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An Empirical Analysis of Trade Openness and Economic Growth in South Asian Countries

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Abstract: This study analyzes the impact of trade openness on economic growth in selected South Asian countries, namely Afghanistan, Bangladesh, Nepal, India, and Pakistan, over the period 2002-2022. Panel data analysis techniques are utilized to investigate the relationship between trade openness and economic growth. Based on the Hausman test result, the fixed-effects model is determined to be the most appropriate one. The empirical analysis of the fixed-effects model reveals that trade openness has a positive and statistically significant effect on GDP, with a one percent increase in trade openness leading to an average increase of 0.87 percent in GDP. Population growth also exhibits a positive and statistically significant impact on GDP, with a one percent increase in population leading to a 0.58 percent increase in GDP. However, the exchange rate has a positive but statistically insignificant impact on GDP, while inflation has a negative but statistically insignificant impact on GDP in the selected South Asian countries. The findings of this paper highlight the potential growth benefits of increased trade openness in South Asian countries. The study recommends policies aimed at reducing trade barriers, improving trade infrastructure, and promoting regional integration to realize these benefits.

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INTRODUCTION

Any successful and dynamic modern economy relies heavily on trade. Trade involves the movement of goods and services between individuals or businesses, often accompanied by the exchange of money. In its earliest forms, trade took place through barter, where goods and services were directly exchanged without currency. However, in modern times, traders typically use a medium of exchange, such as currency, to facilitate transactions, including international trade between countries. Any economy's growth depends heavily on international trade and is often considered as an engine of growth (Ricardo, 2004). It extends beyond commodities and encompasses technology, ideas, and knowledge spillover (Balassa, 1998). Through the creation of jobs, capital formation and greater GDP and per capita GDP, international trade has a positive impact on economies in a number of ways. In recent years,

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the global trading system has grown more competitive and open. Tariffs are declining in both developed and developing countries, and restrictions are being eliminated. Economies are embracing outward-looking policies, seeking to promote growth and employment through expanding export production and attracting foreign investment (Bajwa & Siddiqi, 2011).

The contemporary effort to facilitate the exchange of goods, services, labor information, capital, and ideas across borders is known as trade openness. Its primary goal is to integrate societies and economies globally. Trade openness has facilitated the movement of resources from developing to developed economies and spurred technological advancements. Recently, world economies have benefited from absorbing knowledge and innovations thanks to trade openness (Obstfeld, 1998). Advances in transportation and communication have opened new doors for international trade and access to new markets. Openness also allows for foreign direct investment, which can boost productivity, redefine competitive efficiency, and supplement domestic capital, thus driving economic growth. For trade openness to promote growth, capital mobilization and technology absorption are made possible by healthy financial markets (Khalid, 2016).

Trade openness benefits not only economic aspects but also social aspects, such as living standards and life expectancy. One of the most contentious issues in international economics is the connection between global trade and economic expansion. Developing countries began reaping the benefits of openness after the 1980s, when export promotion strategies through trade liberalization incentivized efficient resource allocation and production (Frankel et.al 1999). These strategies spurred efficiency and productivity gains, leading to further investment in industries with comparative advantages. Similarly, improved resource allocation fosters output and innovation in export-oriented sectors. Trade openness has thus played a key role in promoting structural change and is considered a crucial factor in economic growth (Burange e. a., 2018). Increased openness to international trade is a defining feature of globalization. Assessing its impact on economic growth and development requires examining the effects of trade openness. This subject has garnered significant theoretical and empirical attention. Economically, openness is expected to positively influence long-run growth by enabling technology and innovation transfers. Theoretical models suggest that greater openness facilitates importing and adopting technological advancements from more advanced trading partners, thereby boosting growth rates. However, the empirical evidence on the growth impacts of trade openness remains contested (KARRAS & Georgios, 2003). Empirical studies on the relationship between trade openness and economic growth have produced mixed results. Therefore, a country's level of development—whether it is developed, developing, or at least developed country (LDC)—plays a crucial role in influencing the extent to which trade openness affects its economic growth (Zahonogo, 2017)

As per the World Economic Forum (2024), globalization was one the main sources of Asian Economies which were also drivers of global growth. Historically, the narrative of Asia's economic growth was led by the Asian Tiger economies—Japan, South Korea, Singapore—and later, China at the start of the 21st century. However, now the shift has been experienced

in the favor of South Asian countries like India, Indonesia and Vietnam (Aggarwal & Bhardwaj, 2024)The IMF managing director Kristalina Georgieva while addressing at a conference in Tokyo, Japan (March, 2025), in her opening remarks, categorically said that Asian especially South Asian countries are next growth frontiers of the global growth. She further emphasized that trade openness and economic integration will be important factors in this process (IMF, 2025).

Since the 1980s, South Asian countries have undergone significant trade liberalization, moving away from import substitution strategies towards greater openness and export promotion. Major reforms were implemented following India's 1991 balance of payments crisis and continued under WTO commitments. Average tariff rates have fallen considerably across South Asian nations. The majority of South Asian nations have implemented more liberal exchange rate regimes, and quantitative constraints have been virtually removed (Taneja, 2018). However, trade openness and economic integration in the South Asian Region being contradicted by wide development differences, regional political tensions (India-Pakistan; Afghanistan-Pakistan), border disputes and uneven economic size (India being largest economic power). Given these barriers, the question is often being asked – whether South Asian countries can be the true growth drivers of the global economy.

Against this background, the study aims to empirically investigate and analyze the relationship between trade openness and economic growth in five South Asian countries: Afghanistan, Bangladesh, India, Nepal, and Pakistan. Using panel data analysis, the study explores how trade facilitates importing ideas and technology, leveraging economies of scale and comparative advantages, fostering innovation and competition, and ultimately increasing long-term employment and economic growth. The study is important from two strategic point of view. First, although, we have empirical evidences that trade openness has been growth augmenting for the Asian economies but it was mainly true for the Asian Tigers. However, limited evidences are available about the South Asian economies, which are not only immensely different in terms of topography but also economic and social conditions. The region is also witnessing several geo-political disturbances from the long period. Secondly, while modern perspectives highlight strategic factors and power dynamics, their impact on the relationship between trade openness and economic growth remains insufficiently studied. Although empirical research has assessed the separate effects of trade openness and economic growth, there is a lack of comprehensive analysis on their combined influence, especially across varying institutional and macroeconomic settings.

The impact of trade openness on economic growth across different regions has been widely studied, yet findings remain varied. However, evidence suggests that trade openness significantly influences economic growth in Asian and South Asian countries. Tahir & Khan (2014) focused on developing Asian nations, employing panel econometric methods and a two-stage least squares approach. Their results showed that trade openness substantially contributed to economic growth, alongside domestic investment. Similarly, Alam & Sumon, (2020) analyzed 15 Asian countries from 1990 to 2017 using panel cointegration and causality

techniques. Their study confirmed a positive long-term relationship between trade openness and growth, with bidirectional causality between the two. Kong et.al (2022) Examined various dimensions of trade openness—total, goods, and services—across 39 Asian countries, differentiated by income levels. Their findings indicated a positive impact of trade openness on growth across all income categories, leading to tailored policy recommendations for developing countries.

Bajwa & Siddiqi (2011) Explored the relationship between trade openness and growth in four South Asian nations across two periods: pre- and post-SAARC implementation (1972–1985 and 1986–2007). Their analysis, using panel cointegration and FMOLS, revealed a shift from negative to positive long-run elasticity after SAARC, suggesting improved economic conditions post-implementation. In Africa, Aremo et.al(2021) studied the separate and combined effects of trade and financial openness on economic growth in sub-Saharan Africa (1980–2017), applying system GMM. Trade openness positively impacted growth in low-income countries, while financial openness had limited influence. Bunje et.al (2022) Refined trade openness measures across 52 African countries (2000–2018), finding mixed effects on growth depending on the measure and estimation technique used.

In South Africa, Sikwila et.al (2014) demonstrated that trade openness positively influenced both short- and long-term growth through time series regression analysis. Hye & Laub (2014) Created a new trade openness index for India, using an endogenous growth model and ARDL framework, and found that while human and physical capital positively impacted growth, trade openness had a negative long-term effect. Jawaid (2014) Investigated Pakistan using multiple measures of trade openness and rigorous econometric techniques like ARDL and Granger causality. The study found a significant long-run positive relationship between exports and growth, with unidirectional causality from exports to growth. In Afghanistan, Hemat et.al (2023) found that trade openness positively influenced growth between 2002 and 2021, with GDP driving trade openness in a unidirectional causality framework.

Idris et.al (2016) Analyzed 87 countries, including OECD and developing nations (1977–2011), employing dynamic panel GMM estimation. They supported the endogenous growth theory, where increased openness enhances growth, which in turn fosters more openness. In Turkey, Khalid (2016) confirmed that trade openness boosts short-term growth but lacks a long-run effect, based on ARDL modelling from 1960 to 2014. Burange et.al (2019) Studied BRICS countries, identifying that while India shows a growth-led trade in services, China supports growth-led exports and imports, and South Africa benefits from export- and import-led growth. However, they found no consistent causal link across all BRICS nations. In the GCC region, AbdulkadimAltaee & Al-Jafari, (2018) emphasized exports as key growth drivers (1992–2014), recommending improved import policies to sustain growth. Seti & Mazwane (2025) suggested that financial openness is also required for attaining full-fledged benefits of trade liberalization. Collectively, these studies highlight that while trade openness generally

promotes economic growth, its magnitude and direction vary across regions, income levels, and specific trade components.

The main objectives of the study are to:

- Empirically examine the relationship between trade openness and economic growth.
- Examine how factors including trade openness, population growth, inflation, and the real exchange rate affect South Asian nations' economic growth.

RESEARCH METHOD

The data for this study was collected from two sources: the World Bank's World Development Indicators (WDI, 2022) and Afghanistan statistical yearbooks from 2002 to 2022. The dependent variable is Gross Domestic Product (GDP), while the independent variables in the model include trade openness, population, inflation in consumer prices (annual percentage), and exchange rate. This model aims to analyze the interrelationships among trade openness, exchange rates, inflation, and economic growth in five specific South Asian nations.

Fixed Effect vs Random Effect Model

To decide whether to use a fixed effects or random effects model in place of a pooled OLS regression, the Breusch-Pagan test is used. The null hypothesis states that there is no panel impact and no discernible variation between units. We reject the null hypothesis and determine that a fixed or random effects model is better than pooled OLS if the p-value is significant. In our study, the results indcate that fixed or random effect model are preferred over pooled OLS (See table 7). To determine the selection between fixed effect and random effect, we applied the Hausman test. This test is used to decide whether a fixed effects model or a random effects model is more appropriate. We infer that fixed effects are statistically preferable over random effects since the p-value is smaller than 0.05, which leads us to reject the null hypothesis (See table 8).

A Fixed Effects model is a regression model that includes fixed effects for each individual or entity in the dataset. It is used to compensate for unobserved heterogeneity or individual-specific effects that are stable throughout time. Fixed effects are simply dummy variables representing various entities or groups, and they are included in the model to capture the individual-specific traits that do not vary over time wichmann & Chris brooks (2019).

The general form of a Fixed Effects model can be expressed as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots \beta_n X_{nit} + ai + \mu it$$

Y_{it} is the dependent variable at time t.

$X_{1it}, X_{2it} \ldots \ldots \ldots X_{nit}$ are the independent variables at time t.

$\beta_0, \beta_1, \beta_2, \ldots\ldots\ldots\ldots \beta_n$ are the coefficients associated with the independent variables.

ai is the fixed effect for the individual, encapsulating the unobserved individual − specific traits and μit is the error term.

The model for economic growth is as follows:

$$LnY_{it} = a + \beta 1 lnT_{it} + \beta 2 lnP_{it} + \beta 3 lnI_{it} + \beta 4 lnE_{it} + \cdots + uit$$

Where:

Y represents economic growth, T is the trade openness, P is the population, I is the Inflation and E is the exchange rates and all variables are converted to natural logarithms, and the (i) and (t) represent the countries and periods accordingly.

FINDINGS

Situation of Trade (Export and import) in South Asian Nations

Table 1 demonstrates a growing trend in the flow of goods and services between South Asian economies between 2002 and 2022. South Asian trade statistics shows that, with the exception of Afghanistan, exports and imports have been growing strongly. With exports expected to reach $759.9 billion in 2022, up more than ten times from $73.5 billion in 2002, India continues to be the leading commercial power. Its imports also expanded significantly from $78.5 billion to $911.4 billion over this period to provide to the needs of its vast consumer base and industrial ambitions (De, 2023). However, India's trade deficit has persisted due to higher growth in imports relative to exports. Bangladesh and Nepal have recorded even faster export expansion by over 8 times during 2002-22. While Nepal depends primarily on agricultural exports, Bangladesh's export-led economy is driven by ready-made clothing. Their increased trade openness is encouraging for their ability to compete internationally in the future. Conversely, Pakistan exhibits signs of deindustrialization, as evidenced by its export volume increasing 3.5 times more slowly during this period. Its protectionism and ineffective trade policies that limit export potential are the root causes of its ongoing balance of payments challenges. Finally, because of geopolitical insecurity, Afghanistan's commerce has experienced sharp drops and significant volatility since 2016.

Due to its outdated infrastructure and trade restrictions, it is cut off from important global value chains, which results in poor trade outcomes. Due to the economic instability caused by conflict, Afghanistan saw only modest gains in both exports (from $0.1 billion to $1.1 billion) and erratic imports (from $2.5 billion to $5.1 billion) between 2002 and 2022 (Wani, et al., 2024).

Table 2 shows the annual percentage growth rates in imports and exports for the chosen South Asian economies between 2005 to 2022. In 2005, India's exports increased by 39.66 percent; however, they slowed with time, reaching 14.53 percent in 2022. Similar patterns were seen in its import growth, which increased by 44.69 percent in 2005 and 17percent in 2022. Bangladesh's exports increased at 15–17 percent a year from 2005–07, but they have since slowed to single-digit growth. In 2016, Pakistan's export growth rates ranged from

18.69 percent to a contraction of -3.58 percent, although imports increased significantly faster from a high starting point. Nepal's imports increased by double digits in 2007 and 2019, rising by 18.36 percent and 23.45 percent, respectively, while its exports grew by less than 5 percent. With an unusual export peak of 94.67 percent in 2005 and an erratic trajectory that ended in a 7.48 percent increase in 2022, Afghanistan is an anomaly. Due to geopolitical unrest, its imports plummeted by -8.20 percent that year. During these years, India, Bangladesh, and Nepal had growth in both imports and exports (De, 2023; Wani et al. 2024). In Pakistan, export diffusion was substantially slower than import diffusion. And conflict-ridden Afghanistan experienced rollercoaster trade growth trends during 2005-2022.

Economic Progress in South Asian Nations

The strong GDP growth that South Asian nations have had over the last 20 years is a sign of the region's growing economic expansion and trade openness. With a GDP of more than $3 trillion, India continues to lead South Asia in economic size. During this time, Bangladesh in particular has shown remarkable GDP development, greatly surpassing its regional counterparts. It has grown from a considerably smaller base to an economy that is expected to reach half a trillion dollars in the near future. In the meantime, Pakistan's economy has grown steadily over time. Though more slowly, the economies of smaller South Asian countries like Nepal and Afghanistan have also expanded. This regional expansion indicates that the nations are moving towards economies that are more centered on manufacturing and services and are progressively integrating with international trade networks. However, political unpredictability and infrastructure constraints continue to impede the region's full economic potential. In the upcoming years, addressing these could result in even greater trend line GDP growth in South Asia.

Table 3, demonstrates how the gross domestic product (in US dollars) has changed over the last 20 years in the top economies of South Asia. From $514.9 billion in 2002 to almost $3 trillion by 2022, India's absolute GDP grew at the fastest rate in the world, making it the world's fifth largest economy. Over the 20-year period, Bangladesh's GDP increased by more than 7 times, from $54.7 billion to $460.2 billion, and Pakistan's GDP increased by more than 4.5 times, from $79.9 billion to $376.5 billion, demonstrating remarkable income gains. Nepal's GDP doubled from $6 billion to $40.8 billion, demonstrating consistent development among smaller countries. However, following 2014, conflict hampered economic growth, and Afghanistan's GDP fell back to $16 billion in 2022. Overall, India strengthened its position as the undeniable economic powerhouse of South Asia, while income levels in Bangladesh and Pakistan increased due to steady, rapid growth. Looking ahead, maintaining macroeconomic stability and reforming the business environment continue to be top concerns for the area.

However, there are short-term management concerns due to growing global threats like inflation, financial instability, and climate change.

Table 4, displays the South Asian countries' yearly GDP growth rates (percent) from 2004 to 2022. Even though it slowed after 2010, India's double-digit growth of 18.86 percent in

2004 remained strong at 6 to 9 percent until the pandemic caused it to shrink by -0.58 percent in 2020. But in 2022, growth recovered to 13.35 percent, demonstrating the resiliency of the economy. Before levelling off at 11.54 percent in 2022, Bangladesh's growth soared from single digits in the early years to surpass a 26 percent spike in 2016. In addition to the contraction brought on by the global financial crisis (-7.82 percent in 2020) and regional conflicts, Pakistan also had strong growth, with 13.69 percent in 2006 and 14.17 percent in 2016. Stability allowed Nepal to maintain nearly double-digit GDP growth in the majority of years, including 19.36% in 2008. However, unstable Afghanistan saw a sharp decline of -10.28 percent in 2022 after reaching a peak of 26.26 percent growth in 2010. This underscores the economic implications of fragility. In recent decades, the leading economies of South Asia have had robust economic spurts. However, Nepal and Afghanistan serve as prime examples of the dangers associated with political instability and non-inclusive growth. Although the region has economic potential, sustained institutional and policy reforms are necessary to realize that potential for sustainable growth.

Table 5 shows the trade-to-GDP ratios for a few chosen years, which show the percentage of total commerce (exports + imports) in national production and hence measure the trade openness of South Asian nations. From 29.51 percent in 2002 to over 50 percent by 2022, India's ratio increased gradually, demonstrating the country's growing integration with international trade networks (De 2023; Maurya and Vaishampayan, 2011). Pakistan also saw an increase from 27.63 percent to 32.32 percent over 20 years. For Bangladesh, the ratio was 28.97 percent in 2002, peaking at 37.80 percent in 2010 due to post-recession demand revival and subsequently moderating to 33.78 percent by 2022. These trends for the larger economies showcase gradual embrace of trade openness to boost growth. Due in large part to its reliance on India-Nepal trade lines, Nepal already has high ratios between 45 and 50 percent between 2002 and 2022. But in Afghanistan, where the conflict significantly hampered the nation's ability to engage in international trade, the percentage fell below 40 percent between 2002 and 2022 after being at 66.22 percent in 2002 (Wani et al., 2024). According to the data, trade openness has significantly aided the major South Asian nations' broader economic development. However, the expanding region's short-term trade intensity may be hampered by growing global uncertainty.

***Table 1**: Export and Import of South Asian Countries from 2002 to 2022 (Million US$)*

Years	2002		2005		2007		2010		2013		2016		2019		2022	
country	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
India	73452	78498	160838	183736	253077	302804	375353	449974	472180	527555	439642	480169	529245	602315	759934	911390
Bangladesh	6791	9061	9995	13891	13530	18268	18472	25106	29305	40135	36924	46185	45994	64920	59284	96171
Pakistan	11008	11073	17180	21423	20137	30135	23946	34286	30699	46374	27401	50070	30136	62624	39415	82282
Nepal	1073	1724	1186	2396	1327	3276	1533	5825	2060	7218	2006	8322	2660	14177	2760	17408
Afghanistan	100	2,452	384	2,471	454	3,022	388	5,154	464	7,559	596	6,534	864	6,777	1058	5109

***Table 2.** Average annual growth rate (in percent)*

Years	2005		2007		2010		2013		2016		2019		2022	
country	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
India	39.66	44.69	28.67	32.40	16.11	16.20	8.60	5.75	-2.30	-2.99	6.79	8.48	14.53	17.10
Bangladesh	15.73	17.77	17.68	15.75	12.18	12.48	19.55	19.95	8.67	5.02	8.19	13.52	9.63	16.05
Pakistan	18.69	31.16	8.61	20.33	6.31	4.59	9.40	11.75	-3.58	2.66	3.33	8.36	10.26	10.46
Nepal	3.51	12.99	5.94	18.36	5.17	25.94	11.46	7.97	-0.87	5.10	10.87	23.45	1.25	7.60
Afghanistan	94.67	0.26	9.11	11.15	-4.85	23.52	6.53	15.55	9.48	-4.52	14.99	1.24	7.48	-8.20

Source: Authors' calculations.

***Table 3:** GDP of south Asian countries from 2002 to 2022 (Million US$ at curent prices)*

Country	**Gross Domestic Product (GDP)**										
	2002	**2004**	**2006**	**2008**	**2010**	**2012**	**2014**	**2016**	**2018**	**2020**	**2022**
India	514938	709148	940260	1198895	1675615	1827637	2039126	2294797	2702930	2671595	3385090
Bangladesh	54724	65108	71819	91631	115279	133356	172885	265236	321379	373902	460201

Pakistan	79904	107759	137264	170078	177165	224383	244361	313630	356128	300426	376533
Nepal	6050	7273	9044	12545	16003	21703	22732	24524	33111	33434	40828
Afghanistan	3854	5221	6971	10250	15634	20204	20551	18019	18419	20143	16000

Source: World Development Indicators and Afghanistan statistical yearbook.

Table 4: *Average annual growth in GDP*

Country	**Gross Domestic Product (GDP) at current prices**									
	2004	**2006**	**2008**	**2010**	**2012**	**2014**	**2016**	**2018**	**2020**	**2022**
India	18.86	16.30	13.75	19.88	4.54	5.79	6.27	8.89	-0.58	13.35
Bangladesh	9.49	5.15	13.79	12.90	7.84	14.82	26.71	10.58	8.17	11.54
Pakistan	17.43	13.69	11.95	2.08	13.33	4.45	14.17	6.78	-7.82	12.67
Nepal	10.11	12.18	19.36	13.78	17.81	2.37	3.94	17.51	0.49	11.06
Afghanistan	17.73	16.76	23.52	26.26	14.62	0.86	-6.16	1.11	4.68	-10.28

Source: Authors' calculations.

Table 5: *Trade/GDP Ratio*

country	**2002**	**2010**	**2016**	**2022**
India	29.51	49.26	40.08	49.37
Bangladesh	28.97	37.80	31.33	33.78
Pakistan	27.63	32.87	24.70	32.32
Nepal	46.23	45.98	42.11	49.40
Afghanistan	66.22	35.45	39.57	38.54

Source: Authors' calculations.

Econometric Analysis

Table 6 provides detailed descriptions of the variables examined in this research.

***Table 6**: Data Description and Sources*

Variables	Symbol	Definition measuring method	Data source
Gross Domestic Product	Y	GDP (current US$)	WDI
Population	P	Population, total	WDI
Official Exchange Rate	E	LCU per US$, period average	WDI
Trade openness	To	(Import+Export)/GDP	WDI
Inflation	I	Inflation, consumer prices (annual %),	WDI

Breush Pagan Test Results

The test results suggest that the cross-section p-value is statistically significant ($p<0.01$). This suggests that there are cross-sectional particular effects. At the five percent significance threshold, the time element (p-value of 0.0350) is also significant (Table 7). This further suggests that there are time-specific impacts as well. They are both very significant p-values. This integrates the temporal and cross-sectional effects. The null hypothesis may be rejected because the p-values are substantial, and we can conclude that fixed or random effects would be preferable to pooled OLS. In order to account for unobserved heterogeneity across the cross-sectional units, fixed effects might be the best option, according to the low p-values on the cross-section and both tests. To make a firm decision between fixed and random effects, more Hausman testing would be necessary.

***Table 7:** Breush Pagan Test Results*

	Cross-section random	Time	Both
Breush - Pagan	58.7385	4.4433	63.1819
	0.0000	0.0350	0.0000

Source: Authors' calculations by using Eviews 12 Statistical Software.

Hausman Test

The Chi-Sq value with four degrees of freedom is 59.87 (Table 8). The p-value of 0.000 indicates that this is highly statistically significant. We infer that fixed effects are statistically preferable over random effects since the p-value is smaller than 0.05, which leads us to reject the null hypothesis. This indicates a correlation between the regressors in the model and the distinct errors of the cross-sections. For this to be controlled for, fixed effects are needed. The conclusions drawn from contrasting the fixed and random effects models are supported by the Hausman test. In order to account for unobserved variability across cross-sections, the fixed effects regression model should be the last one used for analysis. For this panel data, the Hausman test demonstrates that fixed effects are statistically better than random effects.

Table 8: *Hausman Test results*

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	p-Value
Cross-section random	59.868402	4	0.000

Source: Authors' calculations by using Eviews 12 Statistical Software.

Descriptive statistics

The Table 9 shows descriptive statistics for the selected variables – GDP, Trade (imports + exports), Population, Inflation, and Exchange Rate. The data covers 103 observations for each variable. The lnGDP has a mean of 11.57 and median of 11.66. The standard deviation is 1.87, indicating a moderate spread in the data. The minimum GDP is 8.26 and maximum is 15.03Compared to other variables, trade has a higher standard deviation (3.42), which suggests greater variability. 10.62 is the median and 10.62 is the mean. The population's median is 18.85 and its mean is 18.68. The data points are closer to the mean, as indicated by the standard deviation of 1.42. The lowest median is 1.90 and the lowest mean is 1.86 for inflation. In certain years, deflation is shown by the minimum value, which is negative -0.47. 3.27 is the highest. The data points are closely clustered around the mean of 4.28, as indicated by the exchange rate's lowest standard deviation of 0.32. While inflation has the lowest average value, population has the greatest. The currency rate fluctuates the least, but trade data fluctuates the most. Both high and low economic growth over the study time are indicated by the range of GDP numbers. This sets the stage for additional regression analysis to examine the connections between the variables.

Table 9: *Descriptive Statistics*

Variables	Observation	Mean	Median	Standard Deviation	Minimum	Maximum
LnY	103	11.5660	11.6551	1.8703	8.2568	15.0348
LnT0	103	10.6173	10.6234	3.4152	7.7164	14.3291
LnP	103	18.6801	18.8526	1.4193	16.8600	21.7109
LnI	103	1.8556	1.90196	0.5290	-0.4681	3.2740
LnE	103	4.2840	4.27782	0.3205	3.7220	5.3223

Source: Authors' calculations by using Eviews 12 Statistical Software.

Pooled OLS Regression Analysis

LnY was the dependent variable in the regression, whereas LnTo, LnP, LnI, and LnE were the independent variables (Table 10). Every variable is transformed into a natural log. With an adjusted R-squared of 0.9911, the model's independent variables account for more than 99 percent of the variation in Y. With a coefficient of 0.77, which means that, when all other factors are held constant, a one percent increase in trade is equivalent to an average 0.77

percent increase in GDP, trade openness (T) and GDP (Y) have a positive and statistically significant relationship. Population (P) also has a positive and statistically significant relationship with GDP. The coefficient of 0.32 indicates that, on average, a 1% increase in population corresponds to a 0.32 percent increase in GDP. The link between GDP and inflation (I) is negligible.

Table 10: *Pooled OLS Regression test results*

Variable	Coefficient	St. Error	t-Statistics	p-Value
C	-4.403686	0.795769	-5.5339	0.0000
Ln T0	0.77186	0.040783	18.62924	0.0000
Ln P	0.321381	0.054019	5.939347	0.0000
Ln I	-0.013784	0.033093	-0.416533	0.6779
Ln E	0.419418	0.066423	6.314360	0.0000
Adjusted R-squared	0.991103			
R-squared	0.991452			
F-statistics	2841.609			
Prob (F-statistics)	0.000000			
No of observation	103			

Source: Authors' calculations by using Eviews 12 Statistical Software.

Fixed effect regression results

With an adjusted R-square of 0.9943, the model shows that the independent variables account for more than 99 percent of the variation in GDP (Table 11). Trade (T) is still statistically significant and favorable. In comparison to the pooled OLS model, the coefficient increased marginally to 0.87. The population (P) remains significant and positive, but the coefficient dropped to 0.58. In terms of forecasting GDP, inflation (I) remains negligible. After controlling for cross-sectional fixed effects, the exchange rate (E) is statistically insignificant, suggesting it has no obvious link with GDP. The whole model is still statistically significant, as seen by the F-statistic, which is still very significant.

When cross-sectional fixed variables were taken into account, the exchange rate lost relevance. This indicates that the correlation between GDP and the exchange rate probably differs depending on the cross-sectional unit. The population's lower coefficient suggests that the strength of this link was overstated by pooled OLS. The explanatory power of the fixed effects model is significantly higher (adjusted R-squared = 0.9943 compared to 0.9911 in pooled OLS). Unobserved heterogeneity across cross-sections is taken into account by the fixed effects model. The GDP continues to benefit greatly from trade and population. The link between exchange rates varies depending on the cross-section. The necessity of fixed effects is reaffirmed by the better model fit compared to pooled OLS.

***Table 11**: Fixed effects regression results*

Variable	Coefficient	St. Error	t-Statistics	p-Value
C	-8.628218	4.035234	-2.13822	0.0351
Ln T0	0.869680	0.038994	22.30306	0.0000
Ln P	0.582209	0.238562	2.440489	0.0165
Ln I	-0.040990	0.027863	-1.471117	0.1446
Ln E	0.037574	0.10115	0.371467	0.7111
Adjusted R-squared	0.994333			
R-squared	0.994778			
F-statistics	2238.2680			
Prob (F-statistics)	0.000000			
No of observation	103			

Source: Authors' calculations by using Eviews 12 Statistical Software.

DISCUSSION

Along with other factors including population, inflation, and exchange rates, this study offers evidence on the relationship between trade openness and economic growth across five South Asian nations (Afghanistan, Bangladesh, Nepal, India, and Pakistan) between 2002 and 2022. The Fixed Effects model was chosen for the final analysis using Pooled Ordinary Least Squares (OLS) because it performed well on the Hausman test. A 1% increase in trade openness leads to an approximate 0.87% increase in GDP, according to the results of the Fixed Effects regression, which showed that trade openness had a positive and statistically significant influence on GDP. This result directly satisfies the primary goal of the study, which was to investigate the connection between trade openness and economic growth in the South Asian context.

Beyond the effect of trade openness, the second objective examined how population growth, inflation, and the real exchange rate influence economic growth in South Asia. The findings underscore the region's potential demographic dividend by demonstrating that population expansion has a positive and considerable impact on GDP, with a 1% increase in population translating into a 0.58% increase in output. A limited direct influence on growth was shown by the negative but statistically negligible effect of inflation. The real exchange rate had a mixed effect, promoting growth when it was steady and impeding it when it was erratic, highlighting how crucial good macroeconomic management is in these nations.

It is evident from the analysis that trade openness and economic advancement are closely related. Economic growth is accelerating in nations like Bangladesh, India, and Nepal as a result of their increased market opening to international trade. Pakistan and Afghanistan, on the other hand, are experiencing either stagnation (Pakistan) or a deterioration in trade

openness (Afghanistan), all of which are impacted by severe political and economic turmoil. Their economic development has been adversely impacted by these developments, among other things. This emphasises the necessity of changing policies to encourage more open trade.

Kumar (2025), who bases his recommendation for greater openness on empirical data, concurs with this viewpoint. To fully reap the rewards of economic liberalisation, Bhattarai (2025) highlights the necessity of increased regional collaboration. Wacziarg and Welch (2008) showed that trade openness and economic growth are strongly correlated, emphasising that open economies tend to grow more quickly. Likewise, Siddique and Selvanathan (2012) discovered that commercial openness greatly accelerates South Asian nations' growth, particularly in Bangladesh and India.

The results of this study, however, are somewhat different from those of Rodríguez and Rodrik (2001), who questioned the strength of the trade-growth relationship, especially in emerging nations where export diversification and institutional quality are important variables. Similarly, the macroeconomic environment can moderate the impact of factors like inflation and the currency rate on economic growth, according to Bahmani-Oskooee and Nasir (2004). This is evident from the study's negligible inflation and exchange rate results.

A high R-squared value (over 99%), which shows that the selected independent variables account for almost all of the variation in GDP, further supports the model's robustness. The study's goals have thus been effectively met: it has examined the less significant effects of inflation and exchange rates, validated these relationships within the particular context of South Asia, and empirically confirmed the beneficial effects of trade openness and population growth on economic performance.

In addition to adding to scholarly discussions, the findings have real-world policy ramifications, particularly the support of free trade agreements and population-based development plans as means of boosting local economic expansion.

CONCLUSION

Using Pooled Ordinary Least Squares (OLS) and Fixed Effects regression models, this study examined the relationship between economic growth (GDP) and important macroeconomic factors, including trade openness, population growth, inflation, and the real exchange rate. The study examined five South Asian nations—Afghanistan, Bangladesh, Nepal, India, and Pakistan—between 2002 and 2022. The Fixed Effects model was chosen as the better approach for the final estimation based on the Hausman test.

According to the findings, trade openness positively and statistically significantly affects GDP; on average, a 1% increase in trade openness results in a 0.87% gain in GDP. A 1% increase in population is equivalent to a 0.58% increase in GDP, demonstrating the positive and significant impact of population growth. On the other hand, the exchange rate exhibits

a positive but statistically negligible link with economic growth, and inflation has a negative but statistically insignificant effect.

With the chosen independent variables accounting for over 99% of the variation in GDP, the model exhibits good explanatory power overall. These results not only demonstrate how important trade openness and population expansion are to South Asia's economic development, but they also raise the possibility that more thorough research or better data may be needed to fully understand the effects of inflation and exchange rate swings.

Based on the empirical results, several policy implications can be drawn.

Implication

It is advised that South Asian nations actively increase trade, create free trade zones, and fund infrastructure initiatives that support international trade in light of the findings. Policies geared at economic liberalisation, such as lowering tariffs and non-tariff barriers, should be given priority in order to encourage growth, given the positive and considerable benefits of trade openness and population increase on GDP.

The current demographic shift in South Asia, which is marked by a sizable working-age population, offers a significant demographic dividend even if population increase is sometimes viewed as a challenge. To optimise economic gains, policymakers should concentrate on making investments in the development of human capital, generating employment possibilities, and guaranteeing efficient use of this labour force.The necessity of stable exchange rate policy is highlighted by the positive (albeit statistically small) link between GDP and the exchange rate. To encourage trade balance and lessen economic uncertainty, governments should work to keep currency values constant.

Governments must also improve governance, make sure trade agreements are implemented effectively, and draw in foreign direct investment by fostering an investment-friendly environment and embracing technological advancement through high-quality capital imports. Development of physical infrastructure and the creation of jobs are still essential for maintaining growth, particularly in order to accommodate the growing labour force. Cross-border trade should not be impeded by political disputes, institutional impediments, or procedural limitations; rather, all bilateral and multilateral agreements should be fully implemented in order to promote regional integration.

In the end, South Asian countries should take more effective steps to further open their economies and foster regional collaboration in order to fully reap the benefits of economic progress.

AUTHORS CONTRIBUTIONS

- Naseerullah Safi conceptualized the study, designed the methodology, and conducted the statistical analysis.
- Nagendra Kumar Maurya contributed to the theoretical framework, interpretation of results, and policy implications.

- Both authors contributed to writing, reviewing, and editing the manuscript.
- All authors reviewed and approved the final version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data utilized in this study is publicly available from the World Bank's World Development Indicators (https://databank.worldbank.org/source/world-development-indicators) and Afghanistan Statistical Yearbooks. Further details can be provided by the corresponding author on reasonable request.

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