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Economic Gains and Losses for Sustainable Policy Development of Crude Oil Resources: A Historical Perspective of Indian Subcontinent

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ABSTRACT

Energy fluctuations and global economic directly hit the Indian Subcontinent (Geopolitically, it generally includes the countries of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) economy and social welfare, which are the net importer of energy sources. This study investigates the relationship between strategic petroleum reserves and welfare losses for the Indian Subcontinent. The breakdown of the crude oil energy supply significantly impacts energy security and and welfare losses. Oil supply security was quantified in terms of the Indian Subcontinent's oil vulnerability index (which accounts for 84% of global oil imports), and welfare losses based on oil supply disruption were calculated. Afghanistan is the most susceptible country in the Indian Subcontinent regarding energy reserves, as per the composite index results, whereas India is the least vulnerable. Empirical findings pointed to a 30% oil supply deficit as the cause of the most volatile pattern of oil pricing, which exacerbates the estimated welfare loss by a 40% drop in GDP, which is around $700 in the Indian Subcontinent $9000 in the top oil-consuming countries. According to this analysis, the Indian Subcontinent should keep at least a hundred days' worth of strategic oil resources to avert social and economic losses due to oil price fluctuations.

Keywords: Oil Supply Security; Unit of GDP; Energy Reserves; Energy Fluctuations and Global Economic; Indian Subcontinent
JEL Classifications: O1, O13, Q01

1. INTRODUCTION

Energy is the main source of economic growth and the most effective means of alleviating poverty. On the other hand, energy sources are a major contributor to poverty and human health problems. As a result, it has a multi-faceted impact on human welfare, economic advancement, and environmental protection (Akhmetov, 2015). Indian Subcontinent primary energy consumption has an increasing trend from year to year (Shahzad et al., 2022). In 2018, it reached 938.5985 million metric tons of oil equivalent, up from 384.3405 million in 2000 (Fuligni and Zhang, 2004). Unfortunately, filthy energy sources such as fossil fuels strongly rely on this massive increase in energy use. Renewable energy share in the Indian Subcontinent's consumed energy has a decreasing trend as it was 52.90% in 2000, while 37.47% in 2018 (Khokhar et al., n.d.). It has happened to the Indian Subcontinent when the World spent enormous amounts of money and time developing and adopting new renewable, sustainable, and cost-efficient energy sources. It might happen because Indian Subcontinent countries lack the financial resources to build an efficient renewable energy source to support economic growth (Ma et al., 2021).

Large energy intensity and a high fraction of import-based energy usage are two more negative energy utilization variables in the Indian Subcontinent (Hou et al., 2021). Due to its poor energy source, one unit of GDP requires much energy to convert. (Akhtar et al., 2020). Import-based power exerts direct pressure on macroeconomic variables such as the rate of exchange, current account deficit, and debt burden, among others. As a result, the Indian Subcontinent's energy sources are inextricably linked to people's well-being.(Beccue et al., 2018).

There are four essential concerns regarding searching for a sustainable solution to energy supply failure. First, the supply interruption magnitude is sufficient to employ strategic petroleum reserves (SPR) (Wang and Sun, 2017). Second, the economic consequences of not maintaining SPR in reserve are significant. (Kanamura, 2019). Third, lacking SPR, macroeconomic indicators become unstable, resulting in significant social and economic losses. Fourth, if the Indian Subcontinent (which is the region of the World's most impoverished people) does not maintain its SPR (Liao et al., 2016), the market fluctuations directly hit ordinary people's welfare as income elasticity toward necessities is very high in this region (Abdel-Latif and El-Gamal, 2019).

Although the collaborative development of the Indian Subcontinent began with a metropolitan circle in the 1982 plan for cooperative urban construction and petroleum reserves, progress was gradual for many years (Ercolano and Romano, 2018). Nonetheless, since the concept of regional integration was first proposed in 2013, progress has been faster (Iliopoulou et al., 2018). In 2014, regional collaborative development (regional growth) was elevated to national policy (Khan et al., 2020). After five years of implementation, the regional integration plan has made great progress. Some of the most obvious instances include increasingly visible synergistic effects, incremental acceleration in traffic integration, constant strengthening of collaboration on eco-environmental security, and ongoing technical advancements and transfers. Even so, according to (Zhang et al., 2017), urban agglomeration and strategic petroleum reserves in this integration at a regional level are the places with the Indian Subcontinent's most apparent discrepancy between economic growth and environmental capital. Indian Subcontinent is reportedly the seventh-largest economic progress hub, followed by metropolitan Chinese regions (Blonigen, 2019).

Even though the Indian Subcontinent is heavily reliant on imported oil in today's world, where countries are increasingly turning to renewable energy sources, this project aims to assess SPR opportunities in this region to improve welfare and mitigate the effects of oil market fluctuations (Zeb Khaskhelly et al., 2022). The two-period model was used because of its flexibility in considering import tariffs, SPR growth, and volume. The relevance of confronting the global economy, shifting cut-off markets, and the fact that SPR choices may reduce/safeguard unfavorable economic disruptions with major oil supply decreases are all discussed in the paper (Zhang et al., 2019). Governments across the Indian Subcontinent have implemented various initiatives to investigate the impact of SPR on social and economic well-being. Such programs have made significant progress in encouraging long-term growth and lowering welfare losses caused by growing SPR (Ahmed et al., 2022). We conducted a full policy review of the regional approach to understand policy enforcement implications better and provide evidence for potential policy adjustments (Hailiang et al., 2023). The Indian Subcontinent is an example in this research to assess the strategy's economic and welfare effects (Khokhar et al., n.d.). The Indian Subcontinent SPR will reach the goal SPR in 2030 in 100 days, according to this analysis. SPR strategy is critical for demonstrating economic efficiency and welfare increase in the region (Begum Siddiqui et al., 2023a).

This research has been important due to the obvious macro-attention through which it will be objectively explored across numerous academics (Yumei et al., 2020). More significantly, the Indian subcontinent's numbers have not yet been positive. Over 1.2 billion people live in poverty, earning less than $1 daily (Khokhar et al., 2020). Most of these folks live in developing nations, with 6.5% being from Eastern Asia, 24% from Sub-Saharan Africa, and 44% from Southern Asia (Khaskhelly et al., 2023). In explaining economic growth, Nigeria, as a hydrocarbon economy, has recently emerged from a recession prompted mostly by the instability of global crude oil prices, a key feature of the resource curse. Someone could easily argue that being connected to multiple in developing nations is a curse (Irshad et al., 2019). Many of these nations are characterized by corruption in the form of school fund misappropriation, contract diversion, political assassinations, a permeable and ineffective health system, and so on (Bhar and Malliaris, 2011).

The remainder of the study has the following structure: the methodology described in section 2, obtained results presented and discussed in section 3. In contrast, section 4 presents a conclusion in terms of the summarized findings of the study.

2. LITERATURE REVIEW

Earlier studies attempted to assess the risk of oil supply shortages (Ciaschini et al., 2013) and (Sueyoshi and Wang, 2017). Responding to criticism of the SPR technique, it was previously thought that the approach was ineffectual due to the method of employment, lengthy processing, and strength demonstrated in employing it. However, if decision-making rules are modified, SPR cost-efficiency may improve, enabling more rapid use of SPR to handle swings in oil price expectations (Waseem et al., 2022).

2.1. Diversity in Oil Supply Source

Much research looked at diversifying an oil supply source to reduce the risk of interruption from a single source. The disparity between oil consumption and production in developing economies is anticipated to widen over time (Zhang et al., 2009). Due to a fast-rising population, a disparity between producer and consumer tastes, and a heavy reliance on imported oil-based energy, oil supply disruptions occur in many parts of the world (Mothafar et al., 2022). These countries have established their strategic petroleum reserve (SPR) to avoid market imbalance, which is emergency oil storage maintenance for the economic process's smooth function (Klemas, 2013). This SPR is generally considered an operative way against the undesirable effects of oil supply disruption due to global political or financial crises (Pontee et al., 2016), (Kundu and Santhanam, 2021) and (Nayak, 2020). Therefore, considering oil supply as a depletion resource, it is necessary to categorize and monitor the global oil supply procedure threats due to oil supply disruption and quantify the general public's welfare losses (Hou et al., 2022).

The longevity of the pandemic, as per (Quispe et al., 2020), limits sustainable development and destabilizes the oil market. Oil prices, on the other hand, climbed to 67.73 USD/bbl. Somewhere at the end of April 2021, according to official figures. As a result, we can reference the contrasting findings of (2005) scientific investigations on the extent of the pandemic's damaging impact on the price of crude oil in the medium to long term (Song et al., 2017). At the same time, as these variables are important contributors to an oil price discrepancy, none is adequate, like a stand-alone justification (Begum Siddiqui et al., 2023b). Given the consumer market's unpredictability and resource economies' failure to decide on an efficient price-balancing method, it could be claimed that irrational trader conduct in the oil market has a considerable impact on price levels (Agustira and Rañola, 2017). Despite making suggestions to address derivatives market transparency, the International Organization of Securities Commissions (IOSCO) stated that there had been no convincing evidence of a regular effect of financial gamblers on oil price changes. According to subsequent studies, financial speculators need not consistently influence the instability of primary and, specifically, oil prices. Still, they do have a determinant role in uncertain times and fear. Volatility in the consumption of oil futures contracts sparked fear among external shareholders in April 2020 (Khokhar et al., 2022). This uncertainty stemmed from both objective and subjective causes (declining output, transportation, and poor global economic forecasts). As a result, it is reasonable to expect such financial investors, while not determining the overall direction of oil prices, can sometimes enhance or destabilize them. This fear reflects in the danger of oil futures markets and other contracts not being realized, lowering oil prices (Rafique et al., 2022).

2.2. Financial Globalisation and Environnemental Quality Research

Ahmad et al. (2022) investigated the impact of globalization, energy use, and financial development on environmental quality in Indian subcontinent countries from 1990 to 2014 (Khokhar et al., 2022). To confirm long-term associations between variables, the researchers used a variety of cross-sectional tests, second-generation stationarity tests, and panel integration tests. The findings show a one-way causal relationship between globalization and environmental quality, confirming that globalization improves environmental quality and implying that countries should prioritize globalization and promote the inflow of green technologies. (Bhar and Malliaris, 2011) investigate the factors that influence the environmental footprint, focusing on the effectiveness of financial development. The authors used robust estimates from second-generation tests to examine the 15 countries with the highest emissions from 1990 to 2017 (Li et al., 2017). According to the findings, financial development and other control variables reduce environmental damage. In contrast, (Murphy and Oliveira, 2010) looked into the impact of financial indices on G7 countries' environmental indices (Hou et al., 2021). According to the authors, financial and environmental indicators correlate significantly. Put another way, for every unit increase in the financial index, the environmental index rises by 0.01 units (Khokhar, 2019).

2.3. Globalization Contribution

For example, look at EKC assumptions in China from 1980 to 2016. The research uses a newly developed augmented ARDL technique to show that the EKC hypothesis does not exist in the countries studied. To the increase in environmental pollution. In contrast, the empirical findings of (Waisman et al., 2013) show that economic growth and natural resources contribute positively to CO_2 emissions, but globalization aids China's environmental quality. However, (Murphy and Oliveira, 2013) assert in their empirical findings that EKC is effective for China by analyzing quarterly data. Furthermore, tourism produces positive environmental externalities in China, whereas globalization produces negative environmental externalities, supporting the latter study. Scholars have empirically made controversial conclusions similar to the discussion above. On the one hand, some researchers have discovered that globalization increases carbon dioxide emissions and degrades the environment (Difiglio, 2014). On the other hand, other authors discuss globalization's benefits regarding environmental degradation (Fantazzini et al., 2011).

This collection of studies explains the critical role that has been funded by geographical constrictions, geopolitical measurements, official inactions, and damaged precautions on short-run oil supply flexibility (Wang and Sun, 2017), (Aleksandrov et al., 2013) and (Kanamura, 2019). The financial impact of supply or price disruptions of oil is significant and wide-ranging (Bhar and Malliaris, 2011). The oil price shocks of the 1970s resulted from the initial momentum of building the backup plan of petroleum reserves as significant macroeconomic disruptions happened in the oil-importing countries (Irshad et al., 2019). Due to the 1973 oil crisis, the phenomena of petroleum stockpiling arose as one of the primary policy tools for the number of OECD countries to recognize the International Energy Agency (IEA) to manage responses to oil market disruptions (Beccue et al., 2018) and (Timilsina, 2014). This study examines the strategic petroleum reserve option for Indian Subcontinent countries as they have been the net oil importer since 1993. Due to this vulnerability, this issue is expected to grow. This study will help fill the literature gap of SPR and stockpiling with the Indian Subcontinent particular contest.

3. METHODOLOGY

Since 1998, oil production has decreased, but oil consumption has surged in the Indian Subcontinent. Further oil imports in this situation could increase oil prices in the future (Boumans et al., 2015), (Zhang et al., 2009). Very few studies have assessed the relationship between strategic petroleum reserves and welfare losses. For such purpose, a flexible model incorporating the two-period was used by (Srivastava et al., 2010) to evaluate China's optimum tariff quantity and stockpile volume by dividing provinces into two classes: the treatment and control groups. The former consists of the provinces handled by the Indian Subcontinent strategy, while the latter represents those left out of the former group.

One y_{it}^{1} and y_{it}^{0} be the ith province outputs for the regional and control group, respectively, where t denotes the strategy when there is no policy employment, $t \in \{1 \ldots T_1\}$), $y_{it}^{1} = y_{it}^{0}$. On the other hand, ononey y_{it}^{1} can be observed in the case of the provinces under treatment (i.e. $t \in \{T_1 + 1 \ldots T\}$). y_{it}^{0} cannot be observed as it occurs with no regional strategy, nlonly y_{it}^{0} , $t = T_1 + 1, \ldots, T$ can be studied in the case of uncontrolled provinces. The treated province in the year t is observed through the following relationship:

$$\Delta_{it} = y_{it}^{1} - y_{it}^{0}\, t = T_1 + 1, \ldots., T, \tag{1}$$

However, there cannot be a simultaneous observation for both y_{it}^{1} and y_{it}^{0} and the data at observation y_{it} can be defined as follows:

$$y_{it} = d_{it} y_{it}^{1} + (1 - d_{it}) y_{it}^{0} \tag{2}$$

Where the weight $d_{it} = 1$ in the presence of a regional strategy, while $d_{it} = 0$ in the other case.

In the present work, the treatment group consists of Indian Subcontinent countries. It assumed that i = 1 is the case of Indian subcontinent countries strategy while i = 2,…N denotes control group provinces.—thedata in this study cwas collected from the National Bureau of Statistics. An econometric model is employed to construct the ex-post counterfactual data sub 1 t to the 0 Quasi-experimental techniques to obtain the counterfactuals when the treatment is not a randomized control trial. For example, regression discontinuity, instrumental variables, and propensity score matching mixed with differences-in-differences. On the other hand, such approaches were developed based on some ideas, sufficient data, and economic models. (Smit et al., 1999). Several non-theoretical strategies, including as the panel data approach as well as the synthetic control system, are often utilized in addition to the methods indicated above that focus on the calculation of theory (Moser and Ekstrom, 2010) and (Saseendran et al., 2000).

The PDA employs ordinary minus squares (OLS) to calculate control unit weights, whereas the SCM analyses covariate weights. The SCM requires that the weights of the control group provinces be non-negative and add up to one. It is impossible to extrapolate the managed units far beyond the convex hull of the covariates. However, (2012) argues that the convex hull SCM restrictions are insufficient or automatically fulfilled in several situations. Furthermore, PDA has no limit on the province weights. The price of the oil is defined as the market starting point. The overall expense of Indian subcontinent oil market instability is viewed as getting the SPR strategy without an oil import tariff and is typically equivalent to an import quota, which is given as:

$$TCSA\left(S,i,s,t\right) = \int_{Pb_t}^{P(S(t),i,t)} D_{SA}\left(p,t\right)dp + P\left(s\left(t\right),i,t\right).s\left(t\right) + UHC.\left[S\left(t\right) + s\left(t\right)\right] \tag{3}$$

Pb_t represent the standard state oil prices in the absence of SRR attainment, which is assumed to be the threshold oil price for the period t; D_{SA} represents the oil import demand of Indian subcontinent, UHC represents the yearly unit SPR cost of holding, while S(t) represents the commencement SPR size in the period t. Equation (3) is the representation of the total cost of insecurity of the Indian subcontinent oil market (indicated as TCSA), which can divide into three parts: the surplus loss of Indian subcontinent consumer due to an enflamed oil market because of the rising demand-interrupted stock/supply of oil; revenue of sales or cost of purchase stockpile; and the stockpile holding costs (Pimentel, 1996).

3.1. Environmental Government Spending (ENE)

We utilize the share of prefecture-level community environmental protection expenditure in local financial spending to compute environmental investment by the policy because of the considerable discrepancy in policy financial power at various city rates. (Kitamura and Managi, 2017) and (de Castro et al., 2009). In this study, the level of environmental protection is calculated using the value-added manufacturing ratio to the production of major pollutants. Industrial dust, wastewater, and sulphur dioxide were chosen as the toxins. Using the above 3 major pollutant emissions and the data of each city's industrial production volume, the comprehensive index of environmental control is developed to check the findings' credibility. It is stated mathematically as follows:

$$ER_{it=} \frac{1}{3}\sum\nolimits_{i=1}^{3} E_{1,it} = \frac{1}{3}\sum\nolimits_{i=1}^{3} \frac{\sum I,it}{\hat{E}_{it}} = \frac{1}{3}\sum\nolimits_{i-1}^{3} \frac{er_{I,it} / Y_{it}}{\sum\nolimits_{i-1}^{273} er_{I,it} / Y_{it}} \tag{4}$$

$$ENR_{it} = 1 / ER_{it} \tag{5}$$

ERit, in equation (5), is a measure of the environmental emission index. It determines the strength of the environmental strategy. This index is used to measure the value of ENRit through an inverse treatment. It is a method of quantifying pollutant discharge to show the strength of an environmental policy.

3.2. Capacity for Innovation (INN)

The performance indexes of R&D and innovation operating in multiple regions are not listed in recent government reports such as the "China City Yearbook" and "China Regional Economic Statistics Yearbook." As a result, the frequency of patent applications per 10,000 people was used to evaluate the country's creative potential (Spitsyn, 2012).The information in this document comes from the State Intellectual Property Office's patent statistics (Zhang et al., 2019).

3.3. Foreign Direct Investment Variation (FDIS)

The foreign direct investment deviation level is used to calculate the FDIS for the industrial structure.(Macdonald and Marsh, 1993) and (Zhang et al., 2017). It depicts the percentage of foreign direct investment in a field to total foreign direct investment, as well as the percentage of gross domestic product value added, as:

$$\mathrm{FDIS} = \frac{\mathrm{FDI_{sce}} / \mathrm{FDI}}{\mathrm{GDP_{sce}} / \mathrm{GDP}} \tag{6}$$

Here FDIsec represents foreign direct investment quantity in the secondary industry. GDPsec represents the GDP value (gross domestic product) in the secondary industry. FDIS > 1 Implies that the industry's investment growth rate is higher than the growth rate of GDP in the industry and vice versa. Similarly, when FDIS = 1, the rates of investment growth and GDP growth are equal (Ercolano and Romano, 2018) and (Mohsin et al., 2019).

3.4. Curse of Resources (RES)

The resource curse coefficient is calculated using the ratio of regional energy resources endowment to the production value of the auxiliary industry in this study. To begin, energy output is utilized to determine the endowment of area energy resources. As a result, the resource curse coefficient is defined as the ratio of primary energy production to primary energy production in all cities, as well as the ratio of auxiliary industry output to auxiliary industry output in all cities.(Li et al., 2017). This formula used for the measurement:

$$\mathrm{ERS} = \frac{\mathrm{E_i} / \sum_{i-1}^{n} \mathrm{E_i}}{\mathrm{SIi} / \sum_{i-1}^{n} \mathrm{SI_i}} \tag{7}$$

In equation (7), ERS depicts the resource curse coefficient, Ei shows the primary energy production of the city i; n reflects the number of cities, and SIi depicts the output value of the secondary industry of the city. Amongst them, primary energy production=raw is coal production 0.714t/t + crude oil production ×1.43t/t + natural gas production ×1.33P/1000m. If the percentage of primary energy production in all cities exceeds that of the secondary industry, then any of the city's resource advantages would not result in economic advantage. It implies that it has experienced the "resource curse" The higher the resource curse coefficient, the more severe the "resource curse" that particular city experiences (Ciaschini et al., 2013).

3.5. Rent-Seeking Tendencies (CRP)

This article examines if a governor or secretary of a municipal committee violates any laws or controls, providing an index of the level of rent-seeking. If there is corruption on part of the city's leader, CRP = 1, else CRP = 0.

3.6. Control Variables

The impact of other influences on the environment should be considered while selecting control variables. The six factors listed below were used as control variables in this study. Population density (POP) has a significant effect on the quality of the environment. The higher the population density, the more severe the environmental pollution and environmental efficiency more reduced. This paper utilizes "the logarithmic value of (total population/area land area × 100%) "For its estimation.

Industrialization (IND). The degree of advancement of secondary industry refers towards the extent of industrialisation. The impact of industrial activities on the environment changes with each stage of industrialization. This paper uses "the logarithmic value of (GDP in secondary industry/regional GDP × 100%)" to estimate it.

Fixed asset investment (CAP). Investment is an important component of economic growth and among the most critical environmental factors. The stress in a regional environment is estimated using fixed asset investment. This paper uses "the logarithmic value of (investment in fixed assets in the current year/ investment in fixed assets in the last year × 100%)" for estimating it.

Human capital (EDU). The level of education of the population has a direct correlation with environmental awareness. The higher the rate of education among inhabitants, the greater the level of environmental consciousness, which will have a good impact on the regional ecosystem. This paper uses "the logarithmic value of (the number of students in colleges and universities/the total household registration population at the end of the year× 100%)" To calculate it.

Government expenditure (GOV). In the regional context, the state has a critical role to play. This study uses "the logarithmic value of (the government's budget to GDP× 100%)" to estimate it.

Economic development (GDP). According to recent studies, the environment has the potential to boost economic growth. Hence, this study uses the economic growth rate as a control variable and uses "the logarithmic value of (GDP in the current year/GDP in the last year× 100%)" to calculate it.

3.7. Welfare Loss Based On Oil Supply Disruption as Described by a Mathematical Model

The direction and magnitude of the supply of oil diversion are used to calculate welfare losses owing to oil supply disruptions. Following (Akhmetov, 2015), we go through the severity of the crude oil supply disruption in oil-importing countries i at time t as Z_{it} [0;1], while Z_{it} = 0 associated to a wide-ranging outage and Z_{it} = 1 associated with the baseline level of service. Suppose that f_{it} Z_{it} shows the probability density function of end-user oil supply disruption Z_{it} in the country, i at time t and suppose that $W_i Z_{it}$ indicate end user willingness-to-pay to evade a physical oil supply disruption Z_{it} in country i at time t. For time duration period T till baseline level of oil is rebuilt, user willingness-to-pay in the household (R) sector to evade a collective provision of oil supply disruption across the country i and the periods of T is given by,

$$W^R = \sum_{t=1}^{T} \sum_{i=1}^{I} \int_0^1 W_i(x) f_{it}(x)\, dx \tag{8}$$

Where x is the variable signifying the values Z_{it} which can be assumed? For a given country i and time, the calculation of $W_i Z_{it}$ includes participating in the area under a demand curve for the level of oil supply disruption Z_{it} especially, end-user willingness-to-pay to evade an oil supply disruption of magnitude Z_{it} in the country i at time t which can be defined as:

$$\mathrm{W_i}\left(\mathrm{Z_{it}}\right) = \int_{\mathrm{Q_i}(\mathrm{Z_{it}})}^{\mathrm{Q_i}} \mathrm{P_i}(\mathrm{x})\, \mathrm{dx} \tag{9}$$

Where P_iQ_i is the oil supply (inverse) demand function for the country i, $Q_i = Q_i\,(Z_{it} = 1)$ is the baseline amount of oil supplied to the public in the country i preceding an oil supply disruption, and $Q_i\,(Z_{it})$ is the supply available after an oil supply disruption in the country i at time t. End-user willingness-to-pay to evade an oil supply disruption of a given magnitude in equation (9) is measured for each country by developing an aggregate demand curve to show the quantity of oil for the public segment. For utilities having uniform pricing structure, $P_i = P_i\,(Q_i)$ containing the general public's volumetric rate under baseline conditions preceding the oil supply disruption in the country i. For any country structure of an increasing block pricing, P_i is the marginal rate paid by an illustrative end-user consumer in the country i associated with the layer on which the last unit of oil consumption occurred. Integrating the welfare losses in equation (9) over the probability distribution of outcomes and the oil supply disruption duration yielded the measurement defined by equation (1). Let $C_i\,(Z_{it})$ shows the evaded unit cost of service in the country i at time t. Therefore, the concurrent ratepayer welfare loss in the country i of a given magnitude level of oil supply disruption is measured by:

$$L_i\left(Z_{it}\right) = \int_{Q_i\left(Z_{it}\right)}^{Q_i} P_i\left(x\right)dx - C_i\left(x\right)dx \tag{10}$$

In essence, the concurrent welfare loss in equation (10) associated with end-user consumer surplus assessments in the case where $C_i\,(Z_{it}) = P_i$. In this situation, equation (10) becomes,

$$L_i\left(Z_{it}\right) = \int_{Q_i\left(Z_{it}\right)}^{Q_i} P_i\left(x\right)dx - P_i\left(Q_i - Q\left(Z_{it}\right)\right) \tag{11}$$

The loss expression in equation (11) is a lower bound corresponding to ratepayers' economic losses and associated with the marginal cost pricing case. For the period of T until baseline oil supply service is regenerated, while the ratepayer welfare loss in the for public (R) sector ensuing from an increasing service disruption across the country I in the regions whereas the T periods is as follows:

$$L^R = \sum_{t=1}^{T}\sum_{i=1}^{I}\int_{0}^{1} L_i\left(x\right)f_{it}\left(x\right)dx \tag{12}$$

The extensive literature has been concerned with the studies in this line of research such as (Zawislak et al., 2012), (Islam et al., 2021), (Akhtar et al., 2020), (Winston, 2022).

4. RESULTS AND DISCUSSION

Among the key variables in the elevated volatility of crude oil prices are decreases in crude oil demand due to the decrease of the international economy, declines in economic activity of economic systems, and expansion of effective energy investment opportunities with the focus on constructing alternative sources of energy, economic investors' anxiety may be included, according to our academic evidence. This issue is undeniably important, especially considering the potential of sustainable livelihood unpredictability (Bianconi and Yoshino, 2014). As the findings demonstrate, financial market hysteria was perhaps the most important cause during the start of the COVID-19 epidemic, when governments enacted lockdowns, causing world oil prices to plummet to new lows. When the lot of nations under lockdown rises by 1%, oil market prices decline by 0.48%, while price fluctuations rise by 0.57%. Despite the continuous fall in business development across the globe and in OPEC member countries, more information regarding fresh epidemic waves, additional surges of disease, and mortality does not contribute to differences in the pricing features of the global oil market (Mohsin et al., 2019). Based on the findings, it can be deduced that future ripples of the COVID-19 disease outbreak will not result in significant drops in the price of oil except if a huge hard shutdown is implemented because, during this time frame, financial shareholders' panic does have the greatest effect on price volatility far significantly larger than the decline in global business activity (Bai et al., 2016). The price of oil fluctuates about supply, which can be explained as follows:

A rise in oil prices (and a backward movement forward curve) can trigger the depletion of oil reserves.

If oil prices rise, Saudi Arabia and other oil-producing countries may soon deplete their stockpiles.

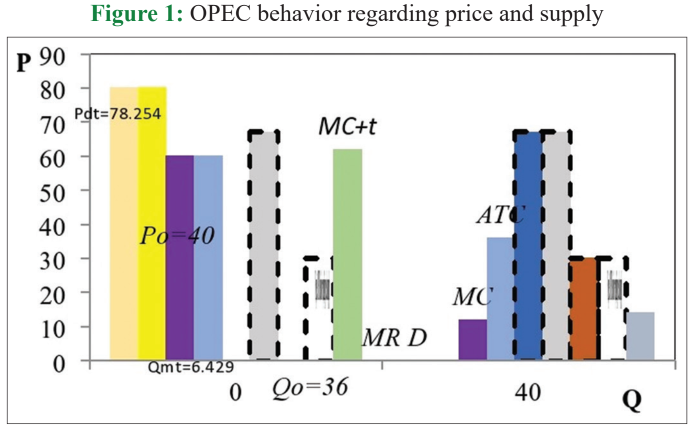
If oil prices fall where the marginal cost of ongoing oil production becomes unfeasible, production from such oil wells may be halted or operations reduced. Increasing oil prices may result in lower-than-average oil production. In a state of limited distribution, the expected average growth rate for 2010-50 is 1.61%, rather than 1.49% when market flooding occurs (Figure 1).

4.1. The Treatment Effects on Indian Subcontinent Economy

Regional Strategy's treatment effect on the Indian subcntinent economy was from superscrip the methodological framework. First, in the case of the Inda woan Subby superscpt use R^2 to sselect the bestpredictors represented by M(1)*, M(2)*,…M(7)*. Secondly, we utilize AICC to choose the optimal M(m)* from M(1)*, M(2)*,…M(7)*.

Table 1 shows the optimum predictors of Indian Subcontinent GDP growth rate. Using the same strategy, ideal predictors of the tertiary industry in GDP in the Indian Subcontinent include nine

Figure 1: OPEC behavior regarding price and supply



provinces, as shown in Table 2. The OLS weight estimations are shown in Tables 1 and 2. The GDP growth rate has a quality rate of 0.992, which indicates that it is a well-fitting pre-intervention result. Before the intervention, the results of the anticipated and actual paths were practically identical.

Then, in the absence of an Indian Subcontinent Countries Strategy, we use the optimal control group and each country's weights to create a counterfactual path for Indian Subcontinent countries from 2014 to 2018. We also provide the 95% confidence intervals in addition to the point estimates. Because a point estimate does not demonstrate how near the prediction is to the parameter, an error margin is included in the interval estimate, enabling us to assess the accuracy of the point estimate and the magnitude of the effect. The actual path of GDP growth is lower than the counterfactual path; thus, the impacts are negative. The confidence interval for projected counterfactuals was determined to be 95%, and the actual path falls within the top and bottom boundaries of the calculated confidence interval. As per Table 3, the projections of the treatment effects reveal that in the absence of the regional plan, the share of tertiary industry in GDP would indeed be lower.

Table 1: Weights of the optimal control group for Indian subcontinent

Country	Beta	Standard	T
Constant	5.467	1.234	6.43
Bangladesh	0.192	0.348	3.43
Bhutan	−0.299	0.175	−6.54
India	0.322	0.162	5.43
Maldives	−0.229	0.139	−2.45
Nepal	0.397	0.149	7.82
Pakistan	0.367	0.154	5.93
Sri Lanka	0.326	0.149	6.54

R^2=0.993 AICC=−49.547, F=359.99

Table 2: Weights of the optimal control group for GDP growth rate for Indian subcontinent

Country	Beta	Std.	T
Constant	0.496	0.948	0.59
Bangladesh	0.444	0.132	3.99
Bhutan	0.421	0.234	3.32
India	−0.437	0.142	−3.08
Maldives	0.500	0.142	4.94
Nepal	0.399	0.143	4.43
Pakistan	0.399	0.226	2.54
Sri Lanka	−0.998	0.156	−1.87

R^2=0.992, AICC=3.5939, F=67.399

Table 3: Treatment effects for GDP growth rate

Country	Actual	Counterfactual	Treatment effects	
			Point	Interval
Constant	4.6	11.36	−1.56	(−3.78, 0.99)
Bangladesh	7.9	7.54	−1.35	(−2.98, 0.89)
Bhutan	6.9	7.99	−0.89	(−2.89, 0.67)
India	6.5	5.97	−1.67	(−3.76, 0.62)
Maldives	5.7	3.96	−1.99	(−3.89, 0.73)
Nepal	2.5	7.97	−0.97	(−2.54, 0.99)
Pakistan	1.7	4.66	−1.54	(−3.42, 0.52)
Sri Lanka	6.7	9.99	−1.87	(−2.19, 0.67)

Table 4 displays the same finding, with each year's confidence interval set to zero, indicating that the treatment effects are statistically insignificant. The point estimates of treatment effects are provided in Table 4. It means that without the plan, the Indian Subcontinent's GDP growth rate would be higher. These findings, however, are statistically insignificant. In the case of industrial organization, the counterfactual route is much lower than the actual path throughout the period following the intervention, implying that the positive impacts are significant. At a 95% confidence interval, the actual path is above the expected counterfactuals, according to our assumption. As a result, the significance level of the favorable impacts may be seen. Table 4 displays the point and interval estimates, demonstrating that the gap estimates' lower bounds are similarly >0, indicating that the impacts are insignificant at the 5% level.

The actual path of GDP growth is lower than the counterfactual route, hence the effect is negative. Because the actual path lies in between predicted confidence interval's lower and upper bounds, we find that the detrimental treatment effects are statistically insignificant at the 5% level. Table 4 shows the same finding, with each year's standard error including 0, indicating statistical insignificance of the treatment effects.

Every time the world's GDP growth slowed unexpectedly, oil prices rose. The price increase caused by the 1973 oil embargo resulted in a 4% drop in GDP growth. Global GDP growth has slowed from 6% to 1% in the last two years. Because of the oil supply shortage caused by the Iranian Revolution in 1979, oil prices doubled, resulting in a 2% to 4% decline in production thereafter. In such a situation, the laws are widely regarded as being exceedingly tough. Stockpiling is prompted by the restriction rather than the organizer's optimizing circumstances, resulting in a final amount of reserves that is greater than ever required throughout the planning period. Increased oil prices led to the financial catastrophe in part because the 2008 collapse culminated in a liquidity freeze; in locations in which the cost of movement is cheap, tremendous lending is done. Rapidly rising oil costs caused a drop in the value of real estate on the city's outskirts, resulting in a huge rise in underwater mortgages.

From a social standpoint, neither harshly rigid laws imposing a significant cost on the current generation nor laws limiting reserves for future generations appear to be beneficial. The difficulty therefore becomes defining an appropriate legislation that is not

Table 4: Treatment effects for a percentage of the tertiary industry in GDP

Country	Actual	Counterfactual	Treatment effects	
			Point	Interval
Constant	35.36	32.27	2.09	(0.89, 1.78)
Bangladesh	33.36	33.14	3.28	(1.99, 3.99)
Bhutan	32.43	29.89	3.87	(1.89, 2.82)
Nepal	36.32	44.57	3.86	(2.88, 4.83)
Maldives	24.29	24.14	5.27	(4.19, 6.36)
India	35.93	32.27	3.19	(1.65, 4.98)
Pakistan	35.98	46.14	2.84	(1.67, 2.43)
Sri-Lanka	24.82	23.45	2.23	(2.88, 4.83)

overly strict while also ensuring that enough reserve is preserved for future generations. We used the inter-generations rule, which states that inertias influence the spread of unconventional oil production. As per the findings, the higher availability of money supplants the prior progress made possible by a larger reserve investment to these oil-importing financial cautions. Similarly, it assumes all secondary assertions that the Little Poisoning possibilities are more attractive to financial caution due to their reduced powerlessness in the face of Peak Oil. Under most situations, this benefit is small and careless about secondary assumptions, with a change of <0.1% in extremely delicate cases. It shows prolonged enduring financial stress (Zhang et al., 2017).

4.2. The Impact of the Strategic Petroleum Reserve on the Environment

The Indian Subcontinent Region's Collaborative Development Guideline reaffirms the region's role as a test bed for environmental protection and betterment. Among the three key areas of joint development is environmental conservation, according to the report. The most noticeable form of pollution in the Indian Subcontinent Region is atmospheric pollution, which is a serious and difficult-to-understand issue. China has been a key problem among the various types of air pollutants and its tendency to endanger human health and negatively influence the economy. The governments of the Indian Subcontinent have banded together to take several steps to combat the rise in PM2.5 levels. As a result, we use concentrations to show environmental pollution and analyze the environmental impact of the Indian Subcontinent region.

More research will be required before analyzing the geological parameters that impact production cost and workability. Among these characteristics are oil source quality, extent, and homogeneity, pay-zone thickness, permeable beds; and maturity are among these characteristics. Despite this, despite a favorable geological finding, tight oil production from North America may not be assured. On-the-ground constraints may have prevented other countries from replicating the US experience for at least a few years. Notably, the findings show that the period of peak oil has no bearing on the historical profile of oil prices shown in Figure 2.

According to Table 5, we can see that the highest average stockpile capacity during the planning phase has been around 141 MMB, 352 MMB, and 712 MMB, with the discount factor being 0.9, 0.95, and 0.99, respectively (in each case, the highest limit reached during year 15). Hence, the ultimate and highest average stockpile capacity rise consistently with the discount factor. With a more significant discount factor, the SPR manager renders higher weight to the forthcoming influence of oil interruption on GDP and comparatively less weight to the explanation that the reserve is creating cost, leading to an increase in the stockpile capacity.

4.3. Economic Trade-Off for Oil Producers

The volume and price of oil are used to generate profiles of earnings from Middle Eastern oil production. Short-term oil production revenues are larger when the market promotes increased revenue derived from oil. However, when marketing flooding occurs due to rising long-term oil prices, this surge is exacerbated. Figure 3 shows that when market flooding occurs, Middle Eastern countries can accept payment in exchange for preceding short-term income. Middle Eastern countries typically export oil to Indian Subcontinent countries, requiring the use of two extreme stages of primary aim functions whenever they place all of their aim of maximizing income from oil at the community welfare stage through a rise above local families. As a result, Middle Eastern oil producers act as revenue-maximizing entities, free of political influence. They select to develop their strategy in response to lower oil revenues. They will choose the market flooding binary if discount rates are less than 7%. The key stakeholders are wary of a high-profit ratio in light of the current financial crisis; the minimum breakeven threshold of 7% alludes to a possible market flooding situation. Consider that Middle Eastern businesses are oriented toward achieving long-term government objectives. It demonstrates how these economies stifle the addition of independent capital to petroleum-producing enterprises.

Our findings are consistent with the severe criteria (imposing a large cost on present oil production), which appear to be the most efficient regarding social welfare. It can define, and a fair

Figure 2: Marginal cost and inverse demand function

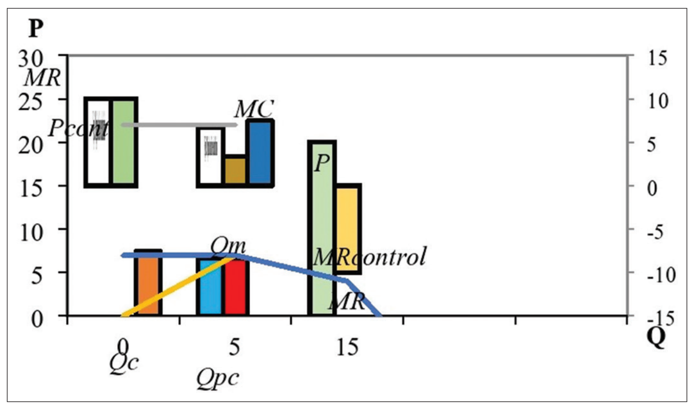


Figure 3: Market response due to tax and subsidy variation in the energy sector

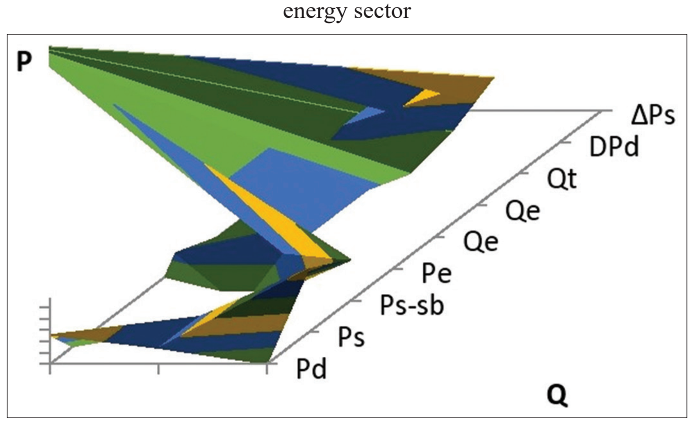


Table 5: The rule suggested by an inter-generation argument for the 25th year

Factor of discount	Rule	Avg. Stock (MMB)
0.90	21	141
0.95	52	352
0.99	115	712

law ensures that appropriate reserves are available at the end of the process for future use. An increase in oil costs will continue to threaten global economic growth. Suppose substantial, large discharges are announced in a timely manner. In that case, oil reserves constructed in a planned manner can assist in protecting the world economy, preventing the oil price spike that would otherwise occur as a result of significant decreases in oil supply. To eliminate or reduce oil price shocks, the government must develop an appropriate framework for adjusting emergency stock release and defining the economic rewards from acceptable stock delivery. It is critical to improve SPR's capability to avoid any negative effects on global oil prices following a large change in oil supply. The Indian Subcontinent should contribute to the development of massive oil reserves. According to the idea, oil supply would be increased in a crisis to restore market equilibrium.

Table 6 shows the parameters employed in the simulations for the various Indian Subcontinent countries, which are quite similar except GDP-oil price elasticity, which varies a lot between countries, showing their different levels of susceptibility to oil price spikes. With modest assets, long-term slowness in installing non-conventional lubricants, and few short-term oil penalties, financial development during peak oil stays quite fair (Table 4). It increased long-term financial strains despite the findings being consistent (Li et al., 2017).

Our findings are by strict constraints that impose a significant cost on present oil production but appear to be the best option from a social welfare standpoint. Determining an appropriate rule ensures an acceptable amount of reserves for future spending at the final stage. The rigorousness rule matched with a discount factor also changes the projected cost of hoarding. It implies that with sufficiently rigorous rules, the value of the economic spectrum of oil reserves becomes positive, implying that the social costs of creating reserves outweigh the GDP gains within the current planning horizon.

The findings also show that the duration of peak oil has little bearing on the oil price time profile (Figures 3 and 4). With the discount factor, both the final and maximum average stockpile sizes will increase monotonically.

4.4. Economic Ramifications and Welfare Losses

We compare the heterogeneity aspects in price springs, introductory rates, and the amount to which overheads are pushed into volumetric charges with a performance for our estimations of usual welfare losses. Figure 5 depicts the willingness of consumers to pay during an oil supply disruption. Consumers will have to spend substantially more during this time than they would under regular circumstances.

(Grimm et al., 2016) identifies seven classifications for conventional and non-conventional oil resources for every country (Garmendia et al., 2010), (Boomiraj et al., 2010) (Bandyopadhyay et al., 2017). Every classification i is categorized through the number of crucial oil sources $Q_{\infty,I}$, whereas the toil generators' threshold selling price of oil overhead gains the oil generation $P(0)$ (i). This oil selling price is considered as the proxy accessibility and production cost. Essentially, the oil shale is not included due to the specification of its handling process., In contrast,t he accompanying high cost of oil production has led us to take it as a substitute for oil rather than a new classification. Each coil classification is succumbed to geological constraints (depletion effects and exploration process), which restricts the expansion rrate ofpotential oil production capacity. Corresponding to the combined investigation of the general economy and of the discovery processes, the highest amount of rise in oil production capacity for classification iIat time t,The parameter bi measures the strength of expansion constraints of oil production growth, while the small (high) value of bi represents the smooth shape of oil production to characterize slow disposition of production capacities. We assume the value of bi to be 0.061 per year designed for the case of conventional oil as presented by (M010)., Inorder to reduce complexity, a similar significance for non-conventional oil has been considered to decrease the hypothesis by seeing higher and lower amounts of non-conventional sources of oil for parameter b_i. Whereas, the variable t0,i I characterizes time as a result of which oil production volumes for oil classification astill vvary withtime because it is subject to the quantity of oil lingering misuse decisions. Oil producers from other than MtheMiddle East are cconsidered the'disastrous producers' as they don't have any strategic aactionon oil markets. For the selling oil ppricespricesice, p_{oil}, it is important to note that the profitable oil classifications are chosen for the potential investment. Oil production capacities are also constructed at a higher rise ΔCap_{max} (t,i) for minimum cost categories (p_{oil}>$p^{(0)(i)}$). However, the high-cost classification investments are discontinued (p_{oil}<$p^{(0)(i)}$) if the prices for oil production capacity for a given classification constantly rise. For the general oil vulnerability index, market liquidity is an effective parameter. The state is dissimilar for oil exporters, which gives the impression that the additional search for parametric expectations is smooth for collective indicators of similarly reduced revenues and promotional financial action. Table 7 shows the vulnerable score of seven Indian Subcontinent countries based on CI and OVI. According to this, India has been ranked first, while Afghanistan has attained the last position.

To determine the average causes of major oil arcades, we present a sympathetic examination to see the associations between different expectations and financial indicators on regional oil resources with

Table 6: Parameter assumptions for the base case with a single regional reserve

Parameter	Value	Unit	Description
∂	0.99	-	Discount factor
ϵ	−0.078	-	Oil demand price Elasticity
β	5.23	US$/barrel capacity	The cost of building one additional unit of capacity
H	0.334	US$/barrel	Annual holding costs per barrel
U	0.222	US$/barrel	The cost of adding one barrel of oil to the stockpile
D	0.241	US$/barrel	The cost of withdrawing one barrel of oil from the stockpile
α	−0.171		GDP-oil price elasticity

quantified opinions among suspicious and cheerful assessments around these resources. For this purpose, we assess several different circumstances in which the amount of income is subject to consistency among two excesses: as a more significant bound, 3.5 Trillion (1012) bbl. (2.3 Trillion bbl. residual conservative and 1-1.2 Trillion bbl. of non-conventional) while lesser bound 2.4 Trillion bbl. (Rodriguez et al., 2019). The weighting factor values have a frequency from 0 to 1, while 0.5 is necessary to examine two units. Keeping restrictive characteristics of short-term elasticity supply and replacements of oil and fuel petition, we calculate the peak oil in an overall balance. In this case, the proclaiming financial cautions are oil-dependent (period of oil reduction), and the fumbling and unreliable carefulness increase the risk of an unanticipated rapid spike in oil prices. Figure 6 shows the vulnerability of Indian Subcontinent countries based on composite index values. It is a deeper grasp of the current state of energy variations and how they affect this region.

A strong economic and financial position is predicted to reduce financial caution by replacing earlier growth by adding renewable resources instead of oil imports. Because it reduces susceptibility to peak oil output, the parametric premise of modest positioning circumstances is more profitable for financial prudence. Given the circumstances above, a comprehensive analysis reveals that each case's peak oil date is moderate to short-term. On the other hand, weekday peak oil is only projected to fluctuate associated with development plans, hire charge creation, and variable time horizons of oil volumes. According to oil exporters, short-term exporters' revenue can be impacted by old low prices. As a result, they concluded that increasing oil demand on weekdays depends on oil-importing financial causality to make place for the long-term bubble of oil exportation profits. As a result, peak oil times and market flooding may raise oil producers' share of welfare contributions. However, this will diminish in the long run due to the advantage of increasing long-term profits shifting in the post-peak oil era due to depression in macroeconomics factors.

Figure 4: Mean oil price during the post-peak oil period

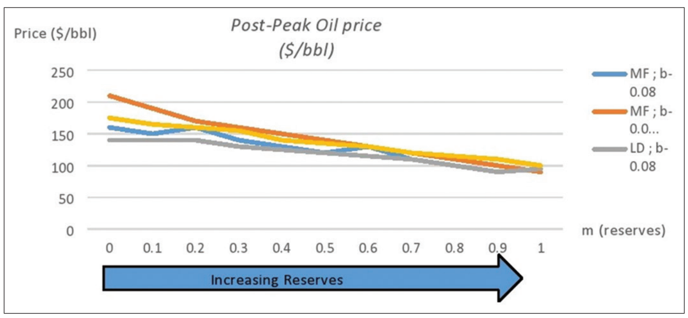


Figure 5: Consumer Willingness to pay during an oil supply disruption

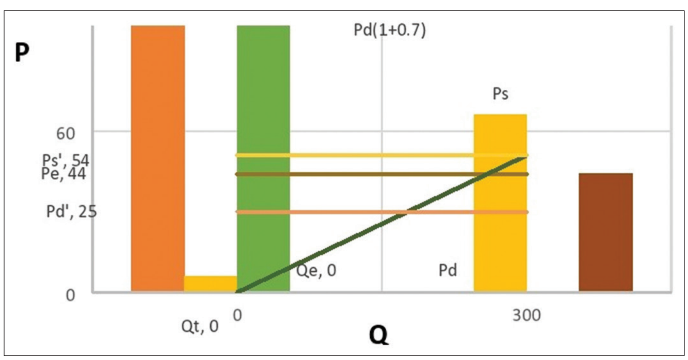


Figure 6: Vulnerably of the Indian subcontinent

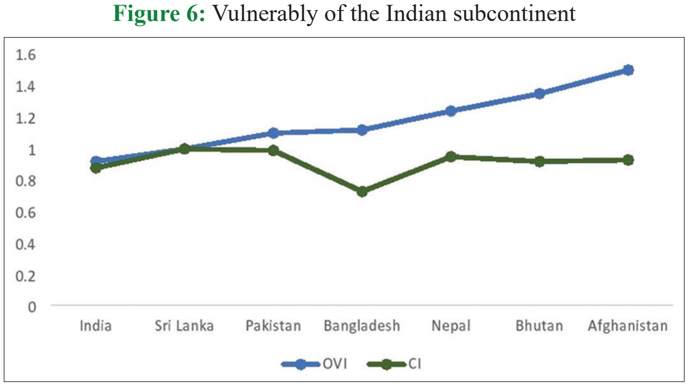


Table 8 shows that countries on the Indian Subcontinent that primarily import oil from the Middle East devised a plan based on lower oil income. They also use the option of single-market flooding for discount rates of <7%. However, current financial crisis participants doubt the long-term viability of the ensuing high-profit ratio, with a breakeven threshold of only 7%, implying that the market flooding execution scenario is suspect.

We discovered a negative elasticity, which suggests that variables that are negatively linked with both oil price and consumption should be described as such. The severity of welfare losses due to unemployment, reduced subsidies, and the abolition of infrastructure activities in the area grows as the quantity of oil supply increases. According to the prospective omitted factor bias evaluation, the insertion of the utility fixed effect model under this specification resulted in an exactly evaluated elasticity of -0.121. Due to the scarcity of supply and a reduction in each utility's supply, the oil supply interruption specification increased in oil price, which was harmed by lower consumption. Economists' current views argue that increased energy consumption promotes

Table 7: The score of vulnerably based on CI and OVI

Country	CI	OVI	Rank
India	0.94	0.98	1st
Pakistan	0.96	1.12	2nd
Sri-Lanka	0.97	1.15	3rd
Bangladesh	0.87	1.29	4th
Bhutan	0.94	1.47	5th
Nepal	0.92	1.55	6th
Maldives	0.91	1.66	7th

Table 8: Discounted oil profits for the Middle East (Billion $)

Rate of discount (%)	The scenario of limited deployment	The scenario of market flooding
15	2.9	2.7
9	6.5	6.4
7	9.7	10.1
5	11.8	11.8
3	20.9	19.5
2	31.2	30.1
0	39.9	39.5

Table 9: Overall oil composite and new composite indicator score

Country	NCI	CI	Rank
Bangladesh	0.85	0.90	7th
Bhutan	0.88	0.91	6th
India	0.90	0.93	5th
Maldives	0.81	0.76	4th
Nepal	0.91	0.96	3rd
Pakistan	0.91	0.95	2nd
Sri Lanka	0.90	0.93	1st

economic development and welfare programs. The estimate of shortfalls yielded an annual home and industrial oil supply interruption, according to welfare losses from oil supply disruptions. The loss of welfare as a primary significant contributor in the country was parameterized by the disruption in the oil supply. It has several effects on average welfare losses per capita due to energy shortages in goods and services production, which are influenced by the heterogeneity in oil price elasticity's actual rates. Simultaneously, the amount of fixed costs is converted into volumetric rates. Low energy consumption prompted the stock trading market and other financial markets.

The welfare losses of crude oil supply disruptions were quantified using heterogeneous oil supply-demand functions; once the fundamental crude oil prices are inefficient, the volumetric rate's considerable part reflects the fixed costs. Significant welfare losses due to oil supply disruptions during the volumetric portion correspond to a component of the fixed costs; the average welfare losses per capita of the shortfall increase significantly. The 30% scarcity of oil supply is responsible for the most volatile oil pricing structure, which raises the estimated welfare loss through a 40% reduction in GDP, around $700 in the Indian Subcontinent and $9000 in the highest oil-consuming countries. Oil supply disruptions result in utility shortages and power outages in the region.

4.5. Sensitivity Analysis

The CI was computed for each country by fitting the adjusting parameter λ as 0.5. The uncertainty that the adjusting parameter's λ different values may affect CI's composite index score may be uncertain. Consequently, we generated nine different values of λ to calculate the composite index score from 2001 to 2016 to check whether varying values of λ may affect the scores of CI. We generated nine different λ, i.e., 0.1, 0.2, and 0.9 to check the outcomes' sensitivity.

Table 9 illustrates the newly generated score of CI. Table 9 shows the comparative box plot of risk score values of each country from 2001 to 2016. CI values' composite index score is less sensitive to different values of λ from 2001 to 2016. However, the CI values slightly fluctuate by changing the values of λ. The CI's composite index score remained insensitive and consistent under the varying values, which may indicate our robust results. Hence, it can be concluded that the proposed approach enables an increase in the robust performance of score CI by reducing the uncertainty during weights allocation of various underlying indicators and that it is reasonable to use λ value as 0.5 to calculate the CI score.

5. CONCLUSION AND POLICY IMPLICATION

This research looked into the prospect of Indian Subcontinent countries creating a strategic petroleum reserve, as well as the social welfare implications of such a reserve. This article looks at the oil supply, the associated risk, the unorganized oil supply cut-off, and the influence that various strategic petroleum stock configurations could have on reducing the negative impact on the economy of oil supply cut-offs while considering SPR efficiency. Governments across the Indian Subcontinent have created policies and benchmarks to assess the impact of social aid on SPR. The results demonstrate a lack of forethought and inactivity, resulting in a surprising jump in oil prices when oil-importing countries in the Indian Subcontinent rely significantly on oil after approaching an oil-declining era. As per the findings, the deployment of strategic oil reserves did not result in a significant decline in the GDP growth rate of Indian Subcontinent countries. During this time, the GDP of India, Pakistan, Sri Lanka, Afghanistan, and Nepal fell.

Before 2025, the SPR goal for the Indian Subcontinent is to maintain a significant petroleum reserve equivalent to 100 days of net oil imports. This study attempts to quantify the impact of constrained deployment, market flooding, and peak oil production on individual and collective welfare losses. We also try to locate the independent observation beneath the IBP schedule. It's worth noting that the macroeconomic consequences of peak oil and the shift in the two-choice goal function boost household welfare and oil earnings; this has the greatest impact on country growth fluctuations. However, interfering with oil resource activities to minimize overall costs may not be a wise strategy. As a result of the strategic oil reserve's structure, environmental pollution has increased; it also lags behind the rest of the region in terms of environmental efficiency, and the environment is extremely polluted. As the findings demonstrate, financial market hysteria was perhaps the most important cause during the start of the COVID-19 epidemic, when governments enacted lockdowns, causing world oil prices to plummet to new lows. When many nations under lockdown rise by 1%, oil market prices decline by 0.48%, while price fluctuations rise by 0.57%. Despite the continuous fall in business development across the globe and in OPEC member countries, more information regarding fresh epidemic waves, additional surges of disease, and mortality does not contribute to differences in the pricing features of the global oil market. Based on the findings, it can be deduced that future ripples of the COVID-19 disease outbreak will not result in significant drops in the price of oil except if a huge hard shutdown is implemented because, during this time frame, financial shareholders' panic does have the greatest effect on price volatility—far significantly larger than the decline in global business activity.

Significant petroleum reserves present a new prospect for countries in the Indian Subcontinent, allowing them to fully immerse themselves in the plan and achieve superior development. To begin with, Indian Subcontinent countries have the least potential to innovate technologically, despite technical disruption being the primary driver driving economic development. As a result, Indian Subcontinent countries should continually impose innovationdriven practices to improve their potential to innovate and boost efficiency via research and development commercialization. Second, Indian Subcontinent countries play an important role in supporting the region's natural environment, but it is also the region's most polluted province. As a result, Indian Subcontinent countries must develop unified environmental avoidance, restrictions, and rules for their ecological ecosystems to implement environmental protection laws and reduce pollution. It would vastly improve environmental quality, making it more capable of assisting and ensuring greater economic development.

5.1. Limitations and Future Recommendations of the Study

Most countries experienced steady growth in the composite measure of sustainable development over the research period, but the Indian Subcontinent (Geopolitically, it generally includes the countries of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) has some limitations due to the economy. When estimating oil prices, the panic factor of financial investors must be considered. This factor is hard to assess using a rational approach even though, as a mental component, it can even be observationally acknowledged or refuted because currency traders will always gain with one or perhaps another financial strategy, implying that perhaps the panic concept can be adjusted to any changes in the value. Since trading in derivatives trading (futures) far outnumber actual oil consumption and production, oil has become a financial instrument. In addition to making sensible decisions regarding prices and transaction volumes, producers and purchasers of this synthetic oil require knowledge about current and future market conditions. The significant source of this data is the trade for the principal asset, physical oil. This means that changes in supply may affect prices even when financial investors are panicking. As per the findings, decreasing oil supply volumes will stabilize oil market rates but harm the countries' development sustainability. The usefulness of the regulatory changes outlined above is further jeopardized by the countries' repeated violations of the agreement's terms. However, actions to minimize production are insufficient to stabilize the market for future recommendations in the current market conditions. Constructing a power industry on digital platforms, reservoirs of intellectual property, digital algorithms, and focused marketing innovations, and the rapid expansion of technologies and information evolutions may help create radical circumstances for managing inventory in the oil sector.

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