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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 effect of important 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 analyze 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 prioritize 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.

Keyword — Economic freedom; business freedom; trade freedom; international tourism; Asian countries.

Introduction

Over the recent decades, the tourism industry has experienced robust development, propelled by the economic globalization process, and has played a significant role in contributing to 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 displayed more impressive growth rates 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 Organization (UNWTO), 2020). However, due to the impact of the COVID-19 pandemic and related health policies, there was a severe decline in international tourist arrivals globally during 2020 and 2021, with a recovery commencing post-2022. According to statistics UNWTO (2024), international tourist arrivals globally recovered to approximately 30% in 2021, 66% in 2022, and 88% in 2023 (Figure 1), with tourism revenues 2023 estimated at 1.4 trillion USD. Interestingly, the Asia-Pacific tourism sector, which attracted 361 million international tourist arrivals,

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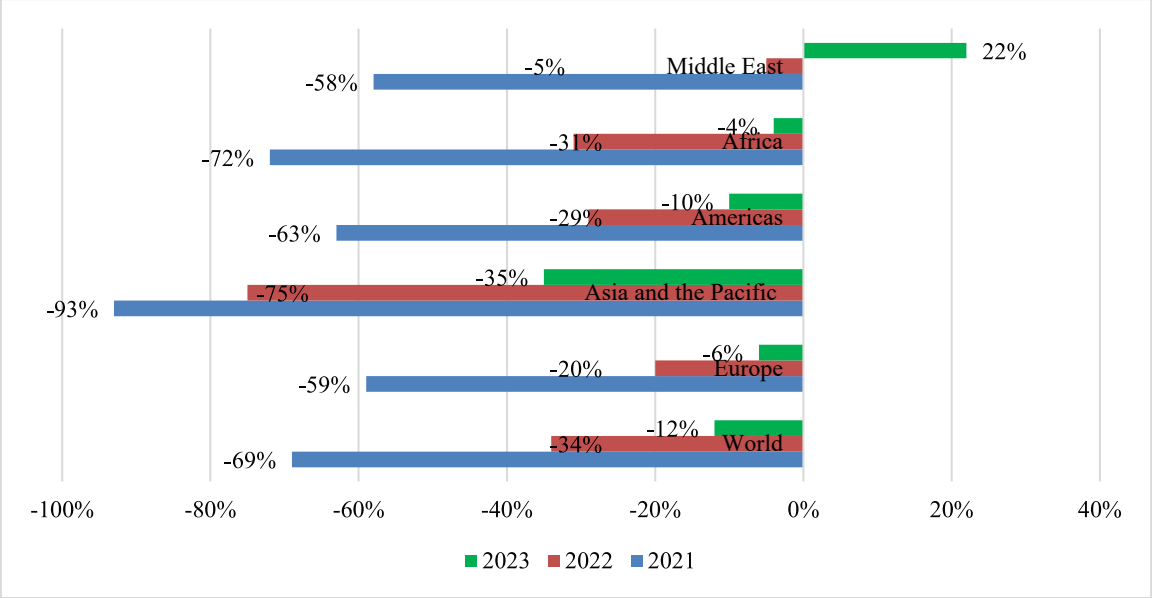
accounting for approximately 24% of the global total in 2019, experienced a slower recovery than other regions worldwide. According to the data, in 2021, the number of tourist arrivals recovered to only 7%; in 2022, it recovered to 25%; and by 2023, it reached 65% of the 2019 tourist numbers (Figure 1).



Source: UNWTO (2024).

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

Meanwhile, recent years have seen high economic integration in Asia, contributing significantly 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 liberalization. Key initiatives that enhance trade and international investment include the Regional Comprehensive Economic Partnership (RCEP), accounting for about 30% of the global GDP, and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), with most member countries from Asia, comprising about 15% of the worldwide GDP. This indicates that nations in the Asia region are increasingly economically liberalized (Park et al., 2021).

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

Economic freedom, defined as the right of every individual to control their labor 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 minimizes interference in the marketplace, facilitating the free movement of labor, 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) suggests 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 potential market for the tourism industry of these countries. Simultaneously, these nations can easily leverage their competitive advantages from available strengths to dominate tourism development. Debates by Stabler et al. (2009), McGrew (2020), Song et al. (2018) and Tribe (2015) also assert that economic liberalization 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 it more, leading to a higher demand for personal freedom. Consequently, they seek to realize their freedom in other countries 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 for businesses to offer better services and respect customers. Additionally, an economically free environment provides a stable legal and monetary system, efficient labor 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 relationship between economic freedom, economic growth, and tourism for 100 countries from 2002 to 2015 using estimation models via the Generalized Method of Moments (GMM). This study found that economic freedom has a significantly positive impact on tourism. Furthermore, the authors suggest that governments should implement necessary changes to enhance economic freedom, which is 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, finding that economic freedom's impact on tourism varies. In less developed countries, tourism responds more quickly to improvements in regulatory efficiency. Specifically, more efficient labor 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 and positive relationship between economic freedom and tourism competitiveness, showing that increased 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 the industry's growth through increased revenue. Contrasting these viewpoints Aslan et al. (2020) showed that economic freedom does not always benefit tourism attraction. Their study included 17 Mediterranean countries from 1996 to 2016, revealing that the increased economic freedom index negatively affected tourist entries. Aslan et al. (2020) concluded that the role of economic freedom in promoting tourism development requires government policy support; without it, economic freedom could negatively impact 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 clear.

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 different regions, but none specifically in Asia. Therefore, this study aims to add empirical evidence on the impact of economic freedom on tourism development in Asian countries, hoping the findings will provide valuable information for policymakers and stakeholders in these countries.

In addition to the crucial factor of economic freedom, the authors also 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 due to infrastructure improvement. 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 inflation or prices in their destination country Cheng (2012). However, studies Tang et al. (2016) suggest that exchange rate volatility does not play a role in tourism development. Athari et al. (2021) found that a decreasing exchange rate (local currency appreciation) drives an increase in tourist numbers in 76 countries between 1985–2018. Agiomirgianakis et al. (2015) discovered an inverse relationship between exchange rate volatility and tourist numbers in the UK and Sweden from 1990 -2012, advising against using exchange rate adjustments to attract tourists. Similarly, Surugiu et al. (2011) found an inverse relationship between exchange rates and international tourist numbers in Romania from 1997 - 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, 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 inflation rate of the destination country 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 leads to increased 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 gathered 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:

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

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

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

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, symbol 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 as the right to control one's labor and property, measured across twelve factors grouped into four categories: Rule of Law, Government Size, Regulatory Efficiency, and Open Markets, with scored 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 with GDP per capita. 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 promote a greater number of tourist arrivals in the countries where they invest. 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 cause biases in the research results due to endogeneity. This paper uses the Generalized 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 due to the long sample period from 1995 to 2020, while the number of observations is relatively small due to a lack of data 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 is normal, with no significant anomalies, and the differences between the mean and median are 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 have values less than 0.8 (except for the BUSF and ECOF pair),

ensuring 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 has a high correlation coefficient. 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 exploit a broad potential market better (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 freedom) are essential pillars in developing countries' tourism (McGrew, 2020; Song et al., 2018; Tribe, 2015). These findings are consistent with previous studies, supporting 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 freedom issues to contribute to the development of international tourism, which is also a channel for attracting foreign currency.

Unlike economic freedom, foreign direct investment negatively impacts the increase in international tourist arrivals, indicated by the negative and 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 significant evidence of 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 increased per capita income typically represents a country with 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 encourages more international tourists to visit and contributes to foreign currency earnings for the country. 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 correlation, 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 within its model, such as 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 system GMM two-step estimation method to regress 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 not as distinct. Foreign direct investment is found to affect international tourism development negatively. 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 Square 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 negatively and significantly affects 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 the efficiency of Islamic banks has a pivotal role in banking stability, considering the efficiency level. 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 the research gap by examining how Islamic bank efficiency affects banking stability, considering 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 still constant debate among the Islamic banking sectors over financial stability. Some studies reveal that Islamic bank has the same banking operations as conventional banks as explained by (Chong & Liu, 2009). As a result, the risk exposure of Islamic banks is no different than its counterparty, particularly in banking stability. On the contrary, studies from Abedifar et al. (2013) document that Islamic banks have different risk exposure because the banks have a different business model that aligns with the Shariah principle. Hence, the risks faced by Islamic banks are different from those

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of conventional banks. Despite the debate, Islamic banks once failed in 2001, namely Ihlas Finans House in Turkey, when the country was experiencing a financial crisis (Ali, 2007). Therefore, understanding what factors contribute to banking stability, especially in the case of Islamic banks, becomes important in 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 one of the critical indicators for measuring 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 Middle East and North African Countries, Ahmad and Luo (2010) in European Countries, Rosman et al. (2014) in 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, which have also been carried out by previous researchers looking at them from various perspectives. For example, Danlami et al. (2022) conducted research on the relationship between banking efficiency and stability in the Organization of the Islamic Conference (OIC) countries (Miah & Sharmeen, 2015) in Bangladesh, Miah and Uddin (2017), Hidayat et al. (2021) and Alsharif (2021) in Middle East Countries, Sakti and Mohamad (2018) in Indonesia, and Saeed and Izzeldin (2016) in Middle East 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 causes the risk of Islamic banking bankruptcy to increase. 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 the better the level of banking efficiency, the better the banking financial performance will be.

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 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) under the concept of institutional theory. On the contrary, Shakil et al. (2019) and Azmi et al. (2021) explain that in developing countries, institutional development is not significant because it has high economic uncertainty and an immature regulatory system.

Given the inconclusive findings, it is necessary to have more studies to find a clear 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 Islamic banks' size 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 the previous research on examining the impact of the efficiency performance of Islamic banks on the banking performance as it has already been studied by Al-Khasawneh et al. (2012), Asmild et al. (2019), dan Alqahtani et al. (2017), and Danlami et al. (2022). Secondly, the study contributes to providing a novel perspective on the impact of a change in the bank's size on banking stability, considering the role of efficiency performance in Islamic banks. The role of size in the banking sector has been highlighted by Ibrahim and Rizvi (2017) to understand whether size matters for Islamic banks.

However, according to the recent literature, no studies examined the importance of Islamic bank size for efficiency performance in relation to Islamic banking stability. Understanding that relation sheds light on whether possessing a certain level of size will benefit efficiency performance or vice versa. Thirdly, the study elaborates on the role of financial turmoil, specifically during the COVID-19 pandemic, and institutional development to 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 section, the first section is the methodology that 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 objective of the study, the study uses samples from Islamic banks in eight countries consisting of Saudi Arabia, Malaysia, United Arab Emirate (UAE), Kuwait, Bahrain, Bangladesh, Turkey, and Indonesia, which represent more than 80% Islamic banking development worldwide (ICD-Refinitiv, 2022). We exclude Islamic banks in Iran because it has a significant difference between Islamic banking concepts and practices in Iran and the rest of the world (Meisamy & Gholipour, 2020). The study period starts from 2013 to 2021 using balanced panel data, which is retrieved 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* shows bank-level variables while *t* and *j* are time and country-level variables, respectively. In addition, a_0 and ε_{ijt} are the symbols of constant and error-term for each. In the model, the dependent variable is bank stability, which is reflected by ZSCORE calculated from the log of $\frac{ROA+ETA}{SDROA}$, where ROA is return on total asset, and ETA stands for equity to total assets (Chiaramonte et al., 2016). A higher score of ZSCORE indicates the bank has more financial stability, and it means inversely when the bank has a low score of ZSCORE.

In addition, efficiency performance (EFF) is measured by the total cost divided by total revenue, meaning that a lower score indicates high-efficiency performance and a higher score is low performance (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, measured by the Islamic bank's capital compared to liabilities, LOANGR explaining the financing growth of the Islamic bank in each year, and ASSET measured by the log of the Islamic bank's total asset. Furthermore, the macroeconomic variable (Macro) is proxied by the yearly growth of gross domestic product (GDP), while institutional development (GOV) is proxied by the accumulative score of the governance index based on the world bank indicator. Furthermore, COVID is measured by dummy variable 1 is for period 2020 and 2021 while 0 represents other periods.

Furthermore, to answer the importance of Islamic bank's 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 bank's size due to a change in efficiency performance of Islamic bank. The equation is formulated as follows,

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

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

Finally, we use a dynamic panel approach employing the least squared dummy variable corrected (LSDVC) as proposed by (Nickell, 1981) and (Bruno, 2005). The reasons behind adopting that method are: (1) The correlation is present between the error term and the first lag of

ZSCORE, causing 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 moment (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 result in bias because it requires a high number of data (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 also addresses the endogeneity issue with a small sample (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 ZSCORE indicates that the stability among the Islamic banks does not have a big difference with referring to the standard deviation of the data. A higher level of ZSCORE indicates that Islamic bank has higher banking stability. 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 two times higher total revenue compared to the total cost. The lower score of EFF indicates that the efficiency of Islamic banks performs better, and it will be less efficient when the score is higher.

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, the financing growth (LOANGR) of Islamic banks is averagely high, with two-digit growth. It indicates the bank has aggressive financing activity in economic sectors. However, in some periods, the financing growth becomes negative due to an adverse effect of the pandemic that disturbs Islamic banking operations in some countries. In terms of the size of Islamic banks, the standard deviation value remains high, indicating that it has a big gap in Islamic bank's assets in the sample in which the largest Islamic bank has USD 166,000 million while the smallest Islamic bank only has USD 24.65 million in the total asset. Regarding the correlation analysis, shown in Table 2, it has a high correlation between ASSET and EFF, which is -0.602. Another correlation between variables that are considered to be high is between COVID and GDPGR, which is -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 with engaging specific bank-level variables (model 1), bank-specific and macroeconomic variables (Model 2), bank-specific, macroeconomic, and financial turmoil variables (Model 3), and finally 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 findings in the baseline result, it can be seen that efficiency performance has consistently been negative and significant to banking stability in Islamic banks. It indicates that the bank tends to have higher stability when efficiency performance is high.

For bank-specific variables, LOANGR has a negative and significant relationship to banking stability. It means that higher financing growth causes less financial stability in Islamic banks. The results are consistent in all four models. Moreover, the bank size has a positive and significant to the banking 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 to banking stability, indicating that both variables econometrically do not affect the banking stability 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 interacts Islamic banks' size (Model 5) to efficiency performance to investigate the impact of banks' size on banking stability in relation to efficiency performance. According to the finding in Table 3 it shows that efficiency performance remains negative and has a significant relationship to banking stability in Islamic banks in the 5% level of significance. A decrease of one point in efficiency performance increases 1.91 points of banking stability. The interaction variables between Islamic bank's size and efficiency performance are also significant but in different directions within a 10% significance level.

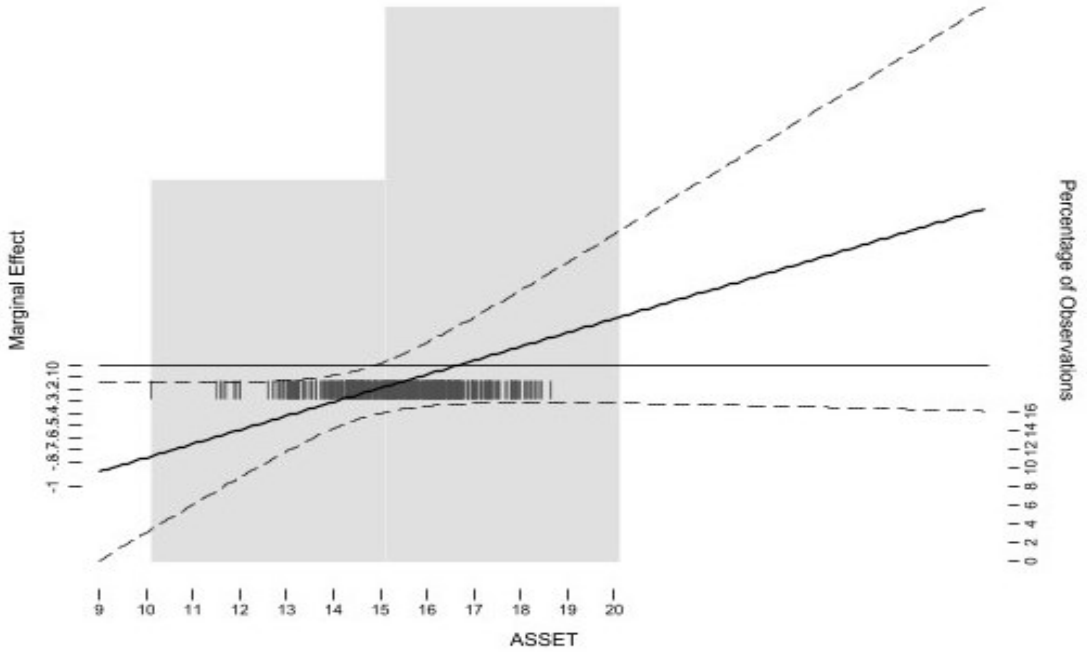

Figure 1. Marginal Effect of Islamic Bank's Size on Efficiency Performance-Banking Stability Nexus

Following the approach of Law et al. (2020), we adopt marginal effect measurement to understand whether the small-big size of Islamic banks has a different influence on banking stability concerning the role of efficiency performance, as shown in Figure 1. With using a 95% confidence level of significance, the X line is Islamic bank's size in all samples. According to the findings, it can be seen that most Islamic banks have a negative and significant relationship to banking stability. However, when the value of Islamic banks' size is bigger, where the X line is roughly above 16.5, it has a positive and significant relationship.

Thirdly, we also interact with the impact of financial turmoil reflected by COVID (Model 6) and institutional development (Model 7). The finding of the study reveals that efficiency performance is consistent with having a negative and significant relationship to banking stability in both models. However, COVID and GOV fail to moderate the role of efficiency performance in banking stability because all the interaction variables are not significant.

Finally, to check the robustness of the study, we decide to exclude the period of the outbreak (2020-2021) in the samples 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 result and whether the result is consistent compared to when the period of financial turmoil is included in the sample. According to the result of the robustness check shown in Table 4, from model 1 to model 5, efficiency performance has consistently had a negative and significant relationship to banking stability in Islamic banks. The findings confirm the baseline results, and then it can be concluded that the results are robust.

The above empirical analysis can be developed into a number of points. Firstly, efficiency performance holds a pivotal role in determining Islamic banking stability. It is found in all models and robustness checks. The finding is in line with Hidayat et al. (2021), who state that efficiency performance is the main determinant of banking performance. When the bank has higher efficiency, the bank can allocate the resources of funds effectively. It also means that the bank reaches its objective of having financial stability at the banking level by effectively allocating the funds to risk-management purposes. Additionally, having an efficient and effective allocation of funds resources also directly increases the probability of the bank having higher returns because the bank spends lower costs in its banking operation. In this case, Islamic banks possess good management practice that supports the future development of the Islamic banking sector

worldwide. Possessing efficient performance also indicates that the bank can suitably supervise lending-borrowing activities and properly manage the bank's portfolio management.

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
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Secondly, as mentioned by Terraza (2015), Aysun (2016), and Ibrahim and Rizvi (2017), banks' size significantly influences banking performance. The finding of this study reveals that the interaction between efficiency performance and bank size has a significant and positive relationship to banking stability. It means that efficiency performance tends to have a positive influence on banking stability if it has an increase in bank size in Islamic banks. Referring to this finding, we follow Ibrahim and Rizvi (2017), Law et al. (2020), and Danlami et al. (2022) to identify the marginal effect of size on banking stability if there is a change in efficiency performance. The result is interesting because the small-medium banks' size inclines to better efficiency performance, negatively affecting banking stability. Inversely, the large banks' size has a positive and significant relationship between efficiency performance and banking stability. It indicates that the large banks' size faces a trade-off between being efficient and effective. The bank's management can perform efficiently, but it increases the level of banking instability. As a larger bank requires more operational cost, for instance, to finance banking operations in more branches, attempting to have efficient performance has a consequence of reducing funds allocation to risk-management purposes. As a result, the large banks' size probably has more return due to lower costs, but at the expense of higher instability. The finding is supported by Aysun (2016), who also highlights that large banks' size tend to be risk-takers.

Thirdly, financial turmoil reflected by the period of the COVID-19 pandemic has a negative and significant relationship to Islamic banking stability. It can be explained that during the outbreak, Islamic banks became relatively unstable due to external financial shocks. The finding is in line 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 for the 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 the bank 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 efficiency performance on banking

stability in Islamic banks. It indicates that institutional development does not matter for Islamic banking stability. The finding can be explained by the argument of Shakil et al. (2019) and Azmi et al. (2021), who state that in developing countries, considering most of the Islamic banks in this study come from developing economy, institutional development has a limited role in developing financial industry due to high uncertainty and lower attention to the stakeholders, particularly shareholder. 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 good efficiency performance have financial stability. Additionally, the size of Islamic banks matters for the stability of Islamic banks in terms of efficiency performance. High-efficiency performance is found to increase the financial stability of small-medium Islamic banks, but it occurs inversely for large Islamic banks. It explains that the role of efficiency performance is different considering the size of Islamic banks and the efficiency level of the bank.

Furthermore, financial turmoil has a significant influence on Islamic banking stability. However, it fails to be a moderating variable for efficiency performance on banking stability. The insignificant influence of the institutional development variable and its failure to act as a moderating variable for efficiency performance indicates that institutional development does not have a pivotal role in Islamic banking stability.

The findings imply that Islamic banking institutions need to ensure efficient performance in their operation because it strengthens the level of financial stability in Islamic banks. In addition, for large-size Islamic banks, efficiency performance must consider the effectiveness of funds allocation, especially for risk-management performance. Indeed, these points need to be taken as a concern for financial authorities on how to regulate effectively and efficiently of Islamic banks in order to achieve and maintain financial stability, particularly for large-size Islamic banks that have more probability of having systematic risk to the financial system.

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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 money supply are included in the model as independent variables.

Findings — The findings reveal no statistically significant long-term and short-term relationships between trade openness and inflation. However, money supply has statistically significant positive effects on inflation in the long run, while economic growth and credit exhibit no statistically significant impact. In the short run, money supply and economic growth reduced inflation. According to the Dumitrescu-Hurlin (2012) panel causality test, a bidirectional relationship exists between inflation and economic growth, money supply, and credit, while 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 NICs. It is crucial to ensure that monetary policy helps align 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 at a certain level 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 low-income groups' wealth levels. 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 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

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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 technical knowledge accumulation, increasing production levels. Thus, increases in real production result in higher trade openness, and high trade openness can become a factor that reduces the general price level (Rogoff, 2003). Trade openness primarily alleviates pressure on prices and reduces inflation by promoting production through increased efficiency, higher foreign investments, better resource allocation, and 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 adversely affect 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, especially fluctuations in the value of the 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; and Terra, 1998). Conversely, other research, including a study by Evans (2007), has identified a positive relationship between inflation and trade openness. These conflicting findings have led to empirical and theoretical debates, indicating that the relationship may vary across countries. As a result, this study focuses on examining 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 of the literature, the third part provides the theoretical background, the fourth part addresses the dataset and methodology, the fifth part presents empirical findings and discussion, and the final part concludes with a conclusion 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 between trade openness, inflation, and other variables, with trade openness having a negative effect on inflation. Lastly, Yılmaz (2024) demonstrated that between 1970 and 2021, economic and social globalization had a significant negative impact on inflation in Turkey, while political globalization did not show 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) highlighted the Romer theory while examining the impact of trade openness on inflation, 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, finding a positive correlation between the two variables. Similarly, Çoban (2020) The study investigated this relationship for the Next-11 countries using the panel ARDL method. It concluded 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, finding a positive long-term relationship. 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, representing 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 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 levels of the series with cross-sectional dependency were examined using the CIPS unit root test developed by Pesaran (2007). It was determined that the series were 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 to apply, 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 no cross-sectional dependence exists, while the alternative hypothesis suggests the presence 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 investigating 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, long-run coefficients must be the same 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 relationship among the variables in the model given in Equation 1 was investigated using the panel causality test introduced to the literature by Dumitrescu & Hurlin (2012). The panel causality test by Dumitrescu & Hurlin (2012) examines the null hypothesis, formulated as the absence of a Granger causality relationship, based on the test statistic calculated using the formula provided in 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-generation or second-generation tests in panel data analysis 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 obtained results in this study, at a 1% statistical 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 occurring in one of the countries composing the panel affected the other countries, demonstrating the interdependence of national economies. It can be expressed that countries are interdependent in terms of economic indicators 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, it was determined that 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 findings, the relationship between the variables constituting the model 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 statistic result, since the slope coefficients of the model exhibited a homogeneous distribution, 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 negatively influenced inflation significantly. 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. For Brazil, it is noteworthy that all variables exhibited statistically significant impacts 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, it was observed that GDP and CREDI variables were statistically significant and had negative coefficients, while other variables were statistically insignificant. In Mexico and Türkiye, MONEY and CREDI variables were statistically significant but had negative coefficients, whereas statistically significant results were not obtained for GDP and OPEN. However, 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 obtained for Brazil and China, the 'cost-push hypothesis' is valid in these 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, the increase in 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 the effect of GDP on inflation is positive for China, it is negative for Brazil and Indonesia. These results are like those of Ali & Asfaw (2023), Salamai et al. (2022), Warsame et al. (2023). Gokal & Hanif (2004) emphasized that inflation negatively affects economic growth due to increased 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 money supply has short-term negative effects on inflation, a statistically significant and positive relationship has been established 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. (Van, 2020) 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, especially with populist approaches, the increase in the money supply can be greater than necessary.

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 investment loans.

Table 7. Results of 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 relationship between the variables in the model using a causality approach. The Dumitrescu & Hurlin (2012) method was employed for the panel causality tests in this study. Given the difficulty in selecting an appropriate lag length in the Dumitrescu & Hurlin (2012) causality test and the annual frequency of the dataset, causality was investigated for lag lengths of 1, 2, and 3. According to the results, at a lag length of 1, a unidirectional causality 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).

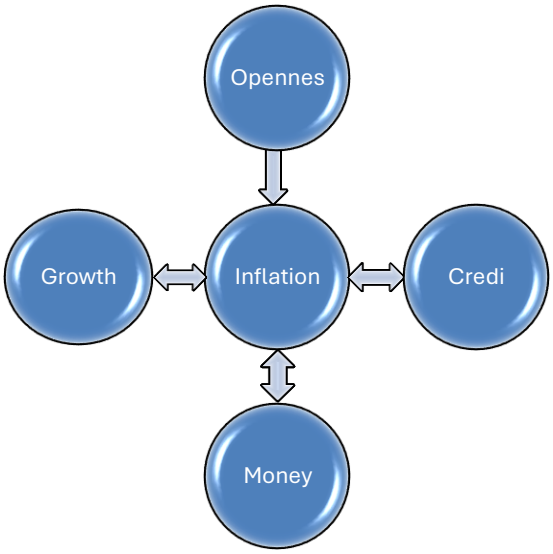

Figure 1. Graphical interpretation of the causality results

Conclusion

Studies examining the relationship between trade openness and inflation have found positive and negative relationships in the literature. Recently, economic globalization has often been regarded as an indicator of trade openness, while traditional measures of trade openness based on international trade are still frequently used. Based on traditional trade openness, the validity of the Romer Hypothesis for Newly Industrialized Countries was investigated from 1990-2022. 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. This is because the causes of inflation include demand and supply imbalances, cost increases, money supply, and various other factors. Inflation is a significant problem, especially in developing countries like newly industrialized ones. As a result, trade openness can increase due to rising exports linked to increased production and imports. 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 expansions, 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 considering imports and exports separately. Moreover, if the dataset is available on a monthly or quarterly basis, the impact of trade openness on inflation can be analyzed periodically. This study is expected to provide a new perspective to previous studies that have examined the relationship between openness and inflation for NIC countries. However, the study's findings indicate that it is important to consider the exchange rate to analyze this relationship comprehensively. Considering the results obtained from this study, we aim to construct 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 investigates this issue in the case of Iran from 1981 to 2021.

Methods — Applying Impulse Responses from VECM and the Structural VAR model separates the relationship between skill and wage into short- and long-term effects. The structural wage model was estimated using the structural vector auto-regression model.

Findings — The results show that skill played a significant role in wage determination only for three periods in the short run, and the 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 education 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 education outcome fields. 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 represented through the Mincerian earnings function that establishes a relationship between wage levels and corresponding skills. Jacob Mincer captures this concept in his study published in 1974, which provided a good background for many human capital studies. However, these investigations lack a focus on the assumption of stable effects of skill on wages, which is proven mostly by linear regression estimation of the Mincerian wage equation. Recently, it has been observed that although the number of university-educated is increasing globally, this number has failed to explain the variations in wage levels 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 minimum power to define the equilibrium nominal wages. This study is mainly dedicated to the co-integration analysis of wages and the number of skilled workers in the short and long run. It considers the case of Iran to conduct the co-integration

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analysis and to determine how wages respond to a variation in the number of university-educated workers. With the time series being I(1) the study provides enough evidence of co-movement between wages and skills of these workers. Although Lazear and Oyer (2007) discussed various types of wage compensation, including various non-wage compensations, workers are mainly compensated through just wages in Iran. 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 two to three periods in the short run, and, in longer horizons, the actual wage-skill curve lies lower than 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 existence of possible skill neutrality that leads to the laziness of resources and recruitment of low-productive 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 considering unrelated shocks, which prevent accurate estimation of the coefficient of skill, the study adds the exogenous non-accelerating inflation rate of unemployment (NAIRU), estimated by the state space model solved by the Kalman Filter (Kalman, 2006).

Many studies are dedicated to labour performance and compensation in world economies. Hendricks (2002) revealed that, in the case of Iran, human capital can explain less than a 31 percent 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 measured by educational attainment reduces earnings per worker by 20 percent for the richest and 40 percent for the poorest countries.

The primary goal of this study to examine structural macro-models based on microdata is rooted in the works by Becker (1964), Mincer (1974), Rosen (1976), Jones (2014), and Mankiw et al. (1992) and introduces the fact that, in the first decade of this century, firms did not adapt their wage structures to respond to the accumulation of human capital; this scenario has led to the determination of wages by skills only for two to three periods in 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 specific identification procedure of the paper by applying specific restrictions according to the actual behaviors of wage, skill, and NAIRU, and restrictions like the ones followed by Blanchard and Perotti (2002) and Sims (1999), the model became fully identifiable which proves that 1 percent increase in NAIRU will decrease wages by 10 percent 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, and, in the longer horizon, skill accumulations, even after seven periods, lead 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 proves the first analysis of skill bias that while university attendance is increasing in most countries globally, in the long run, the share of educated workers will not play a significant role in wage determination.

Methods

By running a unit root test, the study checked whether variables in the model are following integration. All data used in the VECM and structural model, including wages, equilibrium unemployment rates, and educated labour, extracted from the census data, proved to be at I(1). This implies that the data follow a light random walk process. Hence, imposing a structural shock in SVAR will decay in 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 each variable with regard to time to check the possibility of changes in the same direction.

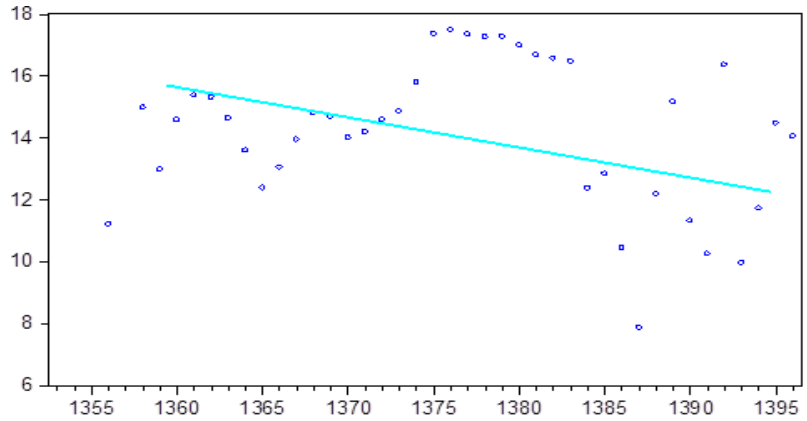

Figure 1. Unemployment in equilibrium rate by removing inflationary pressures

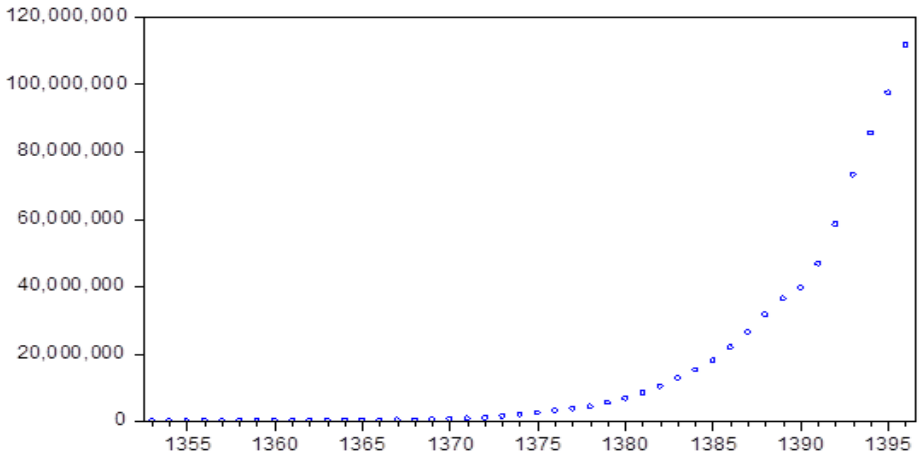

Figure 2. Average yearly wage of all agents in the economy according to Microdata of National Census

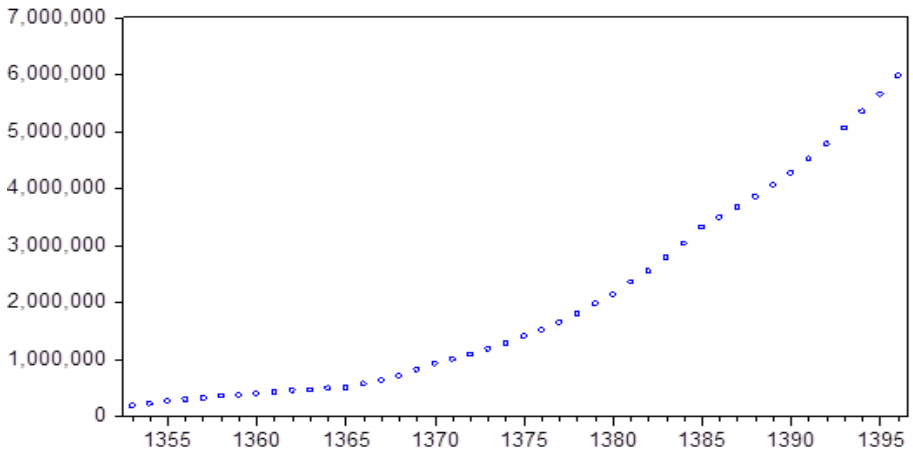

Figure 3. Number of Skilled workers for the whole nation according to Microdata of sample firms on Census data

Annual data analysis reveals partially similar paths of wage and skill; however, unemployment vacillates around a point but shows a downward-sloping trend identical to the linear pattern in scatter plots. The co-integration of wage with skill versus unemployment will approve

two strong co-integrating patterns in 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 like working and job-matching arrangements because of changes in the skilled labour stock of the economy. Jones (2014) clarified the potential limitations of standard human capital accounting by employing the marginal productivity analysis through the regression model, which focuses on variation in *H* across countries. In practice, since the variation in *H* 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 econometrics tools. Concerning the long run, the results prove that wages are skill-neutral, as the hiring process and labour-matching mechanism are hindered by inefficient institutional procedures prevalent in developing economies, and an unskilled, low-quality workforce just dumps 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 in a year assigned to a specific feature of that year of how workers in that year attended school for two or more years. This can be a direct implication of bias in the labour market, according to which an increase in the number of school years explains changes in wages within a yearly period, but, in the same time horizon, university education movements with regard to wages show instability. Hendricks (2002) explained that human capital could only account for 31 percent of the wage difference by the US, computed by the ratio of wage to US wage, for the country in this study, Iran. 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. The combined effect of the physical capital and measured skills is estimated to reduce earnings in the five poorest countries' total sample by 54 percent. Barro and Lee (2000) investigated the same condition for all source countries, and they proved that educational attainment in countries' global data is lower than that in the US. This effect reduces earnings per worker between 20 percent for the wealthiest countries and 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 considering Iran's economy's unique features and ran the SVAR model to solve these models. Subsequently, this study regresses wages to the schooling variable, denoting substantial explanation wage variations by schooling years with a coefficient meaningful at 99 percent interval and adjusted R-square of the model at 99.3 percent. This further supports the assumption that other factors suppress skill, and wages are neutral to workers' skills in the long term. The study analysed whether wages are neutral to skill when co-movements in the long run and short run are separated, to see if skill neutrality in labour market is provable. 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 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 Blis (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 production function of firms with advanced technology, I took the number of workers with a specified contract period who have university degrees in their stock as how skilled they are.

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

Equation 1 implies that when an economy is at equilibrium, there is a balance between demand and supply. Additionally, the equation means that the returns to human capital

for an additional year of education are equal to the rate of the logarithmic value of schooling, also known as the returns to wage (Mincer returns). The pace of technological advancements and complex production procedures requires us to consider precise variables as the proxy for human capital. Holmstrom (2017), the number of workers with a university education is reflective of productive labour supplied by a specific worker who is compensated through wages; therefore, the co-movement of wage and quality of a worker's performance is posited by a generic specification in a principal-agent contract.

It is essential to converge the long-run relationship between wages and human capital because firms are not inclined to change production procedures, increase the recruitment of educated workers, and assume linearity in that no shocks hit wages, human capital, or 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 relationship between human capital fluctuations in the long run and wages is neutral; that is, wages cannot be affected. 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).

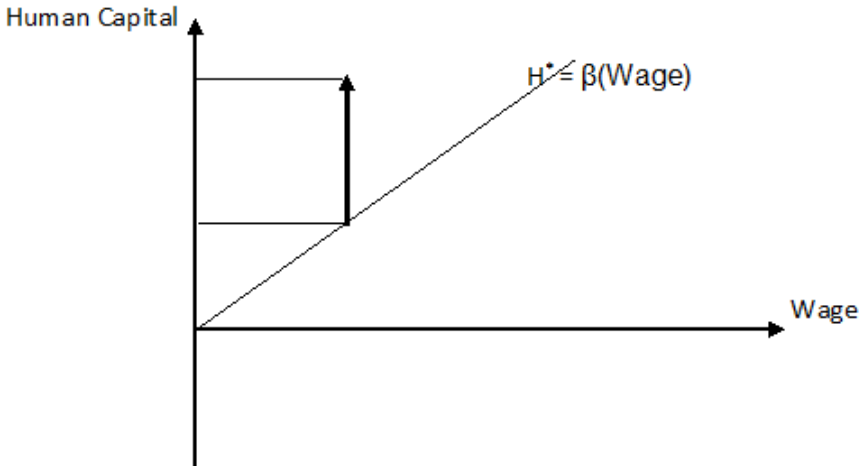

Figure 4. Long-run relationship of human capital, wage, and NAIRU by suppression of inflationary

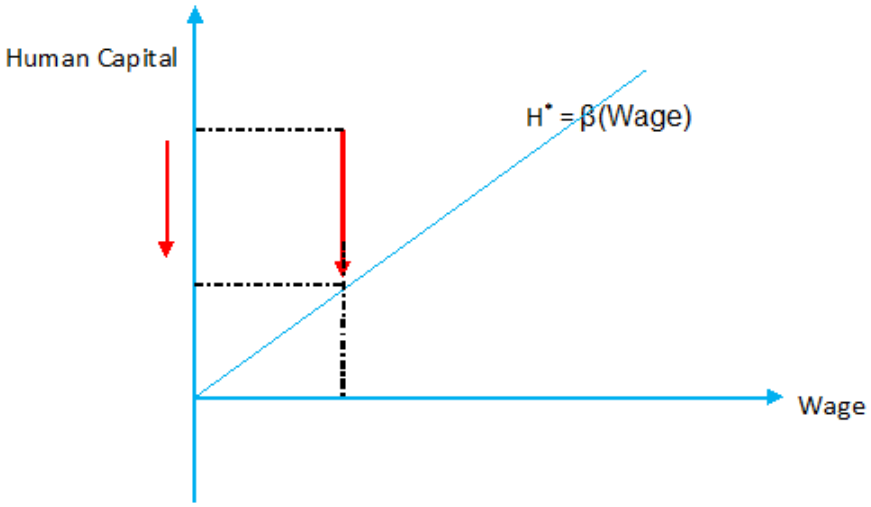

Figure 5. Convergence through Human capital (by the assumption of stabilizing long-run unemployment rate (NAIRU))

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 diversion 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 follow those of Jones (2014) or developed Organisation for Economic Co-operation and Development (OECD) countries; they show the same stable steep linear relationship. Skill bias reflected in the slope of the line implies that a lower variation in wages in response to a one-percent shock from skilled labour mainly determines the structure of the economies.

Consequently, if a change in the gap is a linear function of the long-run relationship structurally dominated in the case of Iran's economy, then human capital in the form of the number of educated workers will decrease because of a positive error from a steady state. In such a case, α_h(error correction coefficient) should be below zero for the procedure to not 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, the adjustment is achieved through wages. Suppose H_t is fixed, and H_t*(the potential capacity of an economy by adding to its stock of human capital, as reflected in the long-run line) and wages are indirectly adjusted to their ratio. Another assumption is that wage changes denote the linear function of the extent of divergence from the potential path, with α_w being more significant than zero to ensure that H_t increases to long-run potential levels in the economy.

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

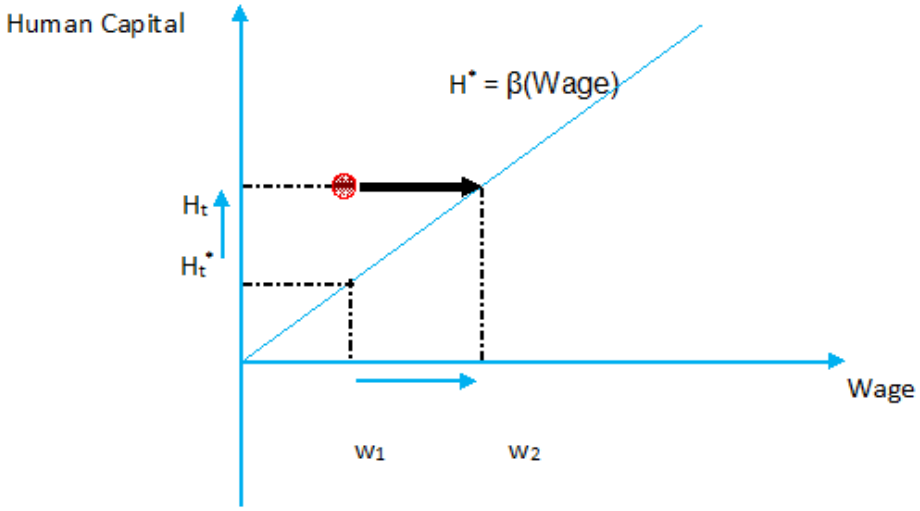

Figure 6. Convergence through wages to long-run skill/wage potential levels

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 of the above graphs is that despite a new shock and heightened number of educated workers, the ratio of wages to the number of educated workers would be identical for various levels of wages. Thus, human capital would not impact wages, and consequently, educated workers would not have any influence over determining employees' wages. This study refers to this effect as skill gap bias in the labour market.

The third method achieves error correction when two co-integration combinations in equation 4, imposed by the labour market structure, lead the economy to 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 magnitude of coefficients explains the pace at which wage and human capital will adjust in the long run (Figure 7).

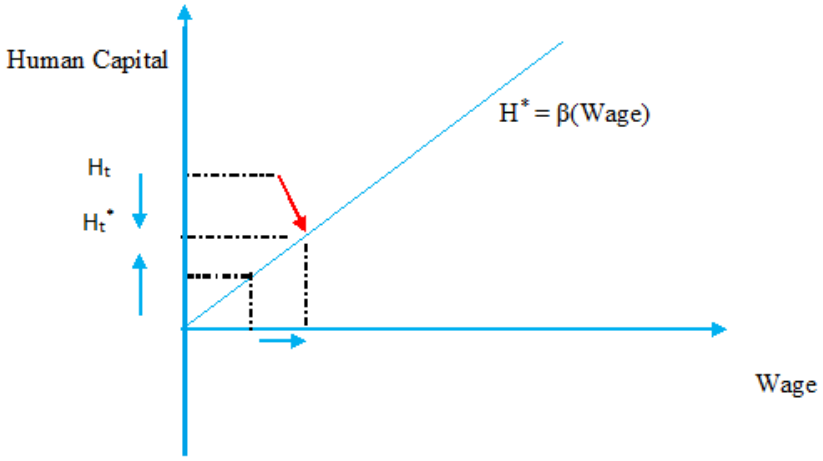

Figure 7. Convergence achieved through both Human Capital wages to long-run skill/wage potential levels

Supposing homogeneity of job search always a constant part of labour force by the given wage would be employed independent of workers ability which implies of β being constant. The assumption is made in the procedures explained above. Conversely, if it is assumed that job search due to structural inadequacies in the economy turns out to be a complicated process, then the probability of a worker being successful would be a function of the worker's participation in complex job search procedures and the success of a worker with average levels of human capital would be directly dependent on the worker's expectation from the labour market so that:

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

In the above probability function, the parameter e is perceived compensation expected by labour force and δ specifies the worker's expectations regarding the complexities 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 partial improvement in the business environment, with the temporary elimination of international sanctions; this environment contributes to easing the job search 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 and makes 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, and β reflects the probability of the job search; hence,

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

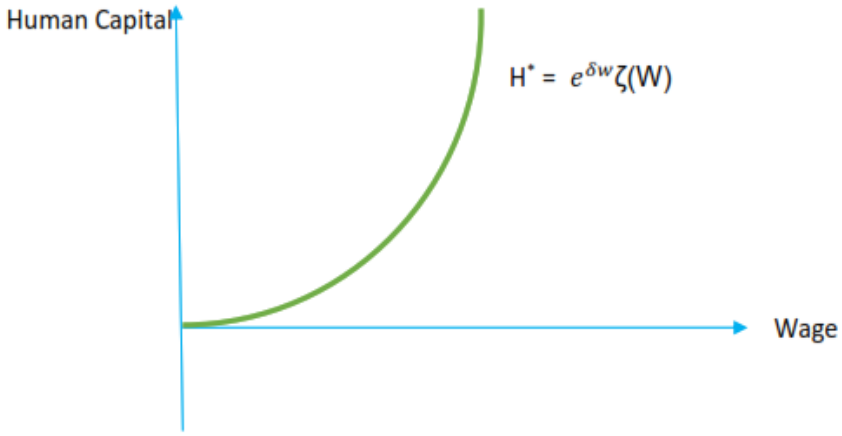

Figure I. Dynamic long-run relationship with search Probability

Considering the innate skills of workers, Herrendorf and Schoellman (2018) reveal that workers are endowed with one unit of unskilled labour that requires no education and can be supplied immediately to the market. 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, *depth* is the first difference between physical and human capital. To remove the cost effects of job search and to achieve homogeneity in job demand, inflation computed according to the Phillips Curve is excluded from expectations that determine labour decisions regarding the job search method. Equation (8)

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

such that,

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

Substituting equation VIII by its components gives:

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

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 will give 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 deterministic equation about 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 technology accumulation is constant during schooling, which will, at last, positively affect average wages.

Procedure for Estimating the structural wage-human capital model for Iran

The SVAR is the most beneficial macro-econometric tool, proposed by Christopher Sims, applied to aggregated microdata. To know the effects of skill on wages, we use the intuition that an increase in the workers' skills leads to better adjustment to job positions and puts them in a higher place in

negotiation with firms, thus resulting in higher wages by matching procedures. To estimate the effects of variations of skilled labour on wages, one needs to identify and isolate purely exogenous and independent movements or shocks to the variable of interest or wage and examine how the variable reacts to these movements. 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 gets the responses of exogenous variables after the economy heats by these shocks. Getting the structural model means determining the proper identification for our models. The identification is the interpretation of historically observed variation in data in a way that allows the variation to predict 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;

$$AX_t = \beta_0 + \beta_1 X_{t-1} + u_t \quad (11)$$

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 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;

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

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

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

We impose $\alpha_{12} = 0$, $\alpha_{21} = 0$, and $\alpha_{32} = 0$, which reflect the stable character of NAIRU desire. Therefore, the wage is not affected by shocks to equilibrium unemployment. 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 Equilibrium.

Results and Discussion

According to data for the average years of schooling, including primary, secondary, and high school, workers with a certificate of school education will have positive co-movements for 56 years, as in Figure 9. Upper secondary education is not compulsory in Iran. Schooling is provided free for the entire population by the government. It includes primary schooling and higher schooling 1 and 2, where higher schooling 1 is equivalent to secondary education at an international level.

As it is clear from the above figure, the average years of schooling is 7 to 8 years, and the average wage growth is about 20 percent. Herrendorf and Schoellman (2018) use this relationship to study the effect of schooling by eliminating the error term from the right-hand side of the equation and thereby ignoring the influence of shocks of skills on wages, which is primarily investigated in this study. This study determines the structural skill shocks decomposed into short and long runs.

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, variation in the growth of skilled workers was higher than 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 like war worsened the distance rate. According to census data collected from

3904 individuals each in urban and rural areas of Iran for the year 2016, only 18.7 percent of currently active workers attained a Bachelor's or higher degree, which, regarding the high growth of university graduates in the last decade, brings inefficiency to the labour market.

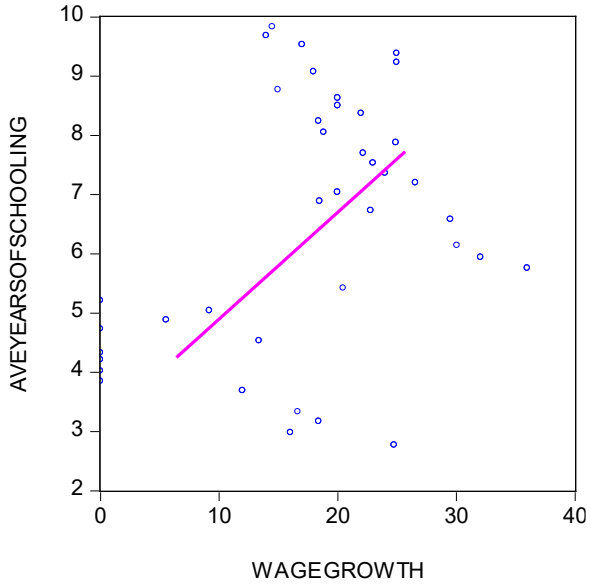

Figure 9. Scatter of wage variations and long-run changes in the number of workers with school education attainments

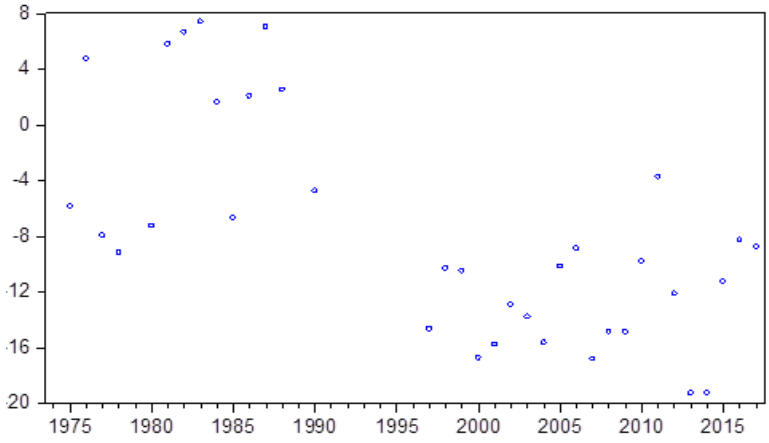

Figure 10. Distance between skilled labor force growth and minimum compensation growth

Results in Table 1 show that human capital shocks in the short run lead to an increase in wages, which is according to the impulse-response function in Figure 13 for about 2 to 3 by coefficient equal to 2.07 significant at five percent according to Table 1, meaning that one percent increase in number of workers with university degree by its short-run surprise is concurrent of wages moving 2.07 percent lasting for about three periods. On the other hand, in the long run, if the structural shock of human capital affects wages, the wages will dwindle by -2.217 percent, as in Table 1, which will be significant at a 5 percent level. These results prove the initial assumption that educated workers play a minimum role in wage bargaining compared to other workers with different qualities, implying that a rise or fall in wages does not happen due to firms' stock of human capital. This result complies with the study performed by Hendricks (2002), which found that human capital can explain the low wage difference (about 31 percent) in Iran. This phenomenon leads to a smooth curve in Figure 11 by increasing the general levels of wages in the horizontal axis. According to Figure 14, 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 like costly registration in private

job campaigns, which, according to statistics, 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 adopt accordingly, which is approved by studies done by Becker (1964), Mincer (1974), Rosen (1976), Mankiw et al. (1992), and Jones (2014) that in developing countries educating does not guarantee job attainment without enough attempt by the 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 revealed through the increase in the unemployment rate in the past 25-30 years, during which a PhD student is expected to attain a PhD degree.

Table 1. Results of estimation of 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 an increase in unemployment by one unit will result in a fall in general wage levels to IRR 2,978,279, as revealed through the empirical data of private firms. The Mincer coefficient for Iran is estimated to be 2.076 percent; that is, in the short run, means a one percent increase in skill will at last increase wages by 2.076 percent, which later by the specification of wage structural model, according to economic theory intuition and Impulse-Responses will be shown not to be persistent for more than two to three periods and in more periods effects decay and impact of human capital will be negative. Subsequently, it solved the estimated model for the sampled period to see if real-world data can prove 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 real-world human capital and wage relationship starts at around zero and at low wage levels. This finding is based on the sampled years between 1978 and 1988 before the Iranian revolution when education was the main criterion for hiring a worker, and a minimum rise in wage resulted in a significant increase in the number of workers with university degrees.

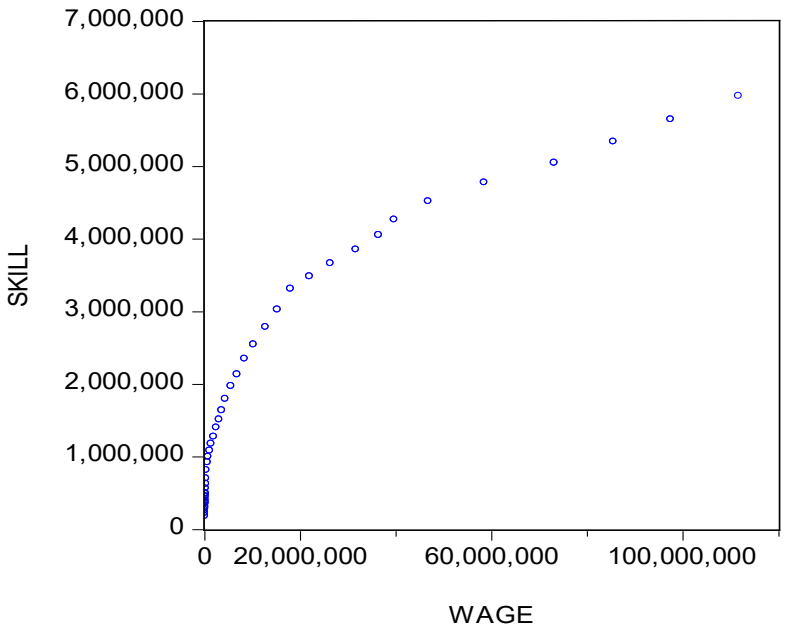

Figure 11. Skill bias in Iran economy

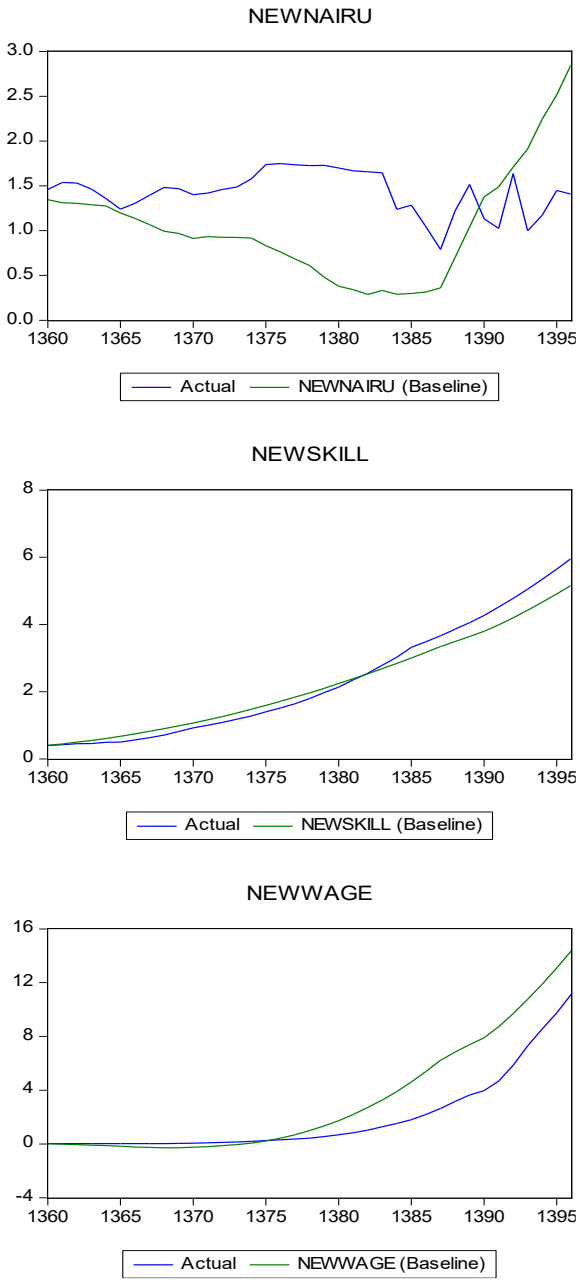

Figure 12. Solving model with baseline scenario

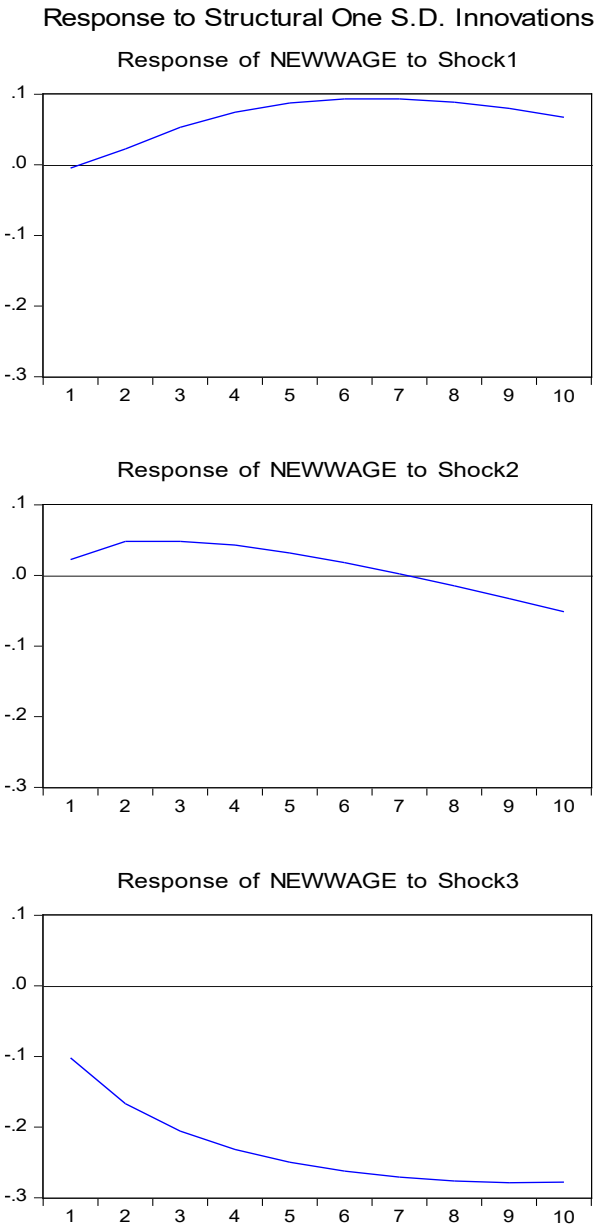

Figure 13. Response of wage to one standard structural shock hit of three endogenous variables

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

The short-term effects of human capital shocks can be proven further by estimating the response of wage to skill shocks, as in Figures 14 and 15. According to the IR figure, the response of wage to human capital shocks as the intercept of IR shows and discusses above for the short run starts at a point 2 percent; it means that a one unit shock of human capital will increase the wages by about 2 percent. This positive feedback will increase to about 5 percent in the second- and third period, and will start to decline after that point, becoming smaller than zero after seven periods, and thereby supporting our result that an increase in human capital in firms in the long

run will cause wages to drop. This implies a low bargaining power in wage bargaining and smoother long-run human capital-wage relationships.

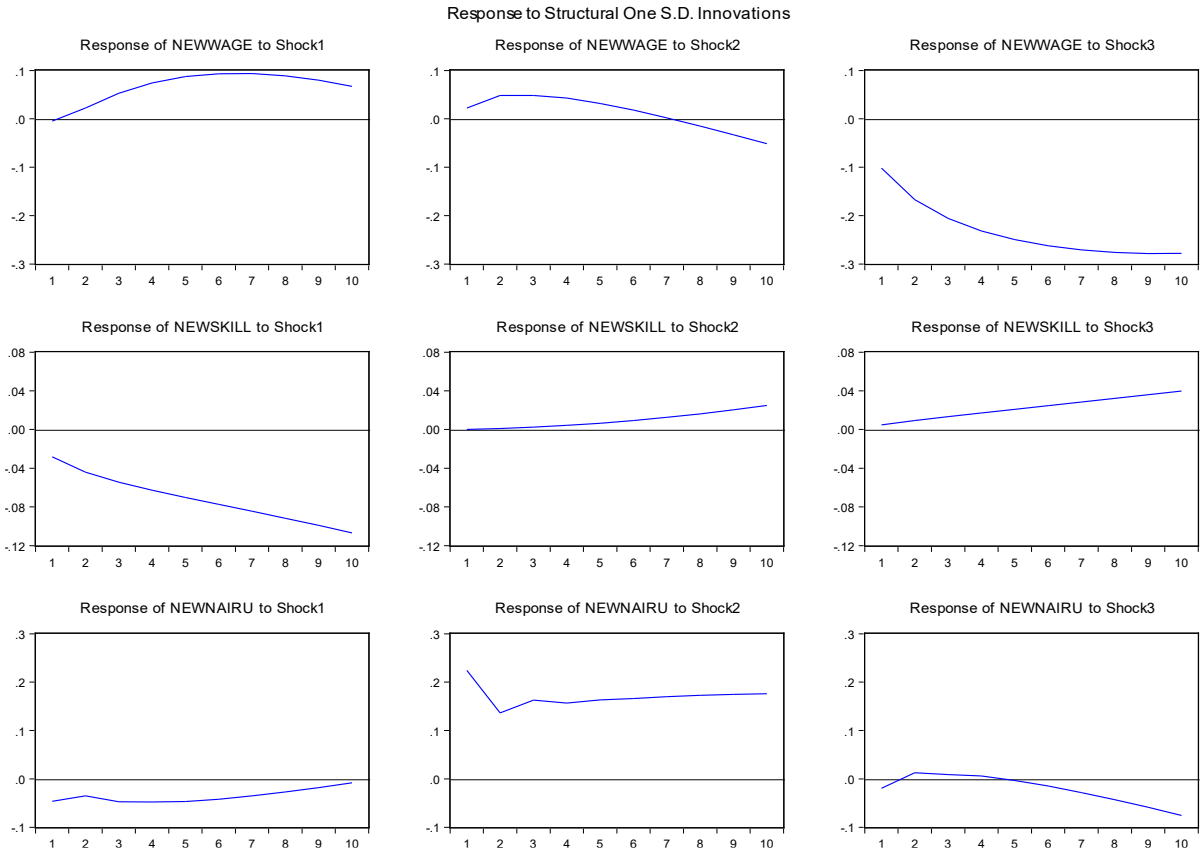

Figure 14. Responses of three endogenous variables to one structural shock hit in wage model

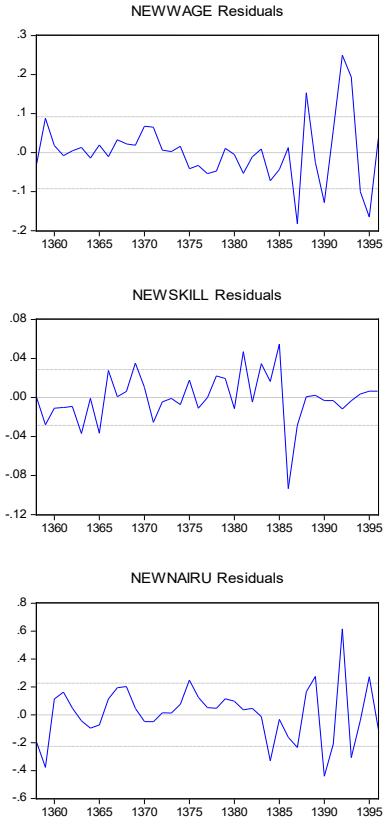

Figure 15. Residuals of endogenous variables in SVAR model

Conclusion

This study puts forward the missing link in the existing literature on wage and human capital models. In other words, although there is an increase in human capital owing to a recent expansion in university education, the low rate of educated workers' employment in firms and their role in wage bargaining fail to adapt. This problem is reflective of the bias of the highly educated workers. Their neutrality has led to a decline in human capital in firms, 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, it is found co-movements in the long-run wage-skill relationship that is lower than the actual curve, implying that the recruitment of university-educated workers is lower than the optimum trend. An estimation of the co-moving equation by VECM gave a coefficient of 2.06 for skill; this was also proved through the SVAR estimation. This study configured a model of wage for the Iranian economy and subsequently solved 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, and, in the longer horizons comprising about seven periods, the educated population negatively determines wage levels. The results imply that human capital causes negative externalities both for the macro-economy and individuals, which minimizes the significance of job search efforts of the educated, thereby thwarting their expectations and isolating them from the labour market. This study refers to this phenomenon as skill bias, where education, intended to facilitate labour market wage negotiations, loses its effectiveness and becomes neutral, as illustrated in 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 function provide the basis of the empirical data for comparison analysis.

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 analyzing and comparing the effects of foreign direct investment on climate change in 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 debatable exactly what factors contribute to environmental contamination. Because of the rising emissions from manufacturing and consumption activities, the environment is getting worse. 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, occur more frequently, with more significant 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 increasing foreign resource mobilization, 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 function of FDI has generated questions that can enhance their 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 aids in financing development initiatives. FDI frequently results in the development of new jobs. When foreign businesses shop in a nation, they usually hire local laborers, which lowers unemployment and creates job prospects (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

In comparison to developed countries, developing countries could have laxer environmental laws. Several causes could be a need for more enforcement resources, conflicting development goals, or a desire to draw in foreign capital to boost the economy. This could include measures or regulations that prefer economic growth over environmental preservation, such as easing the process of obtaining permissions or laxly enforcing existing laws. Due to the lax environmental rules, international investors may find it profitable to move their operations to these countries. By doing this, they may be able to avoid paying expenses related to meeting more stringent environmental regulations back home. The situation presents a potential 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 difficult for policymakers and researchers to understand fully how FDI affects 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 need more cash 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 costly for businesses that use much 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 & Saini, 2021) examined the connection between FDI and environmental sustainability between 1990 and 2016 using a sample of 21 nations using dynamic system GMM, and the finding is that FDI significantly reduces environmental risk.

According to the empirical findings, FDI considerably raises environmental risk in Africa, (Halliru et al., 2020) also investigated the impact of foreign direct investment on the environment in Western Africa and found findings that agreed with those of (Bokpin, 2017; 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 that FDI pollutes the environment. This shows that multinational corporations (MNCs) choose countries with the lowest labor, materials, and land when choosing where to establish worldwide branches (Levinson & Taylor, 2008). Conversely, other researchers contest the arguments made by the advocates of the pollution-haven theory by pointing out several flaws in their work, including unsuitable measurement methods and scant empirical evidence (Kim & Adilov, 2011; Demena & Afesorgbor, 2020) did a thorough evaluation of the research that investigated how FDI affected emissions.

The main reasons for the contradictions in the literature include disparities in data samples (which combine industrialized and developing nations), econometric approaches, variations in environmental indicators, and various control variables. The heterogeneity issues in the plethora of research are exacerbated using different levels of development and emissions, which is why (Halliru et al., 2020) used 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 considering heterogeneity in the study, they discovered that FDI significantly lowers environmental emissions. Thus, the results of the studies on the effect of FDI on pollution levels have been conflicting. Few researchers have looked at the effect of FDI on CO2 emissions in 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 native capital, South Asian countries are known for getting the greatest foreign direct investment. They mainly rely on foreign finance to accelerate the state's pollution level and economic growth. This study examines the effects of FDI on environmental quality in five South Asian states, Bangladesh, India, Nepal, Pakistan, and Sri Lanka, for which time series data are available from 1980 to 2020. 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 interaction of variables, such as the nature of investments, legal frameworks, technical developments, and the dedication of both local and foreign parties to environmental sustainability, determines how FDI affects pollution in South Asian nations. Effective environmental management and regulatory compliance are crucial to minimize potential drawbacks and optimize the advantages 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 (henceforth, PGDP), pollution measured by carbon dioxide (henceforth, CO2), and foreign direct investment (henceforth, 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 $\mathrm{GDP_t}$, α_3, β_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 own 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 that are produced can also be applied to 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 run before the empirical analysis to ascertain whether 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 taken into consideration using some 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 displays the test findings for cointegrating links using the efficient method proposed by (Johansen, 1988). The null hypothesis is that no cointegrating relationship exists 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** (0.00)	$\gamma = 1$	25.52** (0.00)
	$\gamma \leq 1$	$\gamma \geq 2$	7.19 (0.30)	$\gamma = 2$	4.20* (0.51)
India	$\gamma = 0$	$\gamma \geq 1$	64.12** (0.00)	$\gamma = 1$	39.82** (0.00)
	$\gamma \leq 1$	$\gamma \geq 2$	24.30** (0.00)	$\gamma = 2$	17.83** (0.05)
Nepal	$\gamma = 0$	$\gamma \geq 1$	37.77 (0.13)	$\gamma = 1$	16.23 (0.76)
	$\gamma \leq 1$	$\gamma \geq 2$	20.53 (0.31)	$\gamma = 2$	12.79 (0.61)
Pakistan	$\gamma = 0$	$\gamma \geq 1$	26.43** (0.00)	$\gamma = 1$	18.24** (0.00)
	$\gamma \leq 1$	$\gamma \geq 2$	9.18 (0.44)	$\gamma = 2$	7.99 (0.37)
Sri Lanka	$\gamma = 0$	$\gamma \geq 1$	41.31 (0.54)	$\gamma = 1$	24.62 (0.77)
	$\gamma \leq 1$	$\gamma \geq 2$	4.68 (0.39)	$\gamma = 2$	4.75 (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 any shocks to FDI on CO2 variation ranges from 1% to 16%, with Pakistan having the most significant influence (16.13%) and Bangladesh having the most negligible impact (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 nations, the endogenous relationship between foreign investment and pollution is insignificant. However, when contrasting

Bangladesh and Pakistan, the impact of FDI shock on pollution determination is estimated to vary greatly depending on each country's economic environment.

On the other hand, the FDI impacts on GDP of the fifth period are 9.06%, 54.59%, 3.64%, 28.30%, and 3.56%, respectively. In this case, India has the highest (54.59%), and Sri Lanka has the lowest impact on GDP (3.56%). FDI significantly impacts India's GDP because of its advantageous economic policies, sizable and expanding market, sectoral variety, 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 that varies from 0.5% to 33%, with Bangladesh having the most impact (33.45%) and Pakistan having the most minor influence (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 foreign direct investment shock on pollution determination differ significantly based on the respective economic environments of each country.

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 most negligible impact on GDP (0.91%), while India has the most significant (50.48%). Many factors contribute to India's high GDP from CO2 emissions, including the country's reliance on agriculture, health effects, issues in the energy sector, urbanization, effects of climate change, management of water resources, financial expenses associated with mitigation, and the tourism industry. When taken as a whole, these elements demonstrate the intricate connection between India's economic expansion and environmental sustainability. Integrated policies and investments that balance environmental preservation and economic development are necessary for controlling CO2 emissions and reducing their effects. In the case of Nepal, why 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 account for the higher FDI shocks on GDP in Bangladesh as opposed to the lower FDI shocks in India. While India's more significant, diversified economy produces more muted GDP reactions to FDI inflows, Bangladesh's smaller, more concentrated economy leaves it more vulnerable to significant effects from FDI. GDP impacts on CO2 emissions range from 2% to 37%, with the biggest value in India and the lowest value in Pakistan.

In conclusion, India's broad and diverse industrial base, high energy consumption from fossil fuels, rapid urbanization, and historical emphasis on economic expansion above environmental sustainability are the leading causes of the country's most significant CO2 shocks on GDP. On the other hand, Pakistan's less industrialized economy, smaller population, slower rate of urbanization, growing emphasis on renewable energy, and more recent adoption of efficient technology account for the country's lower CO2 shocks on GDP. The two countries' GDPs are affected differently by CO2 emissions due to differences in structure and policy.

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 to 5 show the results of the impulse response function for the five countries. Here, we present them country-wise. 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 the 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, resulting in increased economic output. The analysis highlights the dynamic interplay between these variables over time.

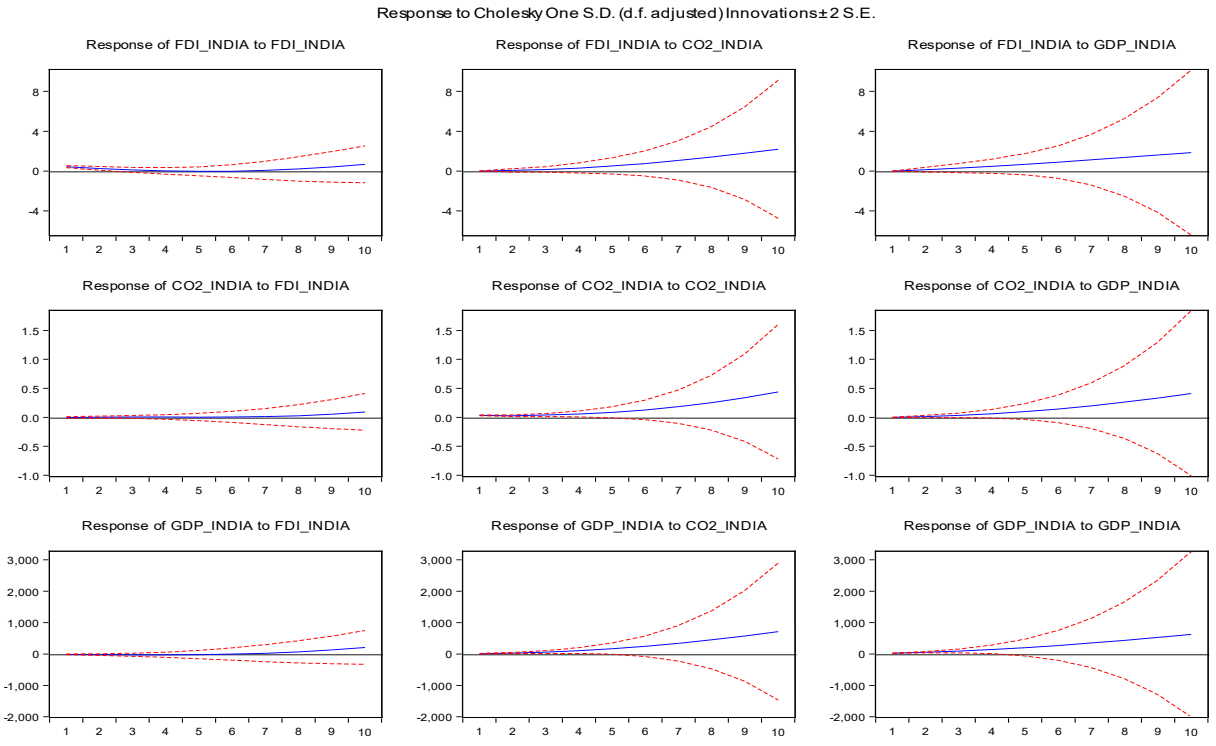

Figure 1. Impulse response function of India

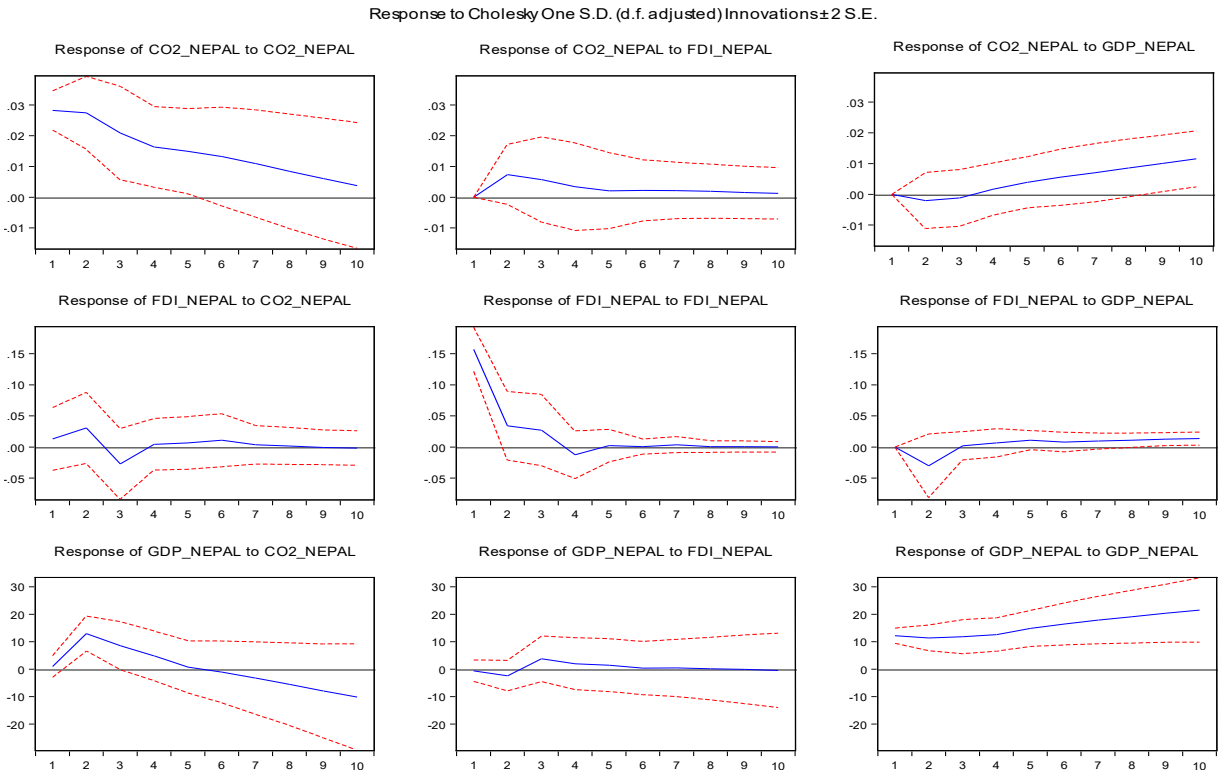

Figure 2. Impulse response function of Nepal

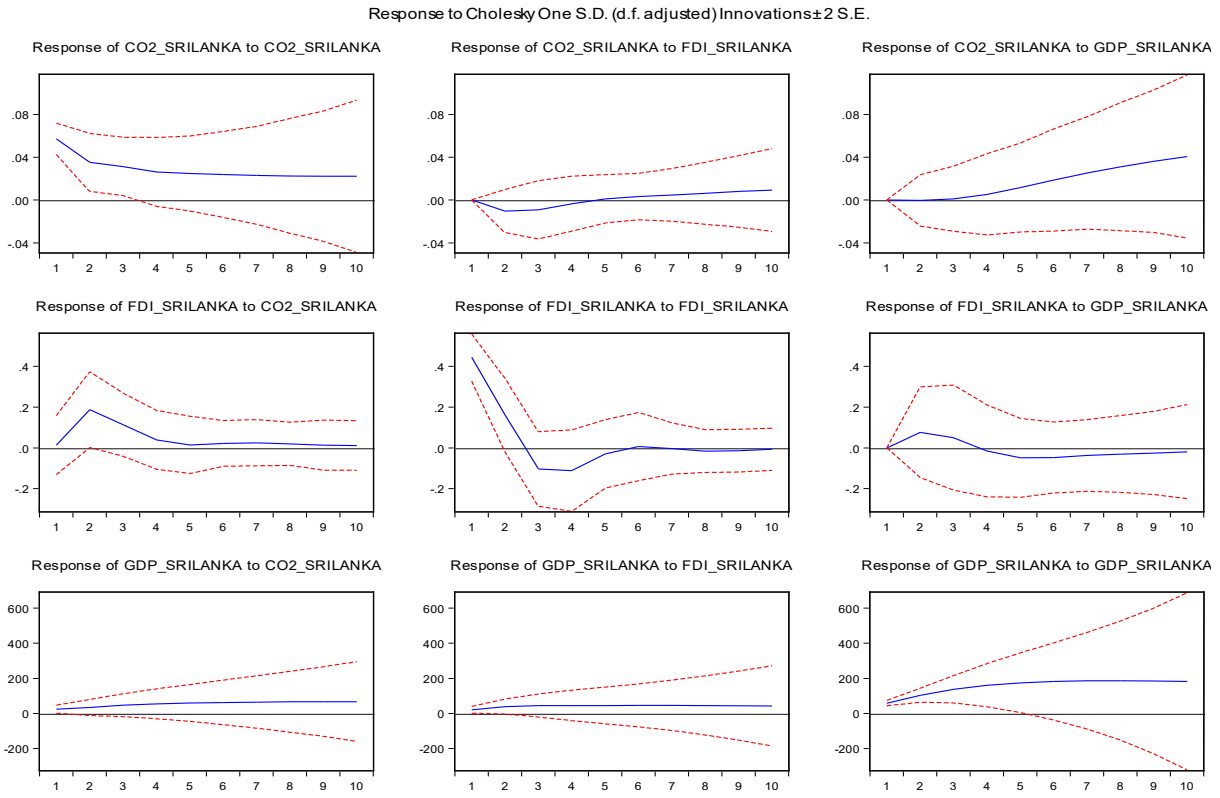

Figure 3. Impulse response function of Sri Lanka

The CO2 emissions shock has a cumulative impact on Nepal's CO2 emissions. The FDI shock has a slight increase in FDI but 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 immediately affect CO2

emissions or GDP significantly. A shock to GDP initially boosts GDP significantly and leads to increased CO2 emissions and FDI, although these effects diminish over time. In the case of Bangladesh, a shock to CO2 emissions initially increases CO2 emissions itself, while a shock to FDI initially boosts FDI and positively impacts GDP over time. A shock to GDP initially has a negative impact on CO2 emissions but leads to increased FDI and GDP over time. 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 positively impacts FDI and GDP itself but leads to decreased CO2 emissions over time.

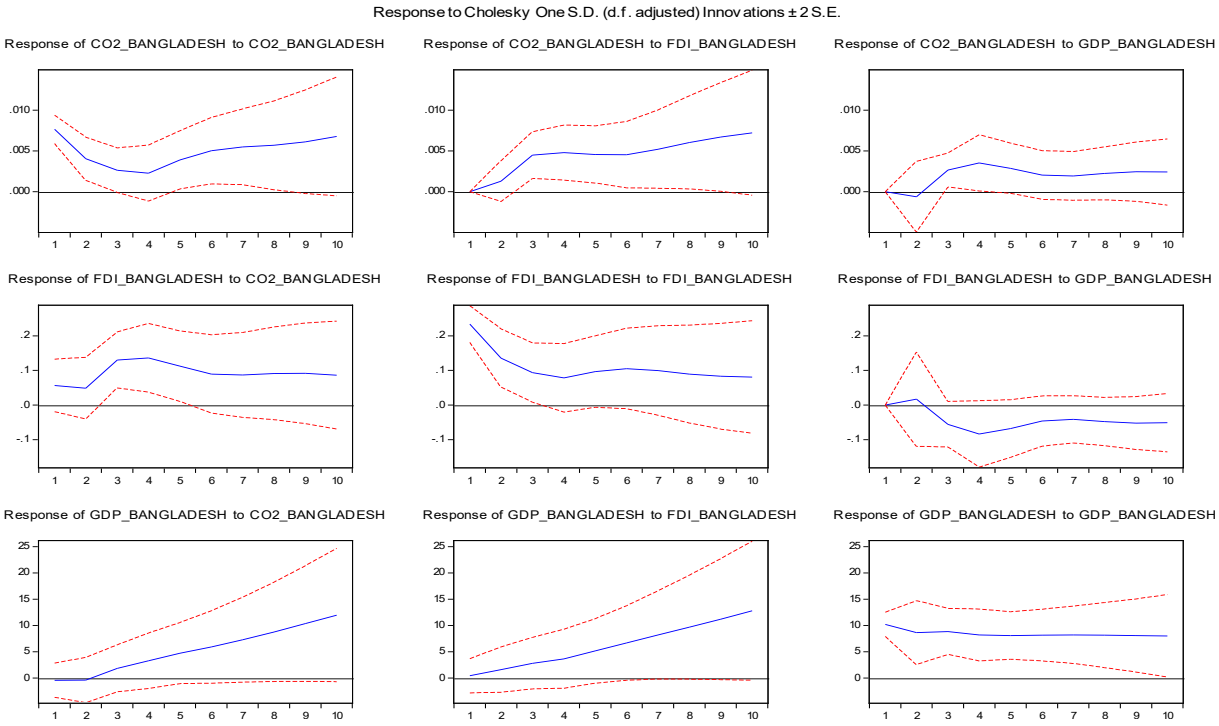

Figure 4. Impulse response function of Bangladesh

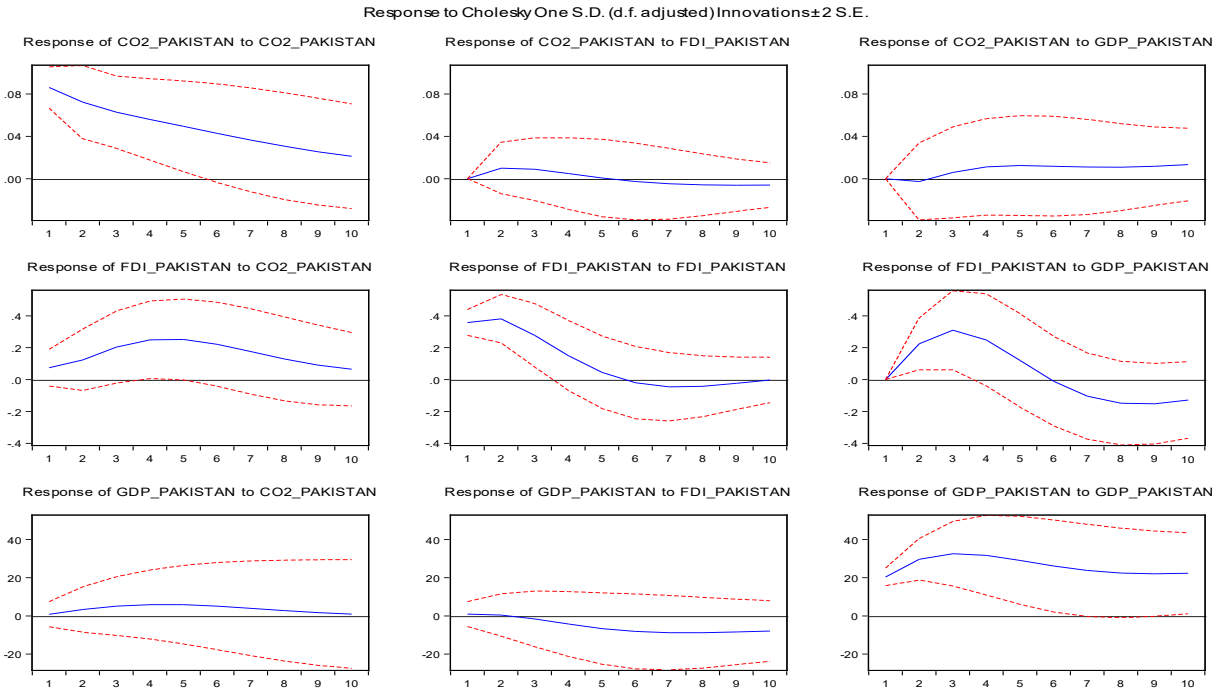

Figure 5. Impulse response function of Pakistan

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, it was concluded from the available research 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 if it can also result in the transfer of cleaner technologies and more substantial environmental restrictions. The kind of industries receiving FDI, the strength and implementation of environmental laws, and the level of economic growth affect how much FDI impacts pollution in South Asia (Acheampong, 2019; Ntow-Gyamfi et al., 2020). Empirical data from many Asian nations reveals inconsistent outcomes. This study examined how foreign direct investment (FDI) affected Indonesia's CO2 emissions between 1975 and 2011. According to their findings, FDI initially raises pollution because it brings in 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 (2010) study examined data from 1985 to 2008 and discovered that although foreign direct investment (FDI) has boosted economic growth, it has markedly increased carbon dioxide emissions.

The energy-intensive sectors that account for the majority of FDI in India are blamed for this rise. However, the report also points out that areas receiving more foreign direct investment tend to enact stronger environmental laws, eventually lowering pollution (Mukherjee, 2010). Cross-countries are also excellent sources of information where the FDI affected the environment in newly industrialized countries from 1971 to 2007. According to the report, FDI has considerably raised pollution levels due to polluting companies moving to new locations. 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 emphasizes 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 luring FDI, the state of environmental laws in place, and the host nation's economic progress. Asian policymakers must strike a balance between the need to preserve and enhance environmental quality and lure in foreign direct investment. To guarantee that foreign direct investment (FDI) has a beneficial impact on sustainable development, it is imperative to reinforce environmental legislation, promote the adoption of clean technologies, and cultivate 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 there has been a lot of research on the connection between FDI and pollution in certain developing nations, this study compares the 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.

Because of this, the impact of foreign direct investment on pollution may vary based 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, better governance, an efficient tax system, equitable tax burden sharing, and fostering public institution

trust 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. Also, it is better to promote capital products than consumer goods to attract foreign investment. It is critical to assess the impact of foreign investment inflow on pollution by controlling governance or transparency and 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 technique 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, which include government effectiveness, political stability, control of corruption and regulatory quality, voice and accountability, and the rule of law, could help facilitate the long-run effect of remittances on GDP growth.

Implication — The findings imply that maintaining high levels of governance indicators is essential for helping Egypt benefit from remittances and enhancing its economic growth.

Originality/value — The study is a pioneer in including the average governance indicators in the remittance-growth nexus study for Egypt. Its purpose is to assess whether governance quality affects the nexus and whether there exists a threshold for the average governance indicators below which the flow of remittances does not encourage economic growth.

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

Introduction

Remittance[1] plays an essential role in economic prosperity by activating the function of sending money from migrant employees to their households. This process will revive growth in remittance flows globally, with approximately an annual average of US$ 123.7 billion from 1970 to 2000, about US$418 billion in 2010, and US$766 billion in 2022. In recent years, remittance flows to developing countries have exceeded the total amount of foreign direct investment and official development assistance, and this difference is growing (World Bank, 2024). According to the DESA (2020) report, remittances go first to lower middle income and with a higher share to the low-income countries. According to the OECD, Egypt is the fifth-highest beneficiary of remittances globally, with USD 28.3 billion in 2022, accounting for about 10% of GDP. The importance of this paper

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

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lies in the fact that remittances play a more significant role in the inflow of global money for several emerging economies. This is especially the case for Egypt, where remittances show three times the impact compared to 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 drawing more attention due to the enormous volume of outflows into developing countries and their impact on the receiving nations' economies. 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).

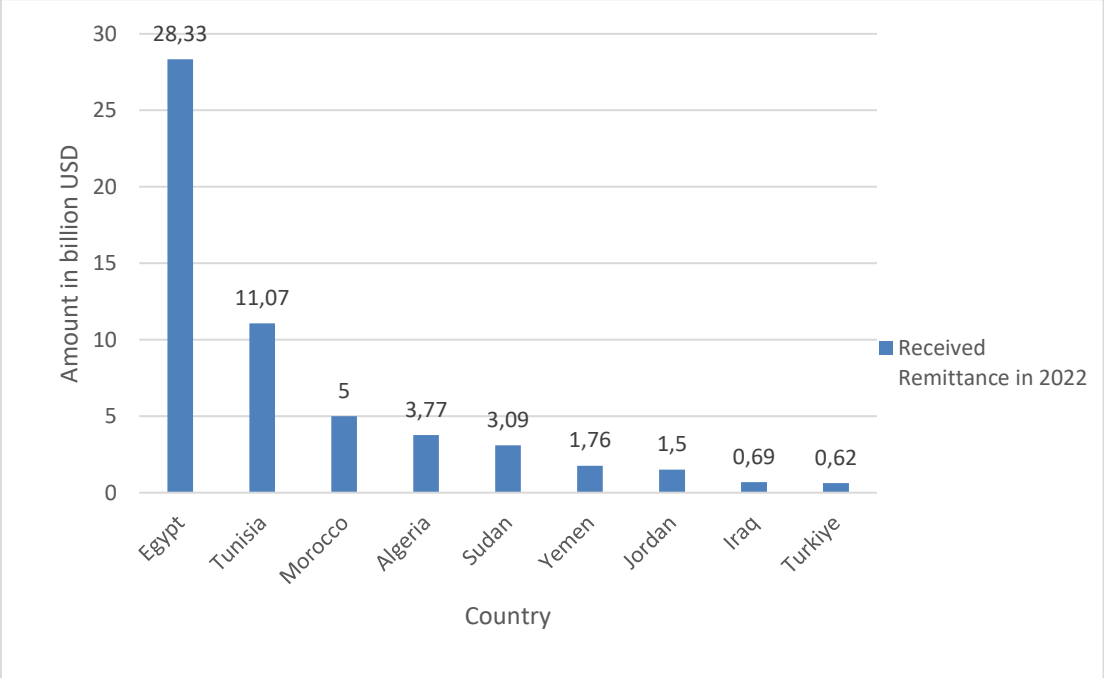

Figure 1. Top 9 remittance-receiving countries in MENA region.

Chenery (1967) postulates that the theory of 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 inflow. As a developing country, Egypt gained quite significantly from remittances brought in by millions of Egyptians working overseas to support their families and communities; remittances are an essential source of income for Egypt. Egypt's economy relies heavily on remittances since they provide a reliable source of foreign currency and maintain the nation's balance of payments. Additionally, remittances support economic expansion and the fight against poverty, enhancing millions of Egyptians' living standards. One of the main advantages of Egypt is that it has a large population of more than 100 million in 2022, and over half of its citizens are young, aged 25. 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 remittance's growing importance in the overall international financial inflows, the nexus between remittance and economic growth has yet to be extensively explored, especially in Egypt. Also, several empirical literature 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 and the conditions of each country under study. The relationship between remittances and economic growth has drawn significant attention in recent years, yet the literature has yet to determine the nature of these relationships. Some literature has indicated that remittances stimulate economic growth by stimulating the consumption function; however, other research has discovered evidence indicating 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 from 2000 to 2015 in 20 sub-Saharan African countries. 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 finding revealed that remittance inflow positively influenced private investment and improved economic growth for these countries.

Similarly, Islam (2022) examined the association between remittances and economic growth using data for the period 1986-2019 using a panel of some selected Asian economies by applying generalized least squares (GLS) and the fully modified ordinary least squares (FMOLS) techniques technique. The result of this study suggests that remittances are an essential 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 for annual panel data for 24 Asia and Pacific countries from 1980 to 2009. By using the same previous technique, Chowdhury (2016) assessed the basic Solow growth model by investigating the relationship between foreign remittance and financial development for 33 top remittance recipient developing countries from 1979 to 2011, and the result indicates that the remittances significantly influenced economic growth. The most recent study by Abdulai (2023) investigated the impact of remittances on GDP growth in Ghana from 1990 to 2020 using 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 essentially promotes the economic growth of the recipient countries directly or indirectly by improving the financial development indicators, several studies have concluded that remittances are negatively linked 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 result 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 result revealed that the economic growth of Ghana County is negatively affected by the inflow of remittances in the long run. Tchekoumi and Nya (2023) applied panel smooth threshold regression (PSTR) and Generalized Method of Moments (GMM) methods to analyze the impact of migrant remittances on economic growth for six African countries in the CEMAC zone from 1990 to 2018. The result shows that remittances would affect the economic growth of these countries depending on their trade openness level, political stability, and private investment.

The literature on the impact of remittances on economic growth shows that it not only failed to provide a clear-cut answer on the specific impact of remittances on economic growth but also ignores the role of average governance indicators and their moderating effect with remittance inflows that enhance growth. This study narrows the gap in previous literature by concentrating on the Egyptian country, which needs to be covered by studies, and 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 applies Unit root tests to justify the stationarity of the series by utilizing the Augmented-Dicky-Fuller (ADF) method (Dickey & Fuller, 1979). It then employs the bound cointegration test to evaluate the series' cointegration after ensuring no unit roots. The bound F-statistic is used to verify the null hypothesis that there is no level cointegration versus the alternative that there is 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 for 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), 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 percentage change in consumer price index (CPI).	INF	Percent	World Bank
Population growth rate	Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage.	POPGRO	Percent	World Bank
Foreign direct investment	Foreign direct investment are 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 received as a share to GDP.	REMIT	Percent of GDP	World Bank
Quality of institutions	It is the average of six governance indicators that include government effectiveness, political stability, control of corruption and regulatory quality, voice and accountability, and the rule of law to measure the quality 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 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 such as 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 deal with series that are integrated of different order to capture the short-run and long-run impact of our interest variables, and secondly, its apparent superiority over the conventional or widely utilized cointegration models of Johansen test (Johansen & Juselius, 1990) and Engle-Granger (Engle & Granger, 1987). More importantly, the advantage is its capacity to hypotheses on the estimated coefficients in the long run and reliability for small samples (Menegaki, 2019) and the way of dealing with endogeneity issues by providing 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, β0 is the intercept term whiles 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 of the bounds testing for our model is that the coefficients of the lag level variables are zero; hence, there is no cointegration between 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, shedding light on the distribution of the variables. Notably, it reveals that the average value of remittance inflows to Egypt over the study period is 6.39 percent as a share of GDP. Over 25% of Egyptians reside in developed countries (Zohry, 2013).

Over the period under study, gross domestic product has grown on average by 4.429%, indicating that Egypt's growth rate is quite good. On average, Egypt received more official development assistance (ODAA) (21.452 percent growth) than FDI (2.295 percent growth). Egypt relies heavily on ODAA and needs to do more to provide incentives to attract 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) is revealed to be the most volatile among the variables, and 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 not much has been done to control corruption, improve transparency, and maintain a high level of political stability and 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 decrease 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 and unstable government institutions, creating uncertainty. The impact of the COVID-19 pandemic, which has affected psychological well-being and global sustainability, has negatively decreased remittances and economic growth.

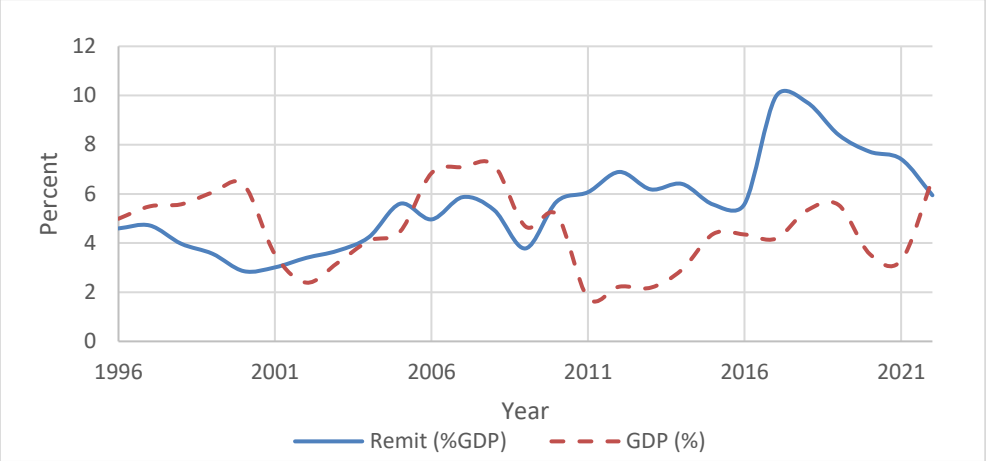

Figure 2. The Trend of Gross Domestic Product and received remittances as % of GDP

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 confirmed that time series are non-stationary series that provide spurious results 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 inflation and GDP but became stationary after first differencing. The ARDL model can be used since none of the model's variables are integrated of order two or 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 a trend or first difference, we applied the F statistics to evaluate the significance of the 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 associated with remittances is positive and statistically significant at 5%, suggesting that personal remittances positively affect GDP growth in the long run. More precisely, a unit increase in remittance inflows increases growth in GDP by 9.28 units, ceteris paribus. The result is expected since a portion of remittance inflows is used for feeding, and the rest is invested in developmental projects, promoting economic growth.

Table 4. Bound Test Results

F- bounds Test H0: No levels 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 of (Abdulai, 2023; Islam, 2022; Adnan et al., 2020; Oteng-Abayie et al., 2020). It is, however, at variance with the findings of (Ustarz & Issahaku, 2017; Sutradhar, 2020). Also, foreign direct investment (FDI) is generally considered a driving factor to economic growth, and our result shows that FDI positively relates to economic growth, suggesting that, in the long run, foreign direct investment boosts the economic growth of Egypt. Foreign direct investment (FDI) is generally considered a driving factor to economic growth, and the result in Table 4 indicates that, in the long run, foreign direct investment encourages economic growth in Egypt. This positive sign of FDI is as expected given that FDI inflow is increasing significantly in developing countries, which has a spillover effect in Egypt by transferring technology and human capital skills development. This result is in line with that of (Sarker & Khan, 2020; Elsadig & Rahim, 2023).

Table 5. 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' globalization, appears with expected signs and contributes significantly to the economic growth of Egypt. The coefficient associated with trade openness indicated that Egypt's growth rate would go up by 0.139 percentage points for every percentage point increase in trade volume, holding all other variables constant. All things being equal, population growth reveals positive and strongly affects the economic growth of Egypt in the long run. Although there are many studies on these associations, there needs to be more agreement on how population expansion affects economic growth (Arbia et al., 2023). While some studies demonstrate that robust population expansion promotes economic growth Peterson (2017), others find evidence to support the contrary conclusion (Alemu & Zegeye, 2024).

In the long run, official development assistance (ODA) has a positive and 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 go up by 0.341 for every percentage point increase in official development assistance, holding all other variables constant. The outcome demonstrates that inflation appears with a negative sign when it enters the equation, suggesting that inflation at any level negatively impacts economic growth. It is neither desired nor expected that inflation would improve the economic growth of Egypt since higher inflation never leads to higher levels of income in the medium and long run since it does not enhance economic development (Hadush et al., 2023). The unemployment variable is statically significant in explaining the variation of the 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 5%, indicating that average governance indicators positively affect GDP growth in the long run. A one percentage point increase in average governance indicators increases growth in GDP by 0.602 percentage points, 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 remittance varies substantially according to the regulatory environment and across countries (Authers & Leatherby, 2019). We, therefore, included the interaction term to capture the threshold of average governance indicators level that can support remittances to 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 equilibrium following disruption, are the three parts of the ARDL. As shown in Table 6, under (CointEq), the ETC is statistically significant at the 1% significance level and exhibits the predicted negative sign. This result supports the bound test's earlier finding that there is 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-run projections, remittances positively and considerably impact 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 all positively and significantly impact GDP growth. FDI and official development assistance (ODA) positively and significantly impact GDP growth during its 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 growth rate increases as long as Egypt's average government indicators stay above a threshold of 8.57%, all other things being equal.

[2] This figure is calculated by 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 diagnosis tests are conducted in this study to check the model's goodness-of-fit and validity of the assumptions. The Jarque-Bera test, the Breusch-Godfrey serial correlation LM test, and the Breusch-Pagan residual test are used to test serial correlation, heteroscedasticity, and normality, respectively, to assess the stability and dependability 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 has 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 has provided valuable insight into the economic influence of flowing remittances on the 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 increasing flow of remittances into Egypt's economy encourages its GDP growth rates in the long and short run. This result is consistent with those of (Abdulai, 2023; Islam 2022; Adnan et al. 2020; Oteng-Abayie et al. 2020; Imai et al. 2014). It is, however, at variance with the findings of (Ustarz & Issahaku 2017; Sutradhar 2020).

Since most emerging economies rely on FDI to fuel economic expansion, the coefficient associated with FDI suggested a significant impact on the GDP growth rate in both runs, as shown in previous results. Globalization, which is proxied by trade openness, plays an important role in

determining the economic growth in Egypt in both the short and long run. These results support the idea that countries are opening to free trade to become more integrated to achieve 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 inflation, regardless of magnitude, hurts economic growth. Since rising inflation never raises 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 significance finding of this paper is by including the governance indicators on the remittance-growth nexus. The magnitude impact of governance indicators suggesting that on average governance indicators positively affect GDP growth in the long run and the result congruent with that of (Acemoglu & Robinson, 2012 and Han et al. 2014). It is also argued by several studies that remittance substantially varies according to the regulatory environment and across countries (see Authers & 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 predicated on the knowledge that, provided Egypt remains over the average governance indicator threshold, the remittance flow might be highly beneficial in promoting rapid 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 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 result has indicated that increases in remittance inflows will continue to decline the growth rate if estimated average governance indicators in Egypt remain within a threshold of 20%, holding all other variables constant. This result and several studies consider a nonlinear relationship between a country's institutional quality and economic growth. Dokas et al. (2023) have found a corruption threshold around which corruption's effect on economic growth changes from positive to negative. Also, Alfada (2023) finds that provinces of Indonesia with low corruption levels support their 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 according to each country's circumstances of its quality toward the governance indicators.

Conclusion

This study offers comprehensive insights into the relationship between remittances, governance indicators, trade, foreign direct investment (FDI), and inflation on Egypt's economic growth from 1996 to 2022. The findings reveal the existence of a long-term positive relationship between remittances and GDP growth, with the former acting as a catalyst for both short-term and long-term growth in Egypt. FDI and trade openness increasingly support economic expansion, while inflation consistently hampers growth prospects, indicating that price stability is critical 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. Further, threshold analysis shows that when governance indicators fall below a certain threshold, remittance inflows do not contribute to economic growth, indicating that the impact of governance is nonlinear on economic performance.

The results provide several important policy implications. First, improving governance through strengthening transparency, accountability and controlling 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 encourage technology transfer and support sustainable growth. Finally, policymakers must be aware of the context-specific nature of macroeconomic variables and governance indicators, so as to adapt governance reforms to effectively support remittance inflows. Overall, these strategies can strengthen Egypt's economic resilience and increase remittance flows to achieve 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 amidst global trade integration efforts and offers policy recommendations based on 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 has been identified as 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 one of the essential parts that should enter into 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, some trade reforms have been conducted by Indonesia, including the entry into 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 to set and endorse domestic reform that may increase competitiveness. Indonesia has been integrating trade with its ASEAN and 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 by conducting trade liberalization from 1989 to 2022 and developing 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 provide whether Indonesia's export growth in the ASEAN and ASEAN Dialogue Partners' market 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 Dialog Market.

This paper consists of five sub-sections. First, it will highlight an introduction, including the background of the study, research question, research objectives, scope of research, and a brief description of the methodology adopted. 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 summarize the discussion with a conclusion and policy recommendation.

Trade integration and competitiveness are intertwined (Galovic, 2021). While economist believes that export expansion relates to higher competitiveness of a country, the debate has continued since Adam Smith and David Ricardo whether free trade is crucial to determining welfare and a country's competitiveness (Krugman & Obstfeld, 2009). The increase in the arguments of comparative advantage from David Ricardo has changed the world's point of view on protectionism (Samuelson & Nordhaus, 2009).

However, lobbyists recognize 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 liberalization. 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 separated and unable to conduct collective actions to influence government policy, and protection remains in place. It is tough to conduct unilateral liberalization even when all governments recognize that free trade will bring better welfare and economic competitiveness (Krugman & Obstfeld, 2009).

The economist believes multilateralism will be a suitable venue for liberalization. However, reaching an agreement under a multilateral trading system is complex (Hoekman et al., 2002). The failure to decide ministers of trade at the Ministerial Conference in Cancun has diminished the hope and created distrust among countries to encourage further liberalization 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 started to question the institutional arrangement of WTO, create distrust among countries, and experience "complex multilateralism which constitutes "heterogeneity, multipolarity, and potentially conflictual" (Narlikar & Wilkinson, 2004; Abbas & Duchesne, 2023).

Regional trade arrangements may have some cost to the economy. Trade will divert from an efficient country not a party to the agreement to a country with less efficient production, which 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). WTO allows the process of breaching the Most Favoured

Nation (MFN) principles under the framework of regional trade agreements as long as 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 all the debate about multilateralism versus regionalism, free trade is becoming strongly believed to be a vehicle to enhance 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 the backward linkage of GVC 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 solve more complex world problems and challenges such as environmental, labor, gender, etc. (Mattoo et al., 2020). At the same time, some economists believe that trade agreements could be a political signal for its 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, among others, 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 see Indonesia's exports and ASEAN exports decomposition.

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.

$$\frac{q_1}{q_2} = f\left(\frac{p_1}{p_2}\right) \tag{1}$$

where q and p are the quantity demanded and the price of exports. Subscripts 1 and 2 will denote country one and country 2. Equation 1 is a relationship that ascribes elasticity of substitution. This is becoming a substantial critique of Richardson (1971) that it will only happen whenever the Armington elasticity is unity or 1 (Fagerberg & Sollie, 1987; Balassa, 1977). However, Widodo (2010) asserts that the usefulness of this approach endorses many researchers adopting it.

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

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

We may recalibrate equation 2 into the following

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

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 reflects that export share will be constant unless there is a change in the ratio of prices between the two countries. 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 Equation 5 reveals the world growth effect (WGE), which implies that any change in actual export relates to world export.

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, then the growth of that commodity is higher than 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 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 establishing an observation period (Richardson, 1971). It is also recognized 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 recognize 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 Dialog Partner's market.

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 established a series of domestic reforms such as removing fuel subsidies, establishing the Indonesian National Single Window (INSW), establishing a specific team for export development, establishing Trade Laws, and various trade facilitation improvement (WTO, 2007; Boediono, 2016). The competitiveness went up 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 Dialog 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 1998. However, medium-tech competitiveness was reduced along with 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 after the IJEPA entered into force in 2008. IJEPA contributed to the increase in Indonesia's 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 gained due to the transformation of the Korean Trade Policy. Starting from shifting into export promotion policy in the 1960s–1980s, Korea has brought up consistent policies to include liberalization as a package of economic reform (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 liberalization 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, holding exports from further decline. 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 stabilizer (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 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 liberalization 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 favor Indonesia's products in the Indian market. India's trade policy shift from protectionism to trade liberalization after 1991 seems to favor Indonesia's export growth to India. India has liberalized its market since 1991 during 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 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 liberalization. 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 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 Asia 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 built competitiveness in manufacturing products exported 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 and proliferated to bilateral arrangements later on. 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 recognize 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 establishing a free trade agreement, so market openness did not endorse further structural change and created 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 composition effect and market effect are not consistently contributing to growth during a crisis, competitiveness will prevent them from further dropping. The observation is mutually seen in all decomposition of Indonesian export growth to ASEAN and Dialog Partners markets.

The market effect tends to be negative for Indonesian export products during the financial crisis in dialog partners' markets. During the financial crisis, the confidence of importers in those countries suffering from the financial crisis is lower. Indonesia definitely suffered from a banking crisis in 1997 – 1999, which created a negative market effect during 1997 – 1999.

This paper recommends that Indonesia encourage further trade integration reform using trade agreements and unilateral reform, including providing a better venue for technological transfer and innovation. Building up internal competitiveness by using trade integration is imminent. Using the steps of Korea, Korea has managed to reform its economy by using unilateral export promotion policy and combining it with trade agreements to gain better market access and open up 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 co-integration 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, co-integration 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 emission as a proxy for greenhouse gas emission. As of 2023, the top global greenhouse gas emitters are China (28%), 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 the 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 the 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 using again 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. And 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 paper 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 research, 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 2000-2020, 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 the 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. 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 length of optimal lag 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 co-integration, 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 and 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 test 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 square 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 stationariness 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' mean is larger than the corresponding standard deviation, 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 as the years progress.

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

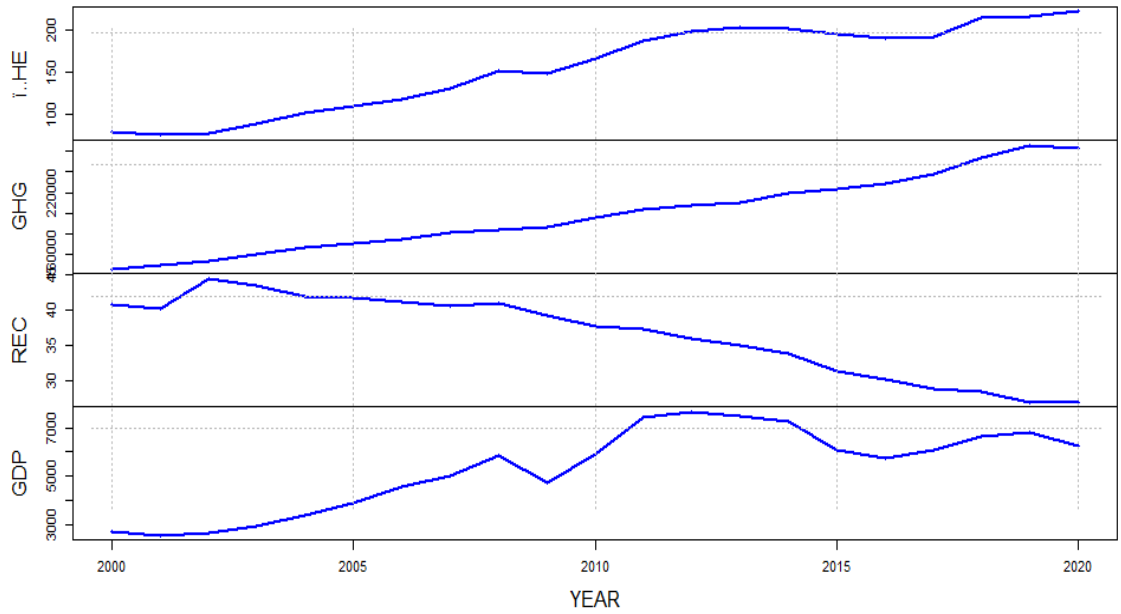

Figure 1. Sequence Plot from 2000-2020

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 exhibit 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 there is no cointegration exist (Wang et al., 2020)(Çobanoğulları, 2024). As depicted in the 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 Square 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 and Figure 2 shows.

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

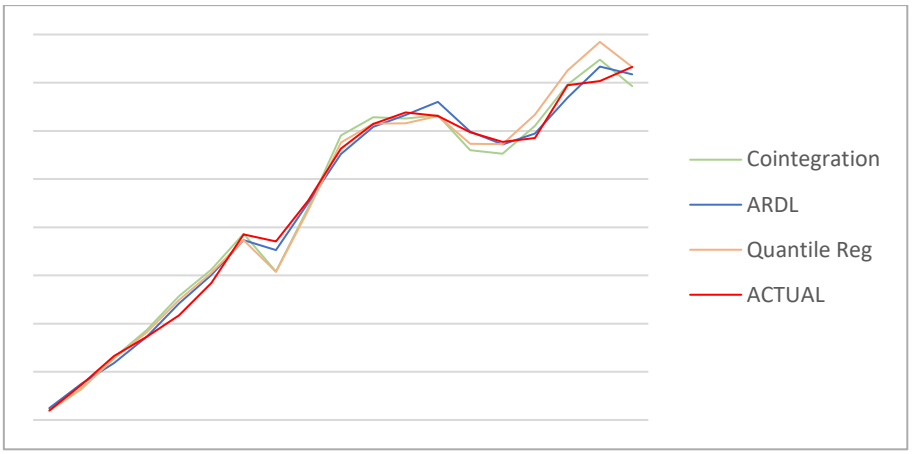

Figure 2. Actual vs fitted values of the three econometric models

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 all three models have a significant influence on GHG and GDP on health expenditure. 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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