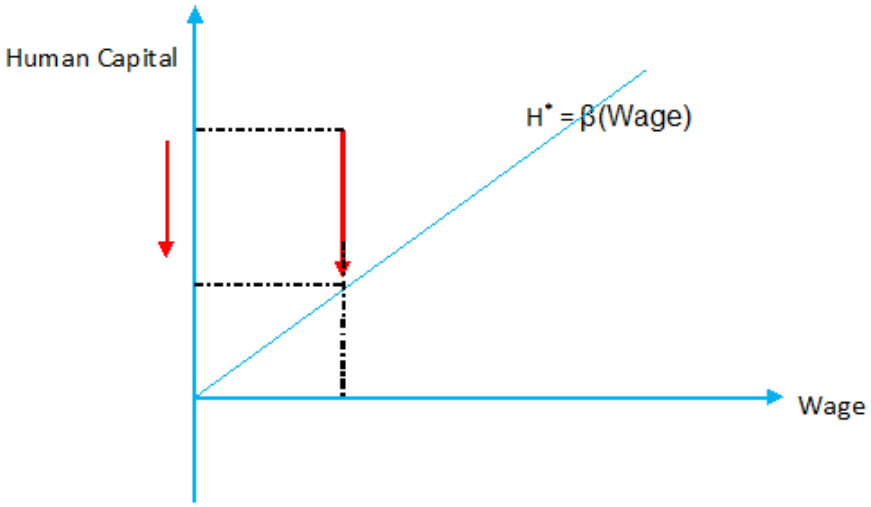

Figure 5. Convergence through Human Capital (by the Assumption of a Stabilizing Long-Run Unemployment Rate (NAIRU))

As shown in Figure 5, a hike in the number of educated workers creates a proportional gap. Assuming all points on the long-run line follow, it verifies the relationship $H^* = \beta(\text{Wage})$. There is a long-run steady-state phase, and any deviation from this state will generate a gap. The dynamics of this co-movement require it to be placed at a point on the line. Similar results are obtained with the co-moving equation approach. These findings align with those of Jones (2014) and the Organisation for Economic Co-operation and Development (OECD), which also demonstrate a

stable, steep linear relationship. Skill bias, reflected in the slope of the line, implies that lower wage variation in response to a one-percent shock to skilled labour mainly determines the structure of the economy.

Consequently, if the change in the gap follows a linear adjustment toward the long-run relationship, deviations from the steady state will gradually be corrected. Human capital, measured by the number of educated workers, will then decline when a positive error from the steady state arises. In such a case, α_h(error correction coefficient) should be below zero for the procedure not to diverge. Thus, the positive shock of an initial increase in educated workers would not last more than three periods. Therefore, the number of workers attaining a university degree will converge at initial wage levels.

$$H_t = \alpha_h(H_{t-1} - H^*_{t-1})\Delta \quad (2)$$

In the second method, adjustment takes place through wages. Assuming that H_t is fixed, both wages and H_t^*—the potential capacity of the economy determined by the long-run stock of human capital—adjust indirectly toward their equilibrium ratio. Another assumption is that wage changes follow a linear function of the extent of divergence from the potential path, with $\alpha_w > 0$, ensuring that H_t converges to the economy's long-run potential.

$$W_t = \alpha_w(H_{t-1} - H_{t-1}^*)\Delta \quad (3)$$

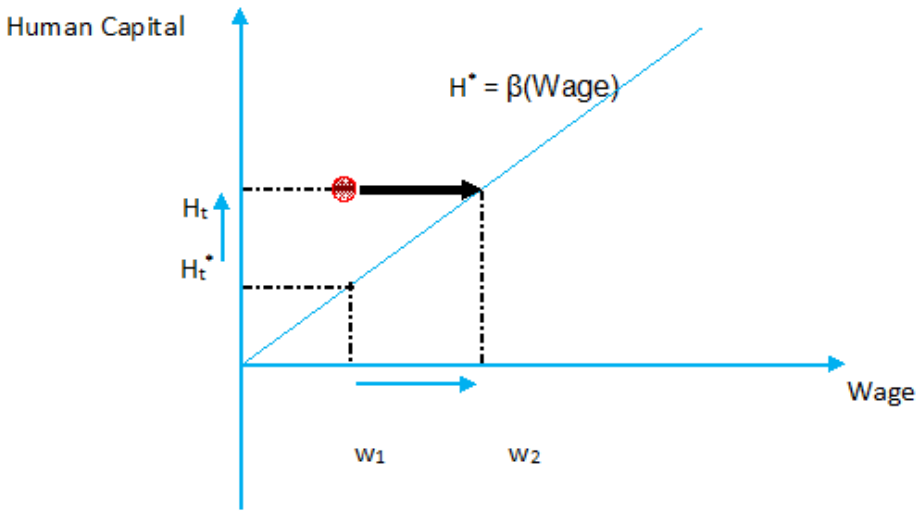

Figure 6. Convergence Through Wages to Long-run Skill/Wage Potential Levels

As shown in Figure 6, wages move from W1 to W2 after divergence from the linear path. Therefore, there is a movement from the subsequent increase in the number of educated workers in the workplace (H_t) to the potential long-run value of the number of educated workers (H*). The fundamental intuition behind the above graphs is that, despite a new shock and an increased number of educated workers, the ratio of wages to the number of educated workers remains constant across various wage levels. Thus, human capital would not affect wages, and consequently, educated workers would not influence wage determination. This study refers to this effect as skill gap bias in the labour market.

The third method achieves error correction through two cointegration relationships specified in Equation (4). These relationships, imposed by the structure of the labor market, guide the economy toward its potential path.

$$H_t = \alpha_h(H_{t-1} - H_{t-1}^*) \quad \alpha_h < 0\Delta$$
$$W_t = \alpha_w(H_{t-1} - H_{t-1}^*) \quad \alpha_w > 0\ \Delta \quad (4)$$

The magnitudes of the coefficients explain the pace at which wages and human capital will adjust in the long run (Figure 7).

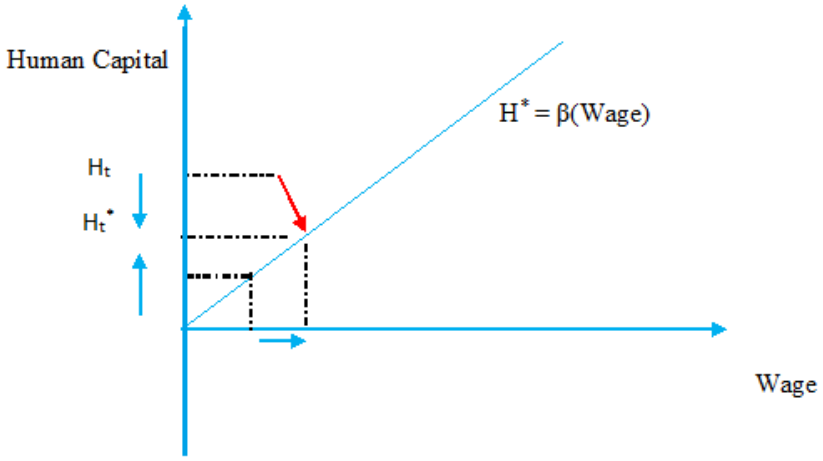

Figure 7. Convergence Achieved Through both Human Capital Wages to Long-run Skill/Wage Potential Levels

Assuming that job search behaviour is homogeneous and remains constant across the labour force at a given wage level, it follows that β can be treated as a constant, irrespective of differences in workers' abilities. The assumption is made in the procedures explained above. Conversely, suppose that structural inadequacies in the economy make the job search process more complex. Under such conditions, the probability of a worker's success depends on the extent of participation in complex job search procedures. As a result, the success of a worker with an average level of human capital is directly influenced by expectations about the labor market (Equation 5).

$$\text{Prob(Search Participation)} = e^{\delta w}\zeta \quad (5)$$

In the above probability function, the parameter e represents the expected compensation for the labour force, and δ specifies the worker's expectations regarding the complexity of a job search. If δ is perceived to be greater than or equal to 1 (δ>1), then the worker would expect the job search in a closed labour market to be complicated and costly. On the other hand, δ<1 reflects a partial improvement in the business environment, with the temporary elimination of international sanctions. This facilitates the job search process for workers. W denotes the general levels of nominal wages that positively correlate with the probability of being involved in a job search, and ζ is a deterministic indicator of the current situation of the labour market. As expected, the increased involvement of a worker in search attempts leads to a decline in the rate of increase in δ, making the long-run steady state vertical. Thus, the probability of labour participation multiplied by the labour force gives the number of workers that attained university degrees in the entire labour force. A β reflects the probability of the job search; hence,

$$\beta = e^{\delta w}\zeta \quad (6)$$

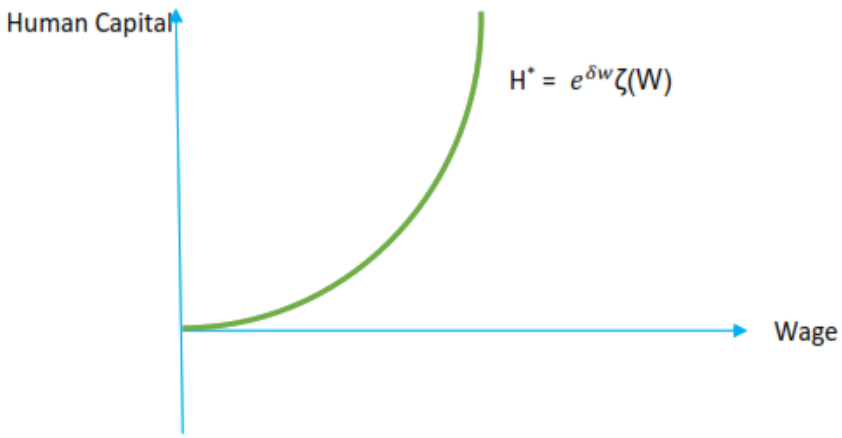

Figure 8. Dynamic Long-run Relationship with Search Probability

Considering workers' innate skills, Herrendorf and Schoellman (2018) show that workers are endowed with one unit of unskilled labour that requires no education and can be supplied to the market immediately. Alternatively, individuals may become skilled by acquiring human capital, characterized by a high amount of abstract knowledge that facilitates innovation and the development of new ideas. This is reflected in the intercept of the curve, denoted by β as the capital-wage long-run relationship rate (Figure 8).

General Structural Model of Wage

Assuming human capital is the production agent, the recruitment decisions of firms will be based on the expected function of these agents. For better analysis, assume that production is labour-intensive, and therefore, in the wage model, we can consider the complete substitution of both human and physical capital as follows:

$$Log(\text{wage}) = \alpha Log(\text{Equilibrium Job Demand}) + \beta \iint \left(\frac{\text{Physical Capital}}{\alpha}\right)\left(\frac{\text{Human Capital}}{\beta}\right) \text{dpdh} + \Omega_t \quad (7)$$

Human capital tends to accumulate over time, so we used the double integration index as the capital part of our formula. In the above equation, *dpdh* is the first difference between physical and human capital. To mitigate the cost effects of job search and promote homogeneity in job demand, inflation is excluded from the expectations that influence workers' job search strategies. Inflation is calculated according to the Phillips Curve.

$$\text{Log(Equilibrium Job demand)} = \text{Log}\left(\frac{Gross\ Job\ Demand}{net\ inflation}\right) \quad (8)$$

such that,

Equilibrium Job Demand = (Equilibrium Job Demand Rate) (Labour Force);
Gross Job Demand = (Labour Force) (Unemployment Rate)

Substituting Equation 8 by its components gives:

$$\text{Log}\left(\frac{(\text{Labour Force})(\text{Unemployment Rate})}{\text{Inflation}}\right) = \text{Log}\big((\text{Equilibrium Job demand Rate})(\text{Labour Force})\big) \quad (9)$$

Eliminating the Labour Force factor from both sides will give the form $\log\left(\frac{(\text{Unemployment Rate})}{\text{Net inflation}}\right)$.
On the right-hand side, this shows the unemployment rate filtered by the effects of inflation. It is also known as NAIRU, or the equilibrium job demand rate.

The total capital in the production process by a firm in the second part of Equation 7, based on the assumption of the Leontief-type production process, can be substituted by human capital because technology growth requires workers of a higher quality. The wage-determining equation for the equilibrium unemployment will eventually take the following form:

$$\text{Log(wage)} = \alpha\log(\text{Equilibrium Job Demand}) + \beta\log\left(\int_{t=12}^{t=18} \text{Human Capital}\right)\text{dH} + \Omega_t \quad (10)$$

where t is the number of years of university attendance (between 12 and 18 years) of a sample worker. It takes 12 years to complete pre-college education in Iran. As the summation implies, human capital accumulation is similar to that of Manuelli and Seshadri (2014). They assume that technological accumulation is constant during schooling, which will positively affect average wages.

Procedure for Estimating the Structural Wage-Human Capital Model for Iran

The SVAR is the most beneficial macroeconometric tool proposed by Christopher Sims and applied to aggregated microdata. To understand the effects of skill on wages, we use the intuition that an increase in workers' skills leads to better job placement and puts them in a stronger position in negotiations with firms, thereby leading to higher wages through matching procedures. To

estimate the effects of variations in skilled labour on wages, it is necessary to identify and isolate purely exogenous and independent shocks to the variable of interest. The response of wages to these shocks can then be examined. The reaction is reflected in the impulse responses. To identify skill shocks, we need to identify the structural model. The structural model facilitates the isolation of purely structural shocks and responds to exogenous variables after the economy is affected by them. Getting the structural model means determining the proper identification for our models. Identification is the interpretation of historical variation in data that enables prediction of the consequences of an action not yet undertaken. Hence, the main challenge is to identify pure shocks. Suppose the structural model follows the following form;

$$AX_t = \beta_0 + \beta_1 X_{t-1} + u_t \tag{11}$$

In our model, the vector X_t depends on its own lag and structural shocks u_t. These structural shocks are independently distributed. Suppose that X has the following three variables: $X_t = \begin{bmatrix} W \\ NAIRU \\ Skill \end{bmatrix}$, where W denotes the Wage, NAIRU denotes the equilibrium unemployment to suppress the inflationary movements in the model, and the number of employees with graduate-level studies is denoted by skill. In such variable specifications, the system will be expressed through the following three equations;

$$\begin{aligned} W_t + \alpha_{12} NAIRU_t + \alpha_{13} Skill_t &= \beta_{10} + \beta_{11} W_{t-1} + \beta_{12} NAIRU_{t-1} + \beta_{13} Skill_{t-1} + u_{wt} \\ \alpha_{12} W_t + NAIRU_t + \alpha_{23} Skill_t &= \beta_{20} + \beta_{21} W_{t-1} + \beta_{22} NAIRU_{t-1} + \beta_{23} Skill_{t-1} + u_{NAIRUt} \\ \alpha_{31} W_t + \alpha_{23} NAIRU_t + Skill_t &= \beta_{30} + \beta_{31} W_{t-1} + \beta_{23} NAIRU_{t-1} + \beta_{33} Skill_{t-1} + u_{Skillt} \end{aligned} \tag{12}$$

If we pre-multiply this VAR specification by the inverse of matrix $A(A^{-1})$, then we will get the reduced form VAR;

$$\begin{aligned} A^{-1}AX_t &= A^{-1}\beta_0 + A^{-1}\beta_1 X_{t-1} + A^{-1}u_t \\ X_t &= G_0 + G_1 X_{t-1} + \varepsilon_t \quad (G_0 = A^{-1}\beta_0 \text{ and } G_1 = A^{-1}\beta_1) \end{aligned} \tag{13}$$

We impose $\alpha_{12} = \alpha_{21} = \alpha_{32} = 0$, reflecting the stable nature of the NAIRU. Therefore, the wage is unaffected by shocks to the equilibrium unemployment rate. NAIRU is also neutral, and surprises to NAIRU will not affect the number of educated firms. Shocks to NAIRU will only affect wage and skill with a lag, but shocks to skill will change the equilibrium.

Results and Discussion

According to data on average years of schooling, including primary, secondary, and high school, workers with a certificate of secondary education exhibit positive comovement for 56 years, as shown in Figure 9. Upper secondary education is not compulsory in Iran. The government provides free schooling to the entire population. It includes primary schooling and higher schooling 1 and 2, where higher schooling 1 is equivalent to secondary education at an international level.

As shown in the figure, the average years of schooling are 7 to 8, and the average wage growth is about 20 percent. Herrendorf and Schoellman (2018) utilize this relationship to assess the impact of schooling by removing the error term from the right-hand side of the equation, thereby disregarding the influence of skill-related shocks on wages. Specifically, this study identifies and decomposes structural skill shocks into their short-run and long-run components.

Figure 10 depicts the history of labour demography in Iran from the years before the revolution that occurred from 1978 to 1988. The figure shows that the workers hired through the pre-revolution system had not retired and continued to work in an environment with outdated infrastructure and institutional systems after the revolution. In these years, the variation in the growth of skilled workers was higher than that in wages. This can be primarily attributed to a firm's tendency to hire more skilled labour. Subsequently, the imposition of institutional changes on the economy and structural shocks, such as war, worsened the distance rate. According to 2016 census data from 3,904 individuals in urban and rural areas of Iran, only 18.7% of active workers held a

bachelor's degree or higher. Given the rapid growth in the number of university graduates over the past decade, this mismatch contributes to labour market inefficiencies.

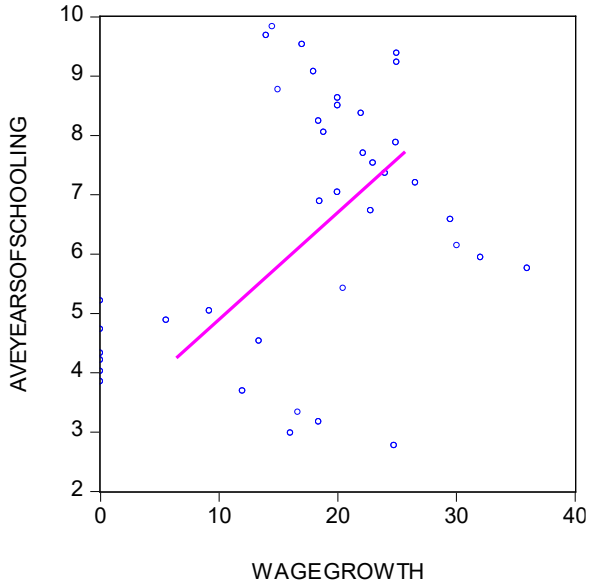

Figure 9. Scatter of Wage Variations and Long-run Changes in the Number of Workers with School Education Attainments

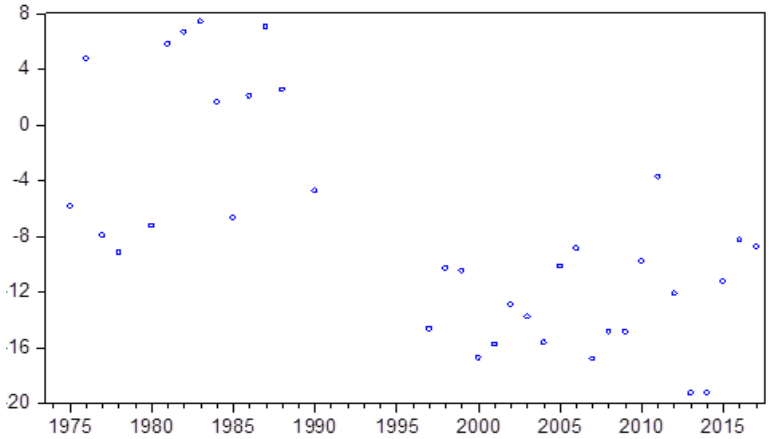

Figure 10. The Distance Between Skilled Labor Force Growth and Minimum Compensation Growth

The results in Table 1 show that short-run human capital shocks lead to higher wages. This finding is consistent with the impulse-response function presented in Figure 13. The effect lasts for about 2 to 3 periods and is reflected in a coefficient of 2.07, which is statistically significant at the 5% level according to Table 1. This result implies that a 1% unexpected increase in the number of workers with a university degree raises wages by approximately 2.07% in the short run. On the other hand, in the long run, structural shocks to human capital lead to a decline in wages. As shown in Table 1, wages decrease by 2.217%, and the effect is statistically significant at the 5% level. These results support the initial assumption that educated workers play a minimal role in wage bargaining relative to other workers with different qualities, suggesting that firms' stock of human capital does not primarily drive wage changes. This result aligns with the study conducted by Hendricks (2002), which found that human capital can account for the low wage difference (approximately 31 percent) in Iran. This phenomenon produces a smooth curve in Figure 11, illustrating a general upward shift in wage levels along the horizontal axis. Structural shocks of NAIRU to human capital are positive, which implies that being unemployed will drive skilled workers to increase their job-search efforts. These workers search for jobs using complicated methods, such as costly registration

for private job campaigns, which, according to statistics, have increased significantly among the educated in recent years. Despite an increase in the share of university-educated workers, their share in firms' wages fails to increase accordingly, as supported by studies by Becker (1964), Mincer (1974), Rosen (1976), Mankiw et al. (1992), and Jones (2014). In developing countries, education does not guarantee job attainment without sufficient effort by educated job seekers. Moreover, an increase in the number of PhD students in recent years is another adjustment considered in the study to show how these students can contribute toward increasing the share of university-educated workers in firms. This is reflected in the increase in the unemployment rate over the past 25–30 years, a period roughly comparable to the time required for a student to complete a PhD.

Table 1. Results of Estimation of the VECM Model and Co-movement Equations

Variables	Dependent variable wage		Mean	Standard Error	P-value
Exogenous variable	Skill	2.076	7.9	1.05	0.0375
Independent variable	NAIRU	-2978279	12	0.5	0.042
R-squared			0.909		
F-statistic			114.25		

The coefficient of NAIRU in the solved model is -2978279, implying that a one-unit increase in unemployment will result in a fall in general wage levels to IRR 2,978,279, as revealed by the empirical data of private firms. The Mincer coefficient for Iran is estimated at 2.076%. In the short run, this implies that a 1% increase in skill raises wages by approximately 2.076%. However, according to the specification of the structural wage model, economic theory, and impulse-response analysis, this effect is not persistent beyond two to three periods, after which it gradually decays and the impact of human capital becomes negative. Subsequently, the model was estimated for the sampled period to see whether real-world data could confirm the dynamic long-run correlation in Figure 11. Results of the solving model with the baseline scenario are presented against actual values for each of the three variables in Figure 12. Figure 11 shows that the relationship between human capital and wages is approximately zero at low wage levels. This finding is based on the sampled years between 1978 and 1988, a period surrounding the Iranian Revolution. During this time, education was the primary criterion for hiring, and increases in the minimum wage led to a significant increase in the number of workers with university degrees.

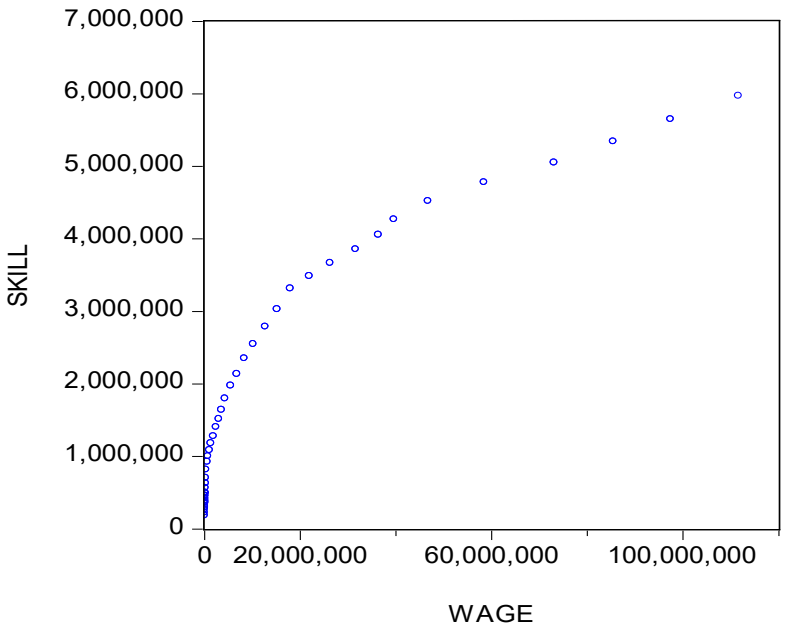

Figure 11. Skill Bias in the Iranian Economy

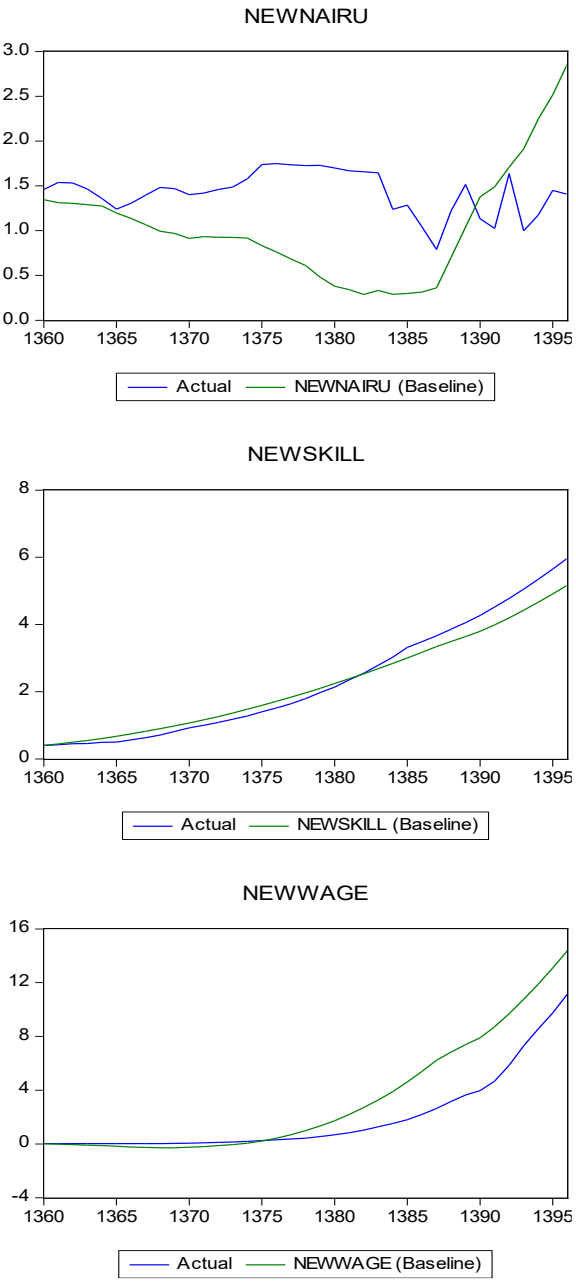

Figure 12. Solving Model with Baseline Scenario

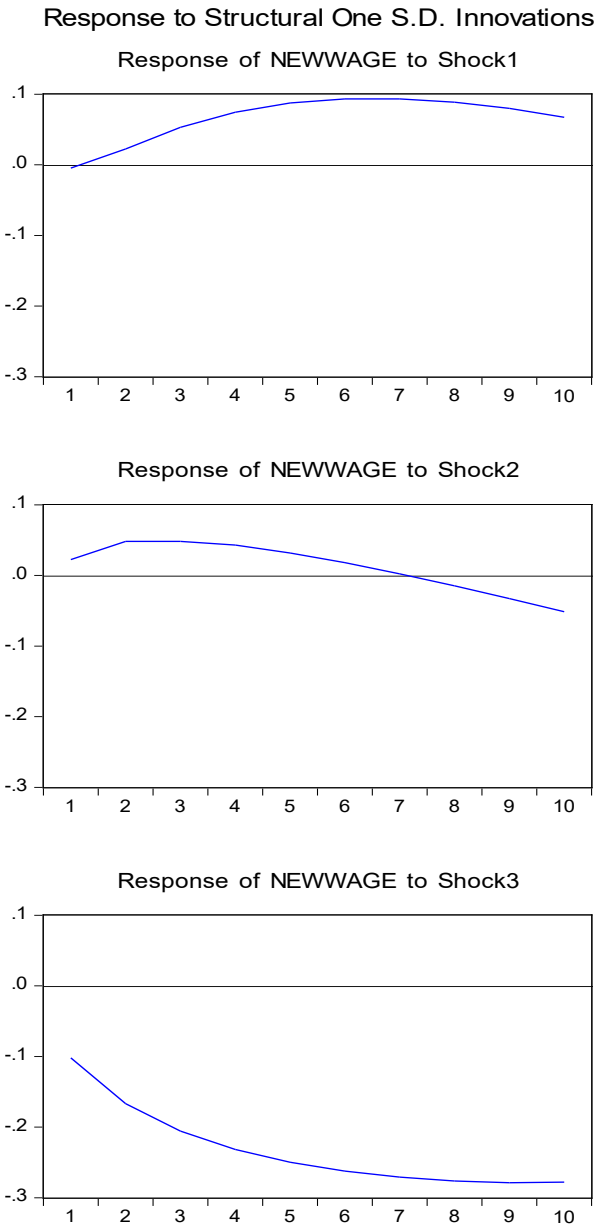

Figure 13. Response of Wages to a One-Standard Structural Shock Hit of Three Endogenous Variables

The error-correction feature of the wage model ensures the existence of significant cointegration. It observed this at the individual level in the microdata, in the form of co-movements. A scatter plot of wage and human capital indicates that, due to firms' inflexible production function, new technological shocks will not alter their labour employment capacity. This situation is described as an adverse selection when wages, taking into account the effects of human capital, are presumed by the macro-production function. Still, wages mostly change due to an error term in the wage model. This is approved by a study done by Carbonero et al. (2022).

The short-term effects of human capital shocks can be proven further by estimating the response of wages to skill shocks, as in Figures 14 and 15. According to the IR figure, the response of wages to human capital shocks—as indicated by the intercept of the impulse response in the short run—starts at approximately 2%. This suggests that a one-unit shock to human capital leads to a 2% increase in wages. The positive effect intensifies to around 5% in the second and third periods, but gradually declines, turning negative after the seventh period. This pattern supports our finding that, in the long run, increases in firm-level human capital may lead to lower wages. Such a

result implies weak bargaining power and a smoother, less responsive long-run relationship between human capital and wages.

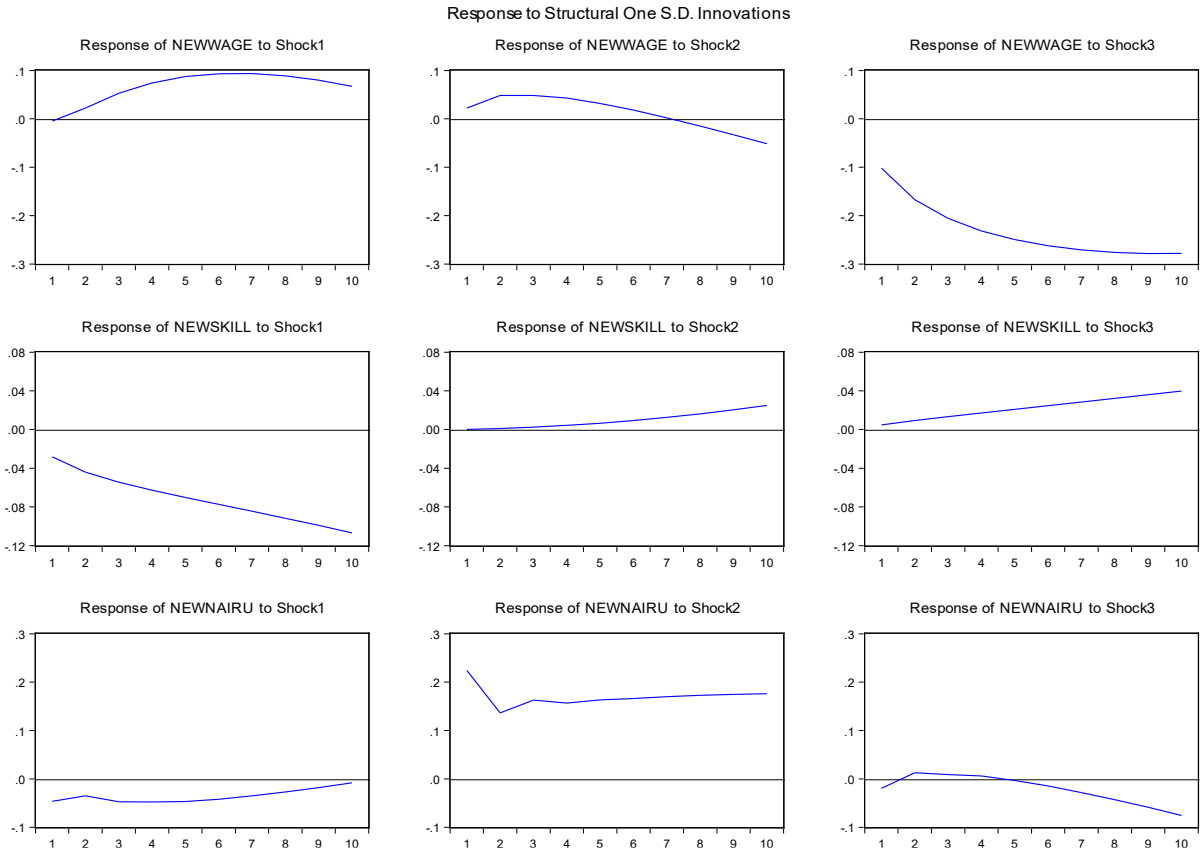

Figure 14. Responses of Three Endogenous Variables to One Structural Shock in Wage Model

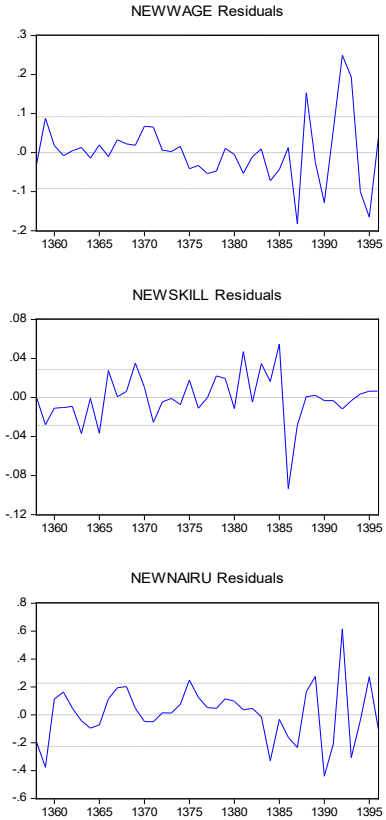

Figure 15. Residuals of Endogenous Variables in SVAR Model

Conclusion

This study puts forward the missing link in the existing literature on wage and human capital models. In other words, despite the recent expansion of university education and the resulting increase in human capital, the employment of educated workers in firms and their influence in wage bargaining have not kept pace. This problem reflects the bias of highly educated workers. Their neutrality has led to a decline in firms' human capital, which, in this study, is defined as skill bias. This study fit data from Iran, derived from microdata of rural and urban centers, to the model specification of the time series.

Additionally, according to the co-movement equation approach, co-movement in the long-run wage-skill relationship is lower than the actual curve would suggest. It implies that the recruitment of university-educated workers is below the optimal level. An estimate of the co-movement equation using a VECM yielded a coefficient of 2.07 for skill; the SVAR estimation also supported this. This study specified a wage model for the Iranian economy and subsequently estimated it using the SVAR approach on aggregated microdata. It is concluded that skilled workers play a significant role in wage bargaining for two to three periods, while in the longer horizons, comprising approximately seven periods, the educated population has a negative impact on wage levels. The results imply that human capital generates negative externalities for both the macroeconomy and individuals, thereby minimizing the significance of job search efforts among the educated, thwarting their expectations, and isolating them from the labour market. This study describes this phenomenon as skill bias, in which education, originally intended to facilitate wage bargaining in the labor market, gradually loses its effectiveness and becomes neutral, as illustrated by the case of Iran.

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Effects of foreign direct investment on climate change in the Asian region

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Abstract

Purpose — This research aims to empirically investigate and compare the effects of foreign direct investment on climate change in five South Asian nations.

Methodology — This research uses yearly data covering 1980–2020 in five South Asian nations: Bangladesh, India, Nepal, Pakistan, and Sri Lanka. Vector Autoregressive (VAR) methods, with variance decomposition and impulse response functions, provide the basis of the empirical data comparison.

Findings — This research shows that foreign direct investment's impact on pollution ranges from 1% to 10% in four countries and 16.13% in Pakistan. This indicates that in five South Asian states, there is little endogenous correlation between foreign direct investment and pollution. Furthermore, a shock to foreign investment improves the environmental conditions in Bangladesh and India while harming the growth of other nations.

Implications — The impact of foreign direct investment on pollution may vary based on each country's economic situation. Public efforts to enhance capital goods, education, health, and infrastructure are essential for reducing pollution and attracting foreign investment. Therefore, improved transparency and governance are essential for a positive relationship between growth and foreign investment.

Value/Originality — This research contributes to the analysis and comparison of the effects of foreign direct investment on climate change across five South Asian nations using Vector Autoregressive (VAR) methods.

Keywords — Climate change, foreign direct investment, South Asia, vector autoregressive

Introduction

Environmental contamination is a growing issue that concerns many nations and is studied by many academics. However, it still needs to be clarified and debated exactly what factors contribute to environmental contamination. Because of rising emissions from manufacturing and consumption, the environment is worsening. In addition to harming people's health and quality of life, this also contributes to global warming, a grave threat to human survival. Natural disasters, including super typhoons, droughts, and forest fires, are occurring more frequently and resulting in greater losses due to climate change (Omri & Kahouli, 2014; Behera & Dash, 2017).

The industrial sector is one of the main drivers of economic growth in these states, accounting for almost 26% of GDP. The most crucial factor influencing development in this

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industry is the increasing mobilization of foreign resources, which is needed to improve industrial production (Khan & Kim, 1999). In addition to a wide range of structural reforms and incentives to be friendly to foreign investors and local sectors, South Asia is implementing good macroeconomic policies (Khan & Samad, 2010; McKinnon, 2010; Sims, 1992). The relationship between FDI inflows and their drivers has been studied (Afza et al., 2019; Hakro & Ghumro, 2021). However, prior research on the connection between pollutant emissions and FDI needs to be more extensive. The role of foreign direct investment in economic growth is gradually growing, as is concern over environmental issues. As a result, the role of FDI has raised questions about how to enhance its capacity for innovation and efficiency (De Gregorio et al., 1998). Foreign direct investment (FDI) is a source of capital and can be essential for investments in technology, infrastructure, and other productive assets. This inflow of capital promotes economic growth and helps finance development initiatives. FDI often leads to the creation of new jobs. When foreign businesses invest in a nation, they typically hire local labourers, thereby reducing unemployment and creating job opportunities (Alfaro et al., 2021).

Foreign businesses frequently introduce cutting-edge management techniques, technology, and expertise to the nation where they operate. Increased productivity and competitiveness in home industries can result from this technology and skill transfer, advancing economic growth. FDI can increase imports and exports. Foreign businesses may export products and services made in the destination nation to increase export revenue. They might also import intermediate products and services, boosting commerce (Ndikumana & Verick, 2018). Foreign direct investment (FDI) frequently includes investments in the construction of factories, transportation networks, and utilities. In addition to helping foreign businesses, these investments strengthen the nation's infrastructure and encourage more trade. Foreign direct investment can produce positive spillover effects on domestic businesses and industries. For instance, through partnerships with regional suppliers, competition, and knowledge sharing, domestic businesses

Compared with developed countries, developing countries may have less stringent environmental laws. Several causes could include a need for more enforcement resources, conflicting development goals, or a desire to attract foreign capital to boost the economy. This could include measures or regulations that prioritize economic growth over environmental preservation, such as easing the process of obtaining permits or enforcing existing laws loosely. Due to lax environmental regulations, international investors may find it profitable to relocate their operations to these countries. By doing this, they may be able to avoid incurring expenses associated with meeting more stringent environmental regulations back home. The situation presents an opportunity for global investors to capitalize on the comparatively lighter regulatory burden. (Khan & Kim, 1999).

The literature has differing opinions on how foreign direct investment (FDI) affects environmental risk. Most studies (Frutos-Bencze et al., 2017; Jorgenson et al., 2007; Omri & Kahouli, 2014) conclude that FDI toxins the environment. On the other hand, other researchers contend that FDI enhances the host country's environment by deploying advanced climate-resilient technologies (Hines & Rice, 1994). This makes it challenging for policymakers and researchers to fully understand how FDI impacts the environment. According to empirical data (De Gregorio et al., 1998; McKinnon, 2010), the availability of capital resources supports economic activity. For this reason, the empirical literature (Frutos-Bencze et al., 2017; Jorgenson et al., 2007; Zhu et al., 2016) is leaning toward examining the impact of capital resources on environmental risk. There is little doubt that South Asia and Africa require additional funds to expand their economies (Ho et al., 2007).

For several reasons, the impact of FDI on the environment is very important. Advanced nations tighten environmental regulations as they become wealthier, making it increasingly costly for businesses that use a lot of carbon to stay in business. Most of these businesses relocate to emerging and developing nations with laxer environmental regulations. This is another reason why studies have found that FDI increases environmental risk. For instance, Singhania and Saini (2021) examined the relationship between FDI and environmental sustainability from 1990 to 2016 using a sample of 21 countries and a dynamic system GMM. The findings indicate that FDI significantly reduces environmental risk.

Empirical findings indicate that FDI significantly increases environmental risk in Africa (Halliru et al., 2020). This study also investigated the impact of foreign direct investment on the environment in Western Africa and found results that agreed with those of Bokpin (2017) and Yang et al. (2017). Numerous studies have linked foreign direct investment to poor environmental quality (Frutos-Bencze et al., 2017; Omri & Kahouli, 2014; Sbia & Shahbaz, 2017; Zheng & Sheng, 2017). The pollution haven theory is the foundation of every study that claims FDI pollutes the environment. This suggests that multinational corporations (MNCs) tend to select countries with the lowest labour, material, and land costs when establishing global branches (Levinson & Taylor, 2008). Conversely, other researchers contest the arguments of advocates of the pollution-haven theory by pointing out several flaws in their work, including inappropriate measurement methods and scant empirical evidence (Kim & Adilov, 2011; Demena & Afesorgbor, 2020). They conducted a thorough evaluation of the research examining how FDI affects emissions.

The main reasons for the contradictions in the literature include disparities in data samples (which combine industrialized and developing nations), variations in econometric approaches, differences in environmental indicators, and diverse control variables. The heterogeneity issues in the plethora of research are exacerbated by the use of different levels of development and emissions, which is why Halliru et al. (2020) employed 65 primary studies to create 1006 elasticities in their meta-analysis of the impact of FDI on environmental emissions. They also state that the underlying impact of FDI on environmental emissions is almost zero. However, after accounting for heterogeneity in the study, they found that FDI significantly reduces environmental emissions. Thus, the results of the studies on the effect of FDI on pollution levels have been conflicting. Few researchers have examined the effect of FDI on CO2 emissions across many countries. Instead, most of the literature focuses on the effect of FDI on carbon emissions in a single country.

Due to a shortage of domestic capital, South Asian countries are known for attracting the most foreign direct investment. They mainly rely on foreign finance to accelerate the state's pollution level and economic growth. This study examines the impact of Foreign Direct Investment (FDI) on environmental quality in five South Asian countries: Bangladesh, India, Nepal, Pakistan, and Sri Lanka. Time series data are available from 1980 to 2020 for these countries. By comparing the potential effects of foreign direct investment on pollution for each of the five South Asian countries, this study seeks to present empirical data. Generally, a complex interplay of variables, including the nature of investments, legal frameworks, technical developments, and the commitment of both local and foreign parties to environmental sustainability, determines how Foreign Direct Investment (FDI) affects pollution in South Asian nations. Effective environmental management and regulatory compliance are crucial for minimising potential drawbacks and optimising the benefits of FDI for sustainable development.

Methods

This study employs a vector autoregression (VAR) model using data from five South Asian countries from 1980 to 2020. The World Development Indicators, produced by the World Bank, provided the data for the three variables: real GDP per capita (hereafter, PGDP), pollution measured by carbon dioxide (hereafter, CO2), and foreign direct investment (hereafter, FDI).

The VAR model assesses the relative significance of numerous dynamic influences on macroeconomic variables (Bernanke, 1986; Sims, 1992). Additionally, the variance decomposition and impulse response function approaches are used to conduct the empirical analysis. The VAR model can be expressed as:

$$CO2_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 CO2_{t-1} + \sum_{i=1}^{p} \alpha_2 GDP_{t-1} + \sum_{i=1}^{p} \alpha_3 FDI_{t-1} + \varepsilon_t \quad (1)$$

$$GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 CO2_{t-1} + \sum_{i=1}^{p} \beta_2 GDP_{t-1} + \sum_{i=1}^{p} \beta_3 FDI_{t-1} + \mu_t \quad (2)$$

$$FDI_t = \gamma_0 + \sum_{i=1}^{p} \gamma_1 CO2_{t-1} + \sum_{i=1}^{p} \gamma_2 GDP_{t-1} + \sum_{i=1}^{p} \gamma_3 FDI_{t-1} + \epsilon_t \quad (3)$$

Where $\mathrm{CO2_t}, \mathrm{GDP_t}$, and $\mathrm{FDI_t}$ represent the values of $\mathrm{CO2}$ emissions, PGDP, and FDI at time t, respectively. α_0, β_0, and γ_0 are the intercept terms. α_1, β_1, and γ_1 are the coefficients representing the effects of lagged values of $\mathrm{CO2}_t$, α_2, β_2, and γ_2 are the coefficients representing

the effects of lagged values of $\mathrm{GDP_t}$, $\alpha_3, \beta_3,$ and γ_3 are the coefficients representing the effects of lagged values of $\mathrm{FDI_t}$ on the current values of each variable. ε_t, μ_t, and ϵ_t are error terms representing the stochastic disturbances or shocks in the system.

The time series of endogenous variables must be stationary, and no cointegration exists to estimate a VAR model. A VAR model helps assess the association among a set of economic variables. Each variable has an equation describing its evolution based on its lags and the lags of all the other variables in the model. This is how all variables in a VAR model are handled symmetrically. The estimates produced can also be used for forecasting. However, if a long-term association between the variables is found, a VEC model is calculated before variance decomposition and impulse response function techniques are used.

Results and Discussion

Unit root tests are conducted before the empirical analysis to determine whether the time series data are stationary. That is, the stationarity requirement of the data is ensured using the conventional technique of the augmented Dickey-Fuller (ADF) test. All conceivable instances of "intercept," "intercept + trend," and "none" are considered, using a selection criterion to identify the best lags for the unit root tests. The results of unit root tests are shown in Table 1, where all variables are non-stationary at levels but stationary when transformed to the first differences, i.e., when each variable is integrated of order one (I(1)), the most basic form of integration.

Table 1. Unit root test

Country	Variable	Intercept		Intercept and Trend		None	
		Level	1st Diff.	Level	1st Diff.	Level	1st Diff.
Bangladesh	CO2	12.23	-0.95	1.83	-7.96**	1.88	0.90
		(1.00)	(0.82)	(1.00)	(0.00)	(0.96)	(0.90)
	PGDP	-2.54	-7.23**	-2.76	-6.14**	0.86	-9.04**
		(0.50)	(0.00)	(0.22)	(0.00)	(0.88)	(0.00)
	FDI	-0.67	-7.54**	-1.39	-4.17*	-2.69*	-2.62
		(0.84)	(0.00)	(0.38)	(0.01)	(0.01)	(0.10)
India	CO2	3.06	-4.82**	-1.29	-6.04**	7.81	-0.21
		(1.00)	(0.00)	(0.88)	(0.00)	(1.00)	(0.60)
	PGDP	-0.91	-7.27**	-4.33	-7.12**	0.55	-7.29**
		(0.77)	(0.00)	(0.06)	(0.00)	(0.83)	(0.00)
	FDI	0.07	-7.22**	-1.21	-5.09**	-1.61	-6.71**
		(0.96)	(0.00)	(0.89)	(0.00)	(0.10)	(0.00)
Nepal	CO2	1.67	-6.88**	-0.82	-7.86**	7.81	-0.21
		(1.00)	(0.00)	(0.96)	(0.00)	(1.00)	(0.60)
	PGDP	-0.91	-7.27**	-2.50	-7.21**	0.55	-7.29**
		(0.77)	(0.00)	(0.33)	(0.00)	(0.83)	(0.00)
	FDI	0.07	-7.22**	-2.07	-7.35**	-1.61	-6.71**
		(0.96)	(0.00)	(0.55)	(0.00)	(0.10)	(0.00)
Pakistan	CO2	-0.89	-5.05**	-3.71	-5.05**	7.75	-3.73*
		(0.75)	(0.00)	(0.24)	(0.02)	(1.00)	(0.01)
	PGDP	-2.30	-7.60	-5.16*	-6.73**	4.07	-8.24**
		(0.62)	(0.00)**	(0.01)	(0.00)	(1.00)	(0.00)
	FDI	0.40	-8.11**	-2.48	-8.24**	2.16	-7.42**
		(0.98)	(0.00)	(0.34)	(0.00)	(0.99)	(0.00)
Sri Lanka	CO2	1.17	-5.16**	-374	-6.23*	14.91	-1.28
		(1.00)	(0.00)	(0.72)	(0.01)	(1.00)	(0.21)
	PGDP	-0.21	-8.25**	-2.42	-8.30**	2.42	-7.40**
		(0.93)	(0.00)	(0.37)	(0.00)	(1.00)	(0.00)
	FDI	-3.58	-7.95**	-3.42	-7.82**	0.08	-8.05**
		(0.11)	(0.00)	(0.06)	(0.00)	(0.71)	(0.00)

Notes: (i) *p*-values are provided in parentheses. (ii) * and **are significant at 5% and 1 % significance levels, respectively.

Examining whether FDI and CO2 have a long-term relationship is crucial because I(1) governs all variables. Table 2 presents the test results for cointegrating relationships using the efficient method proposed by Johansen (1988). The null hypothesis is that there is no cointegrating relationship between CO2, FDI, and GDP. As a result, the analysis is based on VAR models.

Table 2. Cointegration test

Country	H_0	Trace Test		Max-Eigenvalue Test	
		H_1	Statistic	H_1	Statistic
Bangladesh	$\gamma = 0$	$\gamma \geq 1$	32.71**	$\gamma = 1$	25.52**
			(0.00)		(0.00)
	$\gamma \leq 1$	$\gamma \geq 2$	7.19	$\gamma = 2$	4.20*
			(0.30)		(0.51)
India	$\gamma = 0$	$\gamma \geq 1$	64.12**	$\gamma = 1$	39.82**
			(0.00)		(0.00)
	$\gamma \leq 1$	$\gamma \geq 2$	24.30**	$\gamma = 2$	17.83**
			(0.00)		(0.05)
Nepal	$\gamma = 0$	$\gamma \geq 1$	37.77	$\gamma = 1$	16.23
			(0.13)		(0.76)
	$\gamma \leq 1$	$\gamma \geq 2$	20.53	$\gamma = 2$	12.79
			(0.31)		(0.61)
Pakistan	$\gamma = 0$	$\gamma \geq 1$	26.43**	$\gamma = 1$	18.24**
			(0.00)		(0.00)
	$\gamma \leq 1$	$\gamma \geq 2$	9.18	$\gamma = 2$	7.99
			(0.44)		(0.37)
Sri Lanka	$\gamma = 0$	$\gamma \geq 1$	41.31	$\gamma = 1$	24.62
			(0.54)		(0.77)
	$\gamma \leq 1$	$\gamma \geq 2$	4.68	$\gamma = 2$	4.75
			(0.39)		(0.40)

Notes: (i) *p*-values are provided in parentheses. (ii) * and **: significant at 5% and 1 % significance level, respectively

Table 3. Variance decomposition of FDI

Period	Bangladesh	India	Nepal	Pakistan	Sri Lanka
FDI impact on CO2					
1	0.90	3.20	2.90	8.42	5.71
2	1.10	4.22	4.56	11.11	7.37
3	1.44	5.31	5.96	13.11	8.73
4	1.60	6.63	7.16	14.12	9.23
5	1.95	7.80	8.16	16.13	10.94
FDI impacts on GDP					
1	0.00	0.00	0.00	0.00	0.00
2	0.35	5.77	3.28	14.62	2.22
3	3.13	25.22	3.13	26.16	2.89
4	7.48	45.29	3.26	29.47	2.83
5	9.06	54.59	3.64	28.30	3.56

Note: The figures denote the impact of FDI on pollution.

The outcomes of variance decomposition for FDI shocks are shown in Table 3. The results of the fifth period show that the impacts of changes in FDI on the calculation of CO2 are 1.95%, 7.80%, 8.16%, 16.13%, and 10.94%, respectively, for Bangladesh, India, Nepal, Pakistan, and Sri Lanka. In other words, the effect of FDI shocks on CO2 variation ranges from 1% to 16%, with Pakistan exerting the greatest influence (16.13%) and Bangladesh the least (1.95%). Apart from Pakistan, the CO2 shock alone accounts for over 90% of the CO2 volatility in five nations. This indicates that in five South Asian countries, the endogenous relationship between foreign investment and pollution is insignificant. However, when comparing Bangladesh and Pakistan, the

impact of an FDI shock on pollution is estimated to vary greatly across countries, depending on each country's economic environment.

On the other hand, the FDI's impact on GDP for the fifth period is 9.06%, 54.59%, 3.64%, 28.30%, and 3.56%, respectively. In this case, India has the highest impact on GDP (54.59%), and Sri Lanka has the lowest (3.56%). FDI significantly impacts India's GDP due to its advantageous economic policies, sizable and expanding market, sectoral diversity, and strategic advantages.

Table 4 displays the results of the variance breakdown of CO2 shocks. The fifth period's findings indicate that for Bangladesh, India, Nepal, Pakistan, and Sri Lanka, the effects of variations in CO2 on the computation of FDI are 33.45%, 1.21%, 3.97%, 0.89%, and 2.82%%, respectively. Otherwise, any shock to CO2 impacts FDI variation, which ranges from 0.5% to 33%. Notably, Bangladesh has the greatest impact (33.45%), while Pakistan has the least (0.89%). This suggests that the endogenous association between pollution and foreign investment is insignificant in five South Asian countries. However, comparing Bangladesh and Pakistan reveals that the predicted effects of a foreign direct investment shock on pollution differ significantly across the two countries' economic environments.

Conversely, in that order, the fifth period's CO2 impacts on GDP are 14.38%, 50.48%, 0.91%, 1.41%, and 2.30%. In this instance, Nepal has the least impact on GDP (0.91%), while India has the greatest (50.48%). Several factors contribute to India's high GDP despite its high CO2 emissions, including reliance on agriculture, health impacts, energy-sector issues, urbanization, the effects of climate change, water resource management, financial costs associated with mitigation, and the tourism industry. When considered as a whole, these elements illustrate the intricate relationship between India's economic growth and environmental sustainability. Integrated policies and investments that balance environmental preservation and economic development are necessary to control CO2 emissions and mitigate their effects. In the case of Nepal, CO2 has a low impact because CO2 emissions on Nepal's GDP can be attributed to several factors, including its low industrial base, reliance on renewable energy, emphasis on sustainable tourism, efficient government policies, small urban footprint, adaptive economic practices, limited dependency on fossil fuels, and international support. Nepal can manage its environmental impact and preserve economic stability.

Table 4. Variance decomposition of CO2

Period	Bangladesh	India	Nepal	Pakistan	Sri Lanka
CO2 impact on FDI					
1	0.00	0.00	0.00	0.00	0.00
2	2.16	0.88	3.38	0.78	2.27
3	19.62	2.35	4.20	1.06	3.33
4	29.51	1.82	4.20	1.00	3.13
5	33.45	1.21	3.97	0.89	2.82
CO2 impacts on GDP					
1	0.00	0.00	0.00	0.00	0.00
2	0.48	9.65	0.25	0.05	0.00
3	6.70	26.95	0.26	0.25	0.02
4	13.14	42.41	0.35	0.83	0.45
5	14.38	50.48	0.91	1.41	2.30

The variance decomposition of GDP is presented in Table 5. The impact on FDI in the fifth period varies from 1% to 10%, with the highest digit in Bangladesh and the lowest in India. The disparities in economic size, structure, sectoral focus, and growth stages contribute to higher FDI shocks to GDP in Bangladesh than in India. While India's more significant and diversified economy produces milder GDP responses to FDI inflows, Bangladesh's smaller and more concentrated economy leaves it more vulnerable to significant effects from FDI. GDP's impact on CO2 emissions ranges from 2% to 37%, with the highest value in India and the lowest value in Pakistan.

In conclusion, India's broad and diverse industrial base, high fossil fuel consumption, rapid urbanization, and historical emphasis on economic expansion over environmental sustainability are the leading causes of the country's most significant CO2-related shocks to GDP. On the other hand, Pakistan's less industrialised economy, smaller population, slower rate of urbanisation, growing emphasis on renewable energy, and more recent adoption of efficient technologies account for the country's lower CO2 emissions per unit of GDP. The GDPs of the two countries are affected differently by CO2 emissions due to differences in their structures and policies.

Table 5. Variance decomposition of GDP

Period	Bangladesh	India	Nepal	Pakistan	Sri Lanka
GDP impact on FDI					
1	0.15	20.66	0.22	0.21	9.25
2	1.49	10.48	1.33	0.08	10.69
3	3.88	5.46	2.97	0.15	9.65
4	6.57	2.58	2.79	0.63	8.36
5	10.54	1.11	2.42	1.49	7.44
GDP impacts on CO2					
1	0.19	7.48	0.67	0.18	13.63
2	0.20	19.37	37.40	0.92	9.86
3	1.36	27.19	35.67	1.59	9.64
4	3.96	33.22	30.68	2.12	9.65
5	7.70	37.90	24.46	2.46	9.69

Impulse Response Function

Figures 1-5 show the results of the impulse response functions for the five countries. Here, we present them country-wise. The impulse response of three variables (CO2 emissions, FDI, and GDP) in India shows that a shock to CO2 emissions leads to a modest increase in the first period and a cumulative effect in subsequent periods. FDI shows a negative response initially but leads to an immediate increase in GDP. A shock to GDP leads to a significant positive response, boosting economic output. The analysis highlights the dynamic interplay between these variables over time.

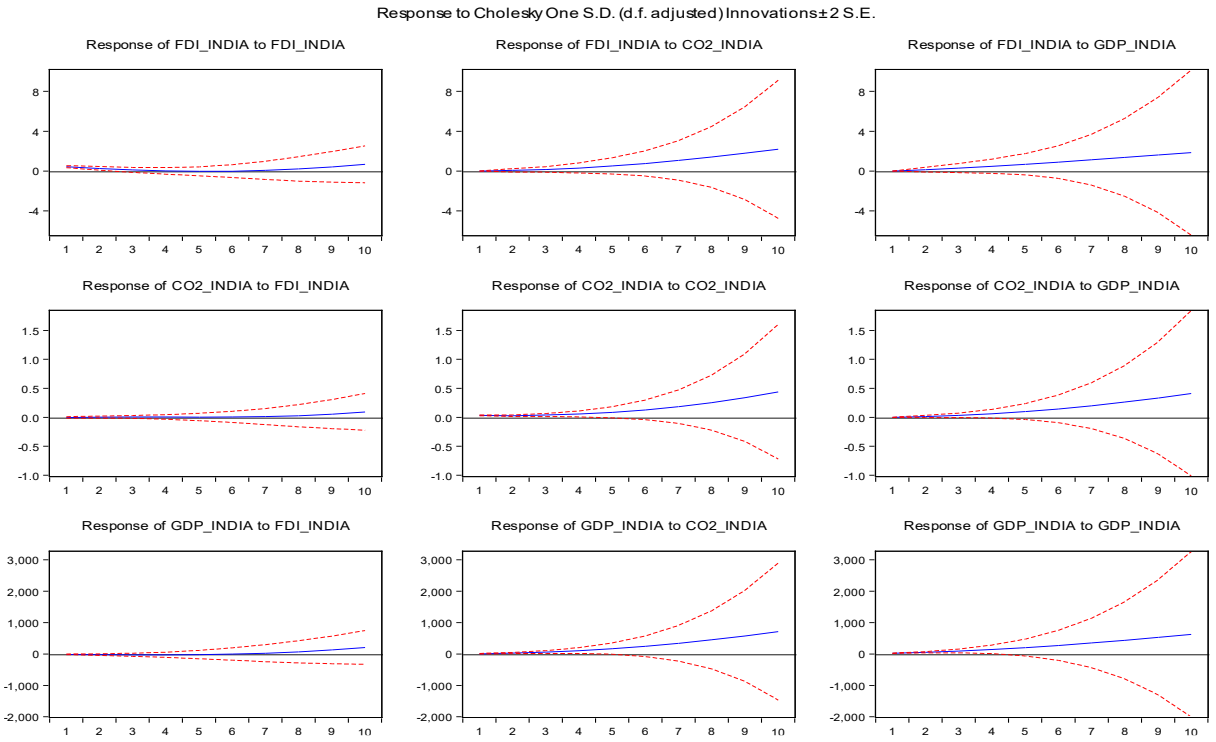

Figure 1. Impulse response function of India

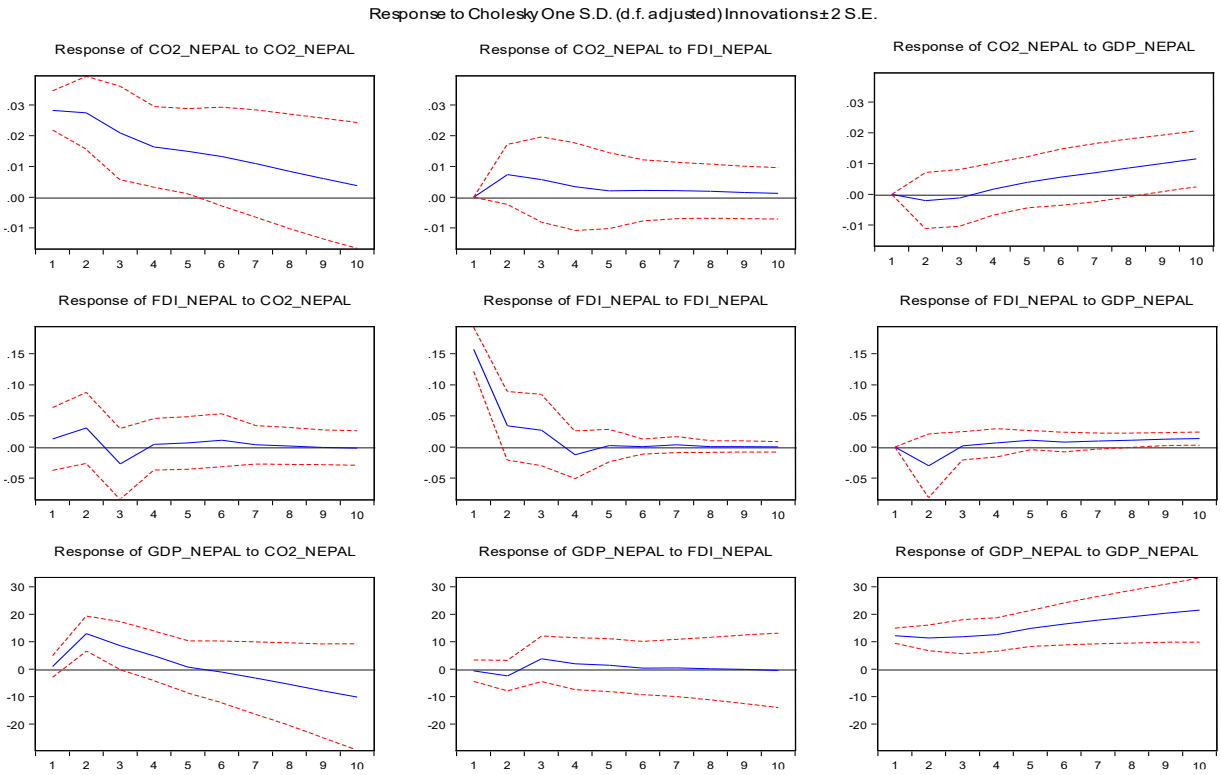

Figure 2. Impulse response function of Nepal

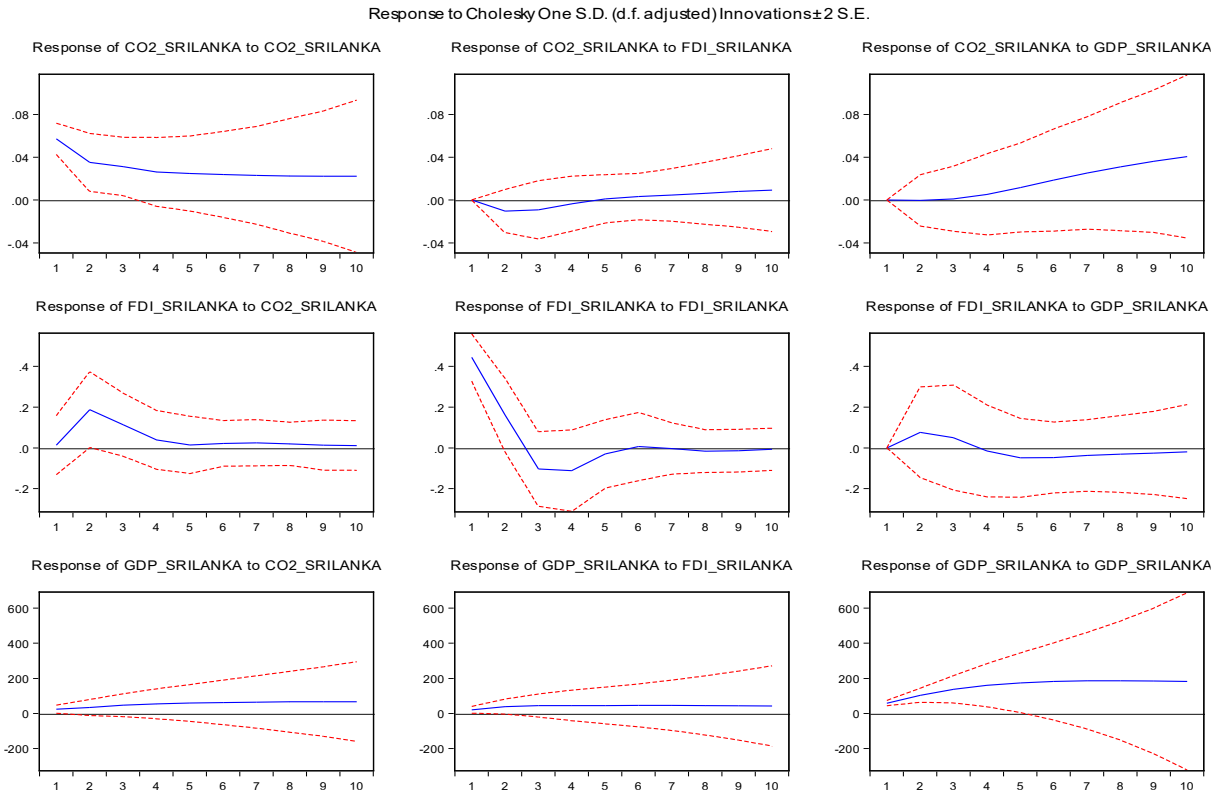

Figure 3. Impulse response function of Sri Lanka

The CO2 emissions shock has a cumulative impact on Nepal's CO2 emissions. The FDI shock results in a slight increase in FDI but has no significant impact on CO2 emissions or GDP. The GDP shock significantly increases GDP but negatively affects CO2 emissions and FDI. In Sri Lanka, a shock to CO2 emissions initially increases CO2 emissions itself but has no immediate impact on FDI or GDP. A shock to FDI initially increases FDI but does not significantly affect

CO2 emissions or GDP in the short term. A shock to GDP initially boosts GDP significantly and increases CO2 emissions and FDI, though these effects diminish over time. In the case of Bangladesh, a shock to CO2 emissions initially increases CO2 emissions, while a shock to FDI initially boosts FDI and has a positive impact on GDP over time. A shock to GDP initially reduces CO2 emissions but, over time, increases FDI and GDP. In Pakistan, a shock to CO2 emissions initially increases CO2 emissions, while a shock to FDI initially boosts FDI and positively impacts GDP over time. A shock to GDP initially has a positive impact on FDI and GDP itself, but leads to decreased CO2 emissions over time.

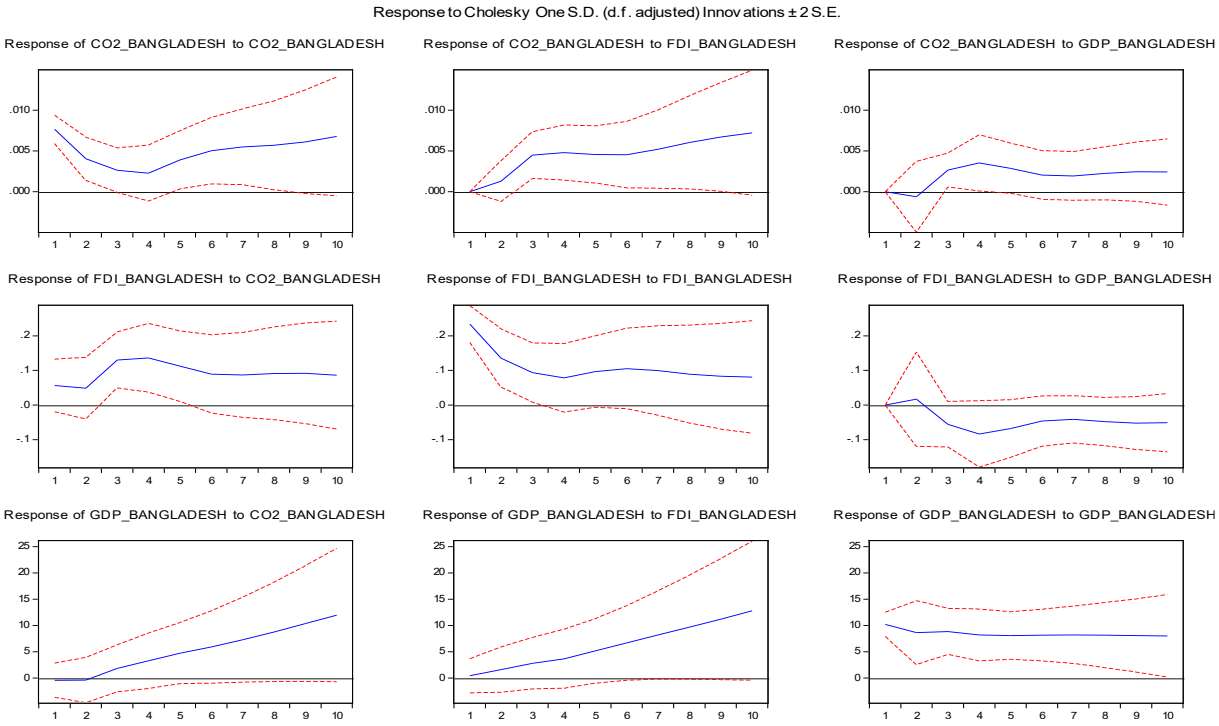

Figure 4. Impulse response function of Bangladesh

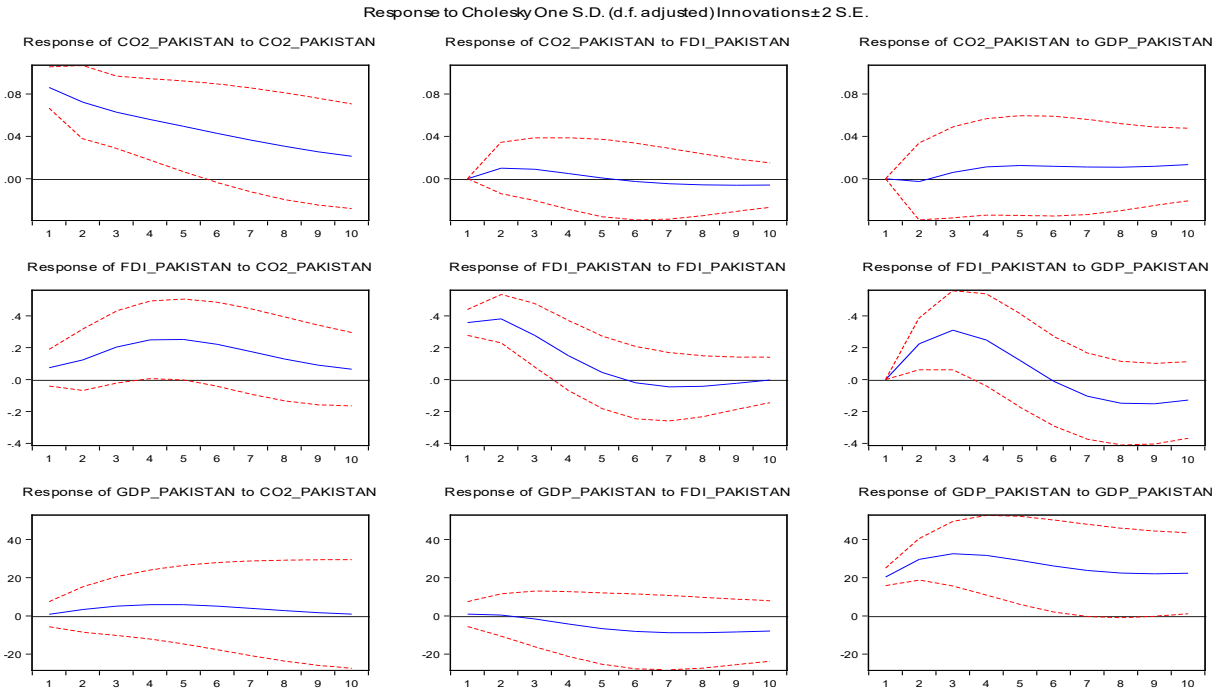

Figure 5. Impulse response function of Pakistan

Many studies have noted that the governance and corruption of the recipient nation may have an impact on how much FDI causes pollution (Ahmed & Long, 2012), (Levinson & Taylor, 2008), (Alfaro et al., 2010; Lai et al., 2020), (Ho et al., 2007) highlighted the possibility that foreign inflow may influence governance, demonstrating an endogenous relationship between the two. Therefore, the available research concluded that foreign direct investment might have a detrimental effect on environmental quality in nations where corruption and weak governance are widespread.

In the South Asian region, foreign direct investment has a wide range of intricate consequences on pollution. More industrial emissions and the relocation of polluting businesses are two outcomes of FDI, even though it can also lead to the transfer of cleaner technologies and more substantial environmental restrictions. The types of industries receiving FDI, the strength and implementation of environmental laws, and the level of economic growth affect the extent to which FDI impacts pollution in South Asia (Acheampong, 2019; Ntow-Gyamfi et al., 2020). Empirical data from many Asian nations reveal inconsistent outcomes. This study examined the impact of foreign direct investment (FDI) on Indonesia's CO2 emissions from 1975 to 2011. According to their findings, FDI initially increases pollution because it attracts industries that produce more emissions. However, as the economy expands and new technologies are embraced, FDI eventually helps lower pollution levels (Shahbaz et al., 2013). On the other hand, research on India, one of Asia's top receivers of foreign direct investment, suggests a more nuanced link. Mukherjee's (2010) study examined data from 1985 to 2008 and found that although foreign direct investment (FDI) has boosted economic growth, it has also markedly increased carbon dioxide emissions.

The energy-intensive sectors, which account for the majority of FDI in India, are blamed for this rise. However, the report also notes that areas receiving more foreign direct investment tend to enact stronger environmental laws, which ultimately lead to lower pollution levels (Mukherjee, 2010). Cross-country studies are also excellent sources of information on how FDI has affected the environment in newly industrialized countries from 1971 to 2007. According to the report, FDI has significantly increased pollution levels by allowing polluting companies to relocate. However, these consequences are beginning to be lessened with the introduction of more stringent environmental regulations and more environmentally friendly technologies (Hossain, 2011). The diverse empirical data emphasize the intricate relationship between FDI and Asian pollution. It emphasizes that how foreign direct investment (FDI) affects pollution depends on several variables, such as the industries attracting FDI, the state of the host nation's environmental laws, and the host nation's economic progress. Asian policymakers must strike a balance between preserving and enhancing environmental quality and attracting foreign direct investment. To ensure that foreign direct investment (FDI) has a positive impact on sustainable development, it is crucial to strengthen environmental legislation, promote the adoption of clean technologies, and foster green industries.

Conclusion

Using annual data from 1980 to 2020, this study empirically investigates the effects of foreign direct investment on pollution in Bangladesh, India, Nepal, Pakistan, and Sri Lanka, 5 South Asian nations. Although considerable research has been conducted on the relationship between FDI and pollution in certain developing nations, this study compares data from five South Asian nations to draw plausible conclusions. Using a vector autoregression model based on variance decomposition, it specifically explored how foreign direct investment affects pollution.

As a result, the impact of foreign direct investment on pollution may vary depending on each country's economic situation. A wide range of public policies can impact every country's economic circumstances. Public efforts to enhance capital goods, education, health, and infrastructure are essential for reducing pollution and attracting foreign investment. Additionally, the success of foreign investment and, by extension, economic progress depends on establishing the rule of law and sound administration. All these infrastructural upgrades, a stronger human capital base, a better business climate, and the absence of corruption require the government's cooperation. The markets are one of many ways to solve these problems.

Public policies that encourage public investment in public health and education, promote better governance, establish an efficient tax system, share the tax burden equitably, and foster trust in public institutions are critical. Thus, the correlation between foreign investment and pollution is more evident in countries with efficient public administration. Therefore, improved transparency and governance are essential for a positive relationship between growth and foreign investment. Additionally, it is more effective to promote capital-intensive products rather than consumer goods to attract foreign investment. It is crucial to evaluate the impact of foreign investment inflows on pollution by examining governance and transparency, as well as by using data on the composition of foreign direct investment.

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Do governance indicators have a role in remittances-growth nexus in Egypt?

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Abstract

Purpose — Drawing on annual data from 1996 to 2022, this study aims to examine the effect of Egypt's real GDP growth.

Methods — Autoregressive Distributed Lag (ARDL) and Cointegration techniques are applied by first examining the stationarity of the series by utilizing the Augmented-Dicky-Fuller (ADF) unit root test. The bound cointegration test is then implemented to evaluate the existence of cointegration among the variables.

Findings — The results indicate that the GDP growth rate has a long-run positive relationship with remittance inflows in Egypt. This paper also finds that the average governance indicators in Egypt, including government effectiveness, political stability, control of corruption, regulatory quality, voice and accountability, and the rule of law, can help facilitate the long-term impact of remittances on GDP growth.

Implication — The findings suggest that maintaining high levels of governance indicators is crucial for Egypt to benefit from remittances and promote its economic growth.

Originality/value — The study is a pioneer in incorporating average governance indicators into the remittance-growth nexus study for Egypt. The study aims to examine whether governance quality affects the remittance–growth nexus and whether a threshold level of average governance indicators exists below which remittance inflows fail to stimulate economic growth.

Keywords — Remittances, economic growth, ARDL model, governance indicators.

Introduction

Remittance[1] plays an essential role in economic prosperity by facilitating the transfer of money from migrant employees to their households. This process is expected to revive global remittance flows, with annual averages of approximately US$123.7 billion from 1970 to 2000, US$418 billion in 2010, and US$766 billion in 2022. In recent years, remittance flows to developing countries have surpassed the total amount of foreign direct investment and official development assistance, and this disparity is increasing (World Bank, 2024). According to the DESA (2020) report, remittances initially go to lower-middle-income countries, with a higher share allocated to low-income countries. According to the OECD, Egypt is the fifth-highest recipient of remittances globally, with USD 28.3 billion in 2022, accounting for approximately 10% of its GDP. The importance of

[1]Workers' or migrant remittances are defined as a portion of migrants' earnings, sent home in cash or goods, to support their families.

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this paper lies in the fact that remittances play a more significant role in the inflows of global capital into several emerging economies. This is especially true for Egypt, where remittances have three times the impact as foreign direct investment (FDI) and foreign aid. Analyzing the impact of remittances has received much attention since the 1990s (see Elsadig & Rahim, 2023).

Remittances are attracting increasing attention due to the substantial volume of outflows to developing countries and their significant impact on the economies of receiving nations. Egypt is among the top five emerging economies receiving remittances in 2023. Remittances to the MENA region increased by 80.6%, around US $67 billion, between 2010 and 2022, whereas the growth rate for all low and middle-income countries combined was 95.2%. The top nine MENA countries in terms of remittance recipients in 2022 are Egypt, Morocco, Jordan, Yemen, Tunisia, Algeria, Sudan, Turkey, and Iraq (see Figure 1), with the highest and lowest ranked countries receiving US$28.33 and US$0.6 billion, respectively, according to the World Bank (World Bank, 2024).

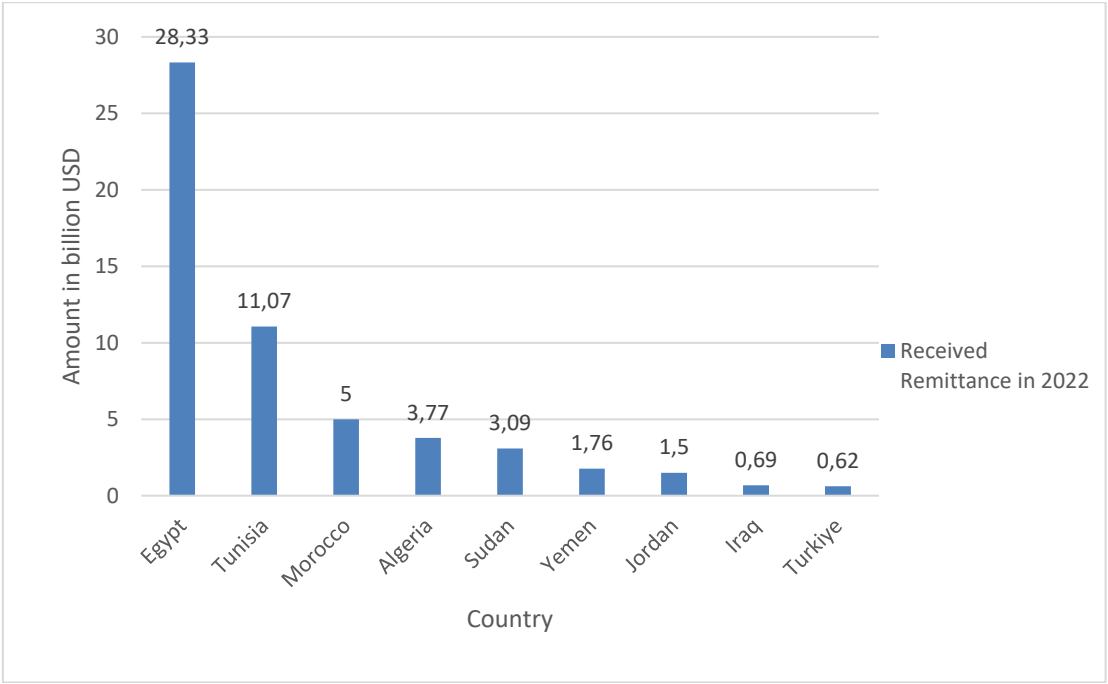

Figure 1. Top 9 remittance-receiving countries in the MENA region.

Chenery (1967) postulates that the Harrod-Domar growth model has been used to explain how developing countries can close the savings-investment gap by taking advantage of remittances and foreign inflows. As a developing country, Egypt has benefited significantly from remittances sent by millions of Egyptians working overseas to support their families and communities; remittances are an essential source of income for the country. Egypt's economy relies heavily on remittances, as they provide a reliable source of foreign currency and help maintain the nation's balance of payments. Additionally, remittances support economic growth and the fight against poverty, enhancing the living standards of millions of Egyptians. One of the main advantages of Egypt is its large population of more than 100 million in 2022, with over half of its citizens aged 25 and below. As a result, Egyptians have become highly mobile and established strong communities throughout most Arab states, especially in Libya, Iraq, Jordan, and the Gulf Cooperation Council states (Sadiq & Tsourapas, 2021). Economic remittances were seen as a significant source of personal income in Egypt.

Despite remittances' growing importance in overall international financial inflows, the nexus between remittances and economic growth has yet to be extensively explored, especially in Egypt. Also, several empirical studies exploring the relationship between remittance inflow and economic growth are inconclusive. While some studies found remittances to be positively linked with economic growth (Abdulai, 2023; Yavuz & Bahadir, 2022; Cazachevici et al., 2020;

Matuzeviciute & Butkus, 2016; Rehman et al., 2021; Chowdhury, 2016), others found no significant or negative relationship between economic growth and remittances (Alhassan, 2023; Anetor, 2019; Jushi et al., 2021; Sutradhar, 2020; Ustarz & Issahaku, 2017; Sobiech, 2015). The results of these studies vary due to variations in the data and methodology employed, as well as the specific conditions of each country under study. The relationship between remittances and economic growth has attracted significant attention in recent years; however, the literature has yet to establish the nature of this relationship. Some literature suggests that remittances stimulate economic growth by increasing consumption; however, other research finds that remittances have a negative or no effect on economic growth. Olayungbo and Quadri (2019) examined the association between remittance inflows, financial development, and economic growth in 20 sub-Saharan African countries from 2000 to 2015. Applying the PMG estimates and vector autoregressive (VAR) techniques, the study revealed a positive long-run and short-run relationship between remittances and human development. Rehman et al. (2021) examined the impact of remittance inflows on private investment in six Western Balkan countries using the GMM methodology from 2000 to 2017. Their findings revealed that remittance inflows positively influenced private investment and improved economic growth in these countries.

Similarly, Islam (2022) examined the association between remittances and economic growth using data for the period 1986-2019, applying a panel of selected Asian economies and employing generalized least squares (GLS) and fully modified ordinary least squares (FMOLS) techniques. The results of this study suggest that remittances are a key factor in improving the economic growth of the countries under study. Imai et al. (2014) investigated the impact of remittances on GDP per capita growth using annual panel data for 24 Asia-Pacific countries from 1980 to 2009. Using the same technique, Chowdhury (2016) assessed the basic Solow growth model by examining the relationship between foreign remittances and financial development for 33 top remittance recipient developing countries from 1979 to 2011. The results indicate that remittances significantly influenced economic growth. The most recent study by Abdulai (2023) examined the impact of remittances on GDP growth in Ghana from 1990 to 2020, utilizing the ARDL estimation technique. The results show a long-run relationship between remittances and several macroeconomic indicators, namely population growth rate, FDI, unemployment rate, inflation, and globalization, with economic growth.

While the above literature shows that the inflow of remittances directly or indirectly promotes the economic growth of recipient countries by improving financial development indicators, several studies have concluded that remittances are negatively linked to or have no effect on economic growth. Using the VAR model, Jushi et al. (2021) examined the relationship among remittances, trade openness, foreign direct investment (FDI), and economic growth in Western Balkan countries. Their results suggested that remittances are insignificant in explaining the variation in economic growth of these countries. Sobiech (2015) examined the effect of remittances on economic growth in a panel of 54 developing countries from 1970 to 2010.

Similarly, Oteng-Abayie et al. (2020) used the ARDL technique to investigate the impact of remittances on economic growth in Ghana's case. Their results revealed that the economic growth of Ghana County is negatively affected by the long-term inflow of remittances. Tchekoumi and Nya (2023) applied panel smooth threshold regression (PSTR) and the Generalized Method of Moments (GMM) to analyze the impact of migrant remittances on economic growth across six African countries in the CEMAC zone from 1990 to 2018. The results show that remittances can affect the economic growth of these countries, depending on their levels of trade openness, political stability, and private investment.

The literature on the impact of remittances on economic growth shows that it not only fails to provide a clear-cut answer on the specific impact of remittances on economic growth but also overlooks the role of average governance indicators and their moderating effect on remittance inflows, which can enhance growth. This study narrows the gap in the previous literature by focusing on Egypt, which has been underrepresented in studies, and by controlling for the role of governance to capture the quality of institutions in Egypt using the ARDL technique. The current study fills this gap in the literature by employing a more sophisticated econometric technique and

including governance quality indicators to evaluate the impact of remittances on economic growth in Egypt. The remainder of this study is organized as follows. Section 2 outlines the methodology and data employed. Section 3 presents the estimation results and offers a discussion of the results. Section 4 concludes.

Methods

Data Source

The study relies on macro-level data from 1996 to 2022, constructed from the World Bank (2024) Database. Firstly, the study employs unit root tests to establish the stationarity of the series using the Augmented Dickey-Fuller (ADF) method (Dickey & Fuller, 1979). It then employs the bound cointegration test to evaluate the series's cointegration after ensuring that no unit roots are present. The bound F-statistic is used to test the null hypothesis of no level cointegration against the alternative of level cointegration. We reject the null hypothesis and accept the alternative that there is a long cointegration between the variables if the calculated F-statistic is greater than the critical value from the F-statistic of the upper bound. We estimate the conditional ARDL long-run model to examine the long-run association among the series. In determining the responsiveness of growth rate to remittances in functional form, the study follows the empirical model of (Bucevska, 2022; Abdulai, 2023) with a modification by adding the role of governance indicators as follows:

$$\mathrm{GDP} = f\ (\mathrm{INF}, \mathrm{POPGRO}, \mathrm{FDI}, \mathrm{REMIT}, \mathrm{GOV.IND}, \mathrm{UNEMP}, \mathrm{TRADE}, \mathrm{ODAA}, \mathrm{GOV.EXP}, \mathrm{INVES}) \quad (1)$$

where REMIT is the remittances received, INF is the inflation rate measured by the consumer price index (CPI), and GOV.IND is the average of six governance indicators to measure the quality of institutions in Egypt; UNEMPT is the unemployment rate. The rest of the variables are defined in Table 1.

Table 1. Variables and their Measurements

Variable	Measurement	Symbol	Unit	Source
GDP growth rate	Annual percentage growth rate of GDP at market prices based on constant local currency (2015 prices)	GDP	Percent	World Bank
Inflation rate	Inflation measured by the percentage change in the consumer price index (CPI).	INF	Percent	World Bank
Population growth rate	The annual population growth rate for year t is the exponential rate of growth of the midyear population from year t-1 to t, expressed as a percentage.	POPGRO	Percent	World Bank
Foreign direct investment	Foreign direct investment is the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors and is divided by GDP	FDI	Percent of GDP	World Bank
Remittances	International migrants' remittances are received as a share of GDP.	REMIT	Percent of GDP	World Bank
Quality of institutions	It is the average of six governance indicators, including government effectiveness, political stability, control of corruption, regulatory quality, voice and accountability, and the rule of law, to measure the quality of institutions in Egypt.	GOV. IND	Estimated	World Bank

Variable	Measurement	Symbol	Unit	Source
Unemployment rate	the share of the labor force that is without work but available for and seeking employment	UNEMP	Percent	World Bank
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	TRADE	Percent of GDP	World Bank
Net official development assistance	Net official development assistance is the disbursement flows. Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients.	ODAA	Percent of GDP	World Bank
Government expenses	Cash payments for operating activities of the government in providing goods and services. It includes compensation of employees (such as wages and salaries), interest and subsidies, grants, social benefits, and other expenses, including rent and dividends.	GOV.EXP	Percent of GDP	World Bank

Model

The linear form of Equation 1 is as follows:

$$GDP_t = a_0 + a1\ INF_t + a_2\ POPGRO_t + a_3\ FDI_t + a_4\ REMIT_t + a_5\ GOV.IND_t + a_6\ UNEMP_t + a_7 TRADE_t + a_8\ ODAA_t + a_9\ GOV.EXP + \varepsilon_t \quad (2)$$

There are several advantages of using the ARDL approach in this study. Firstly, it is more reliable to model a series of different orders to capture the short- and long-run impacts of our interest variables. Secondly, it has an apparent superiority over the conventional or widely utilized cointegration models of the Johansen test (Johansen & Juselius, 1990) and Engle-Granger (Engle & Granger, 1987). More importantly, the advantage lies in its capacity to generate hypotheses about the estimated coefficients in the long run with small samples (Menegaki, 2019) and its approach to endogeneity by incorporating lags into the model (Abdulai, 2023). The ARDL method estimates both short and long-run parameters simultaneously and is specified as follows:

$$\begin{aligned} \Delta\ GDP_t = {} & \beta_0 + \beta_1\ GDP_{t-1} + \beta_2\ INF_{t-1} + \beta_3\ POPGRO_{t-1} + \beta_4\ FDI_{t-1} + \beta_5\ REMIT_{t-1} + \beta_6\ GOV.IND_{t-1} + \beta_7\ UNEMP_{t-1} + \beta_8\ TRADE_{t-1} + \beta_9\ ODAA_{t-1} + \beta_{10}\ GOV._{t-1} + \\ & \sum_{r=1}^{q} \varphi_1\ \Delta\ GDP_{t-r} + \sum_{r=1}^{k} \varphi_2\ \Delta\ INF_{t-r} + \sum_{r=1}^{k} \varphi_3\ \Delta\ POPGRO_{t-r} + \\ & \sum_{r=1}^{k} \varphi_4\ \Delta\ FDI_{t-r} + \sum_{r=1}^{k} \varphi_5\ \Delta\ REMIT_{t-r} + \sum_{r=1}^{q} \varphi_6\ \Delta\ GOV.IND_{t-r} + \\ & \sum_{r=1}^{k} \varphi_7\ \Delta\ UNEMP_{t-r} + \sum_{r=1}^{k} \varphi_8\ \Delta\ TRADE_{t-r} + \sum_{r=1}^{k} \varphi_9\ \Delta\ ODAA_{t-r} + \\ & \sum_{r=1}^{k} \varphi_{10}\ \Delta\ GOV.EXP_{t-r} + \mu_t \end{aligned} \quad (3)$$

In equation (3) Δ is the difference operator, and β0 is the intercept term. At the same time, β1, β2, β3, β4, β5 β6 β7 β8 β9, and β10 represent the coefficients of the long-run relationship between the variables in the model, whereas, φ1, φ2, φ3, φ4, φ5 ,φ6, φ7, φ8, φ9 and φ10 reflect the coefficients of the short run dynamics, q indicate lags of the regressors, and μ t represent the error residuals. The null hypothesis for the bounds testing of our model is that the coefficients of the lag-level variables are zero; hence, there is no cointegration among the included variables.

After revealing a cointegration among variables, both short- and long-run relationships would be specified. Therefore, the short-run coefficients are determined by estimating an error correction model (ECM) as follows:

$$\Delta GDP_t = \sum_{j=1}^{p} \varphi_1 \Delta GDP_{t-j} + \sum_{j=1}^{q} \varphi_2 \Delta INF_{t-j} + \sum_{j=1}^{q} \varphi_3 \Delta POPGRO_{t-j} + \sum_{j=1}^{q} \varphi_4 \Delta FDI_{t-j} + \sum_{j=1}^{q} \varphi_5 \Delta REMIT_{t-j} + \sum_{j=1}^{q} \varphi_6 \Delta GOV.IND_{t-j} + \sum_{j=1}^{q} \varphi_7 \Delta UNEMP_{t-j} + \sum_{j=1}^{q} \varphi_8 \Delta TRADE_{t-j} + \sum_{j=1}^{q} \varphi_9 \Delta ODAA_{t-j} + \sum_{j=1}^{q} \varphi_{10} \Delta GOV.EXP_{t-j} + \Phi ECM_{t-1} + \mu_t \quad (4)$$

Where Φ measures the speed of adjustment toward the long-run equilibrium level and should be significantly negative. In a structural ECM, the long-run equilibrium level is progressively reached by at least one linear combination of variables at a constant adjustment rate (Abdulai, 2023). Diagnostic tests will ensure the model is stable and free of heteroskedasticity and serial correlation.

Results and Discussions

Descriptive Statistics

Table 2 provides a comprehensive descriptive analysis of the distributions of the variables. Notably, it shows that the average value of remittance inflow to Egypt over the study period is 6.39 percent of GDP. Over 25% of Egyptians reside in developed countries (Zohry, 2013).

Over the period under study, the gross domestic product has grown at an average rate of 4.429%, indicating that Egypt's growth rate is quite robust. On average, Egypt received more official development assistance (ODA) (21.452 percent growth) than foreign direct investment (FDI) (2.295 percent growth). Egypt relies heavily on ODAA and needs to do more to incentivize foreign direct investment. Investment recorded the third-highest mean (18.729 as a share of GDP) over the period, suggesting that capital formation and technical progress still account for approximately 19 percent of economic growth. For standard deviation, which measures the variation of the observed variable from its mean, government expenditure (GOV.EXP) and trade openness (TRADE) are the most volatile, while population growth is the most stable. Governance indicators that capture the quality of institutions in Egypt recorded the lowest mean of -3.88 over the studied period. The negative figure may reflect that little has been done to control corruption, improve transparency, and maintain a high level of political stability and the absence of violence.

Table 2. Descriptive Statistics of the Variables

Variables	Observation	Mean	Std. Dev.	Min	Max
GDP	33	4.429	1.579	1.125	7.156
INF	33	9.989	5.882	2.269	29.506
POPGROTH	33	2.085	.213	1.569	2.564
FDI	33	2.295	2.221	-.204	9.348
REMIT	33	6.397	2.756	2.856	14.583
GOV. IND	32	-.6129	.2002	-.9146	-.3109
UNEMP	33	9.904	1.796	6.591	13.154
TRADE	33	46.956	10.752	29.856	71.680
ODAA	32	21.452	.862	18.755	23.001
GOV.EXP	33	10.761	1.571	7.268	12.755

Note: Source: Authors' calculations.
Data Source: World Bank Development Indicators

Figure 2 assesses the trend of remittances and economic growth over the period. It shows that remittances and GDP remained positive and fluctuated stochastically until 2010. Remittances increased slightly throughout the Egyptian Revolution in 2011 despite a significant decline in GDP. Both remittances and GDP growth fluctuated from 2012 to 2016 and increased afterward. Low production and economic growth occurred during this period due to more violent, unstable

government institutions, which created uncertainty. The impact of the COVID-19 pandemic, which has affected psychological well-being and global sustainability, has negatively decreased remittances and economic growth.

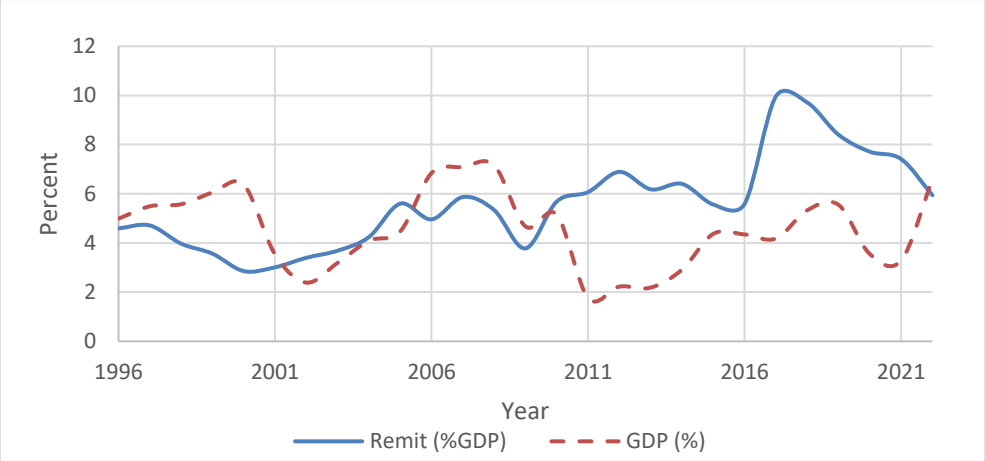

Figure 2. The Trend of Gross Domestic Product and the Receipt of Remittances as % of GDP

Stationarity Test

Conducting a stationarity test is crucial when dealing with time series data, as it allows for the identification and prevention of spurious regressions in the model. Several studies have confirmed that time series are non-stationary, providing spurious results that are unsuitable for forecasting, analysis, or policymaking (Nkoro & Uko, 2016). To test the stationarity of the individual series in the regression model and determine the order of integration of the variables, the Augmented Dicky Fuller (ADF) test is applied for this process.

Table 3 shows the unit root test statistics. It indicates that when the model includes an intercept, none of the variables were stationary at levels, except for inflation and GDP, but they became stationary after first differencing. The ARDL model can be used since none of the model's variables are integrated of order 2 (I(2).

Table 3. Unit Root Test Result (ADF)

Variable	Level Form ADF		First Differenced ADF	
	Intercept	Prob.	Intercept	Prob.
GDP	−3.154	0.023**	5.981	0.000 ***
INF	−3.482	0.016**	−6.153	0.000 ***
POPGRO	2.322	0.975	−3.842	0.008 ***
FDI	−1.701	0.374	−4.421	0.001 ***
REMIT	−0.572	0.285	−5.924	0.000 ***
GOV.IND	−1.326	0.604	−6.210	0.000***
UNEMP	−2.324	0.180	−2.677	0.091*
REMIT_GOV.IND	−2.173	0.220	−3.937	0.005***
TRADE	−2.085	0.280	−5.013	0.000 ***
ODAA	−1.306	0.695	−6.243	0.000 ***
GOV.EXP	−2.589	0.240	−5.974	0.000 ***

Note: Source: Authors' calculations.
*, ** and *** denote significance at 10%, 5% and 1% levels respectively.

Bounds Test for Cointegration

Using the bound cointegration test to determine whether the data-generating process underlying a time series is trend or first-difference stationary, we applied the F-statistic to evaluate the significance of lagged levels of the variables in a univariate equilibrium correction model. The F-

statistic value of 13.250, as presented in Table 4, far exceeds the value of the upper bound, I(1), at a 5% significant level. As a result, we accept the alternative hypothesis and conclude that long-run joint cointegration exists.

The ARDL framework was applied to estimate the long-run coefficients after demonstrating a long-run relationship between gross domestic product (GDP) and the covariates using the bound test for cointegration. Table 4 shows that GDP has a long-run relationship with received remittances (REMIT), Inflation (INF), population growth (POPGRO), foreign direct investment (FDI), governance indicators (GOV.IND), unemployment rate (UNEMP), trade (TRADE), official developmental assistance (ODA), government expenditure (GOV.EXP) and the interaction of governance indicators and remittances (REMIT_GOV.IND). The coefficient on remittances is positive and statistically significant at the 5% level, suggesting that personal remittances positively affect long-run GDP growth. More precisely, a unit increase in remittance inflows increases growth in GDP by 9.28 units, ceteris paribus. The result is expected, as a portion of remittance inflows is used for feeding, and the rest is invested in developmental projects, thereby promoting economic growth.

Table 4. Bound Test Results

F- bounds Test H0: No level relationship				
Test Statistic	Value	Sig	I(0)	I(1)
F-Stat	13.2501	10%	1.91	3.02
K	8	5%	2.29	3.30
		2.50%	2.45	3.4
		1%	2.72	4.0

Source: Authors' calculations.

This result is consistent with those reported of Abdulai (2023), Islam (2022), Adnan et al. (2020), and Oteng-Abayie et al. (2020). It is, however, at variance with the findings of Ustarz & Issahaku (2017) and Sutradhar (2020). Additionally, foreign direct investment (FDI) is generally considered a key driver of economic growth, and our results show a positive relationship between FDI and economic growth. It suggests that, in the long run, FDI contributes to Egypt's economic growth. Foreign direct investment (FDI) is generally considered a key driver of economic growth, and the results in Table 4 indicate that, in the long run, FDI encourages economic growth in Egypt. The positive sign of FDI is consistent with expectations, as FDI inflows have increased significantly in developing countries and generate spillover effects in Egypt through technology transfer and human capital development. This result is in line with that of Sarker & Khan (2020) and Elsadig & Rahim (2023).

Table 5. The long-run effect of Remittance on GDP

Levels Equation Model: ARDL (1,1,2,0,2,2,1,1)			
Variable	Coefficient	Std. Error	Prob.
INF	-0.143	0.197	0. 130
POPGRO	37.251	5.754	0.000
FDI	0.911	0.162	0.000
REMIT	9.285	1.354	0.000
GOV.IND	0.602	0.131	0.000
REMIT_GOV.IND	- 0.819	0.123	0.000
TRADE	0.139	0.021	0.000
ODAA	0.341	0.159	0.051

Source: Authors' calculations.

Table 5 shows that, in the long run, trade openness, which proxies for globalization, exhibits the expected signs and contributes significantly to Egypt's economic growth. The

coefficient associated with trade openness indicated that Egypt's growth rate would increase by 0.139 percentage points for every percentage-point increase in trade volume, holding all other variables constant. All things being equal, population growth has a positive and significant impact on Egypt's long-term economic growth. Although numerous studies have examined these associations, there is a need for greater consensus on how population expansion influences economic growth (Arbia et al., 2023). While some studies demonstrate that robust population growth promotes economic growth (Peterson, 2017), others find evidence to the contrary (Alemu & Zegeye, 2024).

In the long run, official development assistance (ODA) has a positive, high-magnitude coefficient, as expected, suggesting that ODA eventually supports the expansion of Egypt's economy. More precisely, its coefficient indicated that Egypt's growth rate would increase by 0.341 for every percentage-point increase in official development assistance, holding all other variables constant. The outcome shows that inflation appears with a negative sign when introduced into the equation, suggesting that inflation at any level has a negative impact on economic growth. It is neither desired nor expected that inflation will improve Egypt's economic growth, as higher inflation typically does not lead to higher levels of income in the medium to long term, as it does not enhance economic development (Hadush et al., 2023). The unemployment variable is statistically significant in explaining the variation in GDP.

The governance indicators need to be included in the literature on the remittance-growth nexus. The coefficient of governance indicators is positive and statistically significant at the 5% level, indicating that average governance indicators have a positive impact on long-run GDP growth. A one percentage point increase in average governance indicators results in a 0.602 percentage point increase in GDP growth, holding all other variables constant. This finding is congruent with that of Acemoglu & Robinson (2012) and Han et al. (2014). Several studies also argued that remittances vary substantially across countries and regulatory environments (Authors & Leatherby, 2019). We therefore included the interaction term to capture the threshold of the average governance indicator level that can support remittances and have a beneficial influence on economic growth. The interaction term (REMIT_GOV.IND) adversely impacted growth in the long run, suggesting that increases in remittance inflows will continue leading to a decline in growth rate if estimated average governance indicators in Egypt remain within a threshold of 20%[2], holding all other variables constant.

Short-run Dynamics

The long-run, short-run, and error-correction term (ECT), which measures the rate of adjustment necessary to return to equilibrium following a disruption, are the three parts of the ARDL. As shown in Table 6 (CointEq), the ETC is statistically significant at the 1% level and exhibits the predicted negative sign. This result supports the bound test's earlier finding of a long-term link between the variables. The ETC proposes that GDP growth variations (i.e., growth above or below the equilibrium level) be adjusted at a rate of 1.491 units per year to maintain long-run convergence to equilibrium. According to short-term projections, remittances have a positive and considerable impact on GDP growth. However, the GDP growth is adversely and considerably affected by its one-lag time.

Table 6 indicates that, in the short term, trade and foreign direct investment have a positive and significant impact on GDP growth. Foreign direct investment (FDI) and official development assistance (ODA) have a positive and significant impact on GDP growth during their one-lag period. The interaction term between remittances and estimated average government indicators has a negative short-term impact on GDP growth. It implies that increased remittance inflows will sustain higher growth rates as long as Egypt's average government indicators remain above a threshold of 8.57%, all else equal.

[2] This figure is calculated using a threshold model established by Hansen (1999) and extended by Alfada (2023).

Table 6. Short-Run Remittance impact on GDP growth

ARDL Error Correction Regression Model: ARDL (1,1,2,0,2,2,1,1) Case 3: No Trend with Unrestricted Constant			
Variable	Coefficient	Std. Error	Prob.
C	-419.063	24.399	0.000
D(REMIT)	7.842	0.5243	0.000
D(REMIT(−1))	-2.233	0.212	0.001
D(FDI)	0.903	0.084	0.000
D(FDI(−1))	-1.191	0.145	0.000
D(REMIT_GOV.IND)	-1.891	0.061	0.000
D(POPT GROWTH)	120.411	11.545	0.000
D(POP GROW(−1))	-60.221	9.222	0.000
D(TRADE)	0.021	0.007	0.022
D(ODA)	0.815	0.079	0.000
D(INFLATION)	-0.081	0.122	0.013
D(INFLATION(−1))	-0.121	0.010	0.000
D(GOV.EXP)	0.772	0.021	0.000
CointEq(−1)*	-1.491	0.101	0.000
R-squared	0.949		
S.E. of regression	0.580		
Log-likelihood	-16.910		
Schwarz criterion	2.680		
F-statistic	42.248		
Prob(F-statistic)	0.000		

Note: Source: Estimation from data.

Residual and Diagnosis Test

Several diagnostic tests are conducted in this study to check the model's goodness-of-fit and the validity of the assumptions. The Jarque-Bera test, the Breusch-Godfrey serial correlation Lagrange multiplier (LM) test, and the Breusch-Pagan residual test are used to test for serial correlation, heteroscedasticity, and normality, respectively, to assess the stability and reliability of the estimated models used in this study. Since the probability value of the F-statistic is greater than the significance level of 5%, the findings in Table 7 show that the data have a normal distribution and that the model does not suffer from the heteroskedasticity issue.

Table 7. Results of Residual and Stability Tests

Method	**F- Statistic**	**Prob.**
Serial Correlation	29.622	Prob. F(2,6) = 0.001
Heteroscedasticity	11.842	Prob. F(20,8) = 0.446
Normality (Jarque-Bera)	1.390	0.520, Normal

Source: Estimation from data.

In the context of remittances and economic growth in Egypt, this paper provides valuable insights into the economic influence of remittance flows on economic growth from 1996 to 2022. The empirical results of the augmented ARDL bounds testing approach to cointegration suggested a long-run relationship between GDP and remittances received in Egypt. The rising flow of remittances into Egypt's economy supports its GDP growth in the long and short run. This result is consistent with those reported of Abdulai (2023), Islam (2022), Adnan et al. (2020), Oteng-Abayie et al. (2020), and Imai et al. (2014). It is, however, at variance with the findings of Ustarz & Issahaku (2017) and Sutradhar (2020).

Since most emerging economies rely on FDI to fuel economic expansion, the FDI coefficient was significant in both runs, as shown in previous results. Globalization, as proxied by trade openness, plays a significant role in determining economic growth in Egypt in both the short-

and long-run. These results support the idea that countries are embracing free trade to become more integrated, achieving quicker economic growth through the inflow of technology, goods, and services (Islam, 2022; Alamoudi, 2024). The result demonstrates that inflation enters the equation with a negative sign, indicating that, regardless of its magnitude, inflation negatively impacts economic growth. Since rising inflation does not raise income levels over the medium and long term and does not promote economic development, it is neither desired nor expected that inflation will accelerate Egypt's economic growth (Mohamed & Abdi, 2024).

The significant finding of this paper is that including governance indicators in the remittance-growth nexus. The significant impact of governance indicators suggests that, on average, they positively affect GDP growth in the long run, a result consistent with that of Acemoglu and Robinson (2012) and Han et al. (2014). Several studies also argue that remittances vary substantially across countries and regulatory environments (see Authors & Leatherby, 2019). It suggests that a high average of World Governance Indicators (WGIs) is necessary for Egypt to gain from remittances and accelerate its economic growth. Stated differently, Egypt may enhance its economic growth through remittance inflow only to the extent that its government maintains stability in governance metrics. Therefore, the analysis is based on the premise that, as long as Egypt remains above the average governance indicator threshold, remittance inflows can be highly beneficial in promoting sustained economic growth.

This finding underscores the crucial role of effective government indicators in driving economic growth. Countries with more robust governance indicators tend to achieve higher levels of economic growth, a finding that aligns with previous studies emphasizing the importance of governance in development. To further deepen our understanding, we have examined the threshold of the average governance indicators level that can support remittances to benefit economic growth. In doing so, we have included the interaction term between remittances and average governance indicators (REMIT_GOV.IND). The results indicate that increases in remittance inflows will continue to lower the growth rate if estimated average governance indicators in Egypt remain within a threshold of 20% threshold, holding all other variables constant. This result, along with several studies, suggests a nonlinear relationship between a country's institutional quality and economic growth. Dokas et al. (2023) have identified a corruption threshold beyond which the effect of corruption on economic growth shifts from positive to negative.

Additionally, Alfada (2023) finds that Indonesian provinces with low corruption levels experience economic growth when the number of corruption cases is below the corruption threshold. However, when it reaches a threshold, it impedes economic progress in provinces with high levels of corruption. Therefore, the impact of remittances and other macroeconomic variables varies across countries, depending on their quality of governance indicators.

Conclusion

This study offers comprehensive insights into the relationships among remittances, governance indicators, trade, foreign direct investment (FDI), and inflation and their effects on Egypt's economic growth from 1996 to 2022. The findings reveal a long-term positive relationship between remittances and GDP growth, with remittances acting as a catalyst for both short-term and long-term growth in Egypt. Foreign direct investment (FDI) and trade openness increasingly support economic expansion, while inflation consistently hampers growth prospects, underscoring the importance of price stability for sustainable development. Importantly, the interaction between remittances and governance quality highlights that effective governance not only strengthens the positive impact of remittances on growth but also mitigates the adverse impact of poor institutional quality. Furthermore, threshold analysis indicates that when governance indicators fall below a certain level, remittance inflows do not contribute to economic growth, suggesting that governance's impact on economic performance is nonlinear.

The results provide several important policy implications. First, improving governance by strengthening transparency and accountability and combating corruption is critical to maximizing the economic benefits of remittances. Improving institutional quality to meet and exceed

governance indicator thresholds can create a more conducive environment for economic growth by attracting remittances and ensuring their productive use. Second, policies to stabilize inflation must remain a priority, because inflation always hinders economic growth. Third, encouraging trade openness and maintaining FDI inflows is necessary to promote technology transfer and support sustainable growth. Finally, policymakers must be aware of the context-specific nature of macroeconomic variables and governance indicators so that they can effectively adapt governance reforms to support remittance inflows. Overall, these strategies can strengthen Egypt's economic resilience and increase remittance flows, thereby achieving long-term prosperity.

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Indonesia's export growth decomposition in ASEAN and ASEAN dialogue partners

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Abstract

Purpose — This paper evaluates Indonesia's trade integration efforts and their impact on export competitiveness from 1989 to 2021. It examines the evolution of trade arrangements, starting with the ASEAN Preferential Trade Arrangement (APTA) and progressing to bilateral agreements.

Methods — Based on Leamer and Stern, the Constant Market Share Analysis (CMSA) measures Indonesia's export competitiveness over the study period.

Findings — The results indicate no significant improvement in competitiveness during the analysis period, with export growth primarily driven by the effect of world growth. Although competitiveness did not shift markedly over time, it remained positive overall, suggesting a buffer effect during economic crises.

Implications — The paper suggests that Indonesia should pursue deeper trade integration and unilateral economic reforms. Drawing on Korea's experience, combining export promotion policies with trade agreements could enhance market access and foster internal competitiveness.

Originality — This study provides long-term insights into Indonesia's export competitiveness amid global trade integration efforts and offers policy recommendations informed by the success of Korea's trade reforms.

Keywords — Constant Market Share Analysis, Free Trade Agreement, Competitiveness, Decomposition, Trade Integration.

Introduction

Many economists assert that Indonesia is entering a middle-income trap (Basri et al., 2016; Aswicahyono & Hill, 2016). Trade is one of the essential elements of the economy that endorses economic growth (Samuelson & Nordhaus, 2009). Economic transformation is necessary to escape the middle-income trap (Basri et al., 2016). Trade is also an essential component of a comprehensive strategic economic transformation policy (Pangestu et al., 2015). Despite the changing world challenges and conditions, Indonesia should be able to shift from commodity exporters to manufacturing-based product exporters (Pangestu et al., 2015). Based on Indonesia's Trade Policy Review, Indonesia has implemented several trade reforms, including entering many regional trade arrangements with its trading partners (WTO, 2020).

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Free Trade Agreements (FTA) are tools that endorse trade and market access (Krugman & Obstfeld, 2009). However, FTAs can be a tool for setting and endorsing domestic reforms that may increase competitiveness. Indonesia has been integrating into trade with ASEAN and its ASEAN Dialogue Partners (WTO, 2020). Indonesia has also been conducting bilateral free trade agreements with its trading partners, including Japan, Mozambique, the United Arab Emirates, Chile, and Australia (WTO, 2020). Indonesia is also pursuing FTA negotiations with the European Union, Eurasian Economic Union (EAEU), Peru, and MERCOSUR (Ministry of Trade, Republic of Indonesia, 2022).

This paper is a descriptive analysis of the decomposition of Indonesia's export growth from 1989 to 2022. It attempts to relate the effort of economic transformation to trade liberalisation from 1989 to 2022 and to the development of competitiveness. This paper attempts to answer the question, "Does competitiveness become the main contributor to export growth in the ASEAN and ASEAN Dialogue Partners market?" Therefore, this paper attempts to determine whether Indonesia's export growth in the ASEAN and ASEAN Dialogue Partners' markets has been driven by competitiveness.

The scope of this paper will only be limited to the analysis of export value based on SITC Rev 3 from Indonesia to the ASEAN and ASEAN Dialogue Partners' market. The observation is from 1989 to 2021. This paper will adopt constant-share norms in the shift-share analysis, using Leamer and Stern's Constant Market Share Analysis approach to decompose Indonesia's exports worldwide and to the ASEAN and ASEAN Dialogue Market.

This paper consists of five sub-sections. First, it will provide an introduction, including the study's background of the study, research question, objectives, scope of the research, and a brief description of the methodology. Second, it will elaborate on the review of the development of the literature. Third, it will explain the constant market share approach. Fourth, it will provide the analytical results. This paper will summarise the discussion with a conclusion and policy recommendation.

Trade integration and competitiveness are intertwined (Galovic, 2021). While economists believe that export expansion relates to a country's higher competitiveness of a country, the debate, dating back to Adam Smith and David Ricardo, continues over whether free trade is crucial to determining welfare and a country's competitiveness (Krugman & Obstfeld, 2009). David Ricardo's arguments of comparative advantage have changed the world's point of view on protectionism (Samuelson & Nordhaus, 2009).

However, lobbyists recognise that if trade is free, their goods will lose some profits created by protection. Hence, lobbyists will try to influence governments not to impose unilateral liberalisation. There will be collective action to influence government policy to protect specific lobbyist group sectors at the expense of consumer loss. Consumers tend to be fragmented and unable to act collectively to influence government policy, and protection remains in place. It is tough to pursue unilateral liberalisation even when all governments recognise that free trade will improve welfare and economic competitiveness (Krugman & Obstfeld, 2009).

The economist believes multilateralism will be a suitable venue for liberalisation. However, reaching an agreement under a multilateral trading system is complex (Hoekman et al., 2002). The failure to decide on ministers of trade at the Ministerial Conference in Cancun has diminished hope and created distrust among countries about encouraging further liberalisation through multilateral fora. Baldwin (2006) asserts that the significant impact of MC 5 in Cancun is the proliferation of regional trade agreements among WTO members. Many researchers have started to question the institutional arrangements of the WTO, creating distrust among countries and leading to "complex multilateralism which constitutes heterogeneity, multipolarity, and potentially conflictual" (Narlikar & Wilkinson, 2004; Abbas & Duchesne, 2023).

Regional trade arrangements may impose some costs on the economy. Trade will divert from an efficient country that is not a party to the agreement to a less efficient country that becomes a party to the trade agreement. This is called trade diversion (Balassa, 1976). Some economists argue that regionalism may have become a stepping stone toward multilateralism (Mistry, 1995; Fiorentino et al., 2007). The WTO allows the breach of the Most-Favoured-Nation

(MFN) principle under the framework of regional trade agreements, provided it is more liberal than what has been achieved under a multilateral process (Leal-Arcas, 2011). Multilateralism and regionalism could address this issue (Fiorentino et al., 2007).

Despite the debate over multilateralism versus regionalism, free trade is widely regarded as a vehicle for enhancing competitiveness and welfare. The growing global value chain trend has augmented a country's importance in regional trade agreements (Rahman et al., 2024; Suryanta, 2021). Regional trade agreements should be able to facilitate and increase domestic reform that facilitates the global value chain. RCEP will facilitate backward linkages of GVCs among RCEP countries (Rahman et al., 2024).

The debate continues into a deep agreement (Kim, 2015; Mattoo et al., 2020). There is a growing demand for trade agreements to address more complex global problems and challenges, such as environmental, labour, and gender issues (Mattoo et al., 2020). At the same time, some economists believe that trade agreements could serve as a political signal to their partners to endorse friend-shoring (Reiterer & Houng, 2023; Blanga-Gubbay & Rubinuva, 2023). Trade agreements can signify that two countries are allies (Blanga-Gubbay & Rubinuva, 2023). Exploration of trade integration and competitiveness has been conducted by various researchers (Petrović et al., 2008; Stojanovic et al., 2013). However, empirical studies have been conducted by many scholars in Indonesia (Aswicahyono & Rafitrandi, 2018; Rahmadi & Ichihashi, 2012; Widodo, 2010). Widodo (2010) and Rahmadi and Ichihashi (2012) attempted to decompose Indonesia's exports and ASEAN's exports.

Methods

Data

Trade data is secondary data obtained from WITS UNCTAD from 1989 to 2021. The data is described under SITC Revision 3. Based on the work of Lall (2000), we could translate SITC Revision 3 into a technological category of primary, resource-based, low-technology, medium-technology, and high-technology products.

Constant Market Share Analysis

According to the Armington demand approach, the quantity demanded is a function of the relative price of goods and services.

$$\frac{q_1}{q_2} = f(\frac{p_1}{p_2}) \quad (1)$$

where q and p are the quantity demanded and the price of exports. Subscripts 1 and 2 will denote country 1 and country 2, respectively. Equation 1 is a relationship that ascribes elasticity of substitution. This is a substantial critique of Richardson (1971): it will only occur when the Armington elasticity is unity (1) (Fagerberg & Sollie, 1987; Balassa, 1977). However, Widodo (2010) asserts that the usefulness of this approach has led many researchers to adopt it.

By multiplying both sides by $\frac{p_1}{p_2}$Then, we will have the following.

$$\frac{p_1 q_1}{p_2 q_2} = \frac{p_1}{p_2} x\, f(\frac{p_1}{p_2}) \quad (2)$$

We may recalibrate equation 2 into the following

$$\frac{p_1 q_1}{p_1 q_1 + p_2 q_2} = \frac{p_1}{p_2} x\, f(\frac{p_1}{p_2}) \quad (3)$$

This implies:

$$\frac{p_1 q_1}{p_1 q_1 + p_2 q_2} = \left[1 + \frac{p_2 q_2}{p_1 q_1}\right]^{-1}$$

$$\frac{p_1 q_1}{p_1 q_1 + p_2 q_2} = \left[1 + \left[\frac{p_1 f(\frac{p_1}{p_2})}{p_1}\right]^{-1}\right]^{-1}$$

$$\frac{p_1 q_1}{p_1 q_1 + p_2 q_2} = g\left[\frac{p_1}{p_2}\right] \quad (4)$$

This indicates that the export share will remain constant unless the price ratio between the two countries changes. This creates the foundation of "constant share norms" to decompose the growth of exports (Leamer & Stern, 1970).

Leamer and Stern (1970) wrote about constant market share identity to decompose export growth the following:

$$X^{kw\prime} - X^{kw} = rX^{kw} + \sum_{i=1}^{n}(r_i - r)X_i^{kw} + \sum_i^n \sum_j^m (r_{il} - r_i)X_i^{kl} + \sum_i^n \sum_j^m (X_i^{kl\prime} - X_i^{kl} - r_{il}X_i^{kl}) \quad (5)$$

(WGE) (CE) (ME) (COMPE)

$X^{kw}(X^{kw\prime})$: country's *k* export to world (*w*) period 0 (period 1)
$X_i^{kl}(X_i^{kl\prime})$: country's *k* export to country l for commodity *i* period 0 (period 1)
X_i^{kw} $(X_i^{kw\prime})$: Country's *k* export to world (w) for commodity *i*
R : Percentage growth in total world exports from period 0 to period 1
r_i : Percentage growth in total world export for commodity *i* from period 0 to period 1
r_{il} : Percentage growth in world export for commodity *i* to country *i* from period 0 to period 1

The term rX^{kw} in the Equation 5 reveals the world growth effect (WGE), which implies that any change in actual exports is related to world exports.

The term $\sum_{i=1}^{n}(r_i - r)X_i^{kw}$ represent the commodity composition effect. The commodity composition Effect (CE) measures whether the growth of a commodity's world export is higher (lower) than that of the growth of total exports. If it is positive, the growth of that commodity exceeds the growth of total world exports.

The term $\sum_i^n \sum_j^m (r_{il} - r_i)X_i^{kl}$ represent market distribution effects. Market Distribution Effect (ME) measures.

The term $\sum_i^n \sum_j^m (X_i^{kl\prime} - X_i^{kl} - r_{il}X_i^{kl})$ represent the residual or competitiveness of a country's k export.

The caveats of this analysis have been provided by Richardson (1971) and mainly by Fagerberg and Sollie (1987). The most critical critique of constant market share analysis is mainly on the dynamicity of the analysis. Richardson (1971) and Tyszynski (1951) explain that constant market share analysis is discrete. This method is sensitive to the establishment of an observation period (Richardson, 1971). It is also recognised by Fagerberg and Sollie (1987) and Richardson (1971) that the establishment of observation and choosing the base year will alter the results. Constant market share analysis is also sensitive to commodity identification under observation. Commodity aggregate under a particular HS Code will alter the result (Richardson, 1971). The conclusion and the analysis fully recognise the caveats of this method. This method is a discrete method and sensitive to the point of observation.

Results and Discussion

This paper has provided a computation of competitiveness by using Leamer and Stern's (1970) approach to constant market share analysis in the world market, ASEAN, and ASEAN Dialogue Partners' markets.

Indonesia's Competitiveness in ASEAN

The ASEAN Market is a good reflection of Indonesia. 1989 – 1992 was a good combination of domestic reform and a free trade agreement. Indonesian products' competitiveness increased by USD 49 million in 1989-1992. Then competitiveness tends to decrease from USD 49 million during 1989-1992 to about USD 2.3 million during 1992-1997. The same phenomenon happened during 2004-2009. ASEAN leaders agreed to establish the ASEAN Economic Community (AEC) during the ASEAN Leaders Summit 2003. Soesilo Bambang Yudhoyono implemented a series of domestic reforms, including removing fuel subsidies, establishing the Indonesian National Single Window (INSW), establishing a dedicated export development team, enacting trade laws, and implementing various trade facilitation measures (WTO, 2007; Boediono, 2016). Competitiveness rose to USD 1.2 billion during 2004 – 2009. After this period, competitiveness reduces through time until 2021.

Table 1. Constant Market Share for Indonesia's Export Growth to the ASEAN Market

		ASEAN's MARKET					World Market				
No	Products	WGE	CE	ME	COMPE	TE	WGE	CE	ME	COMPE	TE
1	Primary Prods	678.561,32	- 456.917,78	- 100.701,24	4.888,37	125.830,68	3.532.358,46	6.833.115,06	120.496,82	- 9.335.529,15	1.150.441,19
2	ResourceBased	393.958,78	- 103.513,80	- 105.577,31	7.668,38	192.536,05	3.116.063,52	2.666.789,67	58.248,47	- 2.597.084,62	3.244.017,04
3	LowTech	247.124,00	130.050,45	464.961,04	-	842.135,49	1.045.013,43	717.416,95	176.345,98	3.032.020,26	4.970.796,63
4	MediumTech	201.417,00	50.547,70	523.212,19	37.074,04	812.250,94	323.438,16	- 48.425,00	151.269,35	1.417.535,44	1.843.817,95
5	HighTech	29.594,22	5.514,59	183.928,27	64,43	219.101,52	56.906,16	26.551,17	10.302,81	636.039,43	729.799,56
Total	**1989-1992**	**1.550.655,33**	**- 374.318,84**	**965.822,96**	**49.695,23**	**2.191.854,68**	**8.073.779,73**	**10.195.447,85**	**516.663,43**	**- 6.847.018,64**	**11.938.872,37**
1	PrimaryProds	1.093.110,49	- 394.443,84	409.161,13	139,20	1.107.966,98	5.274.511,39	- 2.395.467,18	208.297,32	461.161,76	3.548.503,29
2	ResourceBased	752.751,64	- 292.715,48	145.396,42	19.766,33	625.198,92	5.742.793,31	60.229,67	140.633,45	4.953.778,61	10.897.435,04
3	LowTech	1.185.295,22	- 873.378,14	- 67.348,59	1.237,44	245.805,93	3.824.359,04	- 759.592,34	- 179.661,34	- 1.705.384,87	1.179.720,49
4	MediumTech	1.090.500,94	- 722.414,44	- 86.002,11	8.540,46	290.624,86	1.332.944,44	- 460.087,25	- 34.294,56	1.114.786,44	1.953.349,07
5	HighTech	258.843,30	193.619,29	666.003,11	61,94	1.118.527,64	432.728,53	187.546,80	210.175,09	1.067.140,24	1.897.590,67
Total	**1992-1997**	**4.380.501,59**	**- 2.089.332,60**	**1.067.209,96**	**29.745,37**	**3.388.124,33**	**16.607.336,71**	**- 3.367.370,29**	**345.149,96**	**5.891.482,19**	**19.476.598,56**
1	PrimaryProds	- 342.582,80	- 52.091,91	2.049,74	399,98	- 392.225,00	2.782.948,38	7.585.866,84	- 1.105.814,85	- 11.320.320,03	- 2.057.319,66
2	ResourceBased	- 214.591,25	2.273,61	289.706,94	1.981,52	79.370,83	4.395.420,43	8.581.930,01	277.890,58	- 19.590.989,86	- 6.335.748,84
3	LowTech	- 223.591,32	- 380.691,73	306.104,37	1,84	- 298.176,85	1.747.377,92	- 1.268.505,79	- 571.638,14	2.606.046,09	2.513.280,08
4	MediumTech	- 215.687,65	- 45.113,76	362.463,96	- 0,00	101.662,55	908.393,06	- 422.956,24	- 261.355,73	251.905,79	475.986,88
5	HighTech	- 213.616,79	73.773,21	598.099,07	-	458.255,49	540.159,27	371.441,96	- 524.156,08	238.195,26	625.640,41
Total	**1997-1999**	**- 1.210.069,83**	**- 401.850,57**	**1.558.424,08**	**2.383,34**	**- 51.112,98**	**10.374.299,07**	**14.847.776,78**	**- 2.185.074,22**	**- 27.815.162,75**	**- 4.778.161,13**
1	PrimaryProds	1.022.288,93	1.096.539,10	- 482.999,64	2.707,68	1.638.536,06	7.453.423,29	4.177.311,27	436.418,49	- 5.130.345,86	6.936.807,19
2	ResourceBased	822.786,97	362.402,46	- 114.590,77	71.318,71	1.141.917,38	9.898.584,00	3.524.660,76	164.166,69	- 6.539.001,92	7.048.409,53
3	LowTech	643.534,67	- 67.406,99	- 531.345,58	- 0,00	44.782,10	6.989.567,36	- 1.416.869,09	- 124.837,20	- 3.578.576,14	1.869.284,95
4	MediumTech	839.274,06	70.643,54	163.188,48	15,74	1.073.121,82	3.129.447,07	- 58.876,89	- 27.851,83	675.205,83	3.717.924,18
5	HighTech	1.031.895,53	- 299.534,51	421.518,38	- 0,00	1.153.879,40	2.068.828,24	- 1.056.052,67	188.370,42	2.143.476,80	3.344.622,79
Total	**1999-2004**	**4.359.780,16**	**1.162.643,60**	**- 544.229,12**	**74.042,13**	**5.052.236,77**	**29.539.849,96**	**5.170.173,39**	**636.266,57**	**- 12.429.241,28**	**22.917.048,64**
1	PrimaryProds	1.612.097,82	1.691.399,15	1.283.638,91	- 0,00	4.587.135,89	8.921.254,74	9.278.353,49	204.649,03	3.498.253,15	21.902.510,41
2	ResourceBased	1.215.093,45	763.035,22	725.686,05	1.268.088,79	3.971.903,50	10.843.248,94	6.998.498,03	178.222,21	- 4.499.549,28	13.520.419,89
3	LowTech	555.107,85	320.532,45	- 312.856,99	0,00	562.783,32	6.213.811,11	- 2.032.775,84	370.153,83	- 1.494.462,80	3.056.726,29
4	MediumTech	1.196.727,39	56.083,86	860.620,15	- 0,00	2.113.431,41	4.119.652,70	- 1.328.874,17	262.655,56	3.323.107,19	6.376.541,29
5	HighTech	1.394.262,38	- 954.438,82	- 412.558,55	0,00	27.265,02	3.135.128,26	- 787.511,63	- 482.572,86	- 1.793.717,99	71.325,78
Total	**2004-2009**	**5.973.288,90**	**1.876.611,87**	**2.144.529,58**	**1.268.088,79**	**11.262.519,13**	**33.233.095,75**	**12.127.689,87**	**533.107,77**	**- 966.369,73**	**44.927.523,66**
1	PrimaryProds	6.474.540,51	- 1.617.141,61	- 2.993.649,73	0,00	1.863.749,16	2.741.138,50	- 10.046.569,76	5.519.991,67	12.667.948,37	10.882.508,78
2	ResourceBased	5.293.973,13	12.248.049,16	- 8.946.390,97	19.249,98	8.614.881,31	2.458.334,09	- 2.453.584,98	16.443.524,55	11.096.312,83	27.544.586,49
3	LowTech	1.411.389,69	778.238,23	- 1.439.857,25	105,97	749.876,65	1.096.028,03	2.839.720,26	1.454.601,73	4.548.524,61	9.938.874,64
4	MediumTech	3.766.981,50	- 567.382,11	149.093,96	- 0,00	3.348.693,35	1.016.637,35	- 102.724,35	2.440.503,63	5.657.517,49	9.011.934,13
5	HighTech	2.429.622,55	- 935.061,61	- 1.354.672,03	- 0,00	139.888,91	454.934,00	365.573,92	1.156.349,09	171.441,50	2.148.298,52
Total	**2009-2014**	**19.376.507,38**	**9.906.702,06**	**- 14.585.476,02**	**19.355,95**	**14.717.089,38**	**7.767.071,98**	**- 9.397.584,91**	**27.014.970,67**	**34.141.744,81**	**59.526.202,55**
1	PrimaryProds	1.441.284,40	1.426.700,63	- 2.391.406,22	4,08	476.582,90	5.298.182,42	- 4.480.897,72	2.019.972,46	- 9.619.868,97	- 6.782.611,81
2	ResourceBased	2.209.676,03	- 3.220.293,10	- 2.574.600,45	1.744,28	- 3.583.473,24	6.563.596,04	- 7.871.253,15	880.529,70	- 7.591.799,25	- 8.018.926,66
3	LowTech	364.153,73	103.176,35	521.650,57	- 0,00	988.980,65	2.687.743,14	- 3.563.097,87	262.498,56	3.913.175,90	3.300.319,73
4	MediumTech	1.167.848,60	187.561,08	551.671,24	0,00	1.907.080,92	2.471.964,35	- 871.610,93	771.754,16	1.285.040,43	3.657.148,01
5	HighTech	459.489,10	632.363,62	- 972.133,31	0,00	119.719,41	914.178,03	336.899,60	- 84.625,75	- 1.675.580,35	- 509.128,47
Total	**2014-2019**	**5.642.451,86**	**- 870.491,42**	**- 4.864.818,18**	**1.748,37**	**- 91.109,37**	**17.935.663,98**	**- 16.449.960,07**	**3.850.129,12**	**- 13.689.032,24**	**- 8.353.199,21**
1	PrimaryProds	1.928.273,54	550.494,73	1.763.206,61	48,09	4.242.022,98	15.183.834,70	30.563.286,58	- 5.283.730,58	- 20.289.328,30	20.174.062,40
2	ResourceBased	2.155.443,74	- 433.381,20	1.451.159,56	0,00	3.173.222,10	18.939.151,24	31.125.182,74	- 11.204.678,01	- 19.905.859,73	18.953.796,25
3	LowTech	648.431,57	21.289,91	- 633.478,26	- 0,00	36.243,22	9.966.279,08	1.186.999,25	- 526.676,15	- 1.530.432,13	9.096.170,05
4	MediumTech	1.844.780,84	- 711.171,19	- 613.157,52	- 0,00	520.452,14	9.374.950,18	- 54.226,69	- 1.394.445,33	5.196.690,37	13.122.968,52
5	HighTech	608.763,12	- 4.641,28	- 432.084,61	- 0,00	172.037,22	2.841.921,31	1.253.069,68	- 800.043,83	- 802.481,38	2.492.465,78
Total	**2019-2021**	**7.185.692,82**	**- 577.409,04**	**1.535.645,79**	**48,09**	**8.143.977,66**	**56.306.136,51**	**64.074.311,56**	**- 19.209.573,90**	**- 37.331.411,17**	**63.839.463,00**

Source: Own computation

Indonesia's Competitiveness in ASEAN Dialogue Partners' Market

Japanese Market

The competitiveness of Indonesian products in Japan is showing positive signs, but with minimal contribution to the total growth of exports. Indonesia's competitiveness remained positive from 1989 to 2022. During the Asian economic crisis, Indonesia's export growth to Japan amounted to USD 2 billion, and competitiveness contributed to USD 4.8 million during 1997- 1999. Medium-tech competitiveness significantly contributed to Indonesia's competitiveness in the Japanese market before the Asian Economic Crisis of 1998. However, medium-tech competitiveness declined alongside Japanese investment diversification in ASEAN (Aslam & Yee, 2023). One interesting observation that is taken into consideration is from 2009 to 2014. There was a significant jump in competitiveness from 2009 to 2014, following the entry into force of the IJEPA in 2008. IJEPA contributed to Indonesia's increased competitiveness in the Japanese market. However, competitiveness tends to reduce to USD 17 thousand during 2019-2021.

Table 2. Constant Market Share for Indonesia's Export Growth to the Japanese Market

		Japan's Market					World Market				
No	**Products**	**WGE**	**CE**	**ME**	**COMPE**	**TE**	**WGE**	**CE**	**ME**	**COMPE**	**TE**
1	PrimaryProds	1.001.615,08	426.468,74	- 1.241.901,71	21,21	186.203,32	3.532.358,46	6.833.115,06	- 3.491.099,27	- 5.723.933,06	1.150.441,19
2	ResourceBased	1.019.052,32	1.160.527,33	- 1.401.656,45	5.788,43	783.711,63	3.116.063,52	2.666.789,67	- 1.211.025,45	- 1.327.810,70	3.244.017,04
3	LowTech	85.611,11	- 8.672,80	289.475,92	12,61	366.426,85	1.045.013,43	717.416,95	- 10.322,08	3.218.688,33	4.970.796,63
4	MediumTech	17.891,16	- 2.067,25	5.388,64	5.147,41	26.359,96	323.438,16	- 48.425,00	5.465,89	1.563.338,90	1.843.817,95
5	HighTech	6.297,70	8.873,30	77.711,22	2.202,71	95.084,93	56.906,16	26.551,17	2.961,07	643.381,17	729.799,56
Total	**1989 - 1992**	**2.130.467,38**	**1.585.129,33**	**- 2.270.982,38**	**13.172,36**	**1.457.786,69**	**8.073.779,73**	**10.195.447,85**	**- 4.704.019,84**	**- 1.626.335,36**	**11.938.872,37**
1	PrimaryProds	2.230.884,86	- 1.214.611,74	- 1.177.812,17	1.576,02	- 159.963,03	5.274.511,39	- 2.395.467,18	6.843,82	662.615,25	3.548.503,29
2	ResourceBased	2.560.469,96	- 1.147.663,28	- 1.000.253,84	727.638,99	1.140.191,83	5.742.793,31	60.229,67	- 1.570.571,89	6.664.983,95	10.897.435,04
3	LowTech	362.169,70	111.940,47	- 329.727,62	3,01	144.385,56	3.824.359,04	- 759.592,34	81.429,14	- 1.966.475,35	1.179.720,49
4	MediumTech	51.118,21	10.265,60	245.930,95	17.387,93	324.702,70	1.332.944,44	- 460.087,25	6.988,85	1.073.503,04	1.953.349,07
5	HighTech	59.974,68	104.451,01	110.627,56	81,14	275.134,39	432.728,53	187.546,80	62.571,29	1.214.744,04	1.897.590,67
Total	**1992 - 1997**	**5.264.617,41**	**- 2.135.617,95**	**- 2.151.235,12**	**746.687,10**	**1.724.451,45**	**16.607.336,71**	**- 3.367.370,29**	**- 1.412.738,79**	**7.649.370,93**	**19.476.598,56**
1	PrimaryProds	- 113.287,89	1.716.880,02	- 2.305.880,96	168,89	- 702.119,93	2.782.948,38	7.585.866,84	- 1.211.050,36	- 11.215.084,52	- 2.057.319,66
2	ResourceBased	- 164.110,13	- 920.764,35	- 561.900,45	2.805,67	- 1.643.969,26	4.395.420,43	8.581.930,01	- 4.572.427,92	- 14.740.671,36	- 6.335.748,84
3	LowTech	- 22.777,91	- 54.064,64	140.661,44	445,91	64.264,80	1.747.377,92	- 1.268.505,79	- 83.214,74	2.117.622,69	2.513.280,08
4	MediumTech	- 11.050,81	6.603,18	103.996,39	850,08	100.398,84	908.393,06	- 422.956,24	- 50.374,51	40.924,57	475.986,88
5	HighTech	- 10.240,60	35.288,00	68.017,09	591,36	93.655,85	540.159,27	371.441,96	- 76.285,56	- 209.675,26	625.640,41
Total	**1997 - 1999**	**- 321.467,34**	**783.942,21**	**- 2.555.106,48**	**4.861,91**	**- 2.087.769,70**	**10.374.299,07**	**14.847.776,78**	**- 5.993.353,09**	**- 24.006.883,88**	**- 4.778.161,13**
1	PrimaryProds	1.678.397,50	650.367,39	- 764.523,39	1.524,81	1.565.766,31	7.453.423,29	4.177.311,27	- 365.366,68	- 4.328.560,69	6.936.807,19
2	ResourceBased	2.146.806,36	2.593.573,08	- 2.192.585,04	4.238,68	2.552.033,08	9.898.584,00	3.524.660,76	508.292,42	- 6.883.127,65	7.048.409,53
3	LowTech	430.709,99	- 73.628,40	- 127.551,15	0,10	229.530,54	6.989.567,36	- 1.416.869,09	- 8.870,10	- 3.694.543,23	1.869.284,95
4	MediumTech	240.380,54	175.108,17	344.966,41	91,16	760.546,28	3.129.447,07	- 58.876,89	34.885,52	612.468,48	3.717.924,18
5	HighTech	223.037,13	- 72.304,39	306.318,76	-	457.051,51	2.068.828,24	- 1.056.052,67	62.623,26	2.269.223,95	3.344.622,79
Total	**1999 - 2004**	**4.719.331,52**	**3.273.115,85**	**- 2.433.374,41**	**5.854,75**	**5.564.927,72**	**29.539.849,96**	**5.170.173,39**	**231.564,43**	**- 12.024.539,14**	**22.917.048,64**
1	PrimaryProds	590.791,84	- 474.054,33	2.887.168,48	0,01	3.003.905,99	8.921.254,74	9.278.353,49	- 3.351.741,03	7.054.643,22	21.902.510,41
2	ResourceBased	817.325,36	2.629.967,95	- 3.842.691,93	0,00	- 395.398,63	10.843.248,94	6.998.498,03	- 676.727,95	- 3.644.599,12	13.520.419,89
3	LowTech	132.271,88	77.880,42	- 186.468,93	0,00	23.683,38	6.213.811,11	- 2.032.775,84	- 106.458,03	- 1.017.850,94	3.056.726,29
4	MediumTech	144.809,56	75.159,99	150.352,59	29,60	370.351,75	4.119.652,70	- 1.328.874,17	- 172.747,62	3.758.510,37	6.376.541,29
5	HighTech	106.455,26	- 150.517,41	- 346.106,07	246,87	- 389.921,34	3.135.128,26	- 787.511,63	- 273.224,82	- 2.003.066,03	71.325,78
Total	**2004 - 2009**	**1.791.653,92**	**2.158.436,62**	**- 1.337.745,86**	**276,47**	**2.612.621,15**	**33.233.095,75**	**12.127.689,87**	**- 4.580.899,45**	**4.147.637,49**	**44.927.523,66**
1	PrimaryProds	3.969.074,42	- 831.738,80	- 2.132.916,79	6,53	1.004.425,36	2.741.138,50	- 10.046.569,76	3.481.431,39	14.706.508,66	10.882.508,78
2	ResourceBased	3.306.030,00	5.488.945,45	- 8.184.907,57	856.534,26	1.466.602,15	2.458.334,09	- 2.453.584,98	8.579.643,37	18.960.194,01	27.544.586,49
3	LowTech	577.122,29	- 41.629,46	511.040,34	0,14	1.046.533,32	1.096.028,03	2.839.720,26	241.364,32	5.761.762,02	9.938.874,64
4	MediumTech	797.180,30	234.410,48	- 497.484,90	0,15	534.106,03	1.016.637,35	- 102.724,35	662.077,00	7.435.944,13	9.011.934,13
5	HighTech	268.132,25	- 24.310,63	256.869,87	0,00	500.691,49	454.934,00	365.573,92	115.945,20	1.211.845,39	2.148.298,52
Total	**2009 - 2014**	**8.917.539,27**	**4.825.677,03**	**- 10.047.399,04**	**856.541,07**	**4.552.358,34**	**7.767.071,98**	**- 9.397.584,91**	**13.080.461,28**	**48.076.254,20**	**59.526.202,55**
1	PrimaryProds	- 373.884,22	- 1.620.500,97	- 2.214.978,05	1.104,25	- 4.208.258,98	5.298.182,42	- 4.480.897,72	- 1.603.861,52	- 5.996.034,99	- 6.782.611,81
2	ResourceBased	- 336.829,32	- 2.976.852,46	794,12	16.590,12	- 3.296.297,55	6.563.596,04	- 7.871.253,15	- 1.005.698,83	- 5.705.570,72	- 8.018.926,66
3	LowTech	- 90.676,56	89.134,60	87.120,04	39,57	85.617,65	2.687.743,14	- 3.563.097,87	- 67.825,39	4.243.499,85	3.300.319,73
4	MediumTech	- 88.496,64	190.529,66	449.593,84	211,68	551.838,53	2.471.964,35	- 871.610,93	48.811,07	2.007.983,52	3.657.148,01
5	HighTech	- 42.712,02	- 104.865,71	- 109.237,41	88,24	- 256.726,90	914.178,03	336.899,60	- 80.676,74	- 1.679.529,36	- 509.128,47
Total	**2014 - 2019**	- 932.598,76	- 4.422.554,87	- 1.786.707,47	18.033,85	- 7.123.827,25	17.935.663,98	- 16.449.960,07	- 2.709.251,41	- 7.129.651,70	- 8.353.199,21
1	PrimaryProds	462.937,37	349.776,24	1.438.501,29	17,60	2.251.232,50	15.183.834,70	30.563.286,58	4.122.677,67	- 29.695.736,55	20.174.062,40
2	ResourceBased	462.302,34	- 394.364,94	- 858.992,98	- 0,00	- 791.055,59	18.939.151,24	31.125.182,74	- 2.488.069,77	- 28.622.467,97	18.953.796,25
3	LowTech	213.412,25	- 269.266,44	- 24.080,53	- 0,00	- 79.934,73	9.966.279,08	1.186.999,25	- 201.790,22	- 1.855.318,06	9.096.170,05
4	MediumTech	251.094,54	- 73.783,46	274.074,45	- 0,00	451.385,53	9.374.950,18	- 54.226,69	- 402.798,99	4.205.044,03	13.122.968,52
5	HighTech	73.366,46	- 13.745,83	- 39.100,63	0,00	20.520,00	2.841.921,31	1.253.069,68	- 133.197,98	- 1.469.327,23	2.492.465,78
Total	**2019 - 2021**	**1.463.112,95**	**- 401.384,42**	**790.401,59**	**17,60**	**1.852.147,71**	**56.306.136,51**	**64.074.311,56**	**896.820,71**	**- 57.437.805,79**	**63.839.463,00**

Source: Own computation

Korean Market

Table 3. Constant Market Share for Indonesia's Export Growth to the Korean Market

		Korea's Market					World Market				
No	**Products**	**WGE**	**CE**	**ME**	**COMPE**	**TE**	**WGE**	**CE**	**ME**	**COMPE**	**TE**
1	PrimaryProds	80.329,70	140.265,44	304.889,97	1.629,71	527.114,82	3.532.358,46	6.833.115,06	38.609,68	- 9.253.642,01	1.150.441,19
2	ResourceBased	145.167,16	366.677,90	14.760,30	27.311,74	553.917,10	3.116.063,52	2.666.789,67	80.282,57	- 2.619.118,72	3.244.017,04
3	LowTech	22.851,73	- 24.448,97	47.155,82	2.781,31	48.339,88	1.045.013,43	717.416,95	- 14.942,27	3.223.308,52	4.970.796,63
4	MediumTech	3.234,02	784,27	23.044,25	2.935,14	29.997,67	323.438,16	- 48.425,00	- 2.255,17	1.571.059,96	1.843.817,95
5	HighTech	389,38	21,16	2.903,65	1.689,56	5.003,75	56.906,16	26.551,17	1.370,00	644.972,24	729.799,56
Total	**1989-1992**	**251.971,98**	**483.299,80**	**392.753,99**	**36.347,45**	**1.164.373,23**	**8.073.779,73**	**10.195.447,85**	**103.064,79**	**- 6.433.420,00**	**11.938.872,37**
1	PrimaryProds	651.542,21	- 389.727,40	148.719,59	305,30	410.839,70	5.274.511,39	- 2.395.467,18	41.930,38	627.528,69	3.548.503,29
2	ResourceBased	860.698,51	706.945,88	- 785.793,65	156.623,44	938.474,18	5.742.793,31	60.229,67	790.591,98	4.303.820,08	10.897.435,04
3	LowTech	104.617,27	151.257,53	- 281.856,44	7.607,80	- 18.373,84	3.824.359,04	- 759.592,34	143.075,14	- 2.028.121,35	1.179.720,49
4	MediumTech	33.203,48	- 4.916,28	- 32.674,69	36.480,29	32.092,81	1.332.944,44	- 460.087,25	- 5.751,13	1.086.243,01	1.953.349,07
5	HighTech	5.103,67	3.503,46	7.289,07	20,40	15.916,60	432.728,53	187.546,80	- 7.666,86	1.284.982,19	1.897.590,67
Total	**1992-1997**	**1.655.165,15**	**467.063,19**	**- 944.316,11**	**201.037,23**	**1.378.949,45**	**16.607.336,71**	**- 3.367.370,29**	**962.179,52**	**5.274.452,63**	**19.476.598,56**
1	PrimaryProds	- 158.655,71	110.750,47	- 17.833,85	430,27	- 65.308,82	2.782.948,38	7.585.866,84	- 1.127.704,46	- 11.298.430,42	- 2.057.319,66
2	ResourceBased	- 260.596,26	24.177,23	5.326,48	10.587,25	- 220.505,29	4.395.420,43	8.581.930,01	- 1.203.852,81	- 18.109.246,47	- 6.335.748,84
3	LowTech	- 14.604,03	- 7.539,21	153.161,81	170,51	131.189,09	1.747.377,92	- 1.268.505,79	2.062,37	2.032.345,59	2.513.280,08
4	MediumTech	- 9.523,23	- 4.304,69	28.109,84	3.114,86	17.396,78	908.393,06	- 422.956,24	5.738,13	- 15.188,08	475.986,88
5	HighTech	- 2.879,53	5.870,34	- 8.463,81	284,20	- 5.188,80	540.159,27	371.441,96	9.319,03	- 295.279,85	625.640,41
Total	**1997-1999**	**- 446.258,75**	**128.954,14**	**160.300,48**	**14.587,08**	**- 142.417,04**	**10.374.299,07**	**14.847.776,78**	**- 2.314.437,74**	**- 27.685.799,23**	**- 4.778.161,12**
1	PrimaryProds	1.007.089,95	- 315.499,96	24.618,09	782,78	716.990,85	7.453.423,29	4.177.311,27	- 359.079,59	- 4.334.847,78	6.936.807,19
2	ResourceBased	1.556.336,81	1.091.617,81	- 2.100.937,27	11.345,70	558.363,05	9.898.584,00	3.524.660,76	833.747,30	- 7.208.582,53	7.048.409,53
3	LowTech	211.244,23	- 104.428,65	- 53.135,19	287,52	53.967,90	6.989.567,36	- 1.416.869,09	- 34.874,36	- 3.668.538,97	1.869.284,95
4	MediumTech	78.868,14	- 15.668,44	- 21.988,31	37.142,66	78.354,06	3.129.447,07	- 58.876,89	- 28.461,74	675.815,74	3.717.924,18
5	HighTech	14.819,16	16.541,70	69.478,15	1.854,45	102.693,45	2.068.828,24	- 1.056.052,67	- 10.870,45	2.342.717,66	3.344.622,79
Total	**1999-2004**	**2.868.358,28**	**672.562,47**	**- 2.081.964,54**	**51.413,11**	**1.510.369,31**	**29.539.849,96**	**5.170.173,39**	**400.461,16**	**- 12.193.435,87**	**22.917.048,64**
1	PrimaryProds	911.649,45	1.690.791,62	101.249,78	2.272,35	2.705.963,21	8.921.254,74	9.278.353,49	870.609,97	2.832.292,22	21.902.510,41
2	ResourceBased	1.142.670,05	480.271,13	- 1.517.307,23	48.244,16	153.878,10	10.843.248,94	6.998.498,03	174.684,98	- 4.496.012,06	13.520.419,89
3	LowTech	144.530,29	- 58.234,08	56.139,05	-	142.435,26	6.213.811,11	- 2.032.775,84	4.985,56	- 1.129.294,53	3.056.726,29
4	MediumTech	82.146,48	- 60.829,98	287.201,28	- 0,00	308.517,78	4.119.652,70	- 1.328.874,17	- 20.623,94	3.606.386,69	6.376.541,29
5	HighTech	58.035,36	23.222,24	- 77.026,91	1,95	4.232,63	3.135.128,26	- 787.511,63	43.095,67	- 2.319.386,51	71.325,78
Total	**2004-2009**	**2.339.031,63**	**2.075.220,92**	**- 1.149.744,04**	**50.518,46**	**3.315.026,98**	**33.233.095,75**	**12.127.689,87**	**1.072.752,24**	**- 1.506.014,20**	**44.927.523,66**
1	PrimaryProds	2.903.172,95	- 1.953.291,20	- 2.027.809,22	3.173,38	- 1.074.754,08	2.741.138,50	- 10.046.569,76	1.255.038,48	16.932.901,57	10.882.508,78
2	ResourceBased	1.590.309,44	2.795.154,99	- 1.534.750,51	51.386,72	2.902.100,66	2.458.334,09	- 2.453.584,98	3.659.909,40	23.879.927,98	27.544.586,49
3	LowTech	278.954,15	84.913,11	10.935,25	3,10	374.805,60	1.096.028,03	2.839.720,26	136.026,05	5.867.100,30	9.938.874,64
4	MediumTech	302.527,14	- 159.813,93	- 21.956,26	310,43	121.067,38	1.016.637,35	- 102.724,35	68.929,72	8.029.091,41	9.011.934,13
5	HighTech	78.503,84	20.107,40	39.134,82	304,77	138.050,84	454.934,00	365.573,92	17.654,65	1.310.135,95	2.148.298,52
Total	**2009-2014**	**5.153.467,53**	**787.070,38**	**- 3.534.445,91**	**55.178,40**	**2.461.270,40**	**7.767.071,98**	**- 9.397.584,91**	**5.137.558,29**	**56.019.157,19**	**59.526.202,55**
1	PrimaryProds	117.264,80	417.074,26	- 1.679.680,06	6.513,33	- 1.138.827,67	5.298.182,42	- 4.480.897,72	160.012,79	- 7.759.909,30	- 6.782.611,81
2	ResourceBased	180.734,13	- 2.212.437,22	- 871.929,44	181.641,50	- 2.721.991,03	6.563.596,04	- 7.871.253,15	- 6.458,93	- 6.704.810,62	- 8.018.926,66
3	LowTech	27.222,12	96.400,68	294.915,68	0,00	418.538,48	2.687.743,14	- 3.563.097,87	68.823,73	4.106.850,73	3.300.319,73
4	MediumTech	19.997,59	- 9.237,42	32.280,43	658,70	43.699,31	2.471.964,35	- 871.610,93	- 55.986,88	2.112.781,47	3.657.148,01
5	HighTech	8.747,93	- 37.885,01	55.567,38	80,90	26.511,19	914.178,03	336.899,60	- 7.689,58	- 1.752.516,52	- 509.128,47
Total	**2014-2019**	**353.966,57**	**- 1.746.084,70**	**- 2.168.846,00**	**188.894,43**	**- 3.372.069,71**	**17.935.663,98**	**- 16.449.960,07**	**158.701,13**	**- 9.997.604,24**	**- 8.353.199,21**
1	PrimaryProds	577.670,71	- 133.027,38	216.952,20	985,21	662.580,74	15.183.834,70	30.563.286,58	2.618.983,64	- 28.192.042,52	20.174.062,40
2	ResourceBased	655.182,18	- 338.357,99	240.972,26	206,46	558.002,90	18.939.151,24	31.125.182,74	1.156.580,58	- 32.267.118,32	18.953.796,25
3	LowTech	300.207,68	- 247.801,15	- 105.509,99	119,62	- 52.983,84	9.966.279,08	1.186.999,25	- 181.422,27	- 1.875.686,01	9.096.170,05
4	MediumTech	156.379,27	17.225,64	- 72.677,84	16,06	100.943,13	9.374.950,18	- 54.226,69	82.343,28	3.719.901,76	13.122.968,52
5	HighTech	70.206,68	17.468,58	389.889,60	-	477.564,85	2.841.921,31	1.253.069,68	- 83.517,69	- 1.519.007,52	2.492.465,78
Total	**2019-2021**	**1.759.646,51**	**- 684.492,31**	**669.626,23**	**1.327,35**	**1.746.107,78**	**56.306.136,51**	**64.074.311,56**	**3.592.967,53**	**- 60.133.952,61**	**63.839.463,00**

Source: Own computation

Competitiveness remains positive from this period forward. Indonesia's competitiveness in the Korean market has not contributed significantly to export growth from 1989 to 2021. Along with positive competitiveness, Indonesia benefited from the transformation of the Korean Trade Policy. Starting with a shift to an export promotion policy in the 1960s–1980s, Korea has implemented consistent policies that include liberalisation as part of an economic reform package (Haggard et al., 1991; Amsden, 2007). South Korea's export-oriented trade policy in the 1960s-1980s is a successful economic development model through strategic trade promotion (Amsden, 2007). A combination of domestic reform and trade liberalisation has endorsed Korea's competitiveness (Amsden, 2007; Haggard et al., 1991)

In 2014 – 2019, Indonesia's exports to Korea dropped significantly. Competitiveness became a positive contributor, preventing further declines in exports. Competitiveness was USD 188 million, and the total change of value was USD 3 billion in 2014 – 2019. This is when FTA is effective as a built-in stabiliser (Suryanta, 2021).

Chinese Market

ASEAN-China FTA integrated Indonesia and China. At the beginning of the implementation period of ACFTA, there was a large demonstration and political pressure on the domestic industry (Suryanta, 2021).

Table 4. Constant Market Share for Indonesia's Export Growth to the Chinese Market

		China's MARKET					World Market				
No	Products	WGE	CE	ME	COMPE	TE	WGE	CE	ME	COMPE	TE
1	PrimaryProds	186.711,73	528.198,57	- 316.447,18	16.620,74	415.083,86	3.532.358,46	6.833.115,06	227.557,99	- 9.442.590,32	1.150.441,19
2	ResourceBased	151.506,25	246.816,61	- 19.605,99	48.515,05	427.231,91	3.116.063,52	2.666.789,67	170.475,24	- 2.709.311,39	3.244.017,04
3	LowTech	9.436,67	- 13.085,88	10.318,75	4.272,28	10.941,81	1.045.013,43	717.416,95	- 22.513,07	3.230.879,31	4.970.796,63
4	MediumTech	35.643,41	- 24.398,39	- 44.579,09	8.364,45	- 24.969,62	323.438,16	- 48.425,00	- 1.797,91	1.570.602,70	1.843.817,95
5	HighTech	58,71	21,39	- 93,27	32,17	19,00	56.906,16	26.551,17	- 1.532,53	647.874,77	729.799,56
Total	**1989 - 1992**	**383.356,76**	**737.552,30**	**- 370.406,79**	**77.804,69**	**828.306,96**	**8.073.779,73**	**10.195.447,85**	**372.189,72**	**- 6.702.544,92**	**11.938.872,37**
1	PrimaryProds	742.391,58	280.787,81	- 737.193,41	44.996,85	330.982,84	5.274.511,39	- 2.395.467,18	647.711,14	21.747,94	3.548.503,29
2	ResourceBased	699.437,76	- 630.443,95	134.398,33	138.722,93	342.115,07	5.742.793,31	60.229,67	- 168.665,57	5.263.077,62	10.897.435,04
3	LowTech	26.750,19	- 2.107,15	- 11.680,79	6.518,02	19.480,27	3.824.359,04	- 759.592,34	- 55.220,09	- 1.829.826,12	1.179.720,49
4	MediumTech	29.890,83	9.332,59	78.554,58	13.789,58	131.567,58	1.332.944,44	- 460.087,25	- 36.271,02	1.116.762,91	1.953.349,07
5	HighTech	113,75	107,44	2.268,93	6.261,90	8.752,02	432.728,53	187.546,80	- 3.675,47	1.280.990,81	1.897.590,67
Total	**1992 - 1997**	**1.498.584,12**	**- 342.323,26**	**- 533.652,37**	**210.289,28**	**832.897,77**	**16.607.336,71**	**- 3.367.370,29**	**383.878,99**	**5.852.753,16**	**19.476.598,56**
1	PrimaryProds	22.304,46	- 81.396,90	- 227.605,66	8.152,02	- 278.546,09	2.782.948,38	7.585.866,84	- 1.249.380,79	- 11.176.754,09	- 2.057.319,66
2	ResourceBased	21.674,34	- 39.808,89	- 57.680,49	15.047,74	- 60.767,30	4.395.420,43	8.581.930,01	113.012,12	- 19.426.111,40	- 6.335.748,84
3	LowTech	968,42	- 6.338,68	50.200,22	1.440,82	46.270,78	1.747.377,92	- 1.268.505,79	- 4.206,44	2.038.614,39	2.513.280,08
4	MediumTech	3.476,63	3.267,30	41.835,72	10.865,75	59.445,41	908.393,06	- 422.956,24	4.731,81	- 14.181,75	475.986,88
5	HighTech	193,17	5.454,53	6.558,22	973,04	13.178,96	540.159,27	371.441,96	9.703,55	- 295.664,37	625.640,41
Total	**1997 - 1999**	**48.617,03**	**- 118.822,64**	**- 186.692,00**	**36.479,37**	**- 220.418,25**	**10.374.299,07**	**14.847.776,78**	**- 1.126.139,76**	**- 28.874.097,21**	**- 4.778.161,13**
1	PrimaryProds	1.777.464,77	581.960,87	- 1.628.795,18	654,08	731.284,53	7.453.423,29	4.177.311,27	1.216.506,75	- 5.910.434,12	6.936.807,19
2	ResourceBased	2.228.587,38	- 803.900,79	- 450.072,86	8.088,00	982.701,73	9.898.584,00	3.524.660,76	669.360,89	- 7.044.196,11	7.048.409,53
3	LowTech	216.569,96	- 100.852,43	22.454,49	1.201,05	139.373,07	6.989.567,36	- 1.416.869,09	13.667,01	- 3.717.080,34	1.869.284,95
4	MediumTech	522.728,30	186.014,36	- 185.589,45	8.526,32	531.679,53	3.129.447,07	- 58.876,89	375.458,20	271.895,80	3.717.924,18
5	HighTech	52.631,90	1.873,63	156.226,98	46,26	210.778,77	2.068.828,24	- 1.056.052,67	- 97.538,41	2.429.385,63	3.344.622,79
Total	**1999 - 2004**	**4.797.982,30**	**- 134.904,36**	**- 2.085.776,02**	**18.515,71**	**2.595.817,63**	**29.539.849,96**	**5.170.173,39**	**2.177.454,43**	**- 13.970.429,14**	**22.917.048,64**
1	PrimaryProds	1.427.730,77	2.309.042,04	- 209.555,04	185.521,70	3.712.739,47	8.921.254,74	9.278.353,49	1.409.752,29	2.293.149,89	21.902.510,41
2	ResourceBased	1.853.775,63	1.267.672,86	- 380.560,59	234,97	2.741.122,86	10.843.248,94	6.998.498,03	1.393.513,92	- 5.714.840,99	13.520.419,89
3	LowTech	222.601,67	- 164.224,18	- 15.266,14	0,00	43.111,34	6.213.811,11	- 2.032.775,84	10.776,64	- 1.135.085,62	3.056.726,29
4	MediumTech	726.242,51	- 328.320,71	- 58.475,23	123,29	339.569,86	4.119.652,70	- 1.328.874,17	25.434,37	3.560.328,38	6.376.541,29
5	HighTech	225.276,95	- 89.303,57	- 77.922,77	-	58.050,62	3.135.128,26	- 787.511,63	- 5.481,79	- 2.270.809,05	71.325,78
Total	**2004 - 2009**	**4.455.627,53**	**2.994.866,44**	**- 741.779,78**	**185.879,96**	**6.894.594,15**	**33.233.095,75**	**12.127.689,87**	**2.833.995,43**	**- 3.267.257,39**	**44.927.523,66**
1	PrimaryProds	3.814.501,18	1.851.848,25	- 3.199.594,12	8,73	2.466.764,04	2.741.138,50	- 10.046.569,76	3.073.570,58	15.114.369,46	10.882.508,78
2	ResourceBased	3.423.868,55	4.897.761,87	- 6.338.886,96	430,24	1.983.173,70	2.458.334,09	- 2.453.584,98	7.511.316,70	20.028.520,67	27.544.586,49
3	LowTech	200.834,21	101.210,29	392.944,88	5,73	694.995,11	1.096.028,03	2.839.720,26	24.735,28	5.978.391,06	9.938.874,64
4	MediumTech	801.474,28	- 329.625,08	417.807,61	1.368,59	891.025,40	1.016.637,35	- 102.724,35	201.913,88	7.896.107,25	9.011.934,13
5	HighTech	213.850,60	- 147.627,13	4.402,28	33,18	70.658,94	454.934,00	365.573,92	- 89.735,88	1.417.526,48	2.148.298,52
Total	**2009 - 2014**	**8.454.528,82**	**6.373.568,20**	**- 8.723.326,30**	**1.846,47**	**6.106.617,19**	**7.767.071,98**	**- 9.397.584,91**	**10.721.800,56**	**50.434.914,92**	**59.526.202,55**
1	PrimaryProds	2.897.903,65	- 376.962,60	348.209,65	23,08	2.869.173,78	5.298.182,42	- 4.480.897,72	- 164.889,13	- 7.435.007,38	- 6.782.611,81
2	ResourceBased	2.513.698,40	- 1.716.183,90	3.270.636,79	14.701,12	4.082.852,41	6.563.596,04	- 7.871.253,15	- 317.467,34	- 6.393.802,21	- 8.018.926,66
3	LowTech	366.508,45	306.215,79	420.654,56	7,92	1.093.386,72	2.687.743,14	- 3.563.097,87	412.594,13	3.763.080,33	3.300.319,73
4	MediumTech	749.986,51	- 505.506,37	2.100.356,78	7.576,98	2.352.413,90	2.471.964,35	- 871.610,93	- 180.805,66	2.237.600,25	3.657.148,01
5	HighTech	136.860,06	9.096,96	- 187.841,16	- 0,00	- 41.884,14	914.178,03	336.899,60	- 253.319,89	- 1.506.886,21	- 509.128,47
Total	**2014 - 2019**	**6.664.957,06**	**- 2.283.340,12**	**5.952.016,63**	**22.309,10**	**10.355.942,67**	**17.935.663,98**	**- 16.449.960,07**	**- 503.887,89**	**- 9.335.015,22**	**- 8.353.199,21**
1	PrimaryProds	3.026.113,00	1.506.569,95	5.284.149,82	12,03	9.816.844,80	15.183.834,70	30.563.286,58	1.892.886,28	- 27.465.945,17	20.174.062,40
2	ResourceBased	3.083.268,24	- 147.955,37	2.564.427,84	44,69	5.499.785,40	18.939.151,24	31.125.182,74	- 3.218.189,44	- 27.892.348,30	18.953.796,25
3	LowTech	592.774,13	- 135.148,57	1.566.488,48	0,00	2.024.114,04	9.966.279,08	1.186.999,25	- 227.095,08	- 1.830.013,20	9.096.170,05
4	MediumTech	1.246.065,66	1.880.433,71	5.247.748,23	206,12	8.374.453,72	9.374.950,18	- 54.226,69	734.813,62	3.067.431,42	13.122.968,52
5	HighTech	91.909,27	- 43.588,86	56.492,99	6,03	104.819,43	2.841.921,31	1.253.069,68	- 203.460,04	- 1.399.065,17	2.492.465,78
Total	**2019 - 2021**	**8.040.130,30**	**3.060.310,85**	**14.719.307,35**	**268,87**	**25.820.017,38**	**56.306.136,51**	**64.074.311,56**	**- 1.021.044,66**	**- 55.519.940,41**	**63.839.463,00**

Source: Own computation

One of the findings of this computation is that Indonesia gained from China's accession to the WTO in 2001. After 2001, Indonesia's exports to China increased rapidly. However, China's liberalisation does not alter the competitiveness of Indonesia's exports to China. Since the implementation of the ASEAN-China Free Trade Agreement in 2005, Indonesia's export growth to China has been driven by world growth. Exports grew rapidly from 2004 to 2021.

Indian Market

Indonesia's export competitiveness to the Indian market remains buoyant and consistent from 1989 to 2021. Various factors favour Indonesia's products in the Indian market. India's trade policy shift from protectionism to trade liberalisation after 1991 seems to favour Indonesia's export growth to India. India has liberalised its market since 1991. Prime Minister Rao (Rajagopalan, 2021) asserts that the result of trade reform in India has increased income per capita by sevenfold. Indonesia's exports to India are growing, and there was a positive competitiveness effect from 1992 to 1997.

Table 5. Constant Market Share for Indonesia's Export Growth to the Indian Market

		India's Market					World Market				
No	Products	WGE	CE	ME	COMPE	TE	WGE	CE	ME	COMPE	TE
1	PrimaryProds	- 435,30	79.660,82	- 80.257,23	15.119,46	14.087,75	3.532.358,46	6.833.115,06	68.864,09	- 9.283.896,42	1.150.441,19
2	ResourceBased	- 2.864,78	- 4.436,93	8.257,01	5.546,12	6.501,42	3.116.063,52	2.666.789,67	- 11.196,44	- 2.527.639,71	3.244.017,04
3	LowTech	- 113,86	1.769,09	- 2.075,50	352,24	- 68,03	1.045.013,43	717.416,95	3.702,16	3.204.664,08	4.970.796,63
4	MediumTech	- 482,35	- 1.194,86	- 1.846,01	2.163,83	- 1.359,39	323.438,16	- 48.425,00	- 2.772,06	1.571.576,85	1.843.817,95
5	HighTech	- 11,20	- 55,78	- 52,72	181,32	61,63	56.906,16	26.551,17	732,06	645.610,18	729.799,56
Total	**1989-1992**	**- 3.907,49**	**75.742,35**	**- 75.974,44**	**23.362,97**	**19.223,38**	**8.073.779,73**	**10.195.447,85**	**59.329,80**	**- 6.389.685,01**	**11.938.872,37**
1	PrimaryProds	19.539,05	19.369,70	32.682,47	13.908,53	85.499,75	5.274.511,39	- 2.395.467,18	475,16	668.983,92	3.548.503,29
2	ResourceBased	43.015,65	106.279,58	227.932,45	3.687,94	380.915,61	5.742.793,31	60.229,67	19.927,65	5.074.484,41	10.897.435,04
3	LowTech	1.385,64	- 77,87	17.271,64	3.032,98	21.612,39	3.824.359,04	- 759.592,34	- 4.137,29	- 1.880.908,92	1.179.720,49
4	MediumTech	4.806,77	6.377,75	54.641,31	16.269,68	82.095,51	1.332.944,44	- 460.087,25	16.119,89	1.064.372,00	1.953.349,07
5	HighTech	204,11	570,61	1.164,62	6.038,07	7.977,41	432.728,53	187.546,80	- 2.006,66	1.279.321,99	1.897.590,67
Total	**1992-1997**	**68.951,21**	**132.519,77**	**333.692,49**	**42.937,20**	**578.100,67**	**16.607.336,71**	**- 3.367.370,29**	**30.378,74**	**6.206.253,40**	**19.476.598,56**
1	PrimaryProds	21.101,53	34.286,44	14.550,67	1.819,04	71.757,67	2.782.948,38	7.585.866,84	- 85.810,50	- 12.340.324,38	- 2.057.319,66
2	ResourceBased	85.111,10	196.159,18	- 88.761,58	15.456,95	207.965,66	4.395.420,43	8.581.930,01	94.411,57	- 19.407.510,85	- 6.335.748,84
3	LowTech	4.615,81	2.072,69	26.661,70	882,11	34.232,31	1.747.377,92	- 1.268.505,79	1.527,60	2.032.880,35	2.513.280,08
4	MediumTech	17.441,05	- 40.102,96	- 26.009,78	2.724,62	- 45.947,07	908.393,06	- 422.956,24	- 33.205,88	23.755,93	475.986,88
5	HighTech	1.641,64	- 2.179,44	- 3.917,22	3.383,62	- 1.071,40	540.159,27	371.441,96	1.142,54	- 287.103,36	625.640,41
Total	**1997-1999**	**129.911,12**	**190.235,90**	**- 77.476,20**	**24.266,34**	**266.937,17**	**10.374.299,07**	**14.847.776,78**	**- 21.934,66**	**- 29.978.302,31**	**- 4.778.161,13**
1	PrimaryProds	180.245,19	142.886,16	57.787,60	283,47	381.202,42	7.453.423,29	4.177.311,27	35.590,07	- 4.729.517,44	6.936.807,19
2	ResourceBased	644.019,41	- 514.119,45	597.091,49	448,32	727.439,77	9.898.584,00	3.524.660,76	- 241.142,54	- 6.133.692,68	7.048.409,53
3	LowTech	58.309,19	21.296,63	- 43.291,63	1.093,43	37.407,62	6.989.567,36	- 1.416.869,09	41.458,26	- 3.744.871,60	1.869.284,95
4	MediumTech	41.756,24	6.301,94	23.304,84	1.619,26	72.982,27	3.129.447,07	- 58.876,89	22.909,91	624.444,09	3.717.924,18
5	HighTech	7.244,39	4.255,84	22.232,62	898,97	34.631,82	2.068.828,24	- 1.056.052,67	- 12.119,08	2.343.966,29	3.344.622,79
Total	**1999-2004**	**931.574,41**	**- 339.378,87**	**657.124,92**	**4.343,45**	**1.253.663,91**	**29.539.849,96**	**5.170.173,39**	**- 153.303,38**	**- 11.639.671,33**	**22.917.048,64**
1	PrimaryProds	984.852,25	391.093,68	959.636,05	104,41	2.335.686,39	8.921.254,74	9.278.353,49	323.779,83	3.379.122,35	21.902.510,41
2	ResourceBased	2.399.130,49	- 68.120,22	254.953,43	19.971,43	2.605.935,12	10.843.248,94	6.998.498,03	67.733,65	- 4.389.060,72	13.520.419,89
3	LowTech	167.007,95	- 31.024,26	- 118.703,46	3,03	17.283,26	6.213.811,11	- 2.032.775,84	63.058,91	- 1.187.367,88	3.056.726,29
4	MediumTech	201.107,17	- 20.636,58	1.244,92	32.428,09	214.143,60	4.119.652,70	- 1.328.874,17	46.623,01	3.539.139,74	6.376.541,29
5	HighTech	73.656,79	- 22.688,10	31.663,49	38,73	82.670,92	3.135.128,26	- 787.511,63	- 16.349,94	- 2.259.940,91	71.325,78
Total	**2004-2009**	**3.825.754,65**	**248.624,52**	**1.128.794,43**	**52.545,69**	**5.255.719,29**	**33.233.095,75**	**12.127.689,87**	**484.845,45**	**- 918.107,42**	**44.927.523,66**
1	PrimaryProds	1.597.670,33	580.830,94	1.524.719,14	74.812,04	3.778.032,44	2.741.138,50	- 10.046.569,76	1.287.540,33	16.900.399,71	10.882.508,78
2	ResourceBased	2.189.384,82	- 150.945,19	- 1.592.939,46	4.600,64	450.100,81	2.458.334,09	- 2.453.584,98	873.354,57	26.666.482,81	27.544.586,49
3	LowTech	61.796,88	22.121,40	- 19.100,04	0,00	64.818,24	1.096.028,03	2.839.720,26	17.611,33	5.985.515,02	9.938.874,64
4	MediumTech	181.151,79	43.014,62	42.599,43	69.205,35	335.971,19	1.016.637,35	- 102.724,35	131.393,97	7.966.627,16	9.011.934,13
5	HighTech	68.688,59	- 31.463,42	98.965,50	-	136.190,67	454.934,00	365.573,92	13.729,51	1.314.061,08	2.148.298,52
Total	**2009-2014**	**4.098.692,41**	**463.558,34**	**54.244,57**	**148.618,03**	**4.765.113,35**	**7.767.071,98**	**- 9.397.584,91**	**2.323.629,70**	**58.833.085,78**	**59.526.202,55**
1	PrimaryProds	951.724,26	957.541,28	- 2.751.122,30	240.946,57	- 600.910,19	5.298.182,42	- 4.480.897,72	612.190,39	- 8.212.086,89	- 6.782.611,81
2	ResourceBased	629.887,37	- 1.256.853,83	- 264.958,62	24.717,21	- 867.207,87	6.563.596,04	- 7.871.253,15	- 110.114,49	- 6.601.155,06	- 8.018.926,66
3	LowTech	25.212,91	7.045,57	623.593,11	577,08	656.428,67	2.687.743,14	- 3.563.097,87	- 19.473,96	4.195.148,42	3.300.319,73
4	MediumTech	94.730,47	- 12.935,88	327.343,73	2.878,58	412.016,90	2.471.964,35	- 871.610,93	- 39.938,08	2.096.732,67	3.657.148,01
5	HighTech	37.174,64	63.957,40	- 106.631,97	0,97	- 5.498,96	914.178,03	336.899,60	- 10.146,65	- 1.750.059,45	- 509.128,47
Total	**2014-2019**	**1.738.729,66**	**- 241.245,46**	**- 2.171.776,05**	**269.120,40**	**- 405.171,45**	**17.935.663,98**	**- 16.449.960,07**	**432.517,19**	**- 10.271.420,30**	**- 8.353.199,21**
1	PrimaryProds	1.414.080,54	- 821.934,33	- 718.252,00	65,79	- 126.040,00	15.183.834,70	30.563.286,58	- 1.337.180,35	- 24.235.878,54	20.174.062,40
2	ResourceBased	826.533,19	1.095.494,34	- 782.117,05	63,05	1.139.973,53	18.939.151,24	31.125.182,74	2.301.960,81	- 33.412.498,55	18.953.796,25
3	LowTech	194.068,61	32.441,42	- 279.703,99	- 0,00	- 53.193,96	9.966.279,08	1.186.999,25	- 124.211,61	- 1.932.896,67	9.096.170,05
4	MediumTech	250.652,43	143.228,21	134.375,64	828,43	529.084,71	9.374.950,18	- 54.226,69	- 78.495,42	3.880.740,46	13.122.968,52
5	HighTech	59.420,74	62.713,71	- 138.264,12	0,75	- 16.128,92	2.841.921,31	1.253.069,68	26.661,16	- 1.629.186,37	2.492.465,78
Total	**2019-2021**	**2.744.755,50**	**511.943,35**	**- 1.783.961,52**	**958,02**	**1.473.695,36**	**56.306.136,51**	**64.074.311,56**	**788.734,59**	**- 57.329.719,67**	**63.839.463,00**

Source: Own computation

Australian Market

Based on the Constant Market Share computation, the world growth effect dominates the contribution from 1989 to 2022. Competitiveness remained positive before and after the implementation of AANZFTA and IA CEPA. There is no fundamental shift in terms of competitiveness due to liberalisation. However, the effects of market and commodity composition fluctuated in different periods from 1989 to 2022. During both financial crises, market effects tended to be negative, so Australia prefers to import products from other sources than Indonesia.

However, it will not happen during 2019 – 2021. Market effects tended to be positive. Australian importers are sensitive to the security of transactions. They will shift their sources to a more secure market when trade risk is high. It is essential to build confidence in the banking system for international transactions.

Table 6. Constant Market Share for Indonesia's Export Growth to the Australian Market

		Australia's Market					World Market				
No	**Products**	**WGE**	**CE**	**ME**	**COMPE**	**TE**	**WGE**	**CE**	**ME**	**COMPE**	**TE**
1	PrimaryProds	14.091,38	244.208,41	- 53.297,29	8.106,09	213.108,58	3.532.358,46	6.833.115,06	- 96.476,45	- 9.118.555,88	1.150.441,19
2	ResourceBased	3.132,78	11.090,51	20.569,86	2.734,22	37.527,37	3.116.063,52	2.666.789,67	8.495,95	- 2.547.332,10	3.244.017,04
3	LowTech	3.273,12	9.817,39	67.540,86	2.380,43	83.011,80	1.045.013,43	717.416,95	- 10.812,76	3.219.179,00	4.970.796,63
4	MediumTech	1.451,93	- 126,94	24.349,49	1.084,46	26.758,93	323.438,16	- 48.425,00	- 6.699,51	1.575.504,30	1.843.817,95
5	HighTech	262,21	- 60,97	2.268,41	849,05	3.318,71	56.906,16	26.551,17	- 1.450,79	647.793,03	729.799,56
Total	**1989-1992**	**22.211,42**	**264.928,39**	**61.431,33**	**15.154,25**	**363.725,40**	**8.073.779,73**	**10.195.447,85**	**- 106.943,56**	**- 6.223.411,65**	**11.938.872,37**
1	PrimaryProds	210.177,07	- 86.305,48	182.153,54	162,83	306.187,97	5.274.511,39	- 2.395.467,18	52.701,65	616.757,43	3.548.503,29
2	ResourceBased	42.182,94	- 4.002,54	6.513,29	274.020,94	318.714,62	5.742.793,31	60.229,67	24.910,12	5.069.501,93	10.897.435,04
3	LowTech	64.275,84	- 18.607,90	46.289,55	1.985,95	93.943,44	3.824.359,04	- 759.592,34	- 10.912,37	- 1.874.133,84	1.179.720,49
4	MediumTech	23.870,24	- 313,89	18.279,21	1.499,31	43.334,87	1.332.944,44	- 460.087,25	1.905,30	1.078.586,58	1.953.349,07
5	HighTech	3.612,64	- 113,63	5.491,22	141,87	9.132,11	432.728,53	187.546,80	- 16,82	1.277.332,16	1.897.590,67
Total	**1992-1997**	**344.118,74**	**- 109.343,44**	**258.726,81**	**277.810,90**	**771.313,00**	**16.607.336,71**	**- 3.367.370,29**	**68.587,88**	**6.168.044,26**	**19.476.598,56**
1	PrimaryProds	42.914,40	395.103,02	- 510.032,90	8.915,63	- 63.099,86	2.782.948,38	7.585.866,84	- 795.317,90	- 11.630.816,98	- 2.057.319,66
2	ResourceBased	23.103,79	- 28.603,16	- 87.518,69	10.073,11	- 82.944,95	4.395.420,43	8.581.930,01	- 228.651,54	- 19.084.447,74	- 6.335.748,84
3	LowTech	13.141,20	5.266,03	41.251,91	2.453,94	62.113,09	1.747.377,92	- 1.268.505,79	- 2.055,69	2.036.463,64	2.513.280,08
4	MediumTech	5.356,06	- 16.856,93	58.413,91	331,94	47.244,98	908.393,06	- 422.956,24	- 22.799,09	13.349,15	475.986,88
5	HighTech	955,58	992,31	2.073,73	36,84	4.058,46	540.159,27	371.441,96	4.144,95	- 290.105,78	625.640,41
Total	**1997-1999**	**85.471,03**	**355.901,27**	**- 495.812,04**	**21.811,45**	**- 32.628,30**	**10.374.299,07**	**14.847.776,78**	**- 1.044.679,26**	**- 28.955.557,71**	**- 4.778.161,13**
1	PrimaryProds	443.288,18	508.887,46	- 846.029,07	167,27	106.313,83	7.453.423,29	4.177.311,27	433.386,07	- 5.127.313,44	6.936.807,19
2	ResourceBased	207.584,91	85.875,93	- 147.058,34	192,13	146.594,63	9.898.584,00	3.524.660,76	106.723,90	- 6.481.559,13	7.048.409,53
3	LowTech	187.403,75	- 67.172,87	- 119.686,35	0,63	545,17	6.989.567,36	- 1.416.869,09	- 15.212,35	- 3.688.200,98	1.869.284,95
4	MediumTech	90.292,83	- 23.380,50	26.149,63	2.646,93	95.708,90	3.129.447,07	- 58.876,89	- 14.171,92	661.525,92	3.717.924,18
5	HighTech	13.336,61	- 4.861,91	44.940,87	-	53.415,58	2.068.828,24	- 1.056.052,67	350,93	2.331.496,28	3.344.622,79
Total	**1999-2004**	**941.906,28**	**499.348,11**	**- 1.041.683,25**	**3.006,96**	**402.578,11**	**29.539.849,96**	**5.170.173,39**	**511.076,63**	**- 12.304.051,34**	**22.917.048,64**
1	PrimaryProds	389.353,24	- 95.298,67	587.383,12	62,58	881.500,26	8.921.254,74	9.278.353,49	- 296.379,32	3.999.281,50	21.902.510,41
2	ResourceBased	229.146,25	515.991,58	- 574.269,80	88,29	170.956,32	10.843.248,94	6.998.498,03	313.124,42	- 4.634.451,50	13.520.419,89
3	LowTech	143.130,00	29.046,59	- 74.980,43	- 0,00	97.196,16	6.213.811,11	- 2.032.775,84	51.374,01	- 1.175.682,98	3.056.726,29
4	MediumTech	115.120,26	- 34.362,91	58.447,96	291,68	139.496,99	4.119.652,70	- 1.328.874,17	- 12.448,76	3.598.211,51	6.376.541,29
5	HighTech	35.999,51	467,81	50.865,58	382,15	87.715,04	3.135.128,26	- 787.511,63	5.679,16	- 2.281.970,00	71.325,78
Total	**2004-2009**	**912.749,26**	**415.844,39**	**47.446,43**	**824,69**	**1.376.864,76**	**33.233.095,75**	**12.127.689,87**	**61.349,50**	**- 494.611,46**	**44.927.523,66**
1	PrimaryProds	773.113,62	610.886,85	- 1.489.389,06	772,30	- 104.616,29	2.741.138,50	- 10.046.569,76	1.861.350,53	16.326.589,51	10.882.508,78
2	ResourceBased	295.558,50	- 171.597,06	- 121.096,32	1.625,08	4.490,20	2.458.334,09	- 2.453.584,98	- 180.689,02	27.720.526,40	27.544.586,49
3	LowTech	180.218,01	46.538,94	763.879,82	-	990.636,77	1.096.028,03	2.839.720,26	75.844,81	5.927.281,54	9.938.874,64
4	MediumTech	173.059,39	- 57.347,04	624.868,23	66,92	740.647,50	1.016.637,35	- 102.724,35	64.759,55	8.033.261,58	9.011.934,13
5	HighTech	74.329,28	- 79.806,68	72.547,52	0,00	67.070,12	454.934,00	365.573,92	- 7.016,99	1.334.807,58	2.148.298,52
Total	**2009-2014**	**1.496.278,79**	**348.675,01**	**- 149.189,80**	**2.464,31**	**1.698.228,30**	**7.767.071,98**	**- 9.397.584,91**	**1.814.248,87**	**59.342.466,61**	**59.526.202,55**
1	PrimaryProds	- 22.145,17	- 728.230,82	- 474.456,88	6.448,36	- 1.218.384,52	5.298.182,42	- 4.480.897,72	- 394.698,54	- 7.205.197,97	- 6.782.611,81
2	ResourceBased	- 9.088,73	- 55.091,10	195.844,26	6.592,31	138.256,74	6.563.596,04	- 7.871.253,15	- 12.981,34	- 6.698.288,21	- 8.018.926,66
3	LowTech	- 19.370,90	- 328.483,24	- 475.326,16	0,00	- 823.180,29	2.687.743,14	- 3.563.097,87	- 378.902,31	4.554.576,77	3.300.319,73
4	MediumTech	- 15.652,83	- 88.329,27	- 569.051,63	1,17	- 673.032,56	2.471.964,35	- 871.610,93	- 173.206,37	2.230.000,96	3.657.148,01
5	HighTech	- 3.208,77	- 7.593,98	- 46.759,27	75,48	- 57.486,54	914.178,03	336.899,60	- 8.339,67	- 1.751.866,43	- 509.128,47
Total	**2014-2019**	**- 69.466,40**	**- 1.207.728,41**	**- 1.369.749,68**	**13.117,32**	**- 2.633.827,16**	**17.935.663,98**	**- 16.449.960,07**	**- 968.128,23**	**- 8.870.774,88**	**- 8.353.199,21**
1	PrimaryProds	73.150,11	- 96.208,42	127.500,76	30,69	104.473,14	15.183.834,70	30.563.286,58	- 146.729,51	- 25.426.329,38	20.174.062,40
2	ResourceBased	158.439,39	72.977,20	- 254.539,66	418,70	- 22.704,37	18.939.151,24	31.125.182,74	109.331,58	- 31.219.869,32	18.953.796,25
3	LowTech	112.787,65	44.942,12	258.729,37	- 0,00	416.459,15	9.966.279,08	1.186.999,25	28.481,47	- 2.085.589,75	9.096.170,05
4	MediumTech	89.558,99	78.487,18	120.945,36	4,03	288.995,56	9.374.950,18	- 54.226,69	3.196,07	3.799.048,97	13.122.968,52
5	HighTech	34.551,22	6.322,77	65.832,46	414,34	107.120,79	2.841.921,31	1.253.069,68	41.646,43	- 1.644.171,64	2.492.465,78
Total	**2019-2021**	**468.487,35**	**106.520,87**	**318.468,29**	**867,76**	**894.344,26**	**56.306.136,51**	**64.074.311,56**	**35.926,04**	**- 56.576.911,12**	**63.839.463,00**

Source: Own computation

New Zealand Market

Table 7. Constant Market Share for Indonesia's Export Growth to the New Zealand Market

		New Zealand's Market					World Market				
No	**Products**	**WGE**	**CE**	**ME**	**COMPE**	**TE**	**WGE**	**CE**	**ME**	**COMPE**	**TE**
1	PrimaryProds	3.765,64	- 9.537,89	- 33.534,10	872,46	- 38.433,89	3.532.358,46	6.833.115,06	- 59.279,69	- 9.155.752,64	1.150.441,19
2	ResourceBased	159,55	- 74,27	1.805,68	2.141,97	4.032,92	3.116.063,52	2.666.789,67	- 1.453,33	- 2.537.382,82	3.244.017,04
3	LowTech	399,79	- 149,76	13.611,60	541,88	14.403,51	1.045.013,43	717.416,95	846,89	3.207.519,36	4.970.796,63
4	MediumTech	193,35	- 122,06	2.250,96	393,23	2.715,48	323.438,16	- 48.425,00	- 244,39	1.569.049,18	1.843.817,95
5	HighTech	85,94	- 79,06	37,73	149,79	194,40	56.906,16	26.551,17	- 354,19	646.696,43	729.799,56
Total	**1989-1992**	**4.604,26**	**- 9.963,05**	**- 15.828,13**	**4.099,33**	**- 17.087,58**	**8.073.779,73**	**10.195.447,85**	**- 60.484,71**	**- 6.269.870,49**	**11.938.872,37**
1	PrimaryProds	3.995,37	5.967,07	- 1.232,04	716,38	9.446,78	5.274.511,39	- 2.395.467,18	- 811,44	670.270,52	3.548.503,29
2	ResourceBased	3.860,92	- 69,73	1.573,08	31.681,51	37.045,77	5.742.793,31	60.229,67	2.032,86	5.092.379,20	10.897.435,04
3	LowTech	12.477,24	- 2.847,03	- 12.899,71	753,24	- 2.516,26	3.824.359,04	- 759.592,34	- 925,70	- 1.884.120,51	1.179.720,49
4	MediumTech	3.262,67	- 2.392,48	- 818,89	2.305,22	2.356,52	1.332.944,44	- 460.087,25	- 428,39	1.080.920,28	1.953.349,07
5	HighTech	789,93	- 136,72	- 797,56	1.200,51	1.056,15	432.728,53	187.546,80	263,58	1.277.051,76	1.897.590,67
Total	**1992-1997**	**24.386,12**	**521,10**	**- 14.175,12**	**36.656,86**	**47.388,96**	**16.607.336,71**	**- 3.367.370,29**	**130,90**	**6.236.501,24**	**19.476.598,56**
1	PrimaryProds	- 153,50	- 2.987,84	5.018,68	438,30	2.315,65	2.782.948,38	7.585.866,84	- 3.259,54	- 12.422.875,34	- 2.057.319,66
2	ResourceBased	- 423,48	1.226,67	- 9.228,09	946,59	- 7.478,31	4.395.420,43	8.581.930,01	- 6.604,22	- 19.306.495,06	- 6.335.748,84
3	LowTech	- 163,79	325,13	17.771,16	320,49	18.252,99	1.747.377,92	- 1.268.505,79	147,93	2.034.260,02	2.513.280,08
4	MediumTech	- 72,54	- 1.071,16	7.884,60	2.517,83	9.258,74	908.393,06	- 422.956,24	123,59	- 9.573,53	475.986,88
5	HighTech	- 22,35	430,60	812,93	96,30	1.317,49	540.159,27	371.441,96	1.391,48	- 287.352,31	625.640,41
Total	**1997-1999**	**- 835,66**	**- 2.076,60**	**22.259,29**	**4.319,52**	**23.666,55**	**10.374.299,07**	**14.847.776,78**	**- 8.200,75**	**- 29.992.036,22**	**- 4.778.161,13**
1	PrimaryProds	13.105,86	29.195,14	- 28.952,40	12.004,79	25.353,39	7.453.423,29	4.177.311,27	27.941,12	- 4.721.868,48	6.936.807,19
2	ResourceBased	25.998,76	8.393,11	- 6.766,02	50,53	27.676,38	9.898.584,00	3.524.660,76	9.544,49	- 6.384.379,71	7.048.409,53
3	LowTech	25.546,64	- 7.238,87	- 16.038,60	165,22	2.434,39	6.989.567,36	- 1.416.869,09	289,82	- 3.703.703,15	1.869.284,95
4	MediumTech	12.174,87	- 1.612,31	6.074,39	268,56	16.905,52	3.129.447,07	- 58.876,89	- 1.362,53	648.716,53	3.717.924,18
5	HighTech	2.626,39	- 636,91	1.775,85	2.583,48	6.348,82	2.068.828,24	- 1.056.052,67	- 198,36	2.332.045,57	3.344.622,79
Total	**1999-2004**	**79.452,53**	**28.100,17**	**- 43.906,77**	**15.072,57**	**78.718,50**	**29.539.849,96**	**5.170.173,39**	**36.214,54**	**- 11.829.189,25**	**22.917.048,64**
1	PrimaryProds	3.544,88	24.635,02	86.451,12	24.842,45	139.473,47	8.921.254,74	9.278.353,49	- 5.544,45	3.708.446,63	21.902.510,41
2	ResourceBased	5.177,99	- 5.985,91	- 2.980,55	371,41	- 3.417,06	10.843.248,94	6.998.498,03	- 6.976,44	- 4.314.350,64	13.520.419,89
3	LowTech	3.058,16	1.294,80	- 7.989,45	140,08	- 3.496,41	6.213.811,11	- 2.032.775,84	- 4.961,10	- 1.119.347,87	3.056.726,29
4	MediumTech	2.748,18	- 2.813,88	- 5.727,35	1.423,95	- 4.369,10	4.119.652,70	- 1.328.874,17	- 6.007,56	3.591.770,31	6.376.541,29
5	HighTech	814,34	3.237,98	28.798,44	1.248,81	34.099,57	3.135.128,26	- 787.511,63	197,72	- 2.276.488,57	71.325,78
Total	**2004-2009**	**15.343,54**	**20.368,02**	**98.552,21**	**28.026,69**	**162.290,46**	**33.233.095,75**	**12.127.689,87**	**- 23.291,82**	**- 409.970,14**	**44.927.523,66**
1	PrimaryProds	123.641,56	29.804,42	- 97.154,28	1.899,18	58.190,87	2.741.138,50	- 10.046.569,76	178.902,68	18.009.037,36	10.882.508,78
2	ResourceBased	40.430,41	- 7.400,25	3.500,15	4.330,75	40.861,06	2.458.334,09	- 2.453.584,98	12.845,72	27.526.991,66	27.544.586,49
3	LowTech	22.878,22	- 174,97	1.937,91	-	24.641,16	1.096.028,03	2.839.720,26	3.588,80	5.999.537,55	9.938.874,64
4	MediumTech	19.728,87	- 6.507,59	986,57	511,85	14.719,70	1.016.637,35	- 102.724,35	- 965,79	8.098.986,92	9.011.934,13
5	HighTech	29.796,78	- 15.799,53	- 20.454,43	-	- 6.457,18	454.934,00	365.573,92	9.186,11	1.318.604,48	2.148.298,52
Total	**2009-2014**	**236.475,84**	**- 77,92**	**- 111.184,09**	**6.741,78**	**131.955,62**	**7.767.071,98**	**- 9.397.584,91**	**203.557,52**	**60.953.157,96**	**59.526.202,55**
1	PrimaryProds	3.868,08	- 10.044,92	- 54.556,30	87,11	- 60.646,03	5.298.182,42	- 4.480.897,72	- 17.649,80	- 7.582.246,71	- 6.782.611,81
2	ResourceBased	1.615,41	2.020,89	691,22	3.321,78	7.649,29	6.563.596,04	- 7.871.253,15	1.384,84	- 6.712.654,39	- 8.018.926,66
3	LowTech	938,50	6.062,82	17.496,41	0,04	24.497,77	2.687.743,14	- 3.563.097,87	400,42	4.175.274,04	3.300.319,73
4	MediumTech	704,47	- 3.085,83	- 4.833,16	352,84	- 6.861,67	2.471.964,35	- 871.610,93	- 2.792,47	2.059.587,06	3.657.148,01
5	HighTech	603,34	3.618,65	- 2.783,65	18,01	1.456,34	914.178,03	336.899,60	- 1.436,95	- 1.758.769,15	- 509.128,47
Total	**2014-2019**	**7.729,79**	**- 1.428,38**	**- 43.985,49**	**3.779,77**	**- 33.904,31**	**17.935.663,98**	**- 16.449.960,07**	**- 20.093,95**	**- 9.818.809,16**	**- 8.353.199,21**
1	PrimaryProds	33.136,53	44.057,01	99.462,58	- 0,00	176.656,12	15.183.834,70	30.563.286,58	- 19.492,97	- 25.553.565,92	20.174.062,40
2	ResourceBased	19.900,54	12.634,18	10.528,57	283,49	43.346,79	18.939.151,24	31.125.182,74	19.983,15	- 31.130.520,89	18.953.796,25
3	LowTech	15.247,95	6.680,18	2.580,04	807,44	25.315,61	9.966.279,08	1.186.999,25	1.032,08	- 2.058.140,36	9.096.170,05
4	MediumTech	6.803,95	6.127,11	7.266,15	1.074,72	21.271,94	9.374.950,18	- 54.226,69	2.876,06	3.799.368,98	13.122.968,52
5	HighTech	7.175,17	3.906,14	- 6.459,85	-	4.621,46	2.841.921,31	1.253.069,68	7.455,67	- 1.609.980,88	2.492.465,78
Total	**2019-2021**	**82.264,14**	**73.404,62**	**113.377,50**	**2.165,66**	**271.211,92**	**56.306.136,51**	**64.074.311,56**	**11.854,00**	**- 56.552.839,08**	**63.839.463,00**

Source: Own computation

Based on CMSA computation, there is a substantial shift in competitiveness between product categories. Resource-based product export competitiveness was the most significant contributor to overall competitiveness before the Asian Economic Crisis. However, some manufacturing products started to contribute more to overall competitiveness, except from 2014 to 2019. It is a good sign that Indonesia has developed competitiveness in manufacturing products for export to New Zealand.

Conclusion

Indonesia has been integrating trade with its region and the rest of the world. The path of trade integration began with APTA later expanded into bilateral arrangements. However, based on CMSA computation, there has been no significant change in competitiveness between 1989 and 2021. However, the conclusion is entirely drawn from the results of the CMSA methods, which mutually recognise its caveats. The result showed that the world growth effect dominated the fluctuation of export growth. Theoretically, when barriers are relieved, market access and exports will increase. Competitiveness remained unchanged because domestic reform did not accompany the establishment of a free trade agreement, so market openness did not foster further structural change or enhance domestic competitiveness.

However, it is argued that even though competitiveness did not shift over time from 1989 to 2021, it remained positive overall. This is consistent with this study, which reconfirms that trade integration with a reciprocal approach will prevent a country from further economic crisis. Even when the composition and market effects do not consistently contribute to growth during a crisis, competitiveness will prevent them from falling further. The observation is evident across all decompositions of Indonesian export growth to ASEAN and Dialogue Partners markets. The market effect tends to be negative for Indonesian export products during the financial crisis in the dialogue partners' markets. During the financial crisis, the confidence of importers in those countries affected by it is lower. Indonesia suffered from a banking crisis in 1997 – 1999, which had a negative market effect during that period.

This paper recommends that Indonesia encourage further trade integration reforms through trade agreements and unilateral measures, including by providing a better venue for technological transfer and innovation. Building internal competitiveness through trade integration is imperative. Using the steps of Korea, Korea has managed to reform its economy by using a unilateral export promotion policy and combining it with trade agreements to gain better market access and open the economy.

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Impact of greenhouse gas emission, renewable energy, and economic growth on health expenditure in Southeast Asia: A comparative analysis of econometric models

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Abstract

Purpose — The study explores the effects of greenhouse gas emissions, renewable energy, and economic growth on health expenditures across Southeast Asia while comparing the performance of different econometric models for accuracy in analysis.

Method — The relationships among variables in this study are analyzed using three econometric models: the Autoregressive Distributed Lag Model, the cointegration Model, and the Quantile Regression Model, using annual data from 2000 to 2020.

Findings — The results reveal that greenhouse gas emissions and GDP significantly influence health expenditure in all three models. However, the significance of renewable energy consumption varies, with only the quantile regression model, indicating a significant relationship with health expenditure. A model comparison based on Mean Squared Error (MSE) suggests that the autoregressive distributed lag (ARDL) model provides the most accurate predictions. Also, it found that there is a short-run and long-run causal effect of GHG and GDP on health expenditure and health spending on GDP.

Implication — This study helps to understand how economic growth, environmental factors, and healthcare spending interact to develop sustainable policies to address health and environmental problems in Southeast Asia.

Originality — This research contributes to the body of knowledge examining the impact of economic and environmental factors on health expenditures in Southeast Asia through a comparative analysis of different econometric models.

Keywords — Autoregressive distributed lag model, cointegration model, quantile regression model, mean squared error

Introduction

The relationship between environmental quality, economic growth, and health expenditure has become a critical area of study in recent years, especially in developing regions, with no exception in Southeast Asia. Many developed and developing countries aim for economic growth and development without considering the environmental impact, such as access to clean water and air quality. Rapid industrialization, urbanization, and energy consumption contribute to environmental degradation, affecting human health and threatening healthcare systems. Air pollutants, particularly

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carbon dioxide (CO2) emissions, have been linked to adverse health outcomes, leading to increased healthcare spending (Ibukun & Osinubi, 2020; Atuahene, et. al., 2020; Li, et al., 2022). Greenhouse gases are a consequence of anthropogenic activities, that is, raising the temperature in the environment, resulting in global warming (Xie, 2024). Human activities are the primary drivers of climate change, creating carbon dioxide emissions that significantly increase risks to human health, ecosystems, and economies (Loucks, 2021). The degradation of the environment will lead to increased expenditure on health treatments to sustain a healthy lifestyle (Manisalidis et al., 2020). Human activities increase environmental pollution, such as CO_2, which affects healthcare spending (Alhassan & Kwakwa, 2023), and the cost of reducing greenhouse gas emissions is high (Gillingham & Stock, 2018).

According to the study by (Ebi & Hess, 2020), climate change harms human health; that is, as the greenhouse gas levels increase, health risks also increase. Respiratory illnesses are caused by air pollution such as CO_2, and many people suffer from the effects of air pollution (Mujtaba & Shahzad, 2021). Public funding for facilities and access to universal health services is a challenge, especially among Southeast Asian nations (Lim et al., 2023). The proportion of health expenditure allocated to direct costs is relatively high (Kong et al., 2022) (Behera & Dash, 2020) and the absence of systematic or potentially remediable differences in health status (WHO, 2020).

This current study uses CO_2 emissions as a proxy for greenhouse gas emissions. As of 2023, the top global greenhouse gas emitters are China (28%), the United States (15%), India (14%), the European Union (10%), Russia (5%), and Brazil (4%). When combined, these six emitter countries contribute to over 76% of the total greenhouse gas in the world (European Commission, 2023). Greenhouse gas emissions in various regions of Southeast Asia have been increasing rapidly (Lamb et al., 2021). The world's top energy-consuming nations make a significant contribution to CO_2 emissions. Increasing energy demand drives economic expansion. However, energy consumption also leads to the emission of greenhouse gases. Thus, the goal is to reduce CO_2 emissions by implementing sustainable development practices, focusing on the strategies for sustainable development, and promoting a green economy (Mentes, 2023).

In 2022, the study of Li et al. (2022) analyzed the impact of carbon emissions, economic growth, and health expenditure in the BRICS countries that utilized the Fourier ARDL model. The result shows that Brazil and China have cointegration relationships in health expenditure, CO2 emissions, and economic growth. Moreover, there is a negative causal relationship between India's CO_2 emissions and health expenditure; other countries only show a one-way relationship between CO_2 emissions, health expenditure, or economic growth. Using the ARDL method, Zaidi and Saidi (2018) reveal that economic growth positively impacts health expenditure (HE), while CO2 emissions and Nitrous Oxide Emissions negatively impact HE in the long run. On the other hand, the Vector Error Correction Model (VECM) Granger causality results show a one-way relationship between HE and GDP per capita. On the contrary, a two-way causality relationship is found between CO_2 emissions and GDP per capita and between HE and CO_2 emissions. Another study in Asian countries conducted by Slathia et al. (2024) investigated how carbon emissions, renewable energy use, and economic growth affect healthcare expenditure in 36 Asian countries. The study employs Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) models to analyze the data, revealing that higher levels of carbon emissions and economic growth are associated with increased healthcare costs. At the same time, the consumption of renewable energy contributes to lowering healthcare expenditure. The important finding is the direct and indirect relationships between these variables, particularly how carbon emissions from energy use affect health costs in various Asian sub-regions, offering valuable policy implications for sustainable healthcare. Haseeb et al. (2019) explored the influence of environmental pollution, energy consumption, and economic growth on health expenditure also using the ARDL approach. A related study by Wang et al. (2020) explored the impact of CO2 emissions, health expenditure, and economic growth using the cointegration approach. Finally, Bilgili et al. (2021) used a quantile regression model to assess the effects of health expenditure and economic growth on carbon dioxide emissions, while Apergis et al. (2018) and Farooq et al. (2019) used the quantile regression approach to understand the effect of carbon emissions on health outcomes.

In recent years, many studies have been conducted on the determinants of health expenditure. However, the intersection of economic and environmental factors in influencing health expenditure, especially in Southeast Asia, has not been explored. This study introduces an approach that compares different econometric models to identify the most accurate and robust method for analyzing the impact of these factors on health expenditure. Previous studies also focused only on one or two aspects and a limited geographic scope. This research offers a comprehensive analysis that integrates economic and environmental variables, providing new insights into the drivers of health expenditure.

(Zhang et al., 2022), (Jian et al., 2019), and (Vo et al., 2019) administered the testing for stationarity using the Dickey-Fuller and causality estimates through the autoregressive distributed lag approach, which was also employed in the papers of (Li et al., 2022) and (Çobanoğulları, 2024). While in the study of Arı (2021) and Camba Jr and Camba (2021), they employed the Engle-Granger causality test model. Lastly, two studies, Jian et al. (2019) and Vo et al. (2019) used the Johansen cointegration test.

This study aims to explore the impacts of economic growth, renewable energy consumption, and greenhouse gas emissions on health expenditure among the ten (10) Southeast Asian countries. It also seeks to compare the performance of different econometric models, such as the Autoregressive Distributed Lag (ARDL) Model**,** Cointegration Model, and Quantile Regression Model, from the Mean Squared Error (MSE) value. This comparison will determine which of the proposed models provides a more accurate way of analyzing the impact of economic factors and health spending.

Methods

Data Summary and Source

The study used the annual data from 2000 to 2020, considering the variables of greenhouse gas emissions, economic growth, such as gross domestic product (GDP), renewable energy consumption, and health expenditure across Southeast Asia. Southeast Asia is a diverse and dynamic region located in the southeastern part of Asia, consisting of countries such as the Philippines, Thailand, Vietnam, Indonesia, Malaysia, Cambodia, Myanmar (Burma), Brunei, Timor-Leste, and Laos. The secondary data were collected over 21 years from the World Bank's open data. Table 1 describes the summary of the variables.

Table 1. Summary of Variables across Southeast Asia countries (2000-2020)

	HE		**GHG**		**EC**		**GDP**	
	Average	***Total***	***Average***	***Total***	***Average***	***Total***	***Average***	***Total***
Philippines	85.69	1799.55	171029.90	3591627.9	31.42	659.75	2171.79	45607.7
Thailand	168.09	3529.99	355518.79	7465894.55	22.01	462.21	4637.15	97380.2
Vietnam	84.37	1771.78	260909.12	5479091.56	38.02	798.46	1738.29	36504.05
Indonesia	73.88	1551.58	809660.87	17002878.3	34.35	721.45	2560.03	53760.61
Malaysia	280.84	5897.72	242801.12	5098823.44	3.59	75.34	8046.83	168983.5
Cambodia	57.80	1213.81	28269.30	593655.34	68.44	1437.28	867.81	18223.91
Myanmar	30.44	639.248	94601.25	1986626.2	75.84	1592.55	809.59	17001.34
Brunei	683.83	14360.33	8902.66	186955.9	0.01	0.11	30142.19	632985.97
Timor-Leste	56.97	1196.367	5484.76	115179.9	26.56	557.76	898.54	18869.43
Laos	35.46	744.6178	15542.13	326384.73	64.65	1357.72	1322.25	27767.29

Definition and Measurement of Variables

The dependent variable in this study is health expenditure per capita, defined in Table 2. The independent variables are greenhouse gas emissions, renewable energy consumption, and GDP per capita.

Table 2. Definition and measurement of variables

Variable	Notations	Measurement	Type
Health expenditure per capita	HE	Health expenses per capita through out-of-pocket spending (in U.S. dollars).	Dependent
Greenhouse gas emission	GHG	Overall greenhouse gas emissions (in kilotons of CO2 equivalent) consist of fluorinated gases, all anthropogenic methane sources, nitrous oxide sources, and carbon dioxide (CO2).	Independent
Renewable Energy Consumption	*REC*	Renewable energy consumption represents the proportion of energy in the total final renewable energy consumption.	Independent
GDP	GDP	Gross domestic product per person.	Independent

Source: World Bank Open Data

Econometrics Models

Autoregressive Distributed Lag (ARDL) Model

The ARDL technique examines time series data and uncovers short-term and long-term connections among variables within the specified time frame. One of the benefits of using the ARDL approach is that it can reveal both intra-model and inter-model dimensions. Furthermore, it offers asymptotic properties facilitating the independent variable estimation for stationary and non-stationary series data. The ARDL model is expressed as follows:

$$\Delta HE_{it} = a_i + \sum_{j=1}^{m-1} b_{ij}\Delta HE_{i,t-j} + \sum_{z=0}^{n-1} \varphi_{il}\Delta GHG_{i,t-z} + \sum_{r=0}^{p-1} \gamma_{ir}\Delta REC_{i,t-r} + \sum_{u=0}^{s-1} \theta_{iu}GDP_{i,t-u} + \delta_1 HE_{i.t-1} + \delta_2 GHG_{i.t-1} + \delta_3 EC_{i.t-1} + \delta_4 GDP_{i.t-1} + e_{1i,t}, \quad (1)$$

where Δ is the first-order differential operator and the $e_{1i,t}$ is the error term. The dependent variable in the above model is health expenditure (HE); GHG stands for greenhouse gas emission; REC is the amount of renewable energy used; and GDP represents gross domestic product, measured with GDP per individual. The parameter α in the models represents the speed of alteration towards equilibrium (Haseeb et al., 2019).

The first step of the ARDL approach is to decide the optimal lag length for each variable. The goal is to minimize using the Schwarz Information Criterion (SIC). The null hypothesis was formulated as follows:

$$H_0: \rho_1 + \rho_2 + \rho_3 + \rho_4 = 0$$
$$H_1: \rho_1 + \rho_2 + \rho_3 + \rho_4 \neq 0 \quad (2)$$

If the null hypothesis was not rejected after testing for cointegration, then the long-term association between the variables was evaluated.

After developing a long-run association, error correction terms were determined in equation (3)

$$\Delta HE_{it} = a_i + \sum_{j=1}^{m-1} b_{ij}\Delta HE_{i,t-j} + \sum_{l=0}^{n-1} \varphi_{il}\Delta GHG_{2i,t-l} + \sum_{r=0}^{p-1} \gamma_{ir}\Delta EC_{i,t-r} + \sum_{u=0}^{s-1} \theta_{iu}\Delta GDP_{i,t-u} + aECT_{t-1} + e_{1i,t} \quad (3)$$

where ECT_{t-1} is the error correction term that defines the long-run equilibrium relationship among variables.

Cointegration Model

The last model is the Granger causality test, where a strong causal relationship was examined. The cointegration approach needs to test three null hypotheses:

$$H_o: \varphi_1 = \varphi_2 = \varphi_3 = 0\ (R1 - test),$$
$$H_o: \varphi_2 = \varphi_3 = 0\ (R2 - test), and$$
$$H_o: \varphi_1 = 0\ (A - test). \quad (4)$$

The Bootstrap ARDL cointegration is the new cointegration test, satisfying the above null hypotheses (McNown et al., 2018). In case 1, the null hypotheses are rejected in both the R1 test and the R2 test. In case 2, the null hypotheses in R1 and A are tested, while the R2 test is not rejected. An additional test for $\varphi_2 = 0$ or $\varphi_3 = 0$ is conducted if cointegration exists. If cointegration does not exist, then the Bootstrap ARDL model is used.

Quantile Regression Model

The quantile regression approach addresses both the heterogeneity and structure of quantile data. These models demonstrate greater flexibility and robustness than the ordinary least squares approach because they do not rely on assumptions about the error term distribution (Belaïd et al., 2020). This model aims to estimate the median or quantities (Chernozhukov et al., 2022). The model of the quantile regress can be written as,

$$Q_T z_{it}\left(\tau | z_{i,t-1}, x_{it}\right) = c_i + \gamma(\tau) z_{i,t-1} + x_{it}^T \beta(\tau)\,, i = 1, \ldots, n \; and \; t = 1, \ldots, T_i \tag{5}$$

where z_{it} is the output, $z_{i,t-1}$ is the z_{it} lag, x_{it} is the exogenous variable, $c = (c1, \ldots, cN)'$.

Stationarity Test

Assessing the data's stationarity is necessary before conducting econometric analysis, as this was a prerequisite for econometric modeling. This ensures that the stationarity of variables is imperative to prevent issues associated with spurious regression in the event of non-stationary variables. Typically, stationarity tests like the Augmented Dickey-Fuller test are conducted for macroeconomic data.

Results and Discussions

Data Summary and Correlation Test

Table 3 displays the summary statistics of four (4) variables from the Southeast Asia datasets from 2000 to 2020. All the variables' means are larger than the corresponding standard deviations, indicating low volatility and an increasing trend. The skewness values are nearly zero, suggesting the distribution is roughly symmetric. Additionally, all the kurtosis values are less than 3, indicating lighter tails. Furthermore, the Jarque-Bera Test results fail to reject the null hypothesis, concluding that all the variables follow a normal distribution. The Box-Pierce test results indicate rejecting Ho, suggesting the absence of serial correlation. Figure 1 displays a time plot of the four variables. It shows that HE, GHG, and GDP are on an upward trend, while REC shows a downward trend over the years.

Table 3. Summary statistics of the variables

	HE	GHG	REC	GDP
Mean	155.74	199272	36.49	5319
Median	166.06	195904	37.73	5830
Maximum	221.52	266179	44.46	7645
Minimum	76.05	146265	26.91	2573
Std. Dev.	50.947	36768	5.705	1708.13
Skewness	-0.3315	0.3260	-0.4402	-0.3472
Kurtosis	1.5913	2.0452	1.8076	1.8062
Jarque-Bera	2.1211	1.1741	1.9223	1.6689
Box-Pierce	16.233	15.357	16.365	15.481
Sample	21	21	21	21
Year	2000-2020	2000-2020	2000-2020	2000-2020

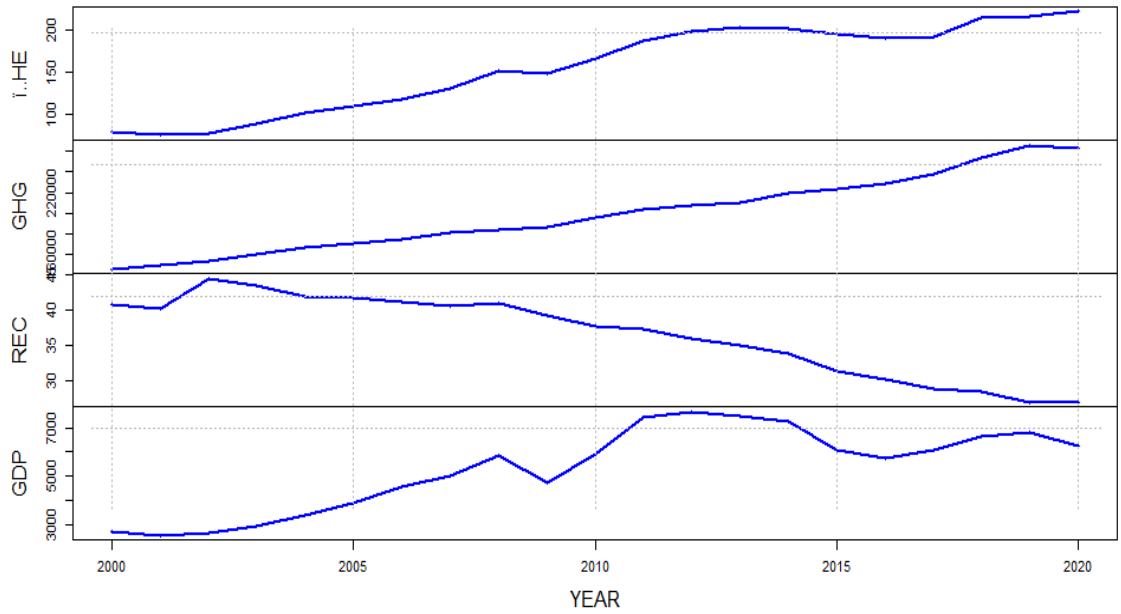

Figure 1. Sequence Plot from 2000-2020

Correlation Test

The correlation test for each variable is presented in Table 4. All the p-values are below 0.05, indicating a significant correlation exists between GHG, REC, GDP, and HE. The correlation reveals strong positive associations between Health Expenditure (HE) and Greenhouse Gas Emission (GHG), as well as Gross Domestic Product (GDP). Additionally, Renewable energy consumption (REC) is significantly inversely related to health expenditure (HE), with a correlation value of -0.874. This indicates that a unit increase in renewable energy consumption is associated with a decrease in health expenditure. The results of (Shahzad et al., 2020) also confirmed that economic growth and CO2 emissions have a positive impact on health expenditure, while renewable energy consumption has a negative impact on health expenditure. This implies that as the economy grows, Southeast Asian countries pay more attention to the healthcare system. However, Atuahene et al. (2020) claimed that economic growth negatively impacts health expenditure in China and India. This means that despite significant economic growth, there has been a lack of focus on healthcare.

Table 4. Correlation between variables

Variable		HE	GHG	REC	GDP
HE	correlation	-			
	p-value	-			
GHG	correlation	0.939	-		
	p-value	0.000*	-		
REC	correlation	-0.874	-0.959	-	
	p-value	0.000*	0.000)	-	
GDP	correlation	0.941	0.789	-0.688	-
	p-value	0.000*	0.000*	0.000*	-

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

Unit Root Test

Before utilizing the three (3) approaches, testing the data stationarity for each variable is important. The Augmented Dickey-Fuller (ADF) test indicated that health expenditure (HE) and greenhouse gas emissions (GHG) are both stationary at the level, and all variables are stationary after being differenced once. Unit root test for stationarity was also executed in the papers of (Çobanoğulları, 2024), (Haseeb et al., 2019), and (Wang et al., 2020).

Table 5. Test for Stationarity

	Augmented Dickey-Fuller (ADF)		Order of Integration
	Level	*First Difference*	
HE	5.518*	2.459*	I (0)
GHG	18.39**	1.541*	I (0)
REC	2.011	9.54**	I (1)
GDP	0.5218	5.019*	I (1)

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

Test for Homogeneity

The result of the heteroscedasticity test gives a p-value (0.4912) greater than 0.05. This value indicates that there is no evidence to suggest that the variability of the errors changes across different levels of the independent variables, thereby satisfying the assumption of homoscedasticity (Haseeb et al., 2019).

Table 6. Test for Homogeneity of Variance

Dependent Variable	Statistic	DF	p-value	Decision
HE	2.4129	3	0.4912	Reject Ho

Cointegration Test

Table 7. Johansen cointegration analysis

Unrestricted Test			
	Trace Statistics	Rejection	P-value
None*	73.06	47.86	0.000
At most 1	27.80	29.80	0.0835
At most 2	9.77	15.49	0.2992
At most 3	0.22	3.84	0.6422
Unrestricted Cointegration Rant Test (Maximum Eigenvalue)			
None*	45.26	27.58	0.0001
At most 1	18.04	21.13	0.1285
At most 2	9.55	14.26	0.2432
At most 3	0.22	3.84	0.6422

The Johansen Cointegration test examines both long- and short-term relationships in health expenditure described in Table 7. The hypotheses is that no cointegration exists (Wang et al., 2020; Çobanoğulları, 2024). As depicted in Table 7, the trace statistics and max-eigen statistics were examined, and the null hypothesis was rejected at a 0.05 significance level. This result suggests there is a long-term relationship between the variables in the model.

Comparison of Econometric Models

The Mean Squared Error (MSE) is used to assess the precision of a model's forecasts. Table 8 shows the results for the three econometric models with their respective MSE values.

Table 8. Mean Square Error (MSE) of the Three Econometric Models

Models	Mean Square Error (MSE)
ARDL	235.12
Cointegration	587.66
Quantile Regression	712.18

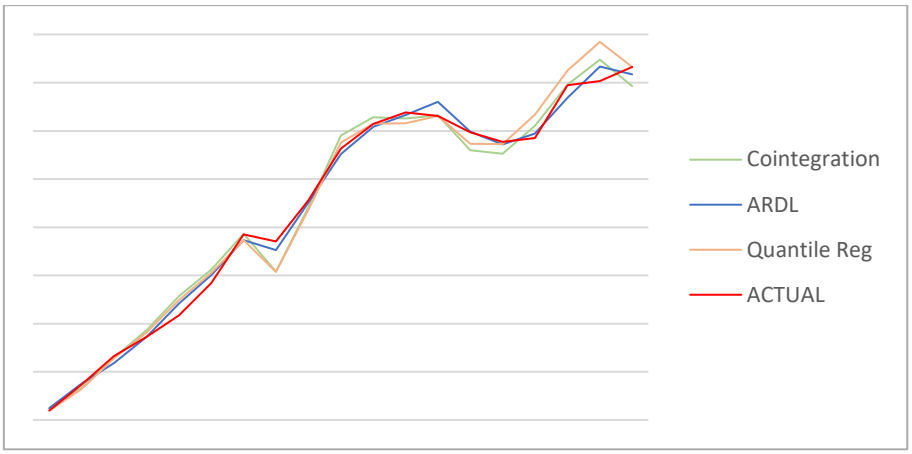

Figure 2. Actual vs fitted values of the three econometric models

The ARDL model performs better than the cointegration and quantile regression models in predictive accuracy, as indicated by the lower MSE value. A similar result was found in the study by Adom & Bekoe (2012), which concluded that the ARDL model is superior, particularly because it is more efficient at handling small sample sizes.

The ARDL model, for current analysis, is the most reliable for making accurate predictions. Conversely, the quantile regression model has the highest MSE, indicating the least accurate predictions among the three models. One of the primary reasons is that quantile regression focuses on estimating the conditional quantiles of the response variable rather than the mean (Chernozhukov et al., 2022). The cointegration model falls in between, performing better than the quantile regression model but not as well as the ARDL model.

Figure 2 shows the visual presentation of the original and fitted values from the three different econometric models. The graph visually assesses how closely the fitted values match the actual values. As observed, all the fitted values from the three models are close to the actual values, indicating that the econometric models are performing well in predicting the observed data.

Table 9. Coefficients' t-Statistics and probabilities across three econometric models

Variable	ARDL		Cointegration		Quantile Regression	
	t-value	prob	t-value	prob	t-value	prob
GHG	3.295	0.004***	2.931	0.009***	8.213	0.000***
REC	0.936	0.363	-1.395	0.181	-6.222	0.000***
GDP	10.569	0.000***	14.79	0.000***	8.737	0.000***

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

Table 9 shows that GHG and GDP have a significant influence on health expenditure in all three models. However, REC's significance varies across models. The ARDL and cointegration models fail to reject the null hypotheses, indicating a non-significant relationship between REC and health expenditure. In contrast, the quantile regression model rejects the null hypothesis, implying a significant relationship between REC and the dependent variable.

Causality Test

Table 10 presents the causality analysis for both the long-run and short-run effects. It reveals that the long-run causal effects of GHG emissions and GDP on HE were significant, with t-statistics of 3.2956 (p-value 0.0049) and 10.5698 (p-value 0.0000), respectively. This result means that greenhouse gas emissions and gross domestic product significantly influence health expenditure in Southeast Asia over the long term. Also, health expenditure has a long-run causality effect on GDP, suggesting that an increase or decrease in health expenditure will lead to changes in GDP. These results were supported by the study of Ibukun and Osinubi (2020), Slathia et al. (2024), Haseeb et al. (2019), and Atuahene et al. (2020), which found that GHG emissions and GDP have a

significant relationship with health expenditure. Additionally, renewable energy consumption (REC) does not significantly affect health expenditures (HE) in the short and long run. While Apergis et al. (2018) shows a unidirectional causality from REC to HE, and Dorbonova and Sugözü, (2024) advocate for the use of renewable energy, the lack of a significant effect in Southeast Asia may be due to several factors, including inadequate infrastructure to effectively translate renewable energy into health benefits, cultural practices and beliefs, and ineffective implementation of policies promoting renewable energy. Furthermore, the limited impact of REC might be influenced by other health challenges/factors and disparities across different countries.

Table 10. Causality analysis

Direction of Causality	t-Statistics	P-value
	Long-Run Causality Effect	
GHG → HE	3.295	0.004**
REC → HE	0.936	0.363
GDP → HE	10.569	0.000**
HE → GHG	-0.352	0.727
HE → REC	-1.282	0.219
HE → GDP	13.233	0.000**
	Short-Run Causality Effect	
GHG → HE	4.019	0.001**
REC → HE	1.033	0.317
GDP → HE	5.737	0.000**
HE → GHG	-0.504	0.621
HE → REC	-1.409	0.179
HE → GDP	5.546	0.000**

Note: *p< 0.10, **p< 0.05, ***p< 0.01, respectively.

In the short-run causality test, it was observed that greenhouse gas (GHG) emissions and gross domestic product (GDP) significantly affect health expenditure. This finding is supported by the results of (Wang et al., 2020), which suggest that increased CO_2 emissions and GDP help improve health expenditures. It was also observed that the short-run causality of health expenditure on GHG and REC was not significant. However, observing the health expenditure has a short-run causal effect on GDP, which implies a direct effect of healthcare spending on economic growth in the short run. This finding is consistent with the results of (Haseeb et al., 2019), who also found no short-term causality between health expenditures and energy consumption (EC), CO2 emissions, or GDP. This means that changes in health expenditures do not directly influence energy consumption, CO2 emissions, or GDP in the short run.

Conclusions

This study examines the impact of greenhouse gas emissions, economic performance, and renewable energy consumption on health expenditure, covering ten (10) Southeast Asian countries from 2000 to 2020. The primary goal of this paper is to address the gap in previous research by considering another set of variables and comparing the existing econometric models. The dependent variable considered in this study is health expenditure (HE), and the independent variables are greenhouse gas (GHG) emissions, renewable energy consumption (REC), and gross domestic product (GDP). These variables are used in the three econometric models: the Autoregressive Distributed Lag Model, the Cointegration Model, and the Quantile Regression Model.

The analysis shows a significant influence of greenhouse gas emissions (GHG) and gross domestic product (GDP) on health expenditure among the three models, but renewable energy consumption (REC) varies across the three models. In comparing the three models, the ARDL model performs better than the cointegration and quantile regression models, which means that

the ARDL model is the most reliable in making accurate predictions of the annual health expenditure of Southeast Asian countries.

Lastly, this paper studied the relationship of the short-run and long-run causality among the variables and found a short-run and long-run causal effect of GHG and GDP on health expenditure. This leads to the conclusion that GHG emissions increase healthcare spending due to the deterioration of air quality, which results in high spending on healthcare services. On the other hand, health expenditure has short-run and long-run causality effects on GDP, indicating that healthcare spending changes impact a specific country's overall economic output.

While this study provides valuable insights into the relationship between greenhouse gas emissions, economic growth, renewable energy consumption, and health expenditure in Southeast Asia, it also has several limitations that must be acknowledged. First, it only considers the annual data from 2000 to 2020, which may limit the analysis and not fully capture recent trends regarding the impact of economic and environmental variables. Additionally, the econometric models employed consider only three models. They may not always hold in real-world scenarios, such as linearity and stationarity, which could affect the validity of the results. Lastly, the study does not account for other factors, such as socio-political changes or health policy interventions, which might influence health expenditure.

The research findings extend previous research by highlighting the importance of environmental and economic factors in influencing health expenditures in Southeast Asia. Future studies should explore other econometric models and consider additional data to better understand the broader impact of healthcare spending across diverse economic contexts.

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