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Can Innovation Stimulate Income Inequality in South Asia?

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Abstract

Income inequality can jeopardize social cohesiveness, stifle economic growth, trigger a recession, and slow the rate of economic development. It may also cause social unrest and dispute, which are the determinants of economic growth. The Schumpeterian growth hypothesis is tested by employing the quantile regression to examine the role of innovation in determining income inequality for the selected South Asian countries. The empirical findings show that innovation, especially the number of patent applications, has a statistically significant and positive association with income inequality in South Asia which increases income inequality. For sustainable economic growth, everyone must be given equal economic opportunities in the economy, and the government must abolish capitalists' oligopoly on wealth. Similarly, everyone must be given equal opportunities to innovate because innovation encourages not only productivity but also economic growth in the long run.

Keywords: Corruption, Governance, Globalization, Inflation, Patents, Unemployment

JEL: E03, O1, O3

Introduction

In most societies, equality is considered a valued trait. People are concerned about inequality regardless of their culture and religion. While income inequality may be an indication of low-income mobility and opportunity in a society. Income inequality concentrates decision-making power in the hands of a few wealthy people, leaving a significant portion of society with little resources. It increases not only the living costs for many people but also gives rise to crime, mental illness, and social instability. Widening economic inequality across the globe has been labeled as the "defining challenge of our time" by President Obama.

Income inequality has increased nearly across the globe, albeit at a different speed (World Economic Forum, 2015). It varies from region to region, even when regions share similar levels of development. Similarly, income inequality is found to be higher in the Middle East than that in Europe (WLI, 2018). Rising income inequality can jeopardize social cohesiveness, stifle economic growth, trigger a recession, and slow the rate of human development (Brzezinski, 2018). Moreover, researchers disagree on the causes of the recent surge in income inequality. As a result, addressing income inequality is crucial to

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reducing vulnerability and poverty, and for sustainable economic growth (Deaton, 2013).

Figure 1.1 represents the levels of income inequality across regions (WIL, 2022). Income inequality varies significantly among the regions, from Europe to MENA. In Europe, the top 10 percent of people have an income share of around 36%, however, it is 58 percent in the MENA. Previous literature showed a variety of visible patterns between these two levels. Coming to East Asia, 43% of the total national income straightly goes to the top 10%, whereas in Latin America, the top 10% earn 55%. Numerous theories present different reasons for this trend. For example, Kuznets (1955) suggested that structural changes may be a reason behind this increasing trend of income inequality across the regions. Though Kuznets has a different explanation, and he believed that the transition from agriculture to industry, and industry to services, mainly financial services, from planned to market-based economy, and the urbanization process had increased income inequality, significantly, in several countries between the late 1980s and early 1990s (Włodarczyk, 2020).

When it comes to reducing income inequality, innovation is a key component (Antonelli & Gehringer, 2013). The World Economic Forum (2014) mentioned in the report that innovation can mitigate income disparities. For instance, let's assume that the report prepared by the World Economic Forum is accurate then, why do the developed countries, including the United States, which is a tremendous driver of innovation, have such high levels of income inequality? A bunch of studies has identified other factors that cause income inequality. It is not only a skill-biased technological change, but also an international trade, globalization, migration, schooling, institutions, and gender inequality that may cause income inequality. Among these factors, technological change is thought to be the most important one (Kierzenkowski & Koske, 2013; Lemieux, 2008).

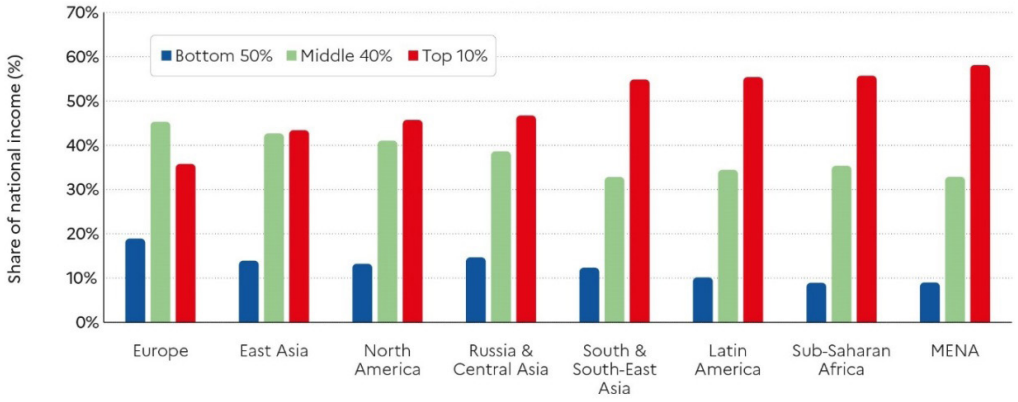

Figure 1.1. Levels of Income Inequality Across Regions
Source: *World Inequality Report 2022*

Income inequality is also considered to be the major factor behind the emergence of the banking crises in 2007-2008 (Rhee & Kim, 2018). In the past, the significance of innovation (knowledge, patents, research, and development in stimulating economic progress) has increased (Hasan & Tucci, 2010). Researchers have not gone into

detail about the possible interaction between innovation and income inequality, so more research is required. Therefore, it is also necessary to examine the innovation's role in determining income inequality.

From a conventional point of view, the technological change increases productivity and workers' wages, which ultimately has either a constructive or destructive effect on income inequality. A change in skill-biased technology exacerbates inequality and boosts the relative demand for highly trained employees, providing an incentive to pursue higher education. Thus, an increase in the supply of highly trained people decreases inequalities. Till the 1990s, this supply and demand framework had successfully explained the variation in the US wage structure (Katz & Murphy, 1992). Still, it is unable to explain the subsequent advancements like a decrease in the real wages at the bottom of the income distribution, wage polarization, and domestic labour substitution by capital (e.g., computers) or foreign labour due to offshoring (Acemoglu & Autor, 2011). Modern literature has addressed these problems. For example, Autor et al. (2003) showed the importance of job assignments by stressing that routine jobs would be replaced by new technologies and non-routine tasks that would be typically augmented by new technology. He used the term "computerization," which would eliminate the jobs for low-skilled people that high-skilled workers cannot replace; resultantly, wage polarization will increase.

In addition to that, widening income inequality may be because new technologies are typically implemented by skilled labour only; as a result, they do the job in different new sectors and earn higher wages than unskilled workers; however, these unskilled workforces remain in traditional sectors, earning prevailing wages. On the other hand, some employees can adapt to cutting-edge technologies more quickly than others, and earn an additional premium (Aghion, 2002). Antonelli and Gehringer (2017) were motivated by the Schumpeterian growth theory, and they believed that if new vintages of technological innovation erode incumbents' competitive advantages and shorten the lifespan of monopolistic rents, the quicker the pace of innovative change, the faster income inequalities will be reduced. Moreover, the Schumpeterian idea of creative destruction can also be used to explain income inequality at the top. Entrepreneurs strive for an exponential increase in earnings, but creative destruction by external innovators thwarts this expansion; as a result, top earnings follow the Pareto efficient reasoning (Jones & Kim, 2018; Schumpeter, 1947).

In the past few years, South Asian countries have experienced tremendous economic growth but remained failed to reduce prevalent inequality. The Gini coefficient has increased in all eight South Asian countries from 2010 to 2017, which shows that South Asia is experiencing more inequality. The Gini coefficient in Afghanistan and Pakistan has expanded from 27.82 to 31 from 29.8 to 33.5 respectively and from 36.4 to 39.8 in Sri Lanka. However, the Gini coefficient in other countries neither increased nor decreased. When the Gini coefficient reaches 40.0, it implies that income inequality has reached a disturbing level in that society. At this stage, few people control the economy while most of the people are deprived of basic services. Recent statistics show that South Asia will cross this mark soon (SAIR, 2019).

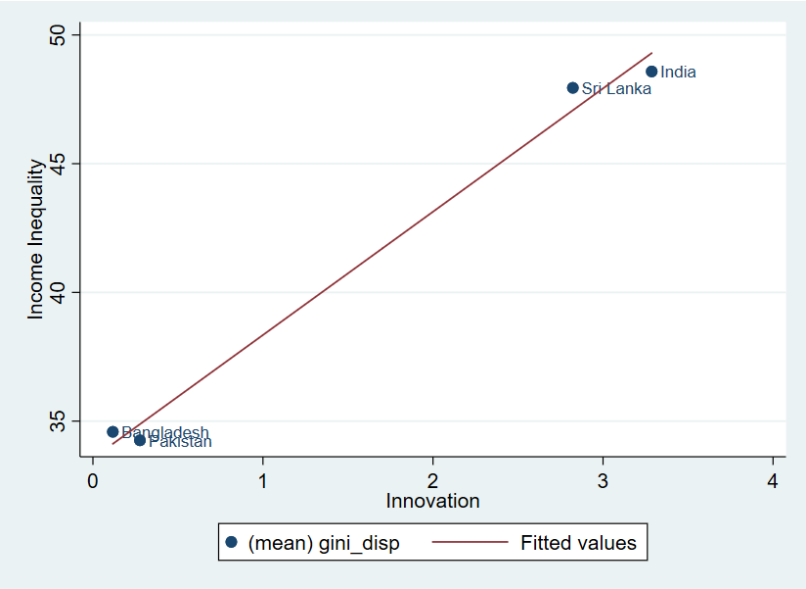

Figure 1.2. Scatterplot of Income Inequality and Innovation (Total Patent Applications/Labor Force)
Source: Authors' plot using data from SWIID and WIPO

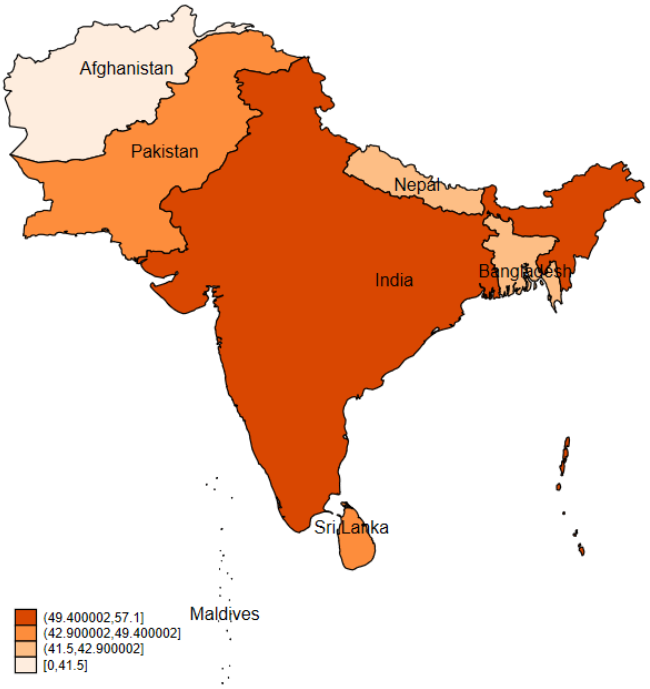

Figure 1.3. Top 10% National Income Share
Source: Authors' plot using data from World Inequality Database

Income equality in several economies has increased; the most notable case was the global financial crisis of 2007–2008; this crisis has sparked a debate not just over the sources and implications of increased inequality but also its impact on future growth (Ostry et al., 2014). In South Asia, the role of innovation in determining income inequality is crucial due to the vulnerability of low-skilled workers to displacement caused by technological advancements. Micro, small, and medium-sized enterprises (MSMEs) are also critical for job creation and economic growth in the region, but innovation can exacerbate income inequality if it is concentrated in a few firms or sectors. Income inequality can lead to social unrest, and political instability, and hinder economic development, making it essential to understand the relationship between innovation and income inequality to promote sustainable economic growth and social stability. Using data from 2000 to 2019 the role of innovation in determining income inequality has been examined in South Asia. The study examines the role of various factors such as innovation, economic growth, inflation, governance, globalization, and unemployment in determining income inequality. By employing the panel quantile econometric approach, the study re-examines the Schumpeterian hypothesis and provides empirical evidence how innovation, particularly the number of patent applications, widens income inequality.

Historically, several descriptive studies full of incoherent theoretical literature have discussed this phenomenon (Weinhold & Nair-Reichert 2009; Acemoglu et al., 2012; Aghion et al., 2019). However, the present study adds to the body of knowledge in three ways. Firstly, the quality of patents has been employed as a proxy for innovation in this work rather than the number of patents, and the quality of patents is measured by patent applications. Secondly, the Schumpeterian idea of technological advancement has a significant effect on lowering income inequality. Owing to creative destruction, the rate of technological change reduces severely skewed wealth and rent inequality, thereby limiting income inequality. Thirdly, the panel data approach has been used for the analysis in this study.

Significance of the Study

No doubt, income inequality is under global attention as it gives rise to many economic crises. However, Kyroglou (2017) believed that many countries successfully reduced their income inequalities since the 1990s. Income equality benefits the wealthy by increasing their power and allowing them to live a more luxurious lifestyle. While the poor lag in terms of social prestige, they try to make up for it by spending beyond their means. As a result, the middle class becomes indebted, causing their purchasing power to erode further. This has a detrimental impact on the economy and the firms that operate within it, leading to an economic crisis.

When a Gini coefficient reaches 40.0, it implies that income inequality has reached a disturbing level where few people control the economy, and most are deprived of basic facilities. The current trend shows that South Asian countries will pass this threshold soon. The richest 20% of Maldivians make 7 times more money than the lowest 20%, and this trend is followed by Bhutan (6.9 times) and Sri Lanka (6.8 times). Except for Bhutan and the Maldives, no other South Asian country was able to reduce inequality between 1980 and 2015. The richest ten percent of Indians currently own roughly three-quarters of the country's total wealth. Similarly, even though roughly 64% of Pakistanis live in rural regions,

only 1% of feudal hold 20%, and the top 20% own 69% of the country's total farmland. The increase in income inequality in South Asian countries has also increased the global poor share from 27.3% to 33.4% from 1990 to 2013. South Asia has become one of the world's most unequal regions as the number of global poor has increased (SAIR, 2019).

The present study makes two major contributions to the present literature. Firstly, it illustrates the importance of innovation, governance, and globalization in determining income inequality in South Asia. Secondly, this study estimates the impact of innovation on income inequality by employing quantile regression with fixed effects.

Objective of the Study

According to the Schumpeterian idea of growth, income inequality can be reduced by improving the quality of innovations made by either incumbents or potential entrants in each industry. Innovation not just increases the entrepreneurial share of revenue but also promotes social movement through creative destruction; as a result, more workers can become business proprietors - the main objective of this study is to investigate the impact of innovation on income inequality in selected South Asian countries. This study focuses on these questions:

- Does innovation impact income inequality in South Asia?
- How does governance influence income inequality in South Asia?

Review of the Literature

Despite the plethora of literature on income disparity and economic growth, there is still a lot of debate over how income inequality affects economic growth (Shin, 2012). Its roots can be traced back to Kaldor (1956), who addressed the interaction between income distribution and economic progress. In the literature, the gap between the rich and the poor is known as income inequality. Several studies have found either a constructive or destructive correlation between income inequality and economic progress (Aghion et al., 1998; Forbes, 2000; Helpman, 2009; Okun, 1975; Sukiassyan, 2007; Tachibanaki, 2009). The positive correlation might be explained as developed countries are usually characterized by higher saving rates as compared to developing economies. The restructuring of income from the wealthiest to the poor people reduces the economy's saving rate, thus slowing economic growth.

Furthermore, income redistribution may remove the incentive for the wealthy to work hard and thus hampers economic growth. Meanwhile, the negative correlation might be explained as people in emerging economies confront credit constraints. They are often unable to invest, and if someone is poor due to income inequality, they would be unable to engage in productive activity. Similarly, income disparity in society may cause social/political unrest and thus slow economic progress.

However, recent studies have analyzed that technological change is the reason for inequality in income. Antonelli and Gehringer (2017) believed that income inequality has increased due to the slow pace of technological change. They tested the idea of Joseph Schumpeter, which asserts that technological change has a major impact on lowering the distribution of income. Due to the substantial impacts of creative destruction, the rate of innovation reduces wealth and rent inequality, thus limiting income inequality. This hypothesis has been tested by employing

a quantile regression on the dataset of developed and industrializing economies. Empirical findings showed that the disparity-lessening impact of innovative change holds along the entire income disparity distribution. Still, it is more prominent in economies where wealth concentration and income gaps are greater.

Similarly, Perera-Tallo (2017) proposed that income shared by reproducible factors is found to be increased by innovation while decreasing the income share of non-reproducible factors. The wealth and preferences of agents are heterogeneous, implying that the savings rates increase as wealth grows. As a result, assets are not dispersed as evenly as raw labour (a non-reproducible factor). This means that innovation raises the portion of factors that are distributed less equally, which causes inequality along with the sustainable roadmap of growth. Similarly, it is not viable to adopt new technologies when reproducible factors and the knowledge base are low. When learning-by-doing and technological change stops and results in stagnation.

Samargandi (2018) investigated the role of innovation in labour productivity in MENA by employing time series data, and he found that innovation accelerates labour productivity. Likewise, Mutero (2021) examined that innovation plays a mediating role and knowledge management systems play a moderating role, and they both are empirically supported.

In contrast, some scholars do not stand with Schumpeter who stated that the innovation rate significantly decreases income disparity. Kinugasa (1998) tested the Schumpeter idea by using data from Japanese trunk route airlines from 1977 to 1993. He investigated the structure of firm productivity to figure out the innovative activity by using the rate of technical change while having some innovative inputs and outputs. The Schumpeter idea is examined with technology, and the empirical evidence shows that it is not valid.

Although several studies have examined the significant part of technological change in influencing income disparity, the part of governance cannot be denied in determining income inequality. Huang and Ho (2018) investigated the impact of governance in determining income inequality in ten Asian countries from 1996 to 2015. The empirical results of the study have shown that democratic quality has significant and negative impacts on income inequality in developing economies and a positive in advanced economies. He suggested that promoting good governance would reduce income disparity only in emerging countries. Similarly, Akram et al. (2011) argued a strong interaction between poor governance and income inequality as they lead to poverty in Pakistan. Good institutions aid in reducing not only poverty but also inequality in society. Similarly, good governance has a more significant influence on inequality and poverty in developed countries as compared to emerging countries (Coccia, 2021).

Kunawotor et al. (2020) argued that institutions do not significantly affect income inequality, however, indicators like control of corruption and the rule of law reduce income inequality. Iqbal and Mehar (2015) found a significant negative association between governance indicators and income inequality. They think that lousy governance profoundly influences Pakistan's economy and that improving governance isn't a one-day job. It can't be done all at once, and it's not a job for any department or group.

The economies that enjoy long-term sustainable growth and economic

development have some standard features; better institutional quality is one of those features. Similarly, better institutional quality has some features, which include effective government, a well-operational parliament, law enforcement, and investor protection (Chong & Calderon, 2000). Prosperous countries can be distinguished from less successful ones based on better institutional quality. Furthermore, the classical theory emphasizes that the economy's growth pattern is determined by technology, the collaboration of resources, comparative advantage with institutional circumstances, and institutional change. This theory signifies the importance of better institutional quality (Adelman et al., 1992).

A plethora of studies analyzes the impact of inflation on income disparity. Inflation was found to have equivocal effects on income inequality. Law and Soon (2020) found that inflation and income inequality interact in a positive manner and a negative with better institutional quality as it improves income inequality. Meanwhile, better institutions play a mediating effect in reducing the impact of inflation on income inequality. Moreover, higher inflation is found to be correlated with higher income disparity. Income inequality rises with inflation and reaches a point where it's about 109 percent, and then decreases (Nantob, 2015). In contrast, Cysne et al. (2005) examined the impact of inflation on the Gini coefficient and found that they interact positively. While Monnin (2014) opposed this view, he believed there is a U-shaped association between inflation and income disparity. He further claimed that inflation rates and income inequality interact negatively. Inequality decreases as inflation increases reach a minimum with an inflation rate of about 13% and then begins to rise again.

Several studies in economics literature have examined the impact of globalization in determining income inequality. Globalization impacts income inequality through the channel of FDI. Investment inflows generate employment for unskilled workers in labor-concentrated economies. However, during times of recession/expansion, FDI outflows create unemployment in developing countries, thus worsening income inequality (Çelik & Basdas, 2010). Asteriou et al. (2014) examined the relation between income inequality and globalization in the European Union. He also performed this analysis at subgroups of countries within the EU27, such as the Core, Periphery, High Technology, and the New EU Member countries. Results showed that trade liberalization has an equalizing effect, whereas financial globalization has exacerbated income inequality. Income inequality is worsened by foreign direct investment. Moreover, the global financial crisis of 2007–2008 increased income inequality.

Bergh and Nilsson (2010) used panel data from nearly 80 economies from 1970 to 2005 to investigate whether there is an association between the KOF and the FIEFI within-country income inequality utilizing the SWIID. The findings of the study showed that trade liberalization is strongly linked to inequality, even when multiple control variables are included, and potential endogeneity is controlled. Similarly, income inequality is also linked to social globalization and deregulation. Moreover, economic reforms stimulate inequality mostly in advanced economies, whereas social globalization is more significant in emerging economies. On the other hand, income inequality is not

caused by monetary reforms, legal reforms, or political globalization.

Atif et al. (2012) also examined the influence of globalization on income inequality. The findings are consistent with a priori assumptions. It is suggested that a rise in globalization causes a rise in income inequality in emerging economies. However, this analysis has some limitations that lead to the conclusion that there is no single relationship on the subject. Moreover, globalization has varied effects on income inequality from country to country, depending on the structures and institutions of specific economies.

In terms of unemployment and income differences, Quintana and Royuela (2012) found that albeit starting high unemployment rates are statistically significant in explaining long-run growth, they do have a negative and substantial influence when linked with increases in income inequality. Income inequality also affects economic growth in both countries with a lot of urbanization and countries with little urbanization and unemployment. A lower unemployment rate promotes human development and reduces poverty (Akinbobola & Saibu, 2004). Blinder and Esaki (1978) found that the frequency of unemployment is quite regressive in the United States. According to their calculations, for each 1% rise in the unemployment rate, the poorest 40% of the population loses 0.269-0.30% of their national income, while the wealthiest 20% gain it.

Nolan (1986) used cross-section data to examine the effect of shifts in unemployment on the UK's size distribution of annual income. An increase in unemployment has been found to have a regressive effect. On the other hand, the decrease in shares was not mainly concentrated at the extreme bottom of the distribution. Due to other working members, many people affected by unemployment throughout the year live in families that are not at the tail end of the income distribution. Across the European continent, unemployment and income inequality are positively associated within countries, between countries, and over time. Countries with minimal inequality, because of such institutions, have lower unemployment rates than those that do not. Furthermore, the continent's unemployment problem is exacerbated by substantial inter-country inequalities (Galbraith et al., 1999).

Income inequality and carbon emissions are related via several different pathways. Ravallion et al. (2000) discovered that income distribution impacts total CO_2 which causes global warming. Lower CO_2 is linked to higher income inequality between and within countries at given average incomes. They also confirmed that economic growth is positively associated with CO_2. Their findings suggested that there are trade-offs between environmental control and economic development. (Hailemariam et al., 2020) investigated whether fluctuations in income disparity impact carbon discharges in organizations for economic and co-activity and advancement nations. They evaluated the association between economic growth and CO_2 by employing a new data source on the highest income discrimination in OECD countries, assessed by the share of pre-tax income obtained by the richest 10% of the population. They learned that top income inequality and CO_2 interact in a positive manner.

The association between income disparity and per-capita CO_2 depends on the income level. Grunewald et al. (2017) revealed that income inequality has a negative relation with CO_2 in poor and emerging economies and a positive in upper-middle-income and advanced

economies. A panel of 68 countries assessed the marginal effect of economic inequality on per-capita CO_2 from 1961 to 2010. Vallejos and Lastuka (2020) supported the hypothesis that per-capita CO_2 and income inequality are linked. However, this relation is not consistent between economies and depends on the country's level of development. Using panel smooth transition regression, they found a negative association for economies having low per-capita income, but it turned modestly positive after reaching a threshold of about $15,000 in 2011. Furthermore, the per-capita inequality elasticity of emissions is equivalent to the income elasticity.

Data and Methodology

South Asian countries are termed as developing countries; resultantly, they have less innovation than developed countries and this study aims to examine the role of innovation in determining income inequality in South Asia. In our study, we considered various factors that have been found to influence income inequality based on previous research. For instance, GDP per-capita was included as a control variable since Yang and Greaney (2017) found that it can reduce income inequality. Inflation was included as a factor since Menna and Tirelli (2017) and Nantob (2015) found that higher inflation tends to widen the income-inequality gap. We also considered governance indicators as a variable as better institutions have been found to reduce income inequality based on studies by Chong and Gradstein (2007) and Lin and Fu (2016). Lastly, we considered globalization since it has been found to increase income inequality by Bergh and Nilsson (2010) and Mah (2013).

To estimate the income inequality or Gini coefficient, the SWIID (Solt, 2016) dataset is used, and the sample period is from 2000 to 2019. The Gini index is a widely used measure of income inequality because it provides a simple and intuitive measure of the distribution of income in a society. It ranges from 0 to 1, where 0 indicates perfect equality (i.e., everyone has the same income) and 1 indicates perfect inequality (i.e., one person has all the income). Unlike other measures of income inequality, such as the mean or median income, the Gini index captures the entire distribution of income, including the extremes of very high and very low incomes. Additionally, the Gini index is less affected by outliers or extreme values, which can distort other measures of income inequality. The Gini index is also useful for comparing income inequality across different countries or regions, as it is a standardized measure that can be easily calculated and compared. We have used the SWIID database, and such databases are useful for cross-country comparisons of income inequality levels and trends over time. They provide a more consistent and reliable basis for analysis and policymaking, as they eliminate the potential bias that may arise from the use of different measures and data sources across different studies.

Similarly, patent applications and patents granted are used as a proxy for innovation, and data is extracted from the WIPO. (Bottazzi & Peri, 2003; Jaffe, 1986; Tebaldi & Elmslie, 2013) and (Wang, 2013) all use the number of patent applications and granted patents as a proxy for innovation. Moreover, data on labour force is extracted from the WDI.

The governance Index has been used to measure the impact of governance on income inequality. It is made using Principal Component Analysis in Stata 15 using the following six institutional indicators: voice and

accountability, government effectiveness, political stability, absence of violence/ terrorism, regulatory quality, the rule of law, and control of corruption. The value of these variables ranges from approximately -2.5 to +2.5 for each institutional indicator. This means a country with perfect institutions will have a value of +2.5, while a country having the worst institutions will be assigned a value of -2.5.

The data on globalization comes from the KOF Swiss Economic Institute database, which measures the economic, political, and social dimensions of globalization. Similarly, the data on carbon emissions, real GDP per-capita, unemployment, and inflation are obtained from WDI.

The present study is based on a panel dataset from 2000 to 2019 for the four selected South Asian countries, which are Bangladesh, India, Pakistan, and Sri Lanka. There are eight countries in South Asia. However, the remaining four countries are excluded (Maldives, Bhutan, Nepal, and Afghanistan) due to the unavailability of the data. The data on patent applications and Gini were missing for these countries. Similarly, the data for governance indicators was not available before 1996 and that's why we have decided to choose the data to range from 2000 to 2019. To address the issue of missing data, interpolation, and extrapolation techniques were employed to estimate the values of the missing observations. These techniques are widely used in economics and social sciences research to fill in gaps in datasets and provide more complete information.

Table 3.1. Brief Description of the Variables

Variable	Definition	Source
Income Inequality (Gini)	Measure the difference in income distribution (Percent)	*Standardized World Income Inequality Database*
Innovation		
Total patent applications	Ratio (in 100,000 workers)	*World Intellectual Property Organization*
Total patent granted		
Voice and Accountability	Capturing perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and a free media	
Government Effectiveness	The quality of public services, the quality of the civil service quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	
Political Stability and Absence of Violence/Terrorism	Capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism	
Regulatory Quality	Capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	
Rule of Law	Capturing perceptions of the extent to which agents have confidence in and abide by the rules of society and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	

Variable	Definition	Source
Control of Corruption	Capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests	
Governance Index	Index of all the six governance indicators	*World Governance Indicators*
Globalization	Scale 1–100	*KOF Globalisation Index*
Carbon emission (CO_2)	Total carbon emission (metric tons per capita)	*World Development Indicators*
Real GDP per capita	US$ (2015 constant prices)	*World Development Indicators*
Unemployment, total	% of the total labor force	*World Development Indicators*
Inflation	Consumer prices (annual %)	*World Development Indicators*

Table 3.1 provides a concise overview of the variables. All the variables are defined with their sources. While ***Table 3.2*** illustrates one measure of tails, the kurtosis, and several other descriptive statistics like mean, skewness, and standard deviation. Skewness essentially measures the symmetry of the distribution or direction of asymmetry. A normal distribution has a skewness value of 0.

Moreover, a negative number suggests a skewness to the left tail, while a positive value indicates a tilt to the right. ***Table 3.2*** shows that none of the variables is normally distributed or has a 0 value. Except for globalization and unemployment, all the variables positively skewed distribution.

In contrast, kurtosis determines the heaviness of the distribution tails. When the kurtosis value exceeds 3, it is commonly assumed that there is an excess of kurtosis or distribution is leptokurtic, with large tails. Similarly, when the value of kurtosis is equal to 3, it's called mesokurtic, and when the value is less than 3 it's called platykurtic. ***Table 3.2*** shows that the distribution of Gini, governance, globalization, and unemployment is platykurtic. While the distribution of patents granted, CO_2, Inflation, and GDP per capita are leptokurtic. Only the distribution of patent applications is roughly equal to 3, categorized as mesokurtic.

Table 3.3 measures the correlation among the variables. The correlation matrix is included to check the correlation among all variables and compare these values with the coefficients of the model. ***Table 3.3*** shows that patent granted, patent applications, governance, globalization, CO_2, GDP per capita, unemployment, and inflation positively correlate with Gini-SWIID.

Table 3.2. Descriptive statistics

Variables	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Gini	41.341	7.067	33.3	52.022	33.3	52.022	.073	1.113
Patent Granted/Labour	.452	.543	.009	2.699	.009	2.699	1.62	6.189
Applications/Labour	1.626	1.833	.041	6.883	.041	6.883	1.064	3.004
Governance	0	1	-1.897	2.263	-1.897	2.263	.149	2.139
Globalization	53.462	6.187	37	63	37	63	-.665	2.973
Co2	.804	.403	.17	1.88	.17	1.88	.733	3.266
GDP per-capita	1625.21	927.301	653.809	4225.106	653.809	4225.106	1.474	4.218
Unemployment	4.268	2.004	.4	8.76	.4	8.76	-.337	2.996
Inflation	7.062	3.841	2.007	22.564	2.007	22.564	1.551	6.355

Table 3.3. Correlation Matrix

Variables	Gini	PTG	PTA	GX	GLOB	CO2	GDP	UEN	INF
Gini	1.000								
patent Granted	0.809	1.000							
Applications	0.862	0.822	1.000						
Governance	0.831	0.659	0.640	1.000					
Globalization	0.750	0.673	0.765	0.676	1.000				
CO_2	0.653	0.603	0.771	0.508	0.780	1.000			
Gdppercapita	0.560	0.485	0.607	0.623	0.567	0.215	1.000		
Unemployment	0.678	0.512	0.404	0.542	0.323	0.177	0.207	1.000	
Inflation	0.004	0.024	-0.084	0.031	0.250	-0.043	-0.011	-0.028	1.000

Research Methodology

Several previous studies have often estimated the conditional mean model with fixed effects to check the role of innovation in determining income inequality.

$$E(y_{it}|x_{it}, \alpha_i) = x^T_{it}\beta + \alpha_i, \quad (1)$$

Equation 1 shows that the y_{it} is the logarithm of TA number for the country at year t, x_{it} = (xT it,1, ... , xT it,p) T is ap × 1 vector of independent variables, and α_i denotes the (unobserved) country effect, which limits for time-invariant sources of unobserved heterogeneity, such as culture, history, geography, and formal institutions. ***Table 3.2*** indicates that the distribution of Gini, governance, globalization, and unemployment is platykurtic. While the distribution of patents granted, CO_2, Inflation, and GDP per capita are leptokurtic. Only the distribution of patent applications is roughly equal to 3, categorized as mesokurtic. Similarly, ***Table 3.2*** shows that none of the variables is normally distributed or has a 0 skewness value. Except for globalization and unemployment, all the variables positively skewed distribution. Resultantly, the distribution of the dependent variable is not

normally distributed. It is against the Gaussian distribution. The basic assumption of normal distribution of the error terms in the Ordinary Least Square method is not guaranteed, leading to incorrect conclusions. The quantile regression approach is superior to normal regression due to the following reasons. Several previous studies have used traditional regressions, which discuss the mean, while the quantile regression approach discusses the median. It can be represented by any points in the conditional distribution of the dependent variable, like the 25%, 50%, 90% quantile, or 35% quantile. The quantiles of the conditional distribution are described as linear functions of the independent variable in the regressions.

Panel quantile regression is a statistical method used to analyze panel data, which is a combination of cross-sectional and time-series data. In this method, the dependent variable and independent variables can be measured repeatedly over time for a set of individuals or units, such as countries, firms, or households. Panel quantile regression is useful in studying the relationship between variables across different quantiles of the dependent variable, which can provide more nuanced insights than traditional regression models that focus on the mean relationship. The panel quantile regression model can be expressed as:

$$y_{it} = X_{it}\beta(q) + \mu_{it}(q)$$

where y_{it} is the dependent variable for the i^{th} unit at time t, X_{it} is a vector of independent variables for the i^{th} unit at time t, $\beta(q)$ is the vector of coefficients for the qth quantile, and $\mu_{it}(q)$ is the error term. The goal of panel quantile regression is to estimate the coefficients for each quantile of the dependent variable and determine whether the relationship between the variables varies across the quantiles.

Panel quantile regression has several advantages over other regression models. Firstly, it allows for a more comprehensive analysis of the relationship between variables by examining the effects across different parts of the distribution of the dependent variable. Secondly, it is robust to outliers, as the estimation of the coefficients is based on the median of the distribution rather than the mean. Finally, panel quantile regression can control for unobserved heterogeneity across units, such as unobserved country-specific factors, by including fixed effects or random effects in the model.

In the past, several studies employed the OLS regression technique which focused on the mean and ultimately led to under/overestimation of the significant coefficient (Binder & Coad, 2011). However, quantile regressions have the advantage of being more robust to outliers than traditional mean regressions. When the residual series is not normal, quantile regression is more effective than the traditional OLS approach. Similarly, quantile regression gives a more flexible and full description, which is why the conditional quantile regression model with fixed effects is used in this study (Zhu et al., 2016).

Table 4.1 indicates the results of the quantile regression estimation technique at $\theta \in \{0.1, 0.25, 0.50, 0.75, 0.9\}$. However, the findings of the OLS estimate of fixed and random effect models are reported for comparison purposes.

Koenker and Bassett (1978) were the first ones who introduced the quantile regression approach in their seminal paper. This method is considered to generalize median regression analysis to other quantiles.

The conditional quantile of y_i given x_i is given as follows.

$$y_{it} = x_{it}\beta_{\circ} + \varepsilon_{\theta it} \quad (2)$$

With

$$Quantile_{\theta}(y_{it}|x_{it}) = x_{it}\beta_{\circ}$$

Where ***t*** denotes time, ***i*** denotes the country, y_{it} can be a dependent variable. At the same time, x_{it} is a vector of regressors, β is the vector of parameters to be estimated, and ε is a vector of residuals. Moreover, $Quantile_{\theta}(y_{it}|x_{it})$ denotes the θ^{th} conditional quantile of y_{it} given x_{it}. The θ^{th} regression quantile $0 < \theta < 1$ solves the following problem as:

$$\min_{\beta} \frac{1}{n}\{\sum_{i,t:y_{it}\geq x_{it}\beta} \theta\,|y_{it} - x_{it}\beta| + \\ + \sum_{i,t:y_{it}<x_{it}\beta}(1-\theta)\,|y_{it} - x_{it}\beta|\} = \\ = \min_{\beta} \frac{1}{n}\sum_{i=1}^{n} \rho_{\theta}\varepsilon_{\theta it} \quad (3)$$

Where $\rho_{\theta}(\cdot)$ is the "Check function" and this function can be defined as

$$\rho_{\theta}\varepsilon_{\theta it} = \begin{cases} \theta\varepsilon_{\theta it} & if\theta\varepsilon_{\theta it} \geq 0 \\ (\theta-1)\varepsilon_{\theta it} & if\theta\varepsilon_{\theta it} < 0 \end{cases} \quad (4)$$

Linear programming methods are used to solve ***Equation 3***. As it increases from 0 to 1, the whole conditional distribution of yit, conditional on xit, is traced (Buchinsky, 1998).

So, it is assumed that GINI is the function of PTG, PTA, GX, GLOB, CO2, GDP, UEN, and INF.

GINI	→	Income Inequality
PTG	→	Total patent granted
PTA	→	Total patent applications
GX	→	Governance Index
GLOB	→	Globalization
CO2	→	Carbon Emissions
GDP	→	Gross Domestic Product
UEN	→	Unemployment
INF	→	Inflation

And the linear equation can be written as

$$Q(GINI)_{it} = \alpha + \beta_1 PTG_{it} + \beta_2 PTA_{it} + \\ + \beta_3 GX_{it} + \beta_4 GLOB_{it} + \beta_5 CO2_{it} + \\ + \beta_6 GDP_{it} + \beta_7 UEN_{it} + \beta_8 INF_{it} + \varepsilon_{it}$$

Empirical Findings & Discussion

Firstly, the Hausman test has been performed, which is also known as the test for model misspecification in panel data estimation. It assists us in deciding between fixed-effects and the random-effects model. The null hypothesis indicates that the random effect model is valid, while the alternative hypothesis is that the fixed-effect model should be selected. If the p-value of the Hausman test is less than 5%, we can reject the null hypothesis.

H_0: RE ($\rho > 0.05$) **(2**

H_1: FE ($p < 0.05$) **(3**

The null hypothesis is rejected by the Hausman test; thus, we infer that the FE model's estimation results are more appropriate than the Random Effect model.

The model is estimated using POLS using FE panel data and RE panel data regression for a direct comparison. ***Tables 4.1*** show the regression findings for POLS and FE panel data and RE panel data in columns 1-2-3.

Except for the negative coefficients of patents granted, CO_2, and GDP per-capita, all significant coefficients in POLS are positive. However, the assumption of normality does not hold, which leads to inaccurate results. As a result, the quantile estimator is required to provide a more accurate answer. Furthermore, the model's coefficients can be estimated along with the demand distribution at various places.

To control distributional heterogeneity, the quantile regression technique with fixed effects can be used (Koenker, 2004). The panel quantile regression estimation findings are shown in ***Table 4.1***. The estimates are presented for the conditional distribution's 10th, 25th, 50th, 75th, and 90th percentiles. The empirical findings of the study show that the effects of different variables on Gini are highly unpredictable. In the case of Patent Granted, the impact on Gini is diverse. The coefficient patent granted has a positive and significant association with Gini at the 10th quantile, while insignificant at the 25%, 50%, 75%, and 95% quantiles. While the coefficient of Patent Application has an insignificant and positive relation with Gini at 25%, 50%, 75%, and 90% levels while significant and positive at 10

Table 4.1. Results of Quantile regression using Gini as the Dependent Variable

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**POLS**	**FE**	**RE**	**Quantile Regression**				
				10th	**25th**	**50th**	**75th**	**90th**
Constant	30.817***	34.29***	30.817***	29.032***	29.57***	34.732***	37.426***	36.935***
	(3.702)	(0.721)	(3.702)	(2.878)	(5.219)	(5.489)	(3.498)	(4.508)
Patent Granted	-0.131	0.269*	-0.131	2.179***	1.182	1.03	0.315	-0.139
	(0.781)	(0.16)	(0.781)	(0.607)	(1.101)	(1.158)	(0.738)	(0.951)
Patent Applications	2.24***	0.454***	2.24***	1.978***	2.597***	1.505***	1.595***	1.966***
	(0.374)	(0.094)	(0.374)	(0.291)	(0.528)	(0.555)	(0.354)	(0.456)
Governance	2.57***	-0.384***	2.57***	2.101***	1.903	2.331***	3.645***	3.889***
	(0.405)	(0.124)	(0.405)	(0.315)	(0.571)	(0.6)	(0.383)	(0.493)
Globalization	0.09	0.122***	0.09	0.158**	0.136	-0.099	-0.045	0.024
	(0.1)	(0.019)	(0.1)	(0.078)	(0.141)	(0.148)	(0.094)	(0.121)
CO_2	-1.02	2.446***	-1.02	-4.199***	-3.876	2.428	1	-0.978
	(1.738)	(0.591)	(1.738)	(1.351)	(2.449)	(2.576)	(1.642)	(2.116)
Gdppercapita	-0.001	-0.001***	-0.001	-0.001**	-0.001	0.001	-0.001	-0.001
	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.001)	(0.001)	(0.001)
Unemployment	0.906***	-0.128**	0.906***	0.491***	0.475**	1.182***	1.065***	0.937***
	(0.162)	(0.055)	(0.162)	(0.126)	(0.228)	(0.24)	(0.153)	(0.197)
Inflation	0.047	-0.039**	0.047	0.029	0.046	0.177	0.109	0.079
	(0.072)	(0.015)	(0.072)	(0.056)	(0.101)	(0.107)	(0.068)	(0.088)

Note: Standard errors are in parentheses below each parameter estimate. *Statistical significance at the 10% level. **Statistical significance at the 5% level. ***Statistical significance at the 1% level.

The findings of the study are consistent with Law et al. (2020), who examined the impact of technological change in determining income inequality in 23 advanced countries. The current study supports the hypothesis that there is a significant positive relationship between innovation and income inequality in selected South Asian countries. New

technologies are often applied by skilled labour exclusively, resultantly; in skilled people finding jobs in different new sectors and earning higher wages (the so-called skill premium), however, unskilled labours stay in traditional areas and earn prevailing wages; as a result, income inequality increases. Labours can adapt to cutting-edge technologies more quickly than others, earning an additional premium (Aghion, 2002).

Similarly, the coefficient of governance has a significant and positive relation with Gini in all percentiles except the 25th, and the findings of the study are similar (Huang & Ho, 2018). Promoting government effectiveness and regulatory quality may increase income inequality in an economy. The positive relationship between the coefficient of governance and the Gini coefficient is that better institutional quality attracts more investment, leading to greater economic growth and development. However, this growth may not benefit all segments of society equally, and some may be left behind. Additionally, better governance may lead to greater flexibility in labor markets, allowing firms to hire and fire workers more easily, which can result in greater income inequality. There is a trade-off between government intervention and efficiency. The greater the government intervention, the lower will be the government's efficiency (Ahrlind, 2021).

Moreover, globalization also shows a significant and positive relation with Gini at the 10th quantile, and it becomes insignificant at higher quantiles. Globalization can increase income inequality in developing countries through various channels. One of the channels is trade liberalization, which may lead to the displacement of workers in certain sectors and regions. This can result in a decline in wages and employment opportunities for low-skilled workers, leading to an increase in income inequality. Another channel is a foreign direct investment (FDI), which may lead to greater competition and productivity gains in certain sectors but may also lead to greater wage differentials between skilled and unskilled workers. Once the investment increases it generates employment opportunities for unskilled workers in labor-intensive countries like Pakistan, India, and Bangladesh (Çelik & Basdas, 2010).

In contrast, the impact of Gini on CO_2 is unclear, the coefficient of CO_2 is significantly negative at 10th percentiles but insignificantly negative at higher percentiles. Demir et al. (2019) argued that higher income inequality lowers aggregate consumption in the economy because wealthy households have a lower propensity to emit, resulting in better environmental quality. Grunewald et al. (2017); Ravallion et al. (2000) also found that CO_2 is associated with higher income inequality in low and middle-income economies. This can be interpreted as carbon emissions and economic growth interacting positively. Higher carbon emissions mean higher economic activity. However, economic growth and income inequality are negatively related. So, higher carbon emissions in an economy are a sign of lower income inequality (Ravallion et al., 2000).

The coefficient of GDP per-capita has insignificant and negative relation with Gini at all the percentiles except the 50th. The findings of the study are consistent with those (Barro, 2000; Steinmo, 2006; Sukiassyan, 2007), who found that income inequality and economic growth interact negatively in Asian countries. People in developing countries, usually, have credit constraints. They neither invest nor take part in any productive activity. As a result, income inequality could cause

social/political unrest, as well as a slowing of economic growth.

Similarly, the coefficient of inflation has an insignificant and positive relation with Gini. When it comes to inflation, price rises tend to outpace salary increases. As a result, income shifts away from wage earners toward profit earners. It is also believed that the increase in prices worsens economic disparity by harming the poor more than the wealthy (Nantob, 2015). A plethora of studies has found that inflation and income inequality have a positive relation (Al-Marhubi, 2000; Albanesi, 2007; Beetsma & Van Der Ploeg, 1996; Romer & Romer, 1998). One possible interpretation of this phenomenon is given by (Galbraith et al., 1999). He claimed that countries with low average incomes are characterized by many relatively poor individuals working in low-wage employment, resulting in high-income inequality across occupations, industries, and sectors. Many such persons seek any available exit from their condition. They seek alternatives, even if they realize that the prospects priori of getting much better employment are limited. In other words, so long as tempting alternatives to low-income employment exist, even when they are not publicly available, people form queues of the unemployed.

However, the coefficient of unemployment has a significant and positive relation with Gini at all percentiles. An increase in unemployment shifts the shape of the income distribution among households, with the shares of the top groups, particularly the top decile, rising (Nolan, 1986). Purchasing power: Inflation reduces the purchasing power of a currency, which means that the same amount of money can buy fewer goods and services than before. This can disproportionately affect low-income individuals who rely on fixed incomes or wages that do not keep up with inflation. As a result, they may have to spend a larger portion of their income on necessities, such as food and housing, leaving less money for other expenses. Inflation can also affect the value of assets, such as real estate and stocks. People who own assets that appreciate, such as real estate, stocks, or other investments, can benefit from inflation because the value of their assets increases. However, those who do not own such assets, or have limited access to them, may not benefit from inflation and may even see the value of their savings decline in real terms. Similarly, inflation can lead to wage stagnation, where wages do not keep up with the rising cost of living. This can disproportionately affect low-income workers who are already struggling to make ends meet. Additionally, when inflation is high, employers may be more hesitant to increase wages, which can exacerbate income inequality. Moreover, inflation can also affect interest rates, which can impact borrowing and lending. High inflation rates may lead to higher interest rates, making it more expensive for individuals to borrow money. This can be particularly challenging for low-income individuals who may rely on credit to make ends meet. Countries with minimal inequality, because of better institutions, have lower unemployment rates than those that do not.

Conclusion

A plethora of literature has analyzed the nexus between technological change and income inequality because innovation promotes economic growth and plays a vital role in determining income inequality. This study uses panel-data techniques to investigate the possible determining factor of income inequality in selected South Asian countries (after dropping the four countries due to the

unavailability of the data) from 2000 to 2019. The panel-data technique has been employed in this study. The study concentrates on South Asian economies since these economies are less innovative than developed countries, while income inequality in advanced countries has increased emphatically throughout recent years. Economists believe that there could be several potential determinants behind this increasing trend of inequality, including innovation, economic growth, inflation, governance, globalization, and unemployment. These factors are found to be widened income inequality. This present research re-examines the role of innovation, governance, globalization, carbon emissions, GDP per-capita, unemployment, and inflation in determining income inequality. The panel quantile econometric approach has been employed to check the Schumpeterian hypothesis. The empirical findings of the study show that innovation and Gini have a statistically significant and positive relationship with each other. Innovation, especially the number of patent applications, widens income inequality. Moreover, empirical evidence also shows that CO_2 and GDP per-capita interact negatively with income inequality or reduce income inequality in selected South Asian countries. It is also found that higher inflation, globalization, governance, and higher unemployment increase income inequality. The number of patent applications and patents granted are used as the proxy for innovation; however, by using the global innovative index, one could examine whether the innovative index also shares similar results or not. Furthermore, several other potential variables, such as industrial structure and international trade, could also influence income inequality, and future researchers can explore these possibilities.

Policy Recommendation

Innovation can play a significant role in reducing income inequality in South Asian countries by creating job opportunities, increasing productivity and efficiency, and promoting economic growth. Through innovation, people can access technology that can help them learn new skills, expand their businesses, and improve their standard of living. It can also lead to skill development, encourage entrepreneurship, and create new social safety net programs that support low-income households and vulnerable groups. Furthermore, innovation can help to improve infrastructure development, which can create job opportunities and improve access to basic services. Policymakers and businesses should prioritize investing in innovation to ensure that the benefits of technological advancements are distributed more equally.

The governance in South Asian countries plays a crucial role in mitigating income inequality by promoting equal access to opportunities, services, and resources through various policies and measures. A progressive taxation system is an effective tool that can help redistribute wealth and income from the wealthy to the poor, thus reducing income inequality. Investments in education and healthcare can provide equal access to opportunities and services, leading to long-term reductions in income inequality. Effective social safety net programs targeting vulnerable groups can alleviate poverty and income inequality. Creating more jobs in sectors that employ low-skilled workers can also promote economic growth and help reduce income inequality. Addressing corruption in public institutions and promoting transparency and accountability can ensure that public resources are used efficiently and effectively, benefiting all citizens.

Governments can use these tools to promote more equitable income distribution, reduce poverty, and foster a more prosperous and inclusive society in South Asian countries.

Globalization can reduce income inequality by creating new economic opportunities and increasing access to international markets. Increased trade and foreign investment can lead to greater economic growth and job creation, especially in sectors that employ low-skilled workers. This can help to reduce poverty and increase incomes, thereby reducing income inequality. Globalization can also lead to greater access to education, technology, and healthcare, which can help to create a more skilled workforce and promote greater economic participation. Additionally, globalization can foster greater competition, leading to greater efficiency and lower prices, benefiting consumers, especially the poor. However, to ensure that the benefits of globalization are shared equitably, governments must ensure that the gains from trade and investment are distributed fairly, and social safety nets are in place to protect vulnerable groups.

GDP per capita, inflation, and unemployment can all play a role in reducing income inequality in South Asian countries. A higher GDP per capita implies a larger economic pie to be shared among the population, potentially reducing income inequality. Low inflation rates help maintain the purchasing power of the poor, thereby reducing their vulnerability to inflationary shocks, which can worsen income inequality. Lower unemployment rates mean more people have jobs and incomes, reducing poverty and income inequality. However, these factors alone may not be sufficient to reduce income inequality, and additional measures such as progressive taxation, investments in education and healthcare, social safety nets, and targeted job creation may be needed to achieve a more equitable income distribution in South Asian countries.

Limitations of the Study

The conclusion of the study is based on the number of patent applications and patents granted, which are used as proxy variables for innovation and it's important to check if the innovative index reveals similar results. Similarly, there are other potential variables, such as a change in industrial structure, foreign trade, human development index, and urbanization that could potentially affect income inequality. Future studies may investigate these possibilities.

References

Acemoglu, D., & Autor, D. (2011). Skills, tasks and technologies: Implications for employment and earnings. In *Handbook of labor economics* (Vol. 4, pp. 1043-1171). Elsevier.

Adelman, I., Morris, C. T., Fetini, H., & Golan-Hardy, E. (1992). Institutional change, economic development, and the environment. *Ambio*, 106-111.

Aghion, P. (2002). Schumpeterian growth theory and the dynamics of income inequality. *Econometrica*, *70*(3), 855-882.

Aghion, P., Ljungqvist, L., Howitt, P., Howitt, P. W., Brant-Collett, M., & García-Peñalosa, C. (1998). *Endogenous growth theory*. MIT press.

Ahrlind, K. (2021). Governance and income inequality: A panel data analysis on the relationship between the quality of government and the Gini index. In.

Akinbobola*, T., & Saibu, M. (2004). Income inequality, unemployment, and poverty in Nigeria: a vector autoregressive approach. *The Journal of Policy Reform*, *7*(3), 175-183.

Akram, Z., Wajid, S., Mahmood, T., & Sarwar, S. (2011). Impact of poor governance and income inequality of poverty in Pakistan. *Far East Journal of Psychology and Business*, *4*(3), 43-55.

Al-Marhubi, F. A. (2000). Income inequality and inflation: the cross-country evidence. *Contemporary Economic Policy*, *18*(4), 428-439.

Albanesi, S. (2007). Inflation and inequality. *Journal of Monetary Economics*, *54*(4), 1088-1114.

Antonelli, C., & Gehringer, A. (2013). *Innovation and income inequality*.

Antonelli, C., & Gehringer, A. (2017). Technological change, rent and income inequalities: A Schumpeterian approach. *Technological Forecasting and Social Change*, *115*, 85-98.

Asteriou, D., Dimelis, S., & Moudatsou, A. (2014). Globalisation and income inequality: A panel data econometric approach for the EU27 countries. *Economic Modelling*, *36*, 592-599.

Atif, S. M., Srivastav, M., Sauytbekova, M., & Arachchige, U. K. (2012). Globalisation and income inequality: a panel data analysis of 68 countries.

Autor, D. H., Levy, F., & Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. *The quarterly journal of economics*, *118*(4), 1279-1333.

Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. *Journal of economic growth*, *5*(1), 5-32.

Beetsma, R. M., & Van Der Ploeg, F. (1996). Does inequality cause inflation?: The political economy of inflation, taxation and government debt. *Public Choice*, *87*(1), 143-162.

Bergh, A., & Nilsson, T. (2010). Do liberalization and globalisation increase income inequality? *European Journal of political economy*, *26*(4), 488-505.

Binder, M., & Coad, A. (2011). From Average Joe's happiness to Miserable Jane and Cheerful John: using quantile regressions to analyze the full subjective well-being distribution. *Journal of Economic Behavior & Organization*, *79*(3), 275-290.

Blinder, A. S., & Esaki, H. Y. (1978). Macroeconomic activity and income distribution in the postwar United States. *The Review of Economics and Statistics*, 604-609.

Bottazzi, L., & Peri, G. (2003). Innovation and spillovers in regions: Evidence from European patent data. *European economic review*, *47*(4), 687-710.

Brzezinski, M. (2018). Income inequality and the Great Recession in Central and Eastern Europe. *Economic Systems*, *42*(2), 219-247.

Buchinsky, M. (1998). Recent advances in quantile regression models: a practical guideline for empirical research. *Journal of human resources*, 88-126.

Castells-Quintana, D., & Royuela, V. (2012). Unemployment and long-run economic growth: The role of income inequality and urbanisation. *Investigaciones Regionales-Journal of Regional Research*(24), 153-173.

Çelik, S., & Basdas, U. (2010). How does globalisation affect income inequality? A panel data analysis. *International advances in economic research*, *16*(4), 358-370.

Chong, A., & Calderon, C. (2000). Institutional quality and income distribution. *Economic Development and Cultural Change*, *48*(4), 761-786.

Coccia, M. (2021). How a good governance of institutions can reduce poverty and inequality

in society? In *Legal-Economic Institutions, Entrepreneurship, and Management* (pp. 65-94). Springer.

Cysne, R. P., Maldonado, W. L., & Monteiro, P. K. (2005). Inflation and income inequality: A shopping-time approach. *Journal of Development Economics*, *78*(2), 516-528.

D Ostry, J., Berg, A., & Tsangarides, C. G. (2014). Redistribution, inequality, and growth. *Revista de Economía Institucional*, *16*(30), 53-81.

Deaton, A. (2013). The great escape. In *The Great Escape*. Princeton University Press.

Demir, C., Cergibozan, R., & Gök, A. (2019). Income inequality and CO2 emissions: Empirical evidence from Turkey. *Energy & Environment*, *30*(3), 444-461.

Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. *American economic review*, *90*(4), 869-887.

Forum, W. E. (2014). *Can innovation beat inequality?*

Galbraith, J. K., Conceição, P., & Ferreira, P. (1999). Inequality and unemployment in Europe: The American cure.

Grunewald, N., Klasen, S., Martínez-Zarzoso, I., & Muris, C. (2017). The trade-off between income inequality and carbon dioxide emissions. *Ecological Economics*, *142*, 249-256.

Hailemariam, A., Dzhumashev, R., & Shahbaz, M. (2020). Carbon emissions, income inequality and economic development. *Empirical Economics*, *59*(3), 1139-1159.

Hasan, I., & Tucci, C. L. (2010). The innovation–economic growth nexus: Global evidence. *Research policy*, *39*(10), 1264-1276.

Helpman, E. (2009). *The mystery of economic growth*. Harvard University Press.

Huang, C.-J., & Ho, Y.-H. (2018). The Impact of Governance on Income Inequality in Ten Asian Countries. *Journal of Reviews on Global Economics*, *7*, 217-224.

Iqbal, A., & Mehar, A. (2015). Governance Issues in Pakistan and their Impact on Income Inequality. *IBT Journal of Business Studies (JBS)*, *2*(2).

Jaffe, A. B. (1986). Technological opportunity and spillovers of R&D: evidence from firms' patents, profits and market value. In: national bureau of economic research Cambridge, Mass., USA.

Jones, C. I., & Kim, J. (2018). A Schumpeterian model of top income inequality. *Journal of Political Economy*, *126*(5), 1785-1826.

Kaldor, N. (1956). Alternative Theories of Distribution, in "Review of Economic Studies", vol. 23.

Katz, L. F., & Murphy, K. M. (1992). Changes in relative wages, 1963–1987: supply and demand factors. *The quarterly journal of economics*, *107*(1), 35-78.

Kierzenkowski, R., & Koske, I. (2013). The drivers of labor income inequality—A literature review. *Journal of International Commerce, Economics and Policy*, *4*(01), 1350004.

Kinugasa, T. (1998). The Schumpeterian hypothesis and technical change. *International Journal of Social Economics*.

Koenker, R. (2004). Quantile regression for longitudinal data. *Journal of Multivariate Analysis*, *91*(1), 74-89.

Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica: journal of the Econometric Society*, 33-50.

Kunawotor, M. E., Bokpin, G. A., & Barnor, C. (2020). Drivers of income inequality in Africa:

Does institutional quality matter? *African Development Review*, *32*(4), 718-729.

Kuznets, S. (1955). Economic Growth and Income Inequality. The American Economic, 45 (1), 1–28. In.

Kyroglou, G. (2017). The Importance of Income Inequality at the Top End of the Distribution as Opposed to the Bottom End as Determinant of Growth. In.

Law, C.-H., & Soon, S.-V. (2020). The impact of inflation on income inequality: the role of institutional quality. *Applied Economics Letters*, *27*(21), 1735-1738.

Law, S. H., Naseem, N., Lau, W. T., & Trinugroho, I. (2020). Can innovation improve income inequality? Evidence from panel data. *Economic Systems*, *44*(4), 100815.

Lemieux, T. (2008). The changing nature of wage inequality. *Journal of population Economics*, *21*(1), 21-48.

Monnin, P. (2014). Inflation and income inequality in developed economies. *CEP Working Paper Series*.

Mutero, J. (2021). Foreign Market Entry Strategies and Competitive Advantage of Fintech Companies in Kenya. *Available at SSRN 3995272*.

Nantob, N. (2015). Income inequality and inflation in developing countries: An empirical investigation. *Economics Bulletin*, *35*(4), 2888-2902.

Nolan, B. (1986). Unemployment and the size distribution of income. *Economica*, 421-445.

Okun, A. M. (1975). Equality and Efficiency: The Big Tradeoff, the Brookings Institution. *Washington, DC*.

Perera-Tallo, F. (2017). Growing income inequality due to biased technological change. *Journal of Macroeconomics*, *52*, 23-38.

Ravallion, M., Heil, M., & Jalan, J. (2000). Carbon emissions and income inequality. *Oxford Economic Papers*, *52*(4), 651-669.

Rhee, D.-E., & Kim, H. (2018). Does income inequality lead to banking crises in developing countries? Empirical evidence from cross-country panel data. *Economic Systems*, *42*(2), 206-218.

Rojas-Vallejos, J., & Lastuka, A. (2020). The income inequality and carbon emissions trade-off revisited. *Energy Policy*, *139*, 111302.

Romer, C. D., & Romer, D. H. (1998). Monetary policy and the well-being of the poor. In: National bureau of economic research Cambridge, Mass., USA.

SAIR. (2019). *Growing Inequality in South Asia*. S. A. A. f. P. E. S. Secretariat.

Samargandi, N. (2018). Determinants of labor productivity in MENA countries. *Emerging Markets Finance and Trade*, *54*(5), 1063-1081.

Schumpeter, J. A. (1947). The creative response in economic history. *The journal of economic history*, *7*(2), 149-159.

Shin, I. (2012). Income inequality and economic growth. *Economic Modelling*, *29*(5), 2049-2057.

Solt, F. (2016). The standardized world income inequality database. *Social science quarterly*, *97*(5), 1267-1281.

Steinmo, S. (2006). Confronting Income Inequality in Japan. A Comparative Analysis of Causes, Consequences, and Reform. In: JSTOR.

Sukiassyan, G. (2007). Inequality and growth: What does the transition economy data say? *Journal of comparative economics*, *35*(1), 35-56.

Tachibanaki, T. (2009). Confronting income inequality in Japan: A comparative analysis of

causes, consequences, and reform. *MIT Press Books*, *1*.

Tebaldi, E., & Elmslie, B. (2013). Does institutional quality impact innovation? Evidence from cross-country patent grant data. *Applied Economics*, *45*(7), 887-900.

UNDP. (2015). *Work for Human Development. Human Development Report*.

Wang, C. (2013). Can institutions explain cross country differences in innovative activity? *Journal of Macroeconomics*, *37*, 128-145.

WIL. (2022). *World Income Inequality Report 2022*.

WLI. (2018). *World Income Inequality Report 2018*.

Włodarczyk, J. (2020). Gender differences in income distributions in Poland. *Nierówności społeczne a wzrost gospodarczy*(63), 210-232.

Zhu, H., Duan, L., Guo, Y., & Yu, K. (2016). The effects of FDI, economic growth and energy consumption on carbon emissions in ASEAN-5: evidence from panel quantile regression. *Economic Modelling*, *58*, 237-248.

Weinhold, D., & Nair-Reichert, U. (2009). Innovation, inequality and intellectual property rights. *World Development*, *37*(5), 889-901.

Acemoglu, D., Aghion, P., Bursztyn, L., & Hemous, D. (2012). The environment and directed technical change. *American economic review*, *102*(1), 131-166.

Aghion, P., Akcigit, U., Bergeaud, A., Blundell, R., & Hémous, D. (2019). Innovation and top income inequality. *The Review of Economic Studies*, *86*(1), 1-45.

Menna, L., Tirelli, P., 2017. Optimal inflation to reduce inequality. Rev. Econ. Dyn. 24, 79–94.

Yang, Y., Greaney, T.M., 2017. Economic growth and income inequality in the Asia-Pacific region: a comparative study of China, Japan, South Korea, and the United States. J. Asian Econ. 48, 6–22.

Nantob, N., 2015. Income inequality and inflation in developing countries: an empirical investigation. Econ. Bull 35 (4), 2888–2902.

Chong, A., Gradstein, M., 2007. Inequality and institutions. Rev. Econ. Stat. 89 (3), 454–465.

Lin, F., Fu, D., 2016. Trade, institution quality and income inequality. World Dev. 77, 129–142.

Bergh, A., Nilsson, T., 2010. Do liberalization and globalization increase income inequality? Eur. J. Polit. Econ. 26, 488–505.

Mah, J.S., 2013. Globalization, decentralization and income inequality: the case of China. Econ. Model. 31, 653–658.