

Are Resources Curse or Blessings? Evidence from Mineral rich Districts of Odisha

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By

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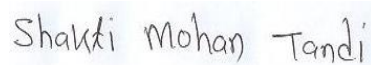
DECLARATION

I, **Shakti Mohan Tandi** hereby declare that this thesis entitled, “**Are Resources Curse or Blessings? Evidence from Mineral rich Districts of Odisha**”, submitted by me under the guidance and supervision of **Dr. Prajna Paramita Mishra** is a bonafide research work, which is also free from plagiarism. I also declare that it has not been submitted previously in part or in full to this University or any other University or Institution for the award of degree or diploma. I hereby agree that my thesis can be deposited in SHODGANGA/INFLIBNET.

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Further, the student has the following publication before submission of the thesis.

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Abbreviations

ARI	Acute Respiratory Infection
CI	Census of India
CSE	Centre for Science and Environment
CADF	Cross-Sectional Augmented Dickey-Fuller Test
DESO	Directorate of Economics and Statistics Odisha
DFE	Dynamic Fixed Effect
DFID	Department for International Development
DOM	Directorate of Mine
DRC	Democratic Republic of Congo
DSH	District Statistical Handbook
EITI	Extractive Industries Transparency Initiative
EL	Earned Leave
FD	Financial Development
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
GE	Government Effectiveness
HDI	Human Development Index
HHI	Herfindahl-Hirschman Index
HI	Health Index
HRD	Human Resource Development
ICT	Information Communication Technology
IBM	Indian Bureau of Mine
INT	Investment
IQ	Institutional Quality
LH	Land Holding
MENA	Middle East and North Africa
MG	Mean Group
MM	Ministry of Mine
MT	Million Tonnes

NDDP	Net District Domestic Product
NRF	Natural Resource Fund
OBC	Other Backward Caste
OECD	Organisation for Economic Cooperation and Development
OES	Odisha Economic Survey
OIC	Organisation of Islamic Corporation
OPEC	Organisation of the Petroleum Exporting Countries
P-ARDL	Panel Autoregressive Distributed Lag Model
ARDL	Autoregressive Distributed Lag Model
PMG	Pooled Mean Group
PSTR	Panel Smooth Transition Regression Model
RL	Rule of Law
R & D	Research and Development
SLF	Sustainable Livelihood Frameworks
SC	Scheduled Castes
SDW	Source of Drinking Water
SL	Sick Leave
ST	Scheduled Tribes
USA	United States of America
TA	Total Assets
TB	Tuberculosis
TDS	Total Dissolved Solids
TMP	Total Mineral Production
TVP	Time Varying Parameter
UAE	United Arab Emirates
UNDP	United Nations Development Programme
WHO	World Health Organisation
WTO	World Trade Report

Chapter 1

Introduction

1.1: Introduction

According to World Trade Report (2010) natural resources are defined as “stock of materials that exist in the natural environment that are both scarce and economically useful in production or consumption, either in their raw state or after a minimal amount of processing.” Natural resource is a commodity which is produced by nature and not produced by human being. These commodities are heterogeneous group in nature (Campenhout, 2002). Different studies have presented this heterogeneity in different ways. Organisation for Economic Cooperation and Development (2009) group them under renewable and non-renewable resources. Stiglitz (1974) has classified some natural resources as private goods, such as coal, gold and iron and some others as public goods such as air and water. Again, they have suggested a third category of resources which are really private goods, but are publicly managed like national parks and forests. Further, some natural resources can be classified under the exhaustible natural resource and others under renewable resources such as fish. One can also categorize natural resources as luxury and necessary resources according to their income elasticity. For example, gold can be categorized as luxury (income elasticity higher than 1), while oil, its deviated products like kerosene can be grouped under necessary. On the basis of their services, Lee et al. (2009) have classified natural resource as provisioning services, cultural service, regulating services and supporting services.

Natural resources symbolize the wealth of a nation and are considered as the main drivers of economic growth (Su et al., 2021a; Umar et al., 2020, 2021a). Those countries which base their economic development on natural resource abundance are in a position to grow their economies rapidly than their resource-poor counterparts (Ampofo et al., 2020). In principle, natural resources should offer many benefits for poor economies (Badeeb et al., 2017). First, most of the developing countries suffer from lack of financial resources. In that case, income generated from natural resources can be funded to increase the government as well as private investment and hence, the real living standards of the people can be enhanced (Yilanci et al., 2021).

Second, natural resources can boost investment both directly and indirectly. Income generated from resource extraction can be used to create capital which in turn can boost production in the future (Hota and Behera, 2019). For instance, Papyrakis and Gerlagh (2004) showed that physical and social infrastructure can be created with the help of revenue generated from natural resources. Third, natural resources can remove a huge barrier to development because receipts earned from exploitation of natural resources are particularly accumulated by the government sector. This accumulated income can be used to finance budget. Many core public goods such as infrastructure can be financed by income generated by natural resources (Sachs, 2007). Fourth, there is shortage of foreign exchange reserves in poor countries. Natural resources assist the country to get foreign exchange revenue through export of primary goods. These foreign exchange earnings help the country to import capital goods and technology that are required to increase production and efficiency of labour (Khan et al., 2019; Dogan et al., 2020; Yilanci et al., 2021). Thus, there is a widespread observation that power, wealth and welfare can be increased with the help of natural resources abundance (Dogan et al., 2020). The abundance of natural resource has helped many developed countries to achieve fast industrialization and hence rapid economic growth (Zhan et al., 2021; Gu et al., 2020). Many resource-rich countries like Australia, Canada, Botswana and Norway have achieved faster economic growth (Belaid et al., 2021).

Different scholars and policymakers have paid attention on the impact of natural resource abundance on economic growth in the past decades. There are large numbers of literature available on this subject. However, there is no agreement among scholars on whether natural resource abundance (dependency) is a blessing or a curse for economic progress (Ampofo et al., 2020; Yilanci et al., 2021; Abdulahi et al., 2019; van der Ploeg, 2011). Meta analysis by Havranek et al. (2016) shows that 40% of studies observe an inverse connection between natural resource abundance and economic progress, 40% of studies show no impact, and 20% of studies present a favourable impact of resource abundance on economic growth. This section uses the term ‘the conventional view’ and ‘the alternative view’ in order to comprehend the significance of natural resources in convenient manner.

1.2: Natural Resource and Economic Development: The Conventional View

The majority of geographer and economists believed that natural resource availability favourably influences the economic development of a country before 1980. (Hilmawan and Clark, 2019). David Ricardo and Adam Smith emphasized “the favorable role of natural resources in economic development” (Yilanci et al., 2021). In the 1950s, for instance, geographer Ginsburg advocated that “the possession of a sizeable and diversified natural resource endowment is a major advantage to any country embarking upon a period of rapid economic growth” (Rosser, 2006). Mainstream economists such as Viner (1952) and Lewis (1955) expressed similar views during this period. According to development theorist Rostow (1961) endowments of natural resource would help developing countries to transit from the stage of underdevelopment to industrial. Countries like Australia, the United States, and Britain had the same experience. Similarly, neoliberal economists such as Balassa (1980), Drake (1972), and Krueger (1980) make similar favourable arguments in the 1970 and 1980 decades.

These views have been challenged by a number of radical economists (particularly Singer, (1950) and Prebisch, (1950) prior to the late 1980s. They propounded that the structure of the world economy and the character of international goods markets continue to disfavour poor nations that rely on natural resource exports. But these views were considered minor and availability of natural resources by and large were found to influence the developing nations (Heinrich, 2011 and Yilanci et al., 2021).

The common notion of a positive relationship between resources and economic development is based on neoclassical economics, specifically the theory of the production function. The abundant capital a nation has, the higher its output and per capita income will be, according to the neoclassical production function (Davis and Tilton, 2005).

1.3: Natural Resource and Economic Development: The Alternative View

After the late 1980s, a large number of literatures has challenged this conventional wisdom and demonstrated that natural resource abundance has become a curse than blessings for economic development in developing countries (Badeeb et al., 2017; Yilanci et al., 2021). The emergence of Dutch disease is considered as the beginning of inverse association between abundance of natural resource and economic growth. The theoretical foundation of Dutch disease theory is laid down after the seminal studies of Corden and Neary (1982) and Corden (1984). The Dutch disease hypothesis advocates that other sector of the economy that have positive impact on economic growth are crowded out by natural resource wealth (Rahim et al., 2021; Yilanci et al., 2021). In 1988 Alan Gelb discussed about the resource curse thesis in its book 'Oil Windfall: Blessing or Curse'. He looked at the economic effects of oil rents and discovered that during the boom years of 1971-1983, oil economies had a more substantial degradation in the efficiency of their home capital formation. Inspired by Gelb, Auty (1993) looked at the industrial strategies adopted by oil-producing nations and the outcome of those policies.

Sachs and Warner have conducted many research in this field (Sachs and Warner, 1995; 1997; 1999 and 2001). These researches were carried out mainly to investigate whether dependence of natural resource unfavourably affect economic growth. Sachs and Warner (1995) study is considered as the pioneer work which initially empirically found a negative relationship between economic development and resource dependency. This confusing event is called as 'Resource Curse Hypothesis'. After Sachs and Warner (1995), a number of studies have investigated resource curse hypothesis and observed confirmation of resource curse theory. All these studies have found some causal mechanisms by means of which abundance of natural resource (dependence) negatively influence economic success. The first one is the type of resources. It is observed that exhaustible point resources have more chance to suffer from resource curse outcome. Others causal mechanisms consist of number of economic and political factors. These factors are Dutch disease, disincentives to education, crowding out of manufacturing, unstable commodity prices, economic mismanagement, rent seeking activities, long-run tendency of commodity prices in the world market, civil war, corruption and weak institution (Isham et al., 2005; Boschini et al., 2007; Bruckner, 2010; Mavrotas et al., 2011; Libman, 2013; Satti et al., 2014; Ahmed et al., 2016;

Gerelmaa and Kotani, 2016; Badeeb and Lean, 2017; Dauvin and Guerreiro, 2017; Kim and Lin, 2017; Tiba, 2019; Corrocher et al., 2020; He and Mou, 2020).

1.4: The Resource Curse Hypothesis

It is found that holding of more natural resources are associated with slower economic performance in the last decades. There has been slow growth of per capita income and reduction in welfare in several African, Latin American and the Middle Eastern countries in spite of their rich natural resources (Hilmawan and Clark, 2019). This type of confusing incident is named as ‘Natural Resource Curse Hypothesis’. It was Richard Auty who advanced the idea of ‘resource curse’. (Auty, 1993). ‘Resource curse’ which is otherwise known as the ‘Paradox of plenty’ is a phenomenon in which resource rich nations are encountered with slower economic performance whereas resource poor nations experience higher economic growth (Roy et al., 2013; Badeeb et al., 2017; Belaid et al., 2021). Thus, it postulates an inverse association between abundance of natural resource/dependence and economic growth (Yilanci et al., 2021).

Many African countries such as Angola, Nigeria, Sudan, and Congo are rich in oil, diamonds and other minerals, yet they have become development failures in terms of per capita income and quality of life. On the other hand, the East Asian economies Japan, Korea, Taiwan, Singapore and Hong Kong have performed well despite their rocky islands and no exportable natural resources (Frankel, 2010; Costantini and Monni, 2008; Hota and Behera, 2019). Between 1960 and 1990, the resource poor countries were able to raise their per capita incomes two to three times faster than the per capita income of resource abundant countries (Auty, 2001). The whole OPEC countries have experienced on average 1.3 percent declines in their gross national product per capita from 1965 to 1998. In contrast to it rest of the developing countries have been able to attain on average 2.2 percent per capita growth (Gylfason, 2001).

Under certain conditions natural resource abundance may promote economic development (Figure 1.1). Natural resources stimulate economic development through various transmission mechanisms. Revenue generated from natural resource sector can help the government to spend on education, health, sanitation and training. It can also attract more investment through various pro-investment strategies. However, rampant rent seeking activities, corruption, mismanagement

of the revenues generated from natural resource sector, poor administration (e.g. bureaucratic incapability, poor implementation of rule of law etc.) in resource-rich economies prevent them to expand.

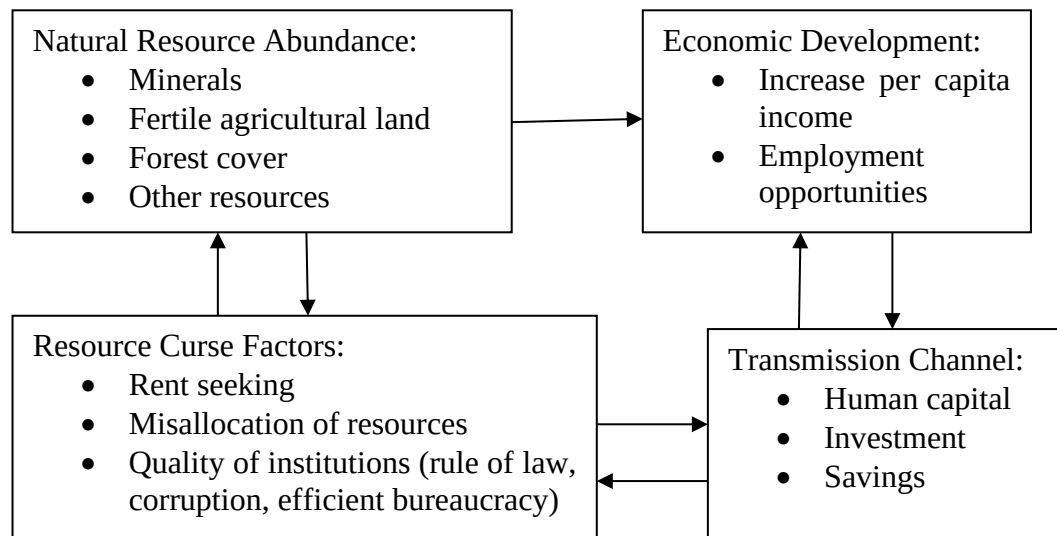


Figure.1.1 Natural Resource Abundance and Economic Development: A Conceptual Framework

Source: Behera and Mishra (2012)

In any economies, rules and laws are implemented by several organizations. These organizations are entrusted with the task of managing natural resources (mainly mining). These agents can easily capture resource rents because it is through them resource rents get transformed into economic success. So, abundance of natural resource can badly affect institutions. In other words, the productive resources from development projects can be diverted into suboptimal development outcomes due to poor institutions, extensive occurrence of rent-seeking activities and corruption in the management of valuable resources.

However, sometimes the unexploited abundance of natural resource may be beneficial to the local people as long as it provides them the basic needs to sustain life such as food, clothing and shelter. On that ground the conventional arguments regarding the connection between abundance of natural resource and economic progress can be contested. It is frequently noticed that exploitation

of natural wealth resources generates environmental externalities. These externalities may harm the well-being of local people and environment. Further, the goal of achieving sustainable development becomes complicated because of non-renewable characteristics of many of the natural resources. This is because on one hand once a non-renewable resource is extracted it will no longer be available for future use and on the other hand, it will bring disastrous consequences for the local people in the exploitation process.

1.4.1: The History of Resource Curse Hypothesis

The idea that abundance of natural resource can lead to harmful outcomes has a prolonged eminent academic history (Ross, 2014). Prior recent philosophers like Bodin, Machiavelli and Montesquieu are of the view that the citizens resource rich countries become myopic and slothful. Adam Smith suggested that instead of replacing capital, mining projects absorbed them. David Ricardo was of the view that the social and economic benefits from mining are very few. He gave evidences that countries like Spain and Portugal were very rich in the production of gold and silver. However, this resource endowment has neither improved the manufacturers and agriculture nor the circumstances of the communities (Ricardo, 1817).

In the 1950s and 1960s, development economists like Raul Prebisch and Hans Singer argued about the potential negative impacts of natural resources. They opined that the exporters of primary products would find themselves in a disadvantaged positions while trading with industrialised countries because the terms of trade are deteriorating (Prebisch, 1950, 1964; Singer, 1950). Income elasticity of demand of primary products is smaller than manufactured goods. If income increases, people demand more of manufactured goods than primary goods. Similarly, primary products have a low price elasticity of demand. When prices decrease, revenue decrease rather than increase it. Thus, those countries which depend heavily on the primary products exports will be in a disadvantageous position. Similarly, others (Seers, 1964; Hirschman, 1958; Baldwin, 1966) advocated that in comparison to manufacturing the linkages effect from primary product exports would be limited. However, another group of researchers (Lewis, 1989; Roemer, 1970) argued that primary goods can also stimulate economic growth.

In 1988 Alen Gelb in his book “Oil Windfall: Blessing or Curse”, discusses about resource curse thesis. He has given a descriptive analysis of the effects of oil rents and found that there has been a significant decline in the productivity of home capital formation of oil rich nations during 1971-1983 compared to the non-oil rich nations. Inspired by the works of Gelb, Auty (1993) discussed how natural resource rich nations had slower economic progress than natural resources poor nations. The outcomes of manufacturing strategies executed by the mineral-rich nations, enclave tendencies of mining industry and explosive tendencies of mineral receipts have been discussed by Auty (1993). He demonstrated that mining corporations that are possessed by foreigners took away the receipts of mineral-rich nations to their own countries and therefore, the mineral-abundant nations had to accumulate little withholdings receipts.

A comprehensive analysis of bigger industrializing nations such as China, India, Brazil and Mexico with modest resource poor economies like South Korea and Taiwan is presented by Auty (1993). During 1950s all these six economies had followed a self-sufficient (i.e. autarkic) industrial policies. But in 1958 and 1963 Taiwan as well as Korea adopted open market-oriented industrial strategies and left their autarkic industrial strategies. Resource poor economies such as Korea and Taiwan failed to obtain enough foreign exchange reserves. In order to overcome their foreign exchange deficiencies, Taiwan and Korea return back to cut-throat industrial exports as compared to India, China, Mexico and Brazil. Bigger industrializing economies such as China, Brazil, India and Mexico encountered with foreign exchange limitations in the 1960s as a result of their autarkic industrial policies. These countries wanted to reform these policies. However, the powerful classes who were gaining from the rents generated by protected infant industries do not allow them to reform. This makes Auty to believe that rent-seeking behavior of powerful vested interests is responsible for delayed competitive industrialization and slowed economic growth (Auty,1993).

Again, Auty (1993) in his book provides the resource curse confirmation of mineral countries such as Bolivia, Zambia, Peru, Jamaica and Papua New Guine in contrast to Chile. Those developing economics which produce at least 40% of their export earnings from the mineral sector are defined as mineral economies by Auty. Auty (1993) argued that developing economies having more natural resources should perform better than natural resource poor economies. This is because

income earned from mineral sector can provide an opportunity to the resource rich economies to industrialize their economies by earning extra foreign exchange and taxes.

However, the economic progress and social welfare of mineral rich countries were lesser than mineral poor countries at a similar level of development. Mineral rich countries fail to increase their industrialization process due to operation of three factors as stated by Auty (1993). These factors are (1) the nature and functioning of the mining sector (2) domestic linkages (3) mismanagement of mineral rents (Auty,1993). Figure 1.2 provides the development of ideas about the resource curse thesis.

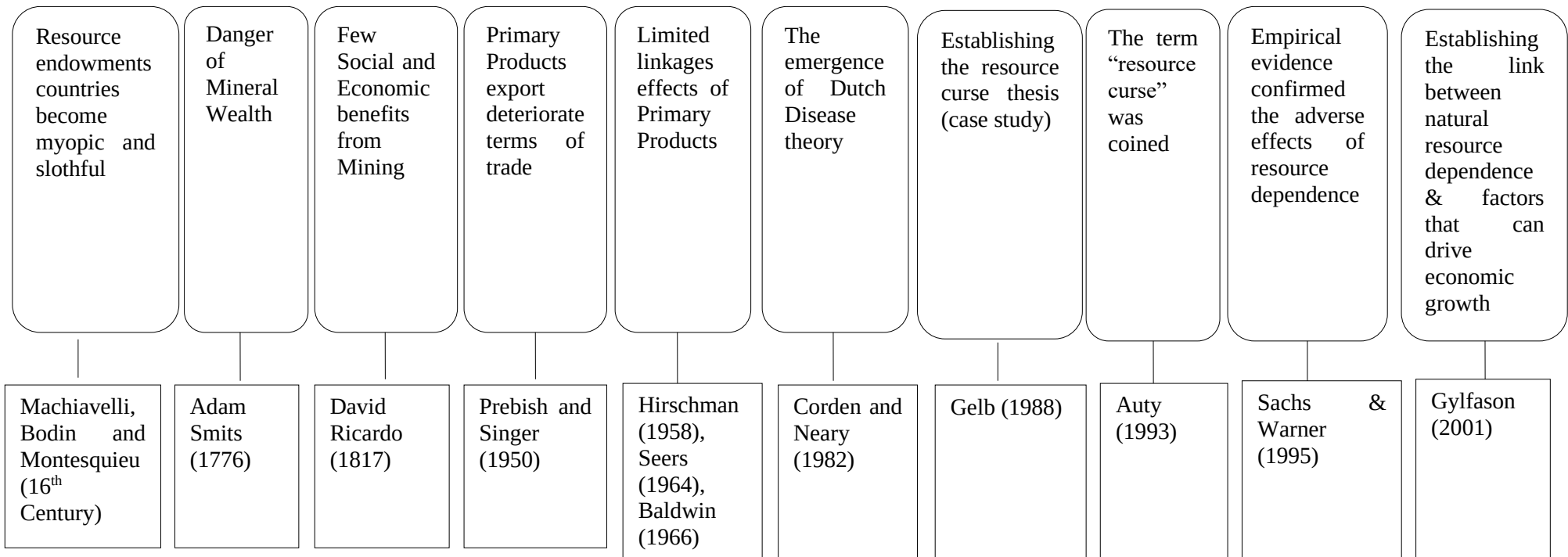


Figure.1.2: The Evolution of the Resource Curse Thesis

Source: Badeeb et al., 2017

1.5: The Resource Curse's proposed economic and political mechanisms

The explanation for resource curse is based on the following logic: Natural resources crowd-out activity x . Activity x pushes growth. Therefore, natural resource is detrimental to growth (Sachs and Warner, 2001). The activity x includes both economic and political factors. Thus, there are two channels viz. economic and political channels through which natural resource dependence negatively affect economic development of resource rich countries. Natural resource dependence affects long-run economic growth through economic mechanisms like Dutch disease, the volatility of commodity prices, failures of economic policy and neglect of education. On the other hand, rent seeking, weak institutions and corruption are the main political mechanism (Badeeb et al., 2017).

A question arises that whether these economic and political factors are exclusively exists in resource rich countries or whether they are rather typical characteristics of poorer economies in general. It is argued that economic elements such as Dutch disease and price volatility are the unique feature of resource rich countries since they are associated with international commodity market. On the other hand, political elements such as corruption and rent seeking are the characteristics of numerous poor countries even though they do not have natural resources. However, the rentier state theory states that resource-rich economies are more prone to such factors than resource-poor economies (Di John, 2011; Badeeb et al., 2017). The following sub-section analyses the key causal transmission channels of the recourse curse.

1.5.1: The Dutch Disease

The “Dutch disease” is considered as the most prominent economic channel for the natural resource curse (Iimi, 2007; Shao et al., 2020). The Dutch disease model was for the first time suggested by Corden and Neary (1982). In Netherlands a new source of natural gas was found and consequently the Dutch manufacturing sector reduced. This incidence gave rise to the concept of Dutch Disease. The Dutch disease model advocated that the economy consists of three sectors: (1) a tradable natural resource sector which is facing the world prices; (2) a tradable sector (e.g. housing); (3) a tradable manufacturing sector that is also subjected to world prices (Corden and Neary, 1982 and Corden, 1984). When the resource boom occurs in the economy because of

discovery of resources, two types of effects are created viz. spending effect and resource movement effect.

The Dutch disease occurs when there is an initial increase in domestic income and spending fueled by resource booms. Now a fraction of increased revenue generated from resource sector can be employed to buy commodities from the non-tradable sectors. As a result, goods of non-tradable sector will have high demand in the market and consequently their price will rise relative to the price of goods from tradable sector that remain at world market prices. (Eisgruber, 2013). This will cause the real exchange rate to appreciate and as a result, goods like domestically produced manufacturing become less competitive on world markets (Corden, 1984; Wu et al., 2018; Ratha and Moghaddam, 2020; Cheng et al., 2021). This type of negative impact generated by resource boom is known as the “spending effect” (Figure 1.3A).

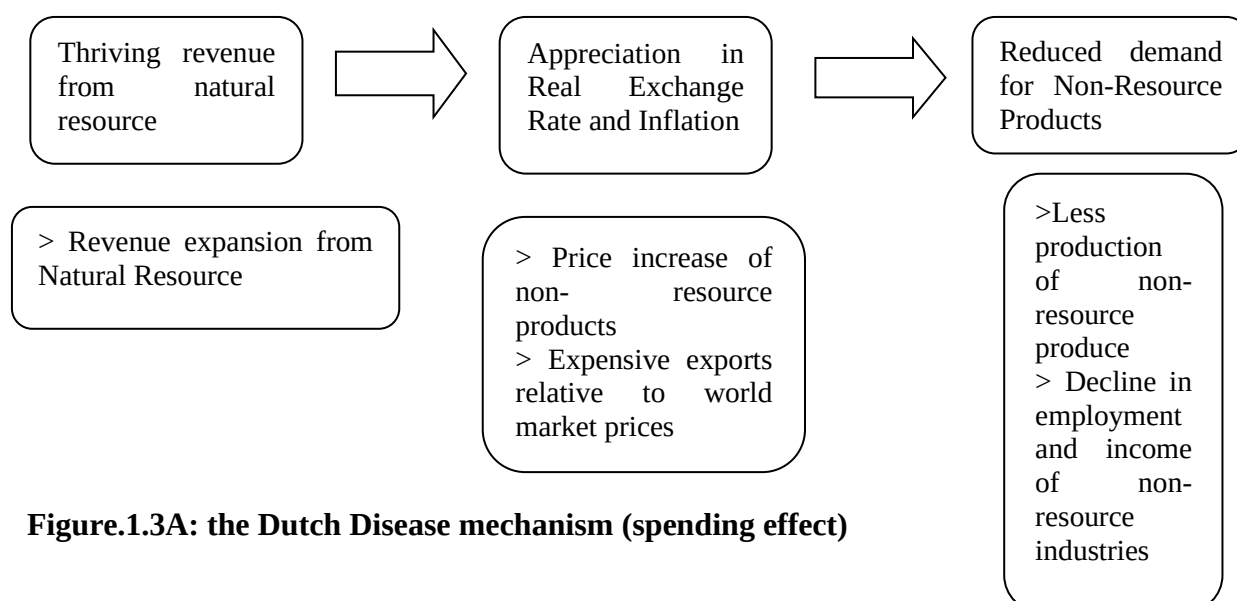


Figure.1.3A: the Dutch Disease mechanism (spending effect)

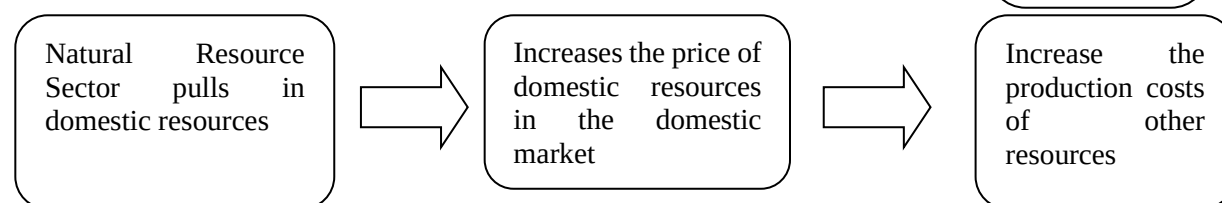


Figure 1.3B: The Dutch Disease mechanism (Pull effect)

Source: Badeeb *et al.* 2017

In addition, there is a shift of internal domestic inputs like labour and materials towards the booming natural resource area. As a result, there is a rise in the prices of domestic factors in the home market. Consequently, the traditional export sectors namely agriculture and manufacturing experience increase in their cost of production. As a result, the traditional export sectors contract. This type of unfavourable impact created by booming resource sector on non-resource sector is described as the resource “pull effect”. (Figure 1.3B) (Corden, 1984 and Humphreys et al., 2007). According to Matsuyama (1992) the non-resource sectors like manufacturing are associated with learning-by-doing and positive spillovers. On the other hand, learning-by-doing do not take place in natural resource sector. As a result, the output of non-resource sector and hence, overall growth will be crowded out by the spending and pull effects generated by the rising natural resource sector.

1.5.2: Volatility in Commodity Prices

Volatile nature of natural resource prices in the international market is an additional economic route via which the resource curse hypothesis operates. (Badeeb et al., 2017). The terms of trade of countries heavily dependent on natural resources are subjected to higher uncertainty. (Aragon et al., 2014). Price volatility affects the implementation of sound, prudent policies. When resource boom takes place and commodity prices increase, commodity-rich countries borrow from abroad using future resource revenue as collateral. When commodity prices fall, international lenders ask the commodity-rich countries to repay the debt. Thus, resource booms lead to debt-overhang problem (Manzano and Rigoban, 2001; Van der Ploeg, 2011 and Kim and Lin, 2017).

1.5.3: Rent Seeking

Rent seeking is another political channel through which natural resources affect economic progress. There are two views on rent seeking as a transmission channel of resource curse. First group of researchers emphasize the matter from the viewpoint of private sector and second group of researchers from the point of view of political actors. Resource windfalls encourage entrepreneur to participate in unproductive ineffective rent seeking activities and thereby divert entrepreneurial talent (Aragon et al., 2014; Orihuela, 2018 and Zalle, 2019). Torvik (2001) and Mehlum et al. (2006) develop models with fixed number of individuals with entrepreneurial skills.

Their skills can be used either in an unproductive sector or in a modern sector. It is assumed that modern sector generates positive growth or demand complementarities (Murphy et al., 1989).

When boom takes place in the natural resource sector entrepreneurs are attracted towards the rent-seeking sector because now a rent-seeking activity is more profitable than other activities. Entrepreneurs consider rent-seeking activities optimal from an individual perspective although this is inefficient from social perspective. On the other hand, there will be losses of positive externalities in the modern sector and economic growth will be negatively affected. Thus, entrepreneurship drives economic growth. However, entrepreneurial activities are crowded out by the booming natural resource sector and consequently there is a reduction in economic growth (Baland and Francois, 2000; Torvik, 2002; Wennekers and Thurik, 1999).

There are various literatures available which emphasize on the incentives provided by the natural resource sector to political class (Eisgruber, 2013). Resource abundance encourages political class to engage in competition to take the rents generated by rising resource sector. The political class which are in power redistribute the resource rents in such a way that helps them to continue in power and increase their personal wealth. The aristocracy class of the society expand their power through revenue windfall in the resource sector and in this way income inequalities are increased by them in the society (Gylfason, 2001; Holder, 2006; Iimi, 2007; Deacon and Rode, 2012). The lion share of revenue windfall is taken away by these aristocracy and powerful class of the society. But they do not focus much on growth-oriented policies and invest these revenues to promote infrastructure. Thus, the economy is adversely affected and increase of economic growth in a sustain matter is affected. (Auty, 2010; Auty and Gelb, 2000). On the other hand, they distribute these revenues to fulfill the interest of their immediate groups. Studies (Salai-i-Martin and Subramanian, 2003; Davis and Tilton, 2005; Iimi, 2007; Boea et al., 2016) show that resource revenues windfall generate dispute among different home shareholders like local tribes, political actors and residents in general. Thus, the economic growth is pushed by healthy government investment in infrastructural activities like education. However, this healthy investment is crowded out by the rising natural resource sector and hence, the economic growth is contracted (Barro, 2001; Egert et al., 2009).

1.6: Research Gap

Most of the empirical resource curse studies have focused on cross-country analysis and comparisons because of better availability of data. But these studies suffer from endogeneity and omitted variable bias problem (Walker, 2013; Hota and Behera, 2019). Just now, resource curse studies have transferred from cross-country level to across states or regions within a country (Zhang et al., 2007; Freeman, 2009; Boutilier, 2017; Walker, 2013; James and Aadland, 2011). However, only few studies are available and whatever within country evidence are available that have concentrated on a few countries, such as the U.S, Canada, Brazil and Peru. Research in other resource-rich contexts such as Asia is needed to increase the external validity of these results and to better inform policy-makers and practitioners. Within country studies have some advantages over cross-country studies. For example, in within studies there is less need to control confounding factors such as differences in spoken language, institutions, government corruption and currencies. These factors influence economic growth (James and Aadland, 2011). The effects of natural resources on economic growth can be better recognized when the institutional structure of a country is homogeneous (Zhang et al., 2007).

In India it is still a research question. Although Damania and Gupta (undated) and Behera and Mishra (2012) have tried to examine the resource curse phenomena in Indian states, the methodology, measurement of the variables and coverage of the resource base they have taken require serious scrutiny. Similarly, very limited studies have discussed resource curse at the micro level. Therefore, the present study attempts to fill up these gaps.

1.7: Objectives of the Study

Odisha provides a good ground to test the relationship between abundance of natural resources and economic growth because there are wide variations in the abundance of natural resources in the state. In this backdrop a few important questions arise. Why mining-rich districts in Odisha have failed to show their true growth potential of their mineral wealth while mineral-poor districts have performed well? Are the mining-rich districts are suffering from resource curse? With this background the main objectives of the study are:

1. To test the Resource Curse Hypothesis in the mining-rich districts of Odisha.
2. To examine the impact of iron ore mine on the livelihoods of people in Keonjhar district of Odisha.

1.8: Study Area

The state of Odisha is very rich in minerals with good quality of bauxite, iron, manganese and chromite. The state also possesses other minerals like limestone, coal, dolomite, graphite. Odisha is home to 96 percent of chromite and 92 percent of nickel, 51 percent of bauxite, 43 percent manganese, 33 percent iron ore, and 24 percent of India's coal resources (Odisha Economic Survey, 2020-21). In mineral production, Odisha was the leader in 2019-20. Of total mineral production in India, Odisha contributed to 34.3%. In the production of bauxite, chromite and iron ore, Odisha occupies rank 1 and 3 in the case of manganese ore. The mining and quarrying sector accounts for 7.72 percent of Odisha's Gross State Domestic Product. and about 52 thousand employment opportunities are generated by this sector (Odisha Economic Survey, 2020-21).

The mining and quarrying industry's contribution to Odisha's mineral reserves has increased significantly in the last several years. In 2019-20, mining sector in the state has generated 11019.86 crore revenue (Odisha Economic Survey, 2020-21). Mining sector has also increased wage rate and consumer durable goods in the state (Mishra, 2009; Hota and Behera, 2019). However, it has resulted in large-scale displacement and other environmental externalities as a result of mines (Mishra and Mishra, 2017). In addition to that, mining in Odisha has resulted in forest degradation

and deforestation, causing loss of biodiversity (CSE, 2008), environmental pollution leading to decrease in crop yields in the mining areas (Hota and Behera, 2015), increase in air and water pollution in the mining areas (Mishra, 2010; Hota and Behera, 2015).

Mineral distribution in Odisha is uneven and concentrated in a few locations. The state's mineral reserves are concentrated in the districts of Angul, Jajpur, Jharsuguda, Keonjhar, Sundargarh, and Koraput. Of all the mining districts, Keonjhar district alone accounts for one-third of the minerals. Jharsuguda, Sundargarh, and Angul districts have coal, while Keonjhar and Sundargarh districts have iron ore. (Hota and Behera, 2019). Odisha's six mining districts account for 98.79 percent of the state's mineral value. The percentage of people belonging to the scheduled caste (ST) is higher in mining districts than in non-mining regions of the state. (Census of India, 2001 and 2011).

The present study has selected Keonjhar district as the study area because of the concentration of iron ore mines in the district. The main iron ore producing hub in Odisha is the Singhbhum-Keonjhar-Bonai mining belt, which runs through Keonjhar and the Joda-Barbil portion of the district. According to 2011 census, about 60% of the population in the district lives below the poverty line. Similarly, only 15.1% of households have access to toilets/latrine facilities within their own premise.

1.9: Data Collection and Sampling

The current study has used multi-stage stratified random sampling technique to select the sample households. There are thirteen administrative blocks in Keonjhar district. Out of which seven blocks are known as mining blocks (Banspal, Champua, Jhumpura Joda, Harichandanpur Hatadihi, and Keonjhar Sadar). A block has been designed as mining block on the basis of existence of mining activity. In the present study two blocks have been selected: Joda block has a high concentration of mines and Keonjhar Sadar does not have any mining operations.

Joda block has six operational iron ore mines such as Adhunik Metallic Ltd., Chamakpur Iron mine of K C Pradhan, SAIL Bolani Iron, Serajuddin and Co., Tarini Minerals Private Ltd., Joda East Iron Mine of Tata Steel Ltd. By using the lottery method of simple random sampling

technique, Balda Block Iron mine of M/s Serajuddin and co. has been selected to assess the impact of mining on people living in mining region. Under Joda block three gram panchayat comes. They are Palasa, Bada Kalimati and Balda. Balda gram panchayat has been selected for this study. Balda panchayat has five villages such as Guruda, Kundaposi, Silijora, Todapani and Balda. Out of these five villages, Balda and Kundaposi villages have been selected through lottery method. Under Keonjhar Sadar, Chaka village coming under Raghunathpur gram panchayat has been selected through lottery method.

The current study has a total sample size of 250 households. Out of which 150 households are selected from mining village (75 households each from Balda and Kundaposi village) and 100 households are selected from non-mining village. Since the effects of mining activities are observed more in villages closer to it, a greater number of households have been chosen from Balda and Kundaposi villages which are closer to mines.

1.10: Sources of Data and Methodology

The present study is based on both primary and secondary data. It has collected annual data covering the period 1995-2018 for 16 mining-rich districts of Odisha. Data on Net District Domestic Product (NDDP) has been collected from the Income Cell Department of the Directorate of Economics and Statistics Odisha. Data on total mineral production has been collected from the Directorate of Mine Odisha. Data on human resource development, financial development, investment, and institutional quality have been collected from the various publication of District Statistical Handbook of the Directorate of Economics and Statistics Odisha, Bhubaneswar. All the variables are transferred into natural logarithm. Similarly, primary data was collected by using a structured survey schedule on the households of mining and non-mining areas. In addition to that, interviews were conducted with various officials of Serajuddin & Co., Deputy Director of Mine at Keonjhar and various other stakeholders in the mining sector.

The Pesaran Cross Sectional Dependence Test is used to determine whether the variables are cross-sectionally dependent. After that to test the stationary properties of variables Pesaran's Cross-sectional Augmented Dickey-Fuller Test is used. After doing all these tests, Panel Autoregressive

Distributed Lag Model (P-ARDL) has been employed to estimate the long-run relationship among variables.

To meet the second objective a cross tabular analysis is used to do a socio-economic analysis of the study villages. Different statistical techniques like, regression analysis and principal component analysis are employed for the data analysis.

1.11: Chapter Outline

The Thesis is divided into five chapters. The present chapter provides an overview of the meaning of natural resource curse, history of resource curse and different economic and political channels through which resource curse operate. It also discusses Dutch Disease, volatility of commodity prices, rent-seeking, corruption and institutional quality that are different explanations of resource curse. Additionally, research gap, objective of the study, study area, data collection & sampling, sources of data and methodology is also given in this chapter. The relevant literature on the impact of natural resource abundance and economic development is highlighted in second chapter. Chapter three provides an overview of natural resources in Odisha with special reference to Keonjhar district followed by panel data analysis in mining-rich districts of Odisha. Chapter four discusses the profile of mining company selected for the present study. It also provides information on the socio-economic profile of the sample households followed by main results and discussions. Chapter five presents the summery of all findings and present the concluding remarks followed by policy recommendations.

Chapter 2

Resource Curse or Resource Boom? Issues across countries

2.1: Introduction

The development of resource curse studies has been scattered. Mainly economists, political scientists and political economists have investigated the relationship between abundance of mineral resource and economic growth in the long-run. But their studies are mainly restricted to the country (macro or provincial (meso) level. On the other hand, the growth effects of extractive industries on the community people (micro level) have been examined by sociologists, anthropologists and other social scientists. The present chapter highlights connection between abundance of natural resources and economic growth in two main categories. The first category focuses on the macro or cross-country experiences on resource curse. Within that a few literatures observe favourable impact of abundance of natural resources on economic growth whereas others notice an unfavourable effect of abundance of natural resources on economic growth. The second category emphasizes on the experiences of resource curse at the regional level.

2.2: Macro or Cross-country Experiences on Resource Curse

The resource curse studies can be split up into three sub-categories. The first sub-categories include natural resources and economic performance, the second sub-categories comprise natural resources and civil war and the third sub-categories consist of natural resources and political regimes. The concept of resource curse was originally connected with the initial sub-categories, out of all three sub-categories. But latter on other two sub-categories have emerged. The seminal work of Collier and Hoeffler (1998) gave rise to the second sub-categories and the third sub-categories emerge after the studies of Wantchekon (1999) and Ross (2001). Thus, the experience of resource curse is now multi-dimensional. It not only leads to reduced economic growth but also generate civil war and authoritarian government.

2.2.1: Natural Resources and Economic Performance

The first work on resource curse was started by Gelb (1988) and Auty (1993) through their case studies. But in the resource curse literature Sachs and Warner (1995) study is considered as the

pioneering study. They examine the relationship between economic growth and natural resource abundance in a sample of 97 developing countries and notice a statistically significant negative association between per capita income growth and abundance of natural resource over the time 1970 to 1989. They have taken natural resource exports such as fuels, minerals and agriculture in 1970 as the measure of abundance of natural resource and mean yearly changes in per capita real GDP from 1970 to 1989 as the proxy for economic growth. According to their result, during the time period 1970 to 1989, given an initial level of income, economies with higher resource exports had slow growth. In another study they updated the time period to 1990. They took the average annual change in real GDP per economically active population as the proxy to measure economic growth the and 1970 share of agriculture, mining, and fuels exports in GNP as the proxy of resource abundance (Sachs and Warner, 1997a).

According to them the resource curse is not explained by other omitted variable (i.e. geographical or climate variables). They have included four geography and climate variables (percent of land area within 100 km of area, kilometers to the closest major port, fraction of land area in the geographic tropics, falciparum malaria index) and found that their inclusions do not eliminate the evidence of resource curse (Sachs and Warne, 2001).

The influential study of Sachs and Warner (1995) on the negative association between abundance of natural resource and economic growth encouraged many scholars to investigate the authenticity of the resource curse hypothesis (Leite and Weidmann, 1999; Gylfason et al., 1999; Sala-i-Martin, 1997). They produced the equivalent inverse relationship between proxy of abundance of natural resource and economic using larger datasets. Leite and Weidmann (1999) have shown both theoretically and empirically the rent-seeking and corruption channel through which natural resource abundance affect economic growth. They have divided the natural resources variable of Sachs and Warner (1995) into four components such as fuel, ores, agriculture and food. Fuel and ores industries are capital intensive while agriculture and food industries are labour intensive and it is found that capital intensive industries encourage higher level of corruption, *ceteris Paribus*. Rodriguez and Sachs (1999) find the evidence of resource curse in Venezuela. Auty (2001) finds that between 1960 and 1990, in resource-poor countries the per capita incomes grow at rates two or three times higher than resource rich countries.

The relationship between resource abundance and genuine income (GDP minus depreciation) is examined by Neumayer (2004) and find the evidence of resource curse. Similar findings are reported by Isham et al. (2005). Resource-rich countries' economic achievement in the Middle East and North Africa (MENA) is examined by Arezki and Nabli (2012) over the period 1960-2008. They find that many countries have performed better in terms of income, but their performance is very poor in other developmental indicators. These countries are undergoing low economic growth and high macroeconomic volatility. Salai-i-Martin and Subramanian (2013) shows a negative association between economic growth and mineral resources in Nigeria. In the same way, Kim and Kin (2015) investigated the resource curse hypothesis in a sample of developing countries. Using heterogeneous panel cointegration techniques, they discovered that resource-rich countries expand at a slower rate than resource-deficient countries. Between 1965 and 2011, Ahmed et al., 2016 investigated the resource curse hypothesis in Iran. They used the Cobb-Douglas production function and looked at natural resources, labour, capital and exports as factors in economic growth. The empirical findings suggest that resource curse hypothesis exist in Iran. Further, the study finds that there is feedback effect between economic growth and abundance of natural resource as suggested by the causality results.

The resource curse experience of Chinese provinces has been investigated by Wu et al., 2018 by using panel data. They have differentiated between two concepts i.e. natural resource abundance and natural resource-oriented industry dependence and found an inverse impact of natural resource-oriented industry dependence on economic growth. There are three transmission channels through which resource industry dependence negatively affect economic growth viz. crowding out effect, Dutch disease effect and institution weakening effect. In the same line, Tiba and Mohamed (2018) tested the resource curse hypothesis in 22 African countries over the period 1990-2013. By using the Pedroni panel cointegration test the study found that there is a negative relationship between economic growth and resource intensity index in the long-run. This finding suggests the presence of resource curse hypothesis in African countries. The research studies of Petkov (2018) clearly indicated that countries with abundant natural resources had worse economic performance when compared to countries with fewer natural resources. Similarly, Tiba (2019) also looked at the resource curse hypothesis in 21 Sub-Saharan African countries between 1990 and 2015. They

used the PSTR model based on nonlinearity to establish the threshold above which the natural resource abundance negatively affects the economic growth of African countries. The study results confirmed the concept of resource curse in African countries.

The impact of abundance of natural resource and resource industry dependence on the green total factor productivity (green economic growth) in China is examined by Cheng et al. 2020. The empirical findings show that with the help of resource industry, abundance of natural resource has reduced the economic green growth of China. Reduction in human capital, technology, investment in innovation and increase in the proportion of secondary industry are the transmission channels found by the study through which resource industry dependence has reduced China's green economic growth. Another recent study by Ampofo et al., 2020 found evidence of resource curse hypothesis in Australia, India and Democratic Republic of Congo. When the total natural resource rents increase in these countries, their economic growth is negatively affected. On the other hand, when the total natural resource rents decreases, it favourably affects their economic growth except in Democratic Republic of Congo. In a recent study Adekoya (2021) classifying the countries into resource-rich and resource-poor found that oil consumption has negatively affected the economic growth of resource-rich countries while in case of resource-poor countries oil consumption does not have any significant impact on economic growth.

Thus, this view argues that natural resource abundance has a considerable detrimental impact on economic growth. That means it supports the existence of resource curse theory.

2.2.2: Natural Resource Curse: A Statistical Mirage

By the late 2000s, a negative effect of natural resources on economic growth was taken for granted particularly in developing countries. However, in the recent time there is a challenge to the resource curse hypotheses. According to James (2015b), resource curse is a statistical mirage. This view argues that there is a positive link between natural resource availability and economic growth. That means, it disproves the resource curse theory. (Zhan et al., 2021).

The beneficial effect of natural resource availability on long-term economic growth is discovered by Alexeev and Conrad (2009). Smith (2015) presented that GDP per capita has increased

significantly due to the discovery of natural resources while Arezki et al. (2017) found that discovery of natural resources has reduced saving rates initially but in the successive years saving rates have increased. Hilmawan and Clark (2019) found a positive link between resource reliance and per capita income in Indonesia.

The findings of above studies reveal that the association between resource availability and economic growth is still unresolved. Lashitew and Werker (2020) suggested that several factors are responsible for conflicting findings on the association between resources and economic growth. one such factor is the failure to differentiate between natural resource abundance and natural resource dependence. Lederman and Maloney (2007 and 2008) and Brunnschweiler and Bulte (2008) have criticized the resource abundance measure used in the resource curse literature. The first empirical resource curse evidence is found by Sachs and Warner (1995) by taking a sample of 97 developing countries. But their proxy of resource dependence is criticized by Lederman and Maloney (2007 and 2008). They argued that out of the 97 countries, for two countries such as Singapore and Trinidad and Tobago, Sachs and Warner have used net resource exports as a share of GDP as a proxy of resource dependence. On the other hand, for rest of the countries they have used total resource exports as a share of GDP as the proxy of resource dependence. Sachs and Warner (1995) have not explained why this adjustment is done for two countries only. Lederman and Maloney (2007 and 2008) could not find any evidence of resource curse when they use either net measure of resource exports or the gross export measure.

In Sachs and Warner's study, the ratio of resource exports to GDP is utilized as the measure of resource availability. This proxy has been criticized by Brunnschweiler and Bulte (2008). They considered it as the measure of resource dependence rather than resource abundance. The denominator GDP of the export/GDP dependence calculates the scale of other activities in the economy. The ratio variable cannot be called exogenous variable rather it suffers from endogeneity problems because it depends on the economic policies and institutions that produce them. They have argued that the export-based measure of resource abundance is a flow measure which suffers from endogeneity problem. On the other hand, stock-based measure such as value of natural wealth and subsoil assets are exogenous and would be a better measure of resource abundance. By using

the stock-based measures of resource abundance World Bank (1997) they found a positive relationship between economic growth and natural resource abundance.

It may be possible that when resources are in the ground, they do not put more problems for institutional quality or economic performance. On the other hand, flows of resource rents may put more problems. Another possible explanation is that causality may run from institutions to dependence instead of from dependence to institutions. Poor institutions make it difficult for countries to establish non-primary output sectors, leaving them reliant on resource exports. In the subsequent year Brunnschweiler and Bulte criticized the endogeneity of common resource dependence. Their view is again criticized by Van der Ploeg and Poelhekke (2010). They took subsoil wealth as the proxy for resource abundance that is linked to resource rents. However, resource rents are endogenous and cannot be taken as an exogenous measure of resource abundance.

Another factor is the selection of sample choices. Different studies have found different results depending on the sample choices (Fan et al., 2012; Gerelmaa and Kotani, 2016; Michieka and Gearhart, 2018; Henri, 2019). The time samples utilized for resource curse examinations were challenged by Alexeev and Conrad (2009). They claimed that the majority of the literature identified an adverse association between economic growth and natural resource availability as a result of data misunderstanding. They used the time period 1965 or 1970. They opined that this time interval is troublesome because majority of oil-exporting states started their commercial exploitation before 1950. This leaves more than 15 years out of the analysis.

The previous studies have used growth rates over time to determine long-term growth. If the time period is too short then it is very difficult to determine the impact of natural resources on the rates of growth. By taking GDP per capita levels rather than growth rates over a given period of time they have shown that natural resource endowment particularly oil and minerals have positive effect on long-term economic growth. They have not taken natural capital as the measure of resource abundance because it includes the value of arable land rather, they have focused on point-source resources or lootable resources. Taking hydrocarbon deposits per capita, per capita production of

oil and per capita mining output they have shown that oil and minerals endowment have positive and statistically significant effect on the per capita GDP levels.

The time samples used in the resource curse literature are also criticized by Stijins (2005); Boyce and Emery (2011); Cavalcanti et al., 2011; James (2015b). The majority of these research suggest that when natural resource dependency is replaced with natural resource availability, as measured by a measure of natural resource wealth, natural resource has a beneficial influence on growth. Manzano and Rigobon (2001) suggested that Sachs and Warner's (1995) resource curse model simply reflected the effects of global oil price shocks in the 1970s and early 1980s. They opined that reduced growth is not an intrinsic trend for natural resource countries.

Recent research has also discovered a positive link between natural resource availability and economic growth. Arin and Braunfels (2018) found a positive relationship between economic growth and natural resources. Better institutional quality has made possible this positive result. Erum and Hussain (2019) studied the association between natural resources, corruption and economic growth by including the role of Information Communication Technologies (ICT) in Organisation of Islamic Corporation (OIC) countries. The study discovered that natural resources affect economic growth positively and corruption negatively affects economic growth. The combined effect of corruption and natural resources, on the other hand, has a favourable impact on economic growth. Again, the study divided the sample into high ICT and low ICT economies. A negative relationship is found between natural resources and economic growth in low ICT economies. But in high ICT economies, natural resources have positive but insignificant effect on economic growth. By using the Bayesian time-varying parameter (TVP) model, Olayungbo (2019) analysed the effect of oil revenue on Nigerian's economic growth over the period 1970 to 2015 and discovered that oil revenue export had a positive impact on Nigerian economic growth. Nawaz et al. (2019) found the similar results in Pakistan. In a recent study in Saudi Arabia and the United Arab Emirates, Aljarallah (2020) discovered a positive link between natural resources and per capita GDP. The study also found a positive impact on total factor productivity in Saudi Arabia. Solarin (2020) examined the effect of shale oil production on economic growth employment. Shale oil production has a beneficial impact on economic growth and total employment, according to the study.

2.2.3: Natural Resources and Civil Wars

There are different theories that explain the resource-conflict link. The first group of theories advocates that abundance of natural resource causes violence by weakening the government's administrative capabilities. As a result, government fails to prevent rebellions (De Sauts, 2002; Fearon and Laitin, 2003; Le Billon, 2005). The second group of theories contend that natural resource riches have no effect on the government, but rather has an impact on rebels, resulting in bloodshed. Rebels from an ethnically marginalised region are encouraged to go for violence. This violence will form an autonomous state for them, with profits generated locally not being shared with the rest of the country (Collier et al., 2009; Ross 2012). The third set of theories focus on the interactions between governments and rebels. Besley and Persson (2011), created a model which implies that resource rents expand the chance of conflict if the state is unable to promote peaceful intergroup transactions.

A large body of evidence suggests that the abundance of natural resources causes civil conflict to break out. Collier and Hoeffler (1998) investigated the experiences of 98 countries and 27 civil wars during 1960-1992. By taking share of primary exports in GDP as the measure of natural resource abundance, they discover that the richness of natural resources is a powerful and substantial driver of the outbreak of civil conflict. The association between these factors appears to be curvilinear, according to them. Initially, the availability of natural resources raises the likelihood of civil strife. This is because as the natural resource export increases the taxable base of the economy expands which will attract the rebels to capture the state. After a certain level of exports is reached, the risk of war decreases. This is because at high level of natural resources, government have sufficient amount of income which expand their financial capacity and hence military expenditure. Therefore, government become in a better position to defend itself from the rebels.

Collier and Hoeffler (2000) used a larger data set in their second analysis to confirm the same curvilinear association between natural resource richness and the commencement of civil war. They looked into the link between natural resource richness and various sorts of civil conflicts in their third study. Natural resources, they discovered, boost the likelihood of both secessionist and

non-secessionist civil wars. Secessionist conflicts, on the other hand, are three times more likely to occur than non-secessionist civil wars.

The link between natural resources and the outbreak of ethnic and non-ethnic civil wars in 138 nations between 1960 and 1995 is examined by Reynal-Querol (2002). She discovered that natural resource availability is a significant factor in explaining non-ethnic civil wars and other forms of political violence, but not ethnic civil wars. In the recent works, Collier and Hoeffler (2005) have used rent-based measure of natural resource abundance. Natural resource wealth continues to have a curvilinear association with the commencement of civil conflict, according to the study.

Some scholars discover that resource richness may increase the duration of civil conflicts. For example, Collier and Hoeffler (1998) discovered a curvilinear link between natural resource richness and the duration of civil conflicts. Countries with abundant illicit resources, such as opium, diamonds, or coca, tend to have more civil wars (Fearon, 2004). Natural resources prolong civil wars in a selection of resource-rich developing countries (Ballantire, 2003).

2.2.4: Natural Resources and Political Regimes

Natural resource wealth, according to the research, is linked to a lack of democracy and supports authoritarian regimes, particularly in African countries. Wantchekon (1999) examined the data for 141 countries between 1950 to 1990 and demonstrated that natural resource dependence in rentier economies generates social and political instability and creates an authoritarian government. Taking the ratio of primary exports to GDP as the measure of resource dependence the study finds a statistically significant correlation between resource dependence and authoritarianism. An increase of 1 percent in resource reliance corresponds to an increase of roughly 8 percent in the likelihood of authoritarianism. Lack of transparency and the absence of rules to distribute rents are the factors responsible for authoritarian governments. The study has also compared the experience of Nigeria to that of Norway. Both the countries experienced oil boom in the same decade. However, Nigerian government turned authoritarian while Norway remained democratic. It is found that Norway remained democratic because of its strong rule of law and better

decentralization of its government. On the other hand, Nigeria converted into authoritarian government because of its weak rule of law and more centralization of government.

There are three aspects of the claim that the oil impedes democracy and these aspects are addressed by Ross (2001). First, there are many other factors other than oil such as effect of Islam and the region's peculiar culture that also affect the absence of democracy in all Middle East governments. Therefore, the question is does oil have negative effect on democracy once all these factors are taken into account? Second does the antidemocratic effect of oil is restricted to Middle East or does it harm democracy in oil exporting countries around the world? Similarly, does oil have only antidemocratic properties? Or do other types of minerals and other types of commodities have antidemocratic consequences on governments in the same way? Third, if oil has antidemocratic properties, then what is the causal mechanism? The study confirmed that the oil hampers democracy. It also discovered that oil exports affect oil-poor governments more than oil-rich governments that reveals that oil hamper democracy even when exports are relatively limited. Oil stifles democracy not only in the Middle East, but also in other nations such as Indonesia, Malaysia, Mexico, Nigeria, and Central Asian oil-rich states. To test whether other types of commodity exports also hamper democracy, two variables such as food and agriculture have been added. It is found that the coefficient of these two terms is positive that reveals that oil and minerals are the only primary commodities that hinder democracy, other primary commodities do not.

It is once again demonstrated that the growth effect of abundant natural resources is dependent on country-specific constitutional structures. They discovered that in 1970, presidential democracies and nondemocratic regions with greater natural resource availability had poorer economic growth. A parliamentary democracy with greater natural resource availability in 1970, on the other hand, has no substantial impact on eventual economic growth. The analysis also demonstrates that proportional election systems are more likely than majoritarian voting systems to suffer from the 'natural resource curse' (Andersen and Aslaksen, 2008). Collier and Hoeffler (2009) argued that autocracy government and established democratic government perform better than the young democratic government in terms of resource allocation.

The long-term effect of oil wealth on democracy is shown by Tsui (2011) by using data on worldwide oil discoveries. He found that discovery of oil degrades the quality of democracy but only in non-democratic countries. A discovery of 100 billion barrels of oil reduces the democracy scores of non-democratic countries to about 10 percentage points, three decades after the discovery. There is no effect of oil on institutions in countries with established democracies. Again, it is reported that democratic transactions are prevented by higher levels of oil wealth. In young democracies there is misallocation of resources caused by rent-seeking activities and hence economic growth will be less (Andersen and Ross, 2014; Wright et al., 2015). Ahmadov and Guliyev (2016) suggested that young democratic are more prone to curse than autocracies. This is because in young democratic there are no institutional barriers which can check rent-seeking activities and hence the misallocation of resources. Acemoglu et al. (2019) argued that autocracy governments have worse impact on economic performance than democratic government. This is due to higher corruption, inequality and lower investment in education in autocracy government. Dell' Anno (2020) looked at the association between natural resource reliance, democracy, and economic growth in Iran in a recent paper. According to the study resource dependence and democracy have positive, negative or no significant effect on long-term growth.

2.2.5: Natural Resource Wealth and Institutions

There are differences of opinion in the resource curse literature on how institutions affect resource-abundant countries' economic growth. Some claim that natural resources have a detrimental impact on the quality of institution of a country. Others opine that institution do not play any role in the resource curse theory. Yet others highlight that quality of institutions determine whether resources are a curse or blessings (Badeeb et al., 2017).

In the first vein, natural resource wealth can damage institutional quality. Oil wealth, or aggregated metrics of resource richness, is inversely connected with measures of institutional quality, according to the study by Bulte et al. (2005), Isham et al. (2005), Beck and Laeven (2006), Knack (2009), Anthonsen et al. (2012), Salai-i-Martin and Subramanian (2013). Many hypotheses exist to explain how resource riches can negatively impact institutional quality. High levels of resource revenue in the resource-rich country force the government not to depend more on taxes from its citizens. As a result, the government is weak, subject to rent-seeking, and incapable of formulating

solid economic policy (Beblawi, 1984; Chaudhry, 1989 and Karl, 1999). It also inhibits politicians from investing in the state's bureaucratic capabilities (Besley and Persson, 2010), as well as encouraging lower-quality individuals to run for government (Brollo et al., 2013). The instability of these revenues causes a government's planning horizon to be shortened and big investments to be sabotaged (Karl, 1997).

The second vein of literature do not find link between institution of a country and its resource curse outcome (Sachs and Warner, 1995, 1997; Brunnschweiler, 2008). In a recent study Belaid et al. (2021) suggests the similar findings in MENA countries. It is discovered that there is no indication of resource curse irrespective of whether MENA countries are democratic or not.

In the third vein authors such as Mehlum et al. (2006) and Mavrotas et al. (2011) opine that institutional quality determine the resource curse outcome of a country. Tornell and Lane (1999), propose a model in which they have shown that how a state with weak institutions after receiving a positive fiscal shock (such as resource boom) may suffer from a voracity effect in which powerful groups compete for the windfall, leading to reduced growth.

Depending on the quality of institutions, countries with abundant natural resources might be growth losers or winners. If the institutions are grabber-friendly (more prone to corruption), more natural resources reduce aggregate income. On the other hand, with producer-friendly institutions (less prone to corruption), more natural resources increase income. Employing the similar information and methodology that Sachs and Warner used, Mehlum et al. (2006) find that resource curse is a phenomenon only in a grabber-friendly institutions countries while it is absent in production-friendly institutions countries. However, their results contradict the claims of Sachs and Warner (1995). According to Sachs and Warner (1995) institutions (bureaucratic quality) has no role in understanding the resource curse. They do not, however, explore the hypothesis that poor institutional quality might induce resource curse and that strong institutional quality cannot cause resource curse (Mehlum et al., 2006). Robinson et al. (2006) claimed that resource booms are wasted by excessive public employment and patronage when institutions are weak ex ante. Resource booms, on the other hand, are helpful when institutions encourage responsible and capable government. Torvik (2009) argued that a strong institutional framework mitigates the

detrimental impacts of natural resource endowments on growth. Similarly, it is found that the negative effect of resource availability on growth fades as institutional quality develops.

It is found that some resource-rich countries (Norway, Chile and Botswana) have been able to attain some measure of development and growth, but-Nigeria, another resource-rich country has stayed static (Asekunowo and Olaiya, 2012). The study shows that Nigeria may be falling behind these countries in terms of growth because it may be suffering from extreme spending, difficulties in institutions, disproportionate borrowing, fractionalization causes of resource curse.

In the recent study Henry (2019) estimated the long-run versus short-run effects of reliance of natural resource on economic growth in Sub-Saharan African region. In order to examine how institutional quality as a transmission channel affects economic growth, the study grouped the countries on the basis of their institutional quality. By using two-step Engle and Granger procedure, the research found three types of results. The study presented that for all categories of countries, inverse link between economic growth and resource reliance is found. Countries that are having weak institutions are more vulnerable to resource curse. In such countries resource dependence also adversely affects the recovery process. The importance of institutional factors which will help Ghana to escape from resource curse is highlighted by Adams et al. (2019). Membership in the Extractive Industries Transparency Initiative (EITI), as well as institution related factors such as effectiveness of the government, sustainability of natural resource, real accounting practices, institutional and governance and control over corruption control helped Ghana break free from its resource curse.

Similarly, a threshold effect of institutional quality on the link between natural resource availability and economic growth is examined by Abdulahi (2019) in 14 Sub-Saharan Africa countries. The results find that when the threshold value of institutional quality is above -1.375 or it falls between -1.375 and -1.23, there is positive association between natural resource availability and economic performance. But when the threshold value of institutional quality is below -1.375, there is negative association between them. Amiri et al. (2020) also show that whether natural resources are curse or blessings depend on the quality of institution in 28 resource-rich countries. The study finds that the countries poor in institutional quality suffer from 'resource curse'. On the

other hand, there is no resource curse in countries that have good institutional quality. The study also finds that the natural resource sector in poor institutional quality countries reduce the manufacturing sector's growth, while this result is not found in good institutional quality countries.

2.2.6: Types of Natural Resources and Institutional Quality

The majority of research in the resource curse literature have utilized a single measure of resource abundance that includes all sorts of natural resources. This indicates that natural resources of all kinds have the same impact on economic growth. Challenging this some researches have distinguished types of natural resources and examined the impact of each natural resource on economic growth (Yilanci et al., 2021). Natural resources were divided into two categories in these studies: point resources like oil, coal, and gas, and diffuse resources like agriculture, forestry, and fisheries. Point resources are those that are harvested from a small geographic area, whereas diffuse resources are dispersed throughout a large area (Leite and Weidmann, 1999; Sala-i-Martin and Subramanian, 2003; Isham et al., 2005).

The most comprehensive study is conducted by Boschini et al. (2007). They looked-at the impact of natural resources on economic growth by separating them into four categories. They are (i) primary commodity export to GDP (ii) mineral production to GDP (iii) export of most appropriable resources (iv) exports of metals and ores to GDP. A particular resource like oil and diamond may be less problematic or boost the economic growth of a country if the institutions are strong. On the other hand, the same resources may be a problem for a country with poor institutions. They discovered that a country will suffer from the resource curse if its institutions are of poor quality and its resources, such as diamonds and precious metals, are easily accessible. In Nigeria Sala-i-Martin and Subramanian (2003) have differentiated four types of resources “(i) food, (ii) agricultural raw materials, (iii) fuels, (iv) ores and metals” and Natural resources, especially fuels, ores, and metals (point resources), have been demonstrated to have a detrimental impact on economic growth due to their negative impact on institutional quality.

Since 1980, ninety developing countries have experienced growth collapse and growth collapse is more in natural resource exporting countries than manufacturers exporting countries. Again, it is found that natural resources exporting countries have experienced different growth rate depending

on the types of natural resources exported by them. The countries that export point source natural resources (fuels, minerals, and plantation crops like sugar) have seen a significant slowdown in growth and have a lack of institutional capacity. On the other hand, diffuse source natural resources (livestock and agricultural produce) exporting countries have experienced no weakened institutional capacity (Isham et al., 2005). Similar kind of result is found by Bulte et al. (2005) and they claimed that resources have an indirect impact on wellbeing that is mediated by institutional quality. They used resource exports as a percentage of overall exports as a proxy for natural resource availability, and separated the data into two categories: point resources (fuels, ores, and minerals) and diffuse resources (all other commodities) (agricultural products and food). The proxies for institutional quality are Rule of Law (RL) and Government Effectiveness (GE). According to the study, point resources have poorer institutions and administrations (lower GE and RL scores). In the case of diffuse resources, the same pattern does not exist. Furthermore, the study claims that this point is associated with worse human development index scores and life expectancy, as well as a higher percentage of the population.

Resource rents, such as oil, forests, natural gas, and minerals, are found to have a favourable impact on economic growth in Asian countries. Forest rentals have the greatest impact on economic growth of all the resources (Jovic et al., 2016 and Prljic et al., 2018). Zuo and Zang (2020) investigated the influence of various natural resources on China's economic growth. According to the findings, coal has a beneficial impact on economic growth but a negative impact on growth-related parameters (R&D and education). In a recent study Yilanci et al. (2021) by classifying ten countries as developed economies (Australia, Canada, USA), moderate economies (Algeria, Brazil, Mexico, Chile), poor economies (India, Indonesia, Nigeria) on the basis of HDI scores and differentiating five types resources such as coal, forest, mineral resources, natural gas and oil, find no significant relationship between economic growth and natural resources in developed economies. However, they find some evidence of resource curse in moderate and poor economies in case of point-resource only.

2.2.7: Form of Governments and its Policies and Institutional Quality

Some studies find that the form of government and its macroeconomic policies determine whether resources are curse or blessings (Atkinson and Hamilton, 2003). Atkinson and Hamilton (2003) found that inability of the governments in resource-rich countries to manage resource revenues sustainably lead to curse and this mismanagement of revenues finally lead to lower or negative rates savings that is adjusted for resource depletion. The amount to which gains from resource depletion are utilized to finance investment is measured by genuine savings. Taking the share of resource rents in GDP as the measure of resource abundance the study find a negative correlation between GDP per capita and measure of resource abundance.

To explain resource curse, the study focused on the role of government policies by introducing three policy variables. They are share of government consumption in GDP, share of government investment in GDP and share of public sector salaries and wages in total government expenditure. It is found that those governments in resource-rich countries use their resource incomes to fund public investment have avoided the curse. On the other hand, those governments who consume the proceeds of their resource abundance have experienced resource curse. Furthermore, the resource curse has been discovered in resource-rich countries that have had zero or negative actual savings. On the other hand, countries where genuine savings are not zero or negative have avoided the resource curse. Again, a number of factors influence the savings and investment in resource-rich countries and quality of institutions is one of them. The study found that resource-abundant nations with high-quality institutions have enjoyed higher rates of investment and to a reduced amount savings.

The indicators of institutional quality used by Boschini et al. (2007) and Mehlum et al. (2006) is criticized by Andersen and Aslaksen (2008). They argued that these measurements are flawed because they have an endogeneity problem, and it is unclear which parts of institutional quality are vital for economic growth. To address these problems, Andersen and Aslaksen (2008) have used institutional design rather than measures of institutional performance and constitutional design is a significant part of a nation's institutional arrangements. They took a sample of 90 countries and categorized them into democratic or nondemocratic countries. They divided the democratic countries into presidential and parliamentary and majoritarian and proportional

electoral systems. They find that democratic presidential countries suffer from resource curse than the democratic parliamentary countries. They claimed that some forms of government, such as parliamentary or presidential, are more important for natural resource expansion than being democratic or autocratic. It is also discovered that proportional voting systems are more prone than majoritarian election systems to suffer from resource curse. Finally, the study reveals that presidential and non-democratic countries are primarily responsible for the resource curse evidence identified by Sachs and Warner (1995, 1997, and 2001).

2.2.8: Natural Resource Abundance and Human Capital Development

It is argued that the economic growth of any country is positively affected by human capital through good education and health. However, the resource abundance challenges such arguments through underinvestment in human capital and thereby creating possibility of a resource curse (Oduyemi et al., 2021). Empirical results show a mixed result regarding the association between natural resources and capital accumulation.

A positive relationship between natural resources and human capital is observed in the first group of studies. (Davis, 1995; Stijns, 2006; emery et al., 2012). Taking 90 countries during 1970-1990, Sachs and Warner (1997) found no statistically significant relationship between natural wealth and education. Stijns (2016) discovered a positive link between resource richness and human capital in a sample of developed and emerging nations. Kim and Lin (2017) found that resource dependency had a favourable impact on schooling while having a detrimental impact on health. Favourable association between natural resources and human capital is discovered by Almutairi (2019).

The second set of studies discovered that natural richness has a detrimental impact on human capital. (Birdsall et al., 2000; Auty 2001a; Kumar, 2017). Primary commodity sectors, according to Gylfason (2001a), employ lower-skilled labour and have few linkages to other sectors of the economy. Recently, in Nigeria the resource abundance has crowded out human capital and thereby confirming an inverse association between human capital accumulation and resource abundance (Akpan and Chuku, 2014). Shao and Yang (2014) also get similar findings based on this study. Ahmed et al. (2016) found that a rise in endowment of natural resources do not bring about any

increase in human capital accumulation and economic growth. In the same line, Cockx and Francken, (2014), Cockx and Francken (2015), Karimu et al. (2017) found the similar findings. Again, in a more recent study Sun et al. (2018) confirmed the inverse association between human capital and natural resource abundance in China.

A micro economic study in Columbia showed the effects of gold mining on human capital. The experimental discoveries of the research suggested that boom in the gold mining has benefited the economy in terms of decrease in unemployment rate in the short-run. But in the long-run the boom has reduced school enrollment. This is because the gold boom has attracted the child labour to work in the mine and they are bound to drop from this schooling (Santos, 2018). Perez and Claveria (2019) evaluated the interactions between economic growth and human development and a set of other variables that reveal the resource dependance. Ten African countries that have higher portion of mineral exports in their total exports between time period 2007 and 2016 are taken by them. Using dimensionally-reduction technique, they observed an inverse relationship between mean growth in human development and comparative mineral rents. Further, economic growth is not favourable contributed by the mean natural resource rents generated by the booming resource sector, according to the research. It indicates that economic growth might be hampered by the corruption. Also, in Sudan the resource rent has negatively affected school enrollment and life expectancy over the long period Mohamed (2020). In a more recent study Oduyemi et al. (2021) supports the similar findings in oil-rich African countries.

The third group of studies suggests neutral results. They argue that whether natural resources will affect human capital negatively or not depend on certain conditions. These conditions are the type of natural resources and quality of institutions (Behbudi et al., 2010; Blanco and Grier, 2012; Toews and Libman, 2013). Cabrales and Hauck (2011) argued the association between natural resources and human capital vary depending on the quality of institution. Resource-rich countries that have strong institutions have experienced favourable impact of natural resources on education while in weak institutions nations, there have been harmful effect. In a similar kind of research Aljarallah (2019) investigated the relationship between natural resource rents and institutional quality and human capital. The result indicates that in the long-run, the human capital reduces by 0.16% and 0.114 respectively as a result of one percentage rise in resource rents and corruption.

2.2.9: Natural Resource Abundance and Financial Development

Income earned through booming resource sector raise liquidity. As a result, it becomes easy on the part of banks to give credit facilities to the businessmen and households. In this way natural resource sector helps in the progress of financial sector of the economy. The institutional quality of a country determines whether progress in the financial sector will be encouraged by the booming resource sector. In institutionally strong countries, natural resources facilitate financial development (Dogan et al., 2020). However, the empirical studies in this regard have found mixed results. Some studies have found that natural resources promote financial development while others find that resources hamper progress in the financial sector. In USA, the financial sector is favourably affected by the resource sector between time period 1960 and 2016, according to the research findings of Shahbaz et al. (2018). In a recent study Dogan et al. (2020) examined the impact of natural resources on financial development in developed countries. They found that the financial development in the developed countries was positively affected by the resource sector.

However, some other studies find that natural resources reduce the financial development in institutionally weaker countries. Financial development of China is negatively affected by mineral resource abundance is found by Yuxiang and Chen (2011). Badeeb et al. (2016) also found that oil rent revenues negatively affect the financial development of Malaysia. Dwumfour and Ntow-Gyamfi (2018) found an ambiguous results in African countries. The proxy employed for financial development determine the effect of natural resource rents on financial progress of a country according to the research. Gu et al. (2020), Naseer et al. (2020) and Sun et al. (2020) found that natural richness has adversely affected the financial development of G-7 countries, South Asian countries and E-7 countries respectively. In the same line studies like Mlachila and Quedraogo (2020), Asif et al. (2020), Guan et al. (2020), Khan et al. (2020a) also found the same results. In a recent research Umar et al. (2021) examined the relationship between increase in oil price and efficiency of banking sector in twelve oil producing countries. The study found that there is decline of banking efficiency worsening of credit infection and rise in probability of default. In this way the study concluded that financial development of twelve-oil producing countries have declined due to rise in oil price. Another recent study by Jiang et al. (2021) found that rents exploited from the resource sector have negatively affected financial development in China.

2.2.10: Lessons, Policy Implications and Limitations of Cross-country Resource Curse Studies

The cross-country literature provides some important lessons. Firstly, owning of resources by a country is not harmful for its economic success. However, the absence of good institutions makes the natural resources to be bad for economic growth. Secondly, all types of natural resources do not suffer from resource curse. But some specific types of natural resources especially point source resources like oil, diamond and minerals that are harvested from narrow geographical areas have the more probability to suffer from curse.

The cross-country literature also provides some policy implications. First, it suggests that a proportion of resource rents generated from exhaustible resources must be accumulated and financed for different types of capital like infrastructural activities, education, health and financial assets. This is called the so-called Hartwick rule (Hartwick, 1977). For example, oil abundant nations like Norway, UAE, Saudi Arabia and Kuwait have established commodity funds or sovereign wealth funds. The practice of establishing sovereign wealth funds have been increasingly adopted by other resource abundant nations like Nigeria, Papua New Guinea, Kazakhstan, and Ghana. Second, it suggests that to identify the right policies is not the main challenge. But, how the people in the society will be able to embrace these policies is the main challenge. This calls for a right institutional environment. Therefore, major policy implications of cross-country research are that the nations that have abundant natural resources must enhance their institutions for the sake of making proper utilization of their grooming resource sector.

The cross-country studies are not free from limitations. First, reverse causality is one of the important challenges. Most of the cross-country studies have taken export-based measure as the proxy of natural resource abundance i.e. the ratio of resource exports to GDP. Any measure with GDP in the denominator is subject to reverse causality. Suppose a country has low GDP due to some reasons that are not related to natural resources. But it would seem that low GDP and other problems related to low GDP are the result of large natural resource wealth while in reality it is the low GDP that causes natural resource wealth to appear to be high (Alexeev and Conrad, 2011). Second, endogeneity is another problem attached with the cross-country studies. When natural resource exports are expressed as shares of GDP, the denominator measures the magnitude of other

economic activities in the economy. Therefore, the numerator variable is dependent on the economic policies and the institutions that produce them (Brunnschweiler and Bulte, 2008). Third, the empirical work suffers from omitted variable biases. Different countries are endowed with different history, culture, geography, institutional quality and macroeconomic policies. It is very difficult to measure all these differences. To address these problems scholars are using richer sets of covariates, exploiting panel datasets, and using instrumental variables.

2.3: Experiences of Resource Curse at Regional Level

Literatures relating to resource curse theory are numerous and plentifully available at the macro level. On the other hand, there is limited availability of literature that focus on the regional level. This section provides the effects of resource availability at the regional level. Resource curse literatures relating to cross-country research considered country as a unit of measurement. On the other hand, the regional resource curse study takes states, municipalities as a unit of measurement. Like cross-country resource curse study, the regional study also finds that abundance of natural resources leads to lower economic performance, corruption and conflicts.

2.3.1: Impact of Natural Resource Abundance on Economic Growth

Just like macro resource curse studies, within-country research also documents an inverse correlation between measures of natural resource availability and economic success. They have used the same regressions model employed in the macro resource curse research, however with the information collected from the provincial, state or county levels. Papyrakis and Gerlagh (2007), by taking the share of primary sectors in local GDP as the proxy of resource abundance, found an inverse correlation between income growth and resource abundance in the U.S. Natural resource availability is associated with reduced schooling, investment, openness and research and development expenditure and raises corruption. James and Aadland (2011) and Douglas and Walker (2013) found similar result from U.S. counties by using more disaggregated data.

Taking percentage receipts generated from mining sectors, fishing, agriculture and forestry as a measure of natural resource abundance, James and Aadland (2011) found the evidence of resource curse theory at the county level. They have conducted a case study of two states viz. Maine and

Wyoming. Wyoming is a resource-abundant state which consists of 23 counties. Natural gas, coal and various other minerals are mainly produced by Wyoming. Natural resource industry of Wyoming generates more than 25% of total receipts. On the other hand, in Maine less than 2% of earnings come from the 16 counties. However, Maine has performed better than Wyoming in terms of real per capita income between the time period 1980 and 1995. There has been a growth of real per capita income of 1.8 per cent in Maine whereas the economic growth of Wyoming has reduced at the rate of -0.2 per cent.

Variation in the growth of per capita consumption over Chinese regions has been investigated by Zhang et al. (2008). Inequalities in the standard of living of people in coastal and inland areas of China has been observed by the study. Shuai and Zhongying (2009) investigated the resource curse hypothesis in China using cross-province panel data between time period 1991 and 2006. They found a notably an inverse association between energy utilization and economic success. Further, the study has identified three causal mechanisms such as human capital investment, S & T innovation and corruption through which energy utilization negatively affect economic progress of China. Of the three causal mechanisms, human capital is found to be more powerful. Corruption and S & T innovation are identified as the second and third powerful causal factors respectively. Yuxiang and Chen (2011) observed that the financial sector of mineral abundant provinces of China has been lower. Zuo and Schieffer (2014) extended Shuai and Zhongying (2009) study by incorporating 30 provinces. They included only 10 Western China provinces which lead to selection bias problem. Like Shuai and Zhongying (2009), they also found a negative relation between natural resource abundance and economic growth. Further, the study found that education and R & D are the two main channel by means of which natural resource richness negatively affect the economic progress of China. The operation of Dutch disease at the state level over Canadian regions is investigated by Papyrakis and Raveh (2014). According to the research the competitiveness of mineral abundant regions of Canada has reduced as a result of inflation.

2.3.2: Impact on Employment and Local living Standards

Coal boom in the coal abundant regions of U.S. Appalachia in the 1970s and following bust in the early 1980s has affected the economic growth in the short-run according to the research of Black et al. (2005). According to the study male people in the main age group as well as employment and remuneration in the non-mining sector increase in the time of boom. However, these impacts are not found during the bust. The study does not support the Dutch disease theory. That means other sectors of the economy are not crowded out by the booming resource sector. Marchand (2012) also examined the effects of 1970s energy boom and bust on local labour markets using data from Western Canada. The study finds very small positive impacts of energy boom mainly in sectors like services, construction and retail. Similarly, Fleming and Measham (2014) found that in Australia recent coal boom increased employment opportunities in other sectors of the economy.

Between time period 1940 and 1990, Michaels (2011) by employing county level information investigated the long run growth effects of oil findings in the Southern U.S. The study found that discoveries of oil do not crowd out the manufacturing sector of the economy. On the other hand, it has increased the overall size of manufacturing. Allcott and Keniston (2013) has expanded Michaels (2011) work by incorporating whole rural counties in U.S. discovered and alike findings. According to the study oil boom, on one hand has increased income, population, employment and wages, but on the other hand it has not crowded out manufacturing sector of the economy. Employment and output in the manufacturing sector has increased as a result of discovery of oil.

Between time period 1969 and 1998, Jacobsen and Parker (2014) have expanded the work of Black et al. (2005) to Western U.S. by using county level data in recent time. Boom has increased nominal income, population, employment and wages in the economy. However, these impacts are not observed at the time of bust. The study found similar kind of results as observed by Black et al. (2005). Again, the study noticed that the manufacturing sector of the economy is not crowded out by boom neither in short run nor in long run. This result is not consistent with the findings of Michaels (2011) and Allcott and Keniston (2013).

The studies discussed above propose that extractive industries like oil and gas, coal mining favourably affect the economy by generating positive spillovers. Other sectors of the economy are favourably contributed by booms in terms of employment and wages. However, there are two major drawbacks of above discussed studies. Firstly, these studies do not give sufficient data on the impacts of booms on real income and other welfare measures. Secondly, they have discussed about developed nations like Canada, U.S. and Australia. Therefore, these studies do not provide information on the impacts of natural resource availability at the local level in underdeveloped countries.

This gap in the literature has been addressed by recent works. Caselli and Michaels (2013), using data at municipality level examined the impact of revenue windfall due to oil boom at the local economic level in Brazil. The study observed that the revenue of local governments has increased due to increase in oil production. However, the local governments have not spent adequately on public utilities services at the local level in spite of increased oil revenue. The study found no substantial increase in household income and population, no progress in housing conditions, provisions of educational and health facilities, and other welfare activities. This finding suggests that the local people have not been favourably affected by increased oil production. Further, Brollo et al. (2013) extended their study to all municipalities of Brazil. The study also found the similar results found by Caselli and Michaels (2013). According to the study corruption in the economy has increased due to fiscal windfall caused by increased oil production.

The importance of linkage between local economies and fiscal windfall associated with oil royalties in Peru is examined by Aragon and Rud (2013b). They have taken Yanacocha for their analysis which is a big gold mine in Peru. Yanacocha gold mine has generated backward linkages effect in the Peruvian local economy by increasing the demand for home factors substantially according to the research. The study has employed difference in difference method and household information and found that real income has increased and poverty has reduced in the economy as a result of generation of backward linkage effects. The gold mine has favourably benefited the local farmers and service workers that are not directly associated to the gold mine. They also examined the impact of the fiscal revenue windfall generated from gold mining production. Mining companies shared corporate taxes to local authorities in the Peruvian case. Like Caselli and

Michaels (2013), Aragon and Rud's (2013) study also discovered that gold mine has increased revenue of local governments and their spending capacity on public goods. However, these public spending do not translate into higher household income.

The effect of mining on social and economic life of people in Peru has been examined by Loayza et al. (2013). They have taken large district level statistics which incorporate both household and census surveys. The study found that mining production has increased the standard of living of the people by raising consumption, literacy rate and reducing poverty. This result is consistent with the findings of Aragon and Rud (2013b). However, they did not find positive relation between increased in government revenue from mine and provision of public utilities services. Besides, the study observed that there is increase in inequality as a result of mining production.

2.3.3: Impact on Corruption and Conflicts

There are very limited within-country studies that have focused on the boom in the natural resource sectors and consequent generation of dispute and corruption. In Brazil, the resource boom has increased the receipts of local government, but at the same time it has generated rent seeking activities and corruption at the provincial level (Brollo et al., 2013 and Caselli and Michaels, 2013). The increased revenue by the resource boom has changed the political consequences. The harmful politicians have been able to continue the government by increasing the public spending with the help of revenue generated by the resource sector. Incumbents are able to reelected number of times due to revenue generated by resource sector. Monteiro and Ferraz (2010) have also showed similar finds in the short-run only.

All the studies discussed above have examined the consequences of actual revenue extracted by the booming resource sector. However, resources at the ground (i.e. before the actual extraction of resources) could have different effect on political behavior. This anticipation may create competition among politicians to occupy future resource rents. This matter has been discussed by Vicent (2010) in case of Sao Tome and principle's declaration of discovery of oil. Public services like public procurement, customs, health care, state jobs and police are found to indulge in increased corruption activities and vote buying after the announcements of oil discovery.

According to the within-country studies there are two transmission channels viz. the opportunity cost effect and the rapacity effect through which natural resource availability create dispute at the local level. The kind of resources extracted determine the effect of resource boom on dispute. Easily appropriable resources like diamond, oil and minerals stimulate dispute whereas resources that raise local wages like agricultural goods reduce dispute. The increase in coca prices is associated with increased violence in rural areas, but modest local economic gains. Domestic dispute is encouraged by coca by providing financial opportunities (Angrist and Kugler, 2008). Gawande et al. (2012) examined the Naxalite conflict in India and found that negative agricultural shocks led to intensification of conflict. The rapacity effect and opportunity have been highlighted by Dube and Vargas (2013). They examined the effects of variation in commodity prices by using data at the municipality level from Colombia. Commodities like oil do not affect local wages, but they produce rents and dispute which the aid of rapacity effect. On the other hand, agricultural commodities, like coffee do not produce rents and dispute, but they create more wages and hence influence the opportunity cost of dispute.

2.3.4: Lessons from Regional Resource Curse Studies

The development of the regional/within state literature on resource curse are very limited, but still, they provide a deep understanding of resource curse dynamic at the regional level. Firstly, like the cross-country studies, the regional resource curse literature suggests that it is not inevitable. Literature shows that resource abundance does not have detrimental effects in some case. The channel through which resource rents are distributed matter more. Resource booms are found to stimulate unfavourable consequences like corruption, dispute and rent-seeking activities if rents exploited from natural resources are allocated through public mechanisms like receipts accrue to local governments from resource exploitation. On the other hand, resource booms will generate favourable effects to the local people at least in the short period if rents are allocated through market mechanisms like increasing demand for local workers.

Secondly, resource booms cause reduction in industrial activities in spite of the rise in price of domestic factors is not conclusive. In certain situation, booms in the resource sector does not support the Dutch disease theory. That means, resource booms are found to raise industrial activities. Thirdly, it underlines the significance of other effects generated by resource booms apart

from effect on economic growth and income. It is found from the literature that in some cases resource booms have shifted employment and generated pollution while in some other cases it is observed that booms have acted as a shock to local inputs demand. These findings suggest that abundance of natural resource can have impact on others welfare parameters like education, inequality and health.

2.4: Conclusion

The above review of literature on resource curse theory shows that there is no agreement among the researchers on whether natural resource abundance is a curse or a blessing for economic success of a country. Some literature shows the favourable effect of natural resource abundance on economic success. However, some other research demonstrates the unfavourable effects of natural resource abundance on economic performance. That means it argues that natural resource abundance is a blessing for economic performance. Whether abundance of natural resource would be curse or blessing to resource rich countries depends on the use of definition, parameter to measure resource abundance and sources of data. It is reported that resource dependence led to curse. On the other hand, abundance of natural resource has favorable effect on economic success.

Chapter 3

Resource Abundance and Economic Growth in Odisha

3.1: Introduction

Odisha has occupied a leading position in India as a natural resource rich region. The state is endowed with huge stock of valuable resources like chromite, iron ore, bauxite, and manganese ore. Additionally, resources like dolomite, coal, nickel, limestone, graphite, diamond, vanadium, decorative stones, gemstones and decorative stones are also found in Odisha. The present chapter highlights the contribution of mining sector to the economy of Odisha followed by the performance and contribution of mining sector in Keonjhar district, which is considered as the heart of mineral of Odisha. Further, the present chapter investigates the long-run association between abundance of natural resource and economic growth in 16 mining-rich districts of Odisha by employing panel autoregressive distributed lag model based on three alternative estimators such as mean group estimator (MG), pooled mean group (PMG) and dynamic fixed effects (DFE) over the period 1995-2018.

3.2: Mining Sector in Odisha: An Overview

According to Odisha Economic Survey 2020-21, Odisha has occupied position 1 in producing minerals like bauxite, chromite and iron ore. In terms of coal and manganese ores production, it has occupied rank 2 and 3 respectively. The mining and quarrying industry contributed 11.8% towards Gross Value Added of Odisha in 2019-20. Odisha played a lead role in producing minerals such as iron ore, coal and bauxite and it was the only producer of chromite in India in 2019-20. Of the total mineral production in India, the share of Odisha is 34.3% (Odisha Economic Survey, 2020-21). This section discusses about the mineral reserves, contribution of mining and quarrying sector, production, exports and employment of minerals in Odisha

3.2.1: Mineral Reserves of Odisha

Odisha has 25% of Indian coal mostly located in Angul, Jharsuguda, Sundargarh and Sambalpur districts of Odisha. Iron ore shares 44% of Indian iron ore. Iron ore in Odisha is mostly found in Keonjhar, Jajpur, Mayurbhanj and Sundargarh district. Bauxite is mostly confined in Koraput and Sundargarh district of Odisha and its share is 54% of Indian bauxite. Nickel, chromite and

manganese ores constitute 92%, 94% and 45% of Indian reserves respectively. They are found in Bargarh, Bolangir, Koraput, Sundargarh, Dhenkanal, Jajpur, Keonjhar, Rayagada and Sundargarh districts of Odisha. Other minerals like limestone, and graphite are also found in Odisha but their share is very less (Odisha Economic Survey, 2020-21).

Table 3.1: Mineral Reserves in Odisha and in India (in Million Tonnes)

Minerals	Odisha (% of all India reserves)	India	Major districts of Odisha
Bauxite	2128.5 (54%)	3896	Koraput, Sundargarh
Chromites	315.8(94%)	334	Dhenkanal, Jajpur, Keonjhar
Coal	80697.5(25%)	315149	Angul, Jharsuguda, Sundargarh, Sambalpur
Iron ore	10010.0 (44%)	22487	Keonjhar, Jajpur, Mayurbhanj, Sundargarh
Dolomite	8221.21 (97%)	8415	Bargarh, Bolangir, Koraput, Sundargarh
Limestone	2204.9 (0.86%)	203224	Koraput, Bargarh, Keonjhar, Sundargarh
Manganese ore	227.0 (45%)	495.87	Bolangir, Rayagada, Keonjhar, Sundargarh
Graphite	20 (9%)	194.89	Bolangir, Bargarh, Kalahandi, Kandhamal, Nuapada, Rayagada

Source: Economic Survey of Odisha, 2020-21 and Indian Minerals Yearbook, 2019

3.2.2: Share of Mining and Quarrying Industry in GSDP of Odisha

GSDP of Odisha is contributed notably by the mining and quarrying sector (Figure 3.1). Its contribution is increasing significantly from 1990-91 to 2019-20. However, in 2009-10 its contribution has decreased which is due to the suspension of 128 mines by the state government on charge of violating environmental clearances, deemed renewal and other statutory clearances. After 2010-11 its contribution has increased significantly. In the year 2014-15 mining sector's contributions has declined again which is due to the suspension of 102 mines by the state government on the direction of Supreme Court. Most of the mining lease holders were unable to pay the compensation as against their violation of environmental clearances. As a result, their

operations were again suspended, leading to fall in the contribution of mining sector in the year 2017-18. After that its contribution has increased slightly.

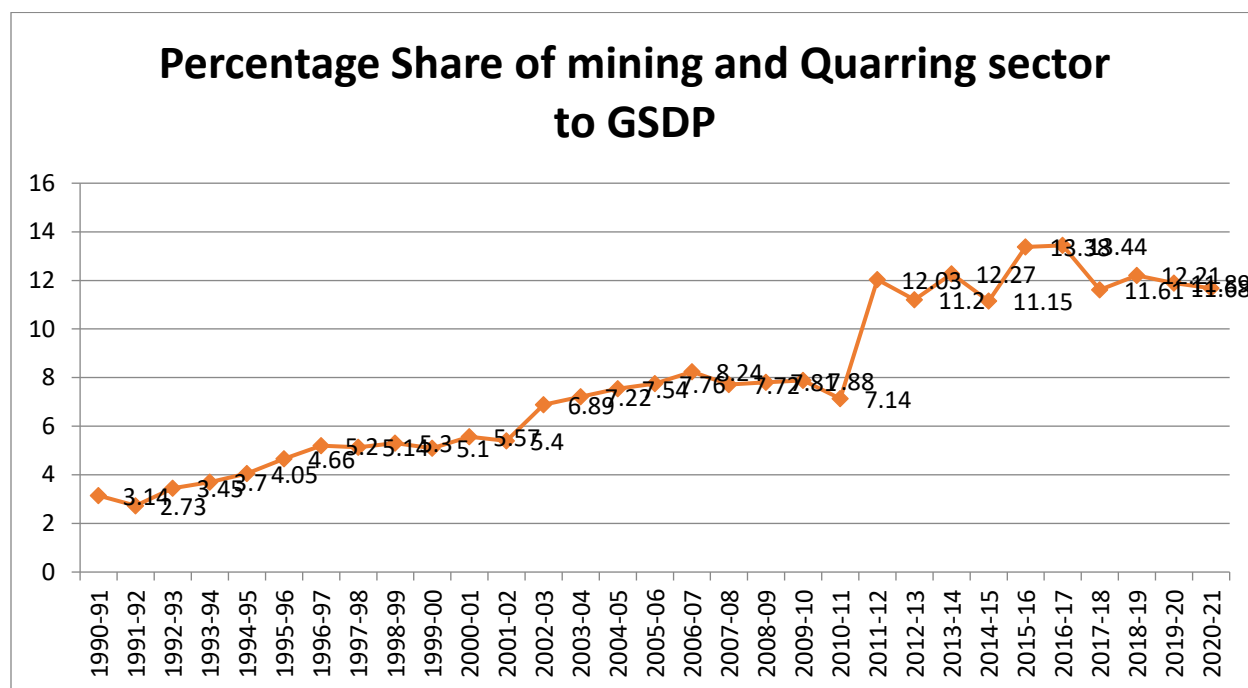


Figure 3.1: Share of Mining and Quarrying Sector in Odisha's GSDP

Source: Economic Survey of Odisha 2014-15 and 2020-21

3.2.3: Production of minerals in Odisha

Odisha was the principal producer of mineral in the country in 2017-18. Out of the total mineral production, its contribution was 34.3% in India. Rajasthan, Chhattisgarh, Karnataka, Madhya Pradesh and Jharkhand come after Odisha in terms of mineral production (Odisha Economic Survey, 2019-20). In the production of minerals trend in Odisha there has been a decline in the mineral production in 2009-10 (Figure 3.2). This reduction is due to the suspension of 128 mines operations by the state government. In the early October 2009, the state government launched a massive drive in order to verify the documentations of the mines being operated in the state. It was observed that many of the mines are being operated as deemed renewal, some are being operated without forest clearance and other statutory clearances. As the result, the state government ordered for the suspension of mines (mostly iron ore and manganese). This suspension of mines has resulted in decline in mineral production in 2009-10 in the state.

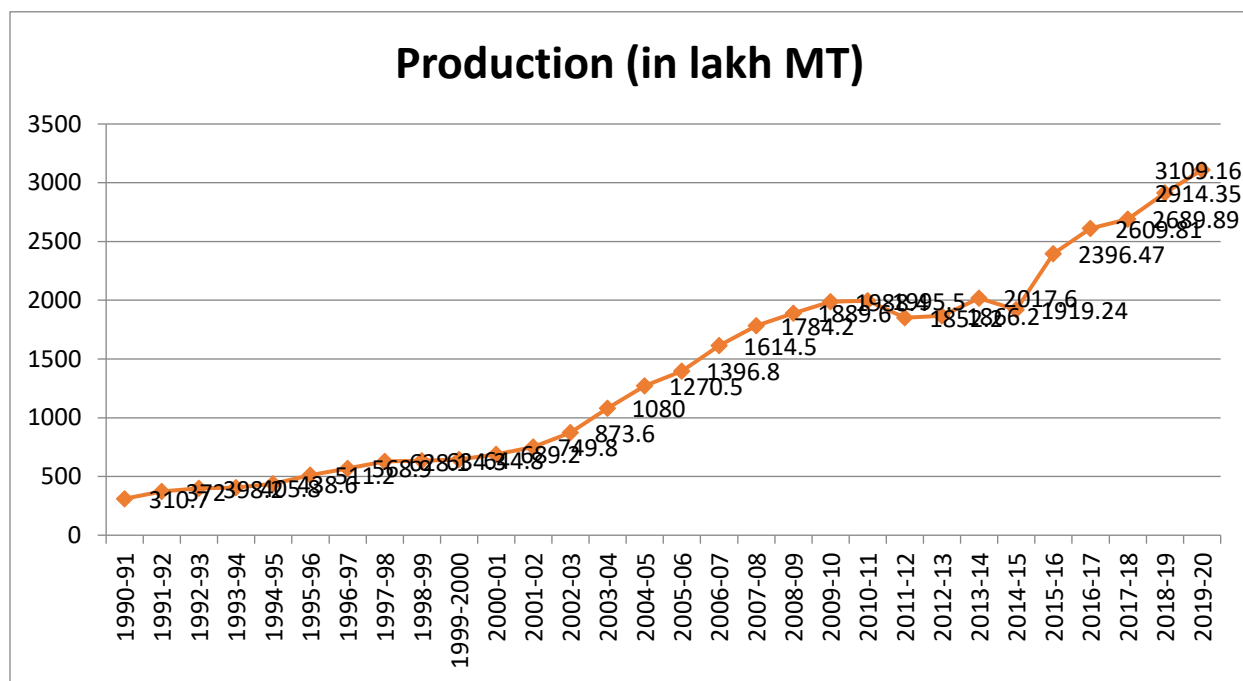


Figure 3.2: Mineral production in Odisha
Source: Various issues of Economic Survey of Odisha

Again, in the year 2014-15, the mineral production in the state has declined. A writ petition was filed in the Supreme Court on ground of illegal mining activities in the state. In May, 2014 the Supreme Court directed the Odisha government to suspend the operation of 102 mines as they violated environmental clearances by producing excess output beyond the quantum fixed. Due to this mining production has declined in 2014. After 2015, the mineral production has increased significantly. It has been possible because of steady increase in the production of chromite, limestone, bauxite, iron ore and manganese ore. Out of these minerals, the increase in production of iron ore is substantial. Its production was 533.29 lakh million tons in the year 2014-15 which expanded to 1209.73 lakh million tons in the year 2018-19.

3.2.4: Exports of minerals from Odisha

If a country rich in mineral resources can effectively utilize its export-oriented mineral resources, then it would be able to earn enormous amount of foreign exchange reserve. Exports and value of minerals from Odisha shows that both total exports and value of exports from Odisha has declined in the year 2009-10 (Figure 3.3 and 3.4). The fall in mineral production in the state is due to suspension of mines operations on ground of illegal mining. This factor is responsible for decline

in mineral exports. Besides, the global financial crisis faced by the world in the year 2007-08 is also responsible for decline in mineral exports. It created an uncertain situation in the international market. The global price volatility directly affected the exports of ores and minerals and consequently India's exports of ores and minerals declined.

Again in 2012-13 and 2014-15 the exports and value of exports of minerals has declined. The reduction in mineral production in Odisha is responsible for declining trend of mineral exports. The Supreme Court had directed the mining lease holders to pay the compensation for production of minerals in excess of environmental clearances. But the mining lease holders were unable to pay the compensation. Hence their operation (mostly iron ore and manganese) was suspended causing decline in the mineral production. Of all the minerals exported from Odisha, iron ore comprises the single most important mineral. The decline in mineral production has increased their prices and making them internally uncompetitive. However, after 2015-16, there is significant rise in exports and value of exports of minerals in Odisha. It can be seen from the figure that export has increased. Total mineral exports was 6.58 lakh MT in the year 2015-16 which increased to 63.86 lakh MT in the year 2016-17. Likewise, value of mineral export has expanded from Rs. 158.72 to Rs. 1261.40 crore during the same period. It is a good sign for the state as it will help the state to earn huge amount of foreign exchange. Thus, it can be said that mining sector is doing well with respect to export of minerals.

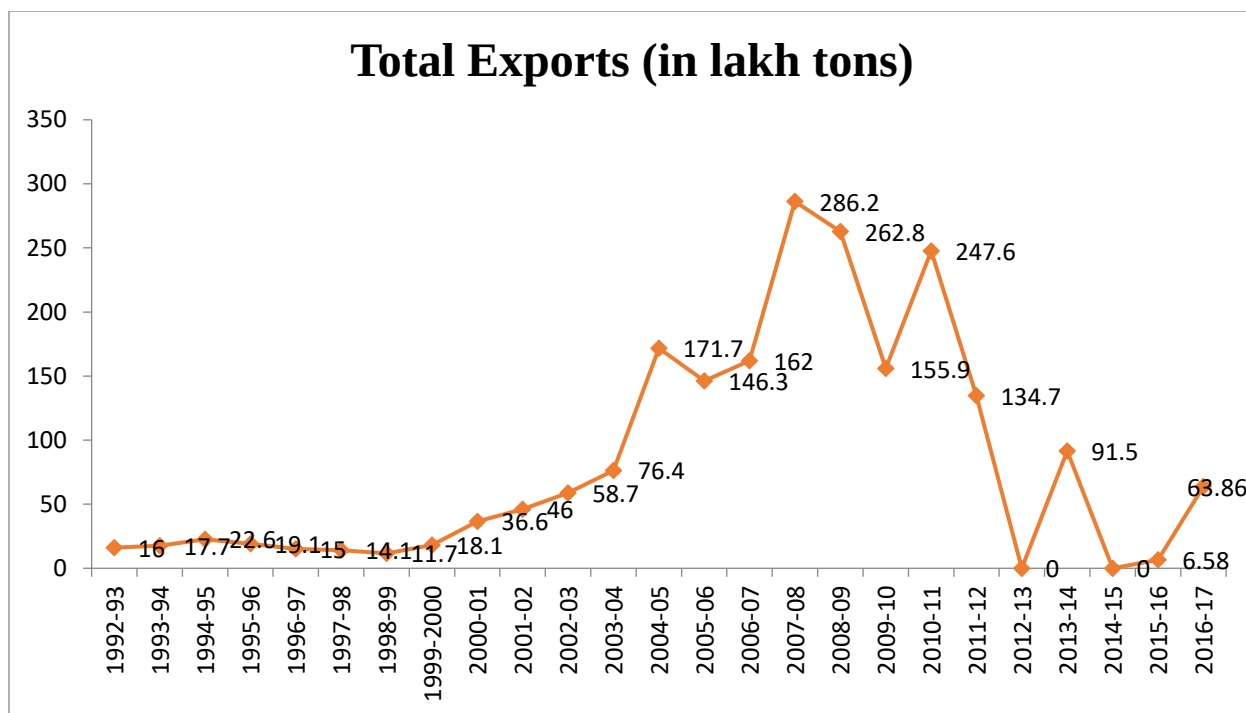


Figure 3.3: Total exports of minerals from 1992-93 to 2016-17

Source: Various issues of Economic Survey of Odisha

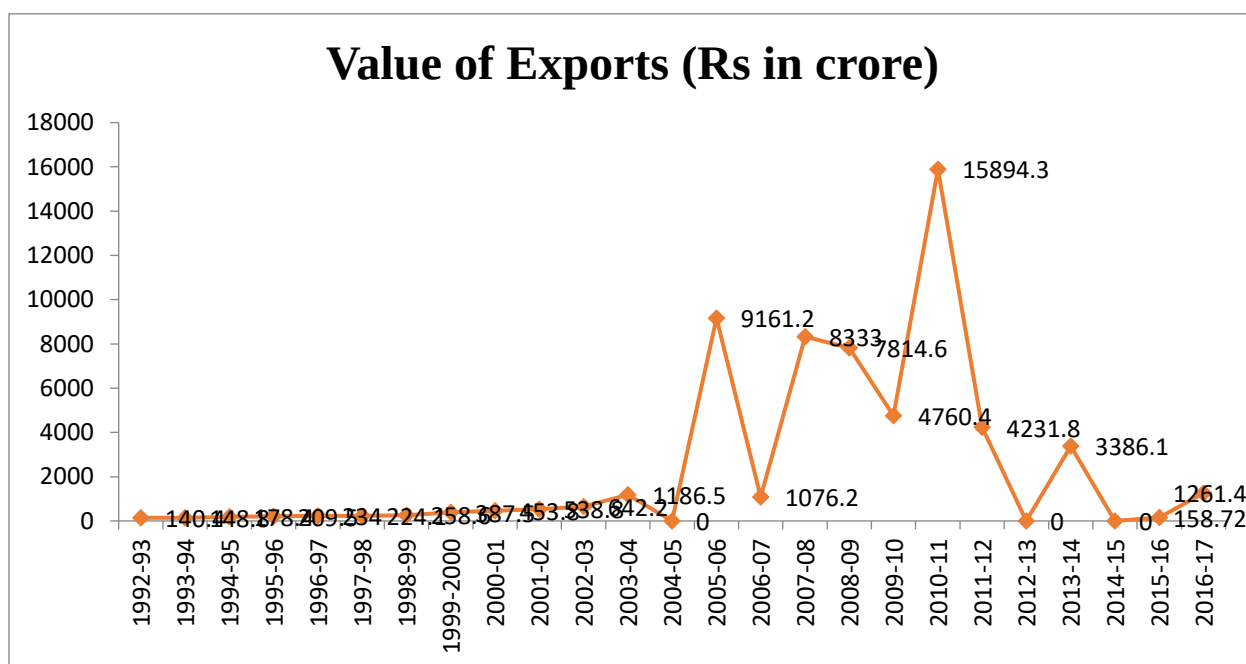


Figure 3.4: Total value of exports of minerals

Source: Various issues of Economic Survey of Odisha

3.2.5: Contribution to Employment

A particular sector is considered as more efficient on the basis of its employment generating capacity, besides other things. More the level of employment of a country, higher will be its economic development. It can be observed that mining sector is not providing enough employment opportunities (Figure 3.5). The number of people employed in the mining sector declines from 67596 in 1990-91 to 59,636 in 2019-20. On one hand the production of mineral has been increasing but on the other hand the employment generation in the mineral sector is declining. Most of the minerals are found in the tribal area of the state. The reduction in the employment in major mineral activities of the state indicates that tribal and unprivileged people of the mining belt have not benefited from higher production of mineral. This is because the mineral sector has been progressively using capital-intensive technique of production in place of labour-intensive technique over the years.

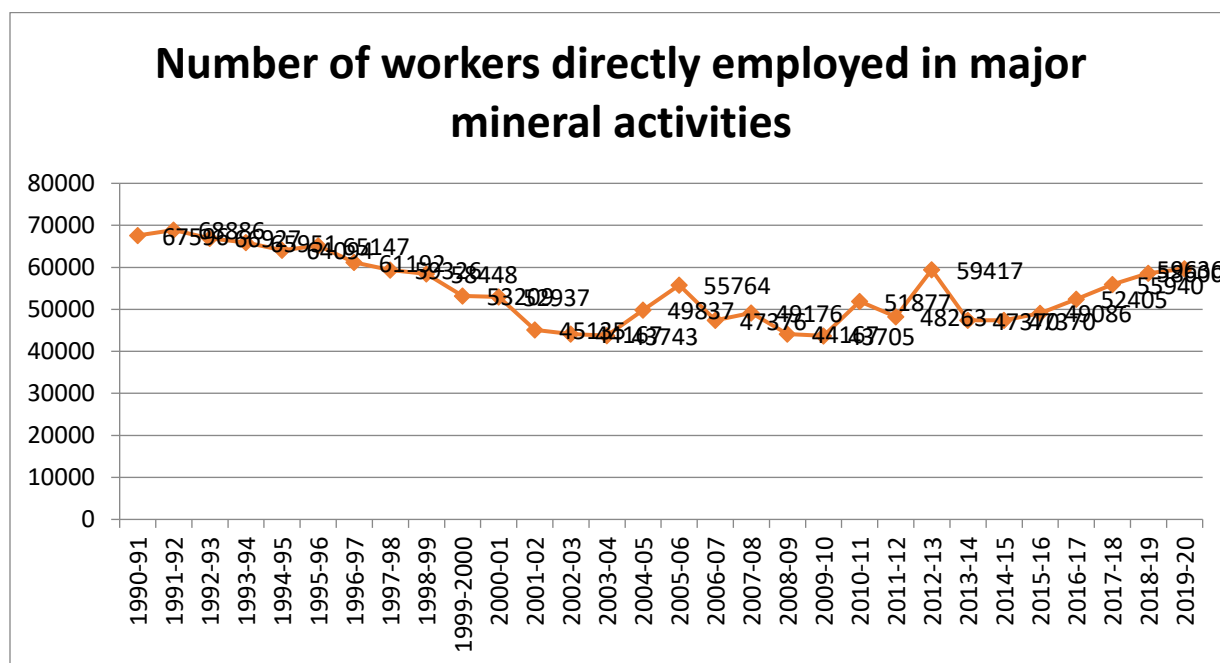


Figure 3.5: Number of workers directly employed in major mineral activities in the state

Source: Various issues of Economic Survey of Odisha

3.3: Mining sector in Keonjhar District

Keonjhar district is endowed with abundant resources of high-grade iron ore, manganese, chromites ore, limestone, dolomite, nickel, quartz and vanadium. The district has also occupied an important position as a mineral-rich district in the country (Annul Report, Ministry of Mines, 2020-21). The district mainly produces iron ore which has documented an iron ore reserve of above 1000 million tones. The iron ore and manganese producing centre of is the Singhbhum-Keonjhar-Bonai area which runs through Keonjhar and the Joda-Barbil circle of the district.

3.3.1. Contribution of mining to production in Keonjhar district

The district is endowed with huge amount of iron ore, chromites and manganese ore. However, the district produces huge amount of iron ore (Figure 3.6). The production of iron ore has reduced in the district in 2014-15. This is due to the suspension of iron ore mines in the state for violating environmental clearances. After that there has been a steady increase in the iron ore production. However, in the year 2020-21, again iron ore production has declined due to nationwide lockdown of economic activities caused by COVID-19

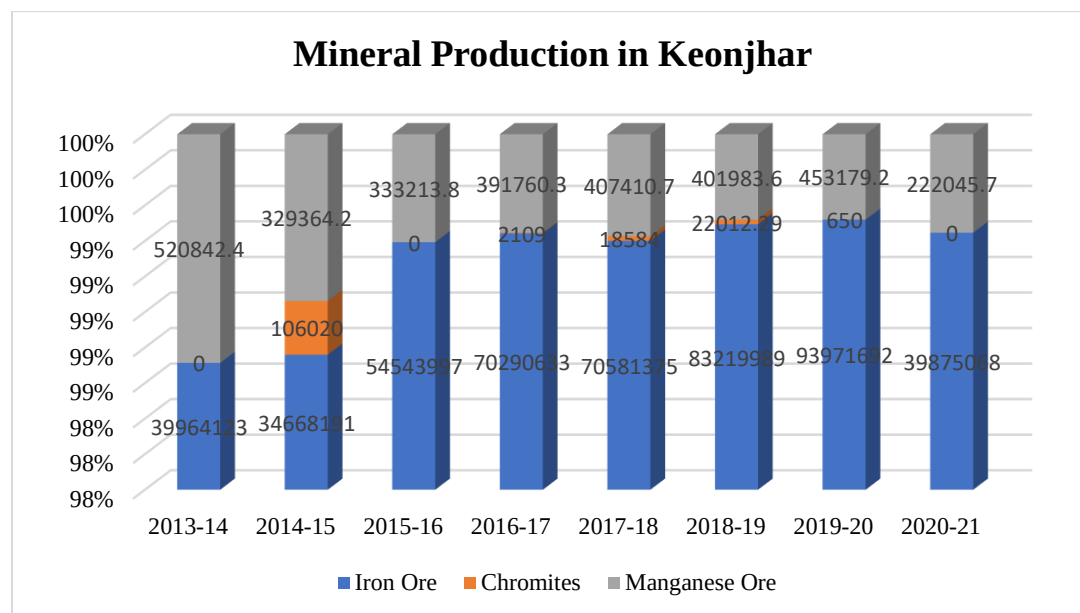


Figure 3.6: Mineral production (in lakh MT) in Keonjhar district

Source: Directorate of Mine, Bhubaneswar, Odisha

3.3.2. Contribution of mining in the export of minerals from Keonjhar district

The Keonjhar district mostly exports iron ore which is because the district is rich in iron ore and produces a lot of iron ore. The district helps the country to export iron ore in the international market and earn huge amount of foreign exchange. Now-a-days the district is exporting other minerals like chromite and manganese but in small quantity. It is clear from the figure that the export trend line is zigzag shape. This zigzag nature of export trend line is due to the reasons cited in section 3.2.3.

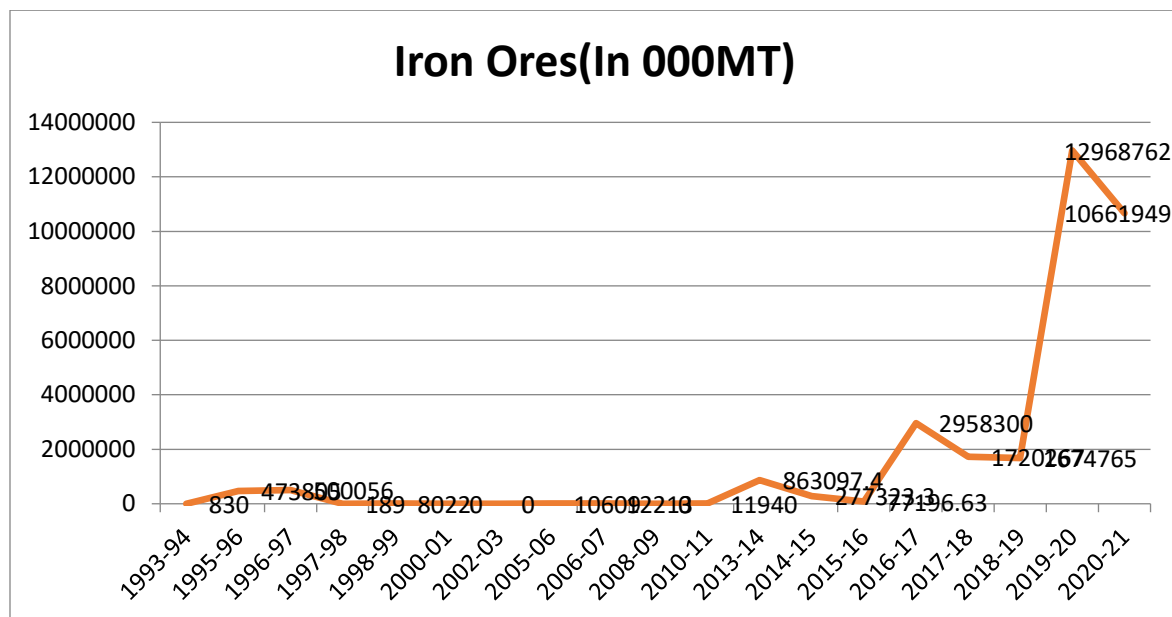


Figure 3.7: Quantity of minerals exported in Keonjhar district of Odisha

Source: Various issues of District Statistical Handbook, Keonjhar and Directorate of Mine, Bhubaneswar, Odisha

3.4: Abundance of Natural Resource and Economic Growth in Mining-abundant districts

When there is a worldwide discussion regarding the negative relationship between natural resource abundance and economic growth, the present section aims at checking the long-run association between abundance of natural resource and economic growth and other independent variables (human resource development, institutional quality, financial development and investment) in 16 mining-rich districts of Odisha over the period 1995-2018. Further, it compares the results of two sample time period viz., one time period is from 1995 to 2015 and another is from 1995-2018.

There are thirty districts in Odisha. In the present study a district has been defined as mining district on the basis of existence of mining activity in that district. Accordingly, sixteen districts are defined as mining district according to the information provided by the District Statistical Handbook of Directorate of Economics & Statistics Odisha, Bhubaneswar. These districts are Angul, Bargarh, Bolangir, Dhenkanal, Ganjam, Jajpur, Jharsuguda, Kalahandi, Keonjhar, Koraput, Mayurbhanj, Nuapada, Rayagada, Sambalpur, Subarnapur and Sundargarh.

The present study has taken Net District Domestic Product (NDDP) per capita as the measure of economic growth. In the literature share of natural resources exports in GDP has been the common proxy of natural resource abundance. This proxy is a flow measures which suffer from many problem (Alexeev and Conrad, 2009; Brunnschweiler and Bulte, 2008). The present study has taken the stock-based measure of resource abundance i.e. total mineral production (TMP). Other control variable includes investment, human resource development, financial development and institutional quality. Normally the gross district fixed capital formation is taken as the proxy for investment. However, district-wise gross fixed capital formation data is not available. The data is available only for 2009. The district-wise progressive small savings data are available. Therefore, the study has taken progressive small savings as the proxy of investment (INT).

Human resource development (HRD) is another control variable. Some literature has used the percentage of the education outlay to the provincial monetary outlay as the proxy of human resource development. However, this is a flow indicator and the stock level of human resource development influence economic growth (Shuai and Zhongying, 2009). Therefore, the present study has taken the number of enrolled students in primary schools, secondary schools and colleges as the measure of human resource development. Financial development and institutional quality are other two control variables. The credit-deposits ratio in a district is taken as the measure of financial development (FD). Finally, the present study has taken incidence of crimes as the proxy of institutional quality. The number of incidences recorded due to theft, murder, robbery, rioting, kidnapping, burglary etc. in a particular district are used to measure the occurrence of offence. However, since these are dissimilar qualitative variables, an index has been constructed by using principal component analysis.

3.4.1: Conditional Convergence

According to the theory of conditional convergence different states experience various growth rates on the basis of numerous features possessed by those states. All other things equal, high-income countries have lower growth rates than low-income countries. That means, low-income countries grow faster than high-income country, other things remaining constant. Therefore, Thus, per capita economic growth from period t_0 to t_T denoted by $y_{iT} = (1/T) \ln(Y_{iT}/Y_{i0})$ depends inversely on starting per-capita income Y_{i0} . It also depends on the natural resource abundance R_{it} and on a vector of other control variables X_{it} .

$$y_{it} = \beta_0 + \beta_1 \ln Y_{i,t-1} + \beta_2 R_{it} + \gamma X'_{it} + \varepsilon_{it}$$

Where, i = Cross-sectional units (Districts)

t = time period

y_{it} = economic performance indicator

$Y_{i,t-1}$ = income level lagged one period

R = measure of natural resource abundance

X = matrix of other growth-related variables (investment, human resource development, financial development, & institution quality)

Table 3.2: Conditional convergence test results

Dependent Variable lnNDDP

Variables	Coefficients	P-values
C	-0.137	0.342
lnNDP (-1)	0.836***	0.000
lnTMP	0.004	0.248
lnINT	0.020**	0.089
lnHRD	-0.011	0.883
lnFD	-0.004	0.644
IQ	0.007	0.596

Note: The ***, **, and * indicate 1%, 5%, and 10% level of significance.

The results show that the coefficient β_1 is positive and significant which do not support conditional convergence. It indicates that there is divergence. That means low-income districts are growing lesser than high-income districts. Mineral-rich districts are diverging (Table 3.8).

3.4.2: Testing Pesaran Cross Section Dependence Test

The first empirical work of the present study is to check the cross-sectional dependence among Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD), Financial Development (FD) and Institutional Quality Index (IQ). Pesaran (2004) proposed CD test which is based on the average of the pair correlation coefficients $(\rho)_{ij}$ of OLS residuals regressions. Pesaran (2004) considered the following model

$$y_{it} = \mu_i + \beta_i x_{i,t} + u_{i,t} \dots \dots \dots (1)$$

Where:

μ_i = intercept of the individual district; i

β_i = slope coefficient of individual district i

$t = 1, 2, 3 \dots \dots$, T is the total time period;

$i = 1, 2, 3 \dots \dots$, 16 Corresponding 16 districts;

$x_{i,t}$ is vector of observing time varying regressions

y_{it} follows iid $(0, \sigma_i^2)$ for all i, t

Pesaran (2004) proposed following CD statistic

$$CD_p = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{i,j} \dots \dots \dots (2)$$

Where: e_{it} the OLS are estimates of $u_{i,t}$, $\hat{\rho}_{i,j}$ is the sample estimate of the pair-wise correlation of residuals.

$$\hat{\rho}_{i,j} = \hat{\rho}_{j,i} = \frac{\sum_{t=1}^T e_{i,t} e_{j,t}}{(\sum_{t=1}^T e_{i,t}^2)^{1/2} (\sum_{t=1}^T e_{j,t}^2)^{1/2}} = \frac{\sum_{t=1}^T e_{i,t} e_{j,t}}{(\sum_{t=1}^T e_{i,t}^2)^{1/2} \sum_{t=1}^T (e_{j,t}^2)^{1/2}}$$

3.4.3. Pesaran's Cross-sectional Augmented Dickey-Fuller (CADF) Test

After confirming cross-sectional dependence, in order to understand the stationary properties of the variables the study has applied Pesaran CADF test (Pesaran, 2007). The presence of cross-sectional dependence among the variables can be solved by augmenting the standard Dickey-fuller regression with cross sectional average of lagged levels and first differences of the individual series (Pesaran, 2007). The main Pesaran CADF equation follows as

$$\Delta y_{i,t} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i \bar{y}_{t-1} + Q_i \Delta \bar{y}_t \varepsilon_{i,t} \dots \dots \dots (3)$$

where the unit root test hypothesis will be tested based on the OLS results derived from Eq. (3) with t ratio by $t_i(N, T)$. The Pesaran CADF test is

$$\text{CADF} = t_i(N, T) = \frac{\Delta y_i' \bar{M}_w y_{i-1}}{\delta(y_{i-1}' \bar{M}_w y_{i-1})^{1/2}} \dots \dots \dots (4)$$

Where:

$$\Delta y_i = (\Delta y_{i,1}, \Delta y_{i,2}, \dots, \Delta y_{i,2}, \dots, \Delta y_{i,T})', y_{i-1} = (y_{i,0}, y_{i,1}, \dots, y_{i,T-1})', \tau_T = (1, 1, \dots, 1)'$$

$$M_w = I_T - \bar{W}(\bar{W}'\bar{W})^{-1}\bar{W}', \bar{W} = \tau(\Delta \bar{y}), \bar{y}_{-1}$$

$$\Delta \bar{y} = (\Delta \bar{y}_1, \bar{y}_2, \dots, \Delta \bar{y}_T)', \bar{y}_{-1} = (\bar{y}_0, \bar{y}_1, \dots, \bar{y}_{T-1})'$$

$$\hat{\delta}_i^2 \frac{\Delta y_i' M_{i,w} \Delta y_i}{T-4} M_{i,w} = I_t - (G_i(G_i' G_i))^{-1} G_i' \text{ and } G_i = (\bar{W}, y_{i-1})$$

3.4.4. Panel Autoregressive Distributed Lag Model (P-ARDL)

The present study has applied panel autoregressive distributed lag model in order to estimate the long-run relationship among variables based on three alternative estimators such as mean group estimator (MG), pooled mean group estimator (PMG) and dynamic fixed effects (DFE). According to Pesaran et al. (1999), an ARDL dynamic heterogeneous panel regression can be written by using ARDL (p, q) approach where ‘ p ’ is the lags of dependent variable and ‘ q ’ is the lags of independent variables. The equation can be written as

$$PNDDP_{it} = \sum_{j=1}^p \lambda_{ij} PNDDP_{i,t-j} + \sum_{j=0}^q \delta'_{ij} TMP_{i,t-j} + \sum_{j=0}^q \alpha'_{ij} INT_{i,t-j} + \sum_{j=0}^q \beta'_{ij} HRD_{i,t-j} + \sum_{j=0}^q \Psi'_{ij} FD_{i,t-j} + \sum_{j=0}^q \Phi'_{ij} IQ_{i,t-j} + \mu_i + \varepsilon_{it} \dots \dots \dots (5)$$

Where: $i = 1, 2, 3, \dots, N$ number of cross sectional (Here $i = N = 16$);

$t = 1, 2, 3, \dots, T$ total time period ($T = 24$);

$TMP_{i,t}, INT_{i,t}, HRD_{i,t}, FD_{i,t}, IQ_{i,t}$ are $k \times 1$ vector of the explanatory variables; $\delta'_{ij}, \alpha'_{ij}, \beta'_{ij}, \Psi'_{ij}, \Phi'_{ij}$ are the $k \times 1$ coefficient variables; λ_{ij} are the scalars; and μ_i is the cross-section effects.

If the variables in Eq. (5) are $I(1)$ and cointegrated, then the error term should follow $I(0)$ order in all cross-sections to have long-run equilibrium relationship among the variables. The principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. This explain that an error correction model in which the short-run dynamics of the variables in the system can be influenced by the deviation from equilibrium. Here it is necessary to reparametrize Eq. (5) into an error correction equation.

$$\Delta PNDDP_{it} = \phi_i(PNDDP_{i,t-1} - \theta'_i PMT_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta PNDDP_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta TMP_{i,t-j} + \sum_{j=0}^{q-1} \psi_{ij}^* \Delta INT_{i,t-j} + \sum_{j=0}^{q-1} \alpha_{ij}^* \Delta HRD_{i,t-j} + \sum_{j=0}^{q-1} \beta_{ij}^* \Delta FD_{i,t-j} + \sum_{j=0}^{q-1} \Omega_{ij}^* \Delta IQ_{i,t-j} \dots \dots \dots (6)$$

Where:

$$\Phi = - (1 - \sum_{j=1}^p \lambda_{ij}), \theta_i = \frac{\sum_{j=0}^q \delta_{ij}}{(1 - \sum_{k=1}^p \lambda_{ik})}$$

$$\lambda_{ij}^* = - \sum_{m=j+1}^p \lambda_{im},$$

$$j = 1, 2, \dots, p-j$$

$$\delta_{ij}^* = - \sum_{m=j+1}^q \delta_{im} \quad j = 1, 2, 3, \dots, q-1$$

$$\psi_{ij}^* = - \sum_{m=j+1}^q \delta_{im} \quad j = 1, 2, 3, \dots, q-1$$

$$\alpha_{ij}^* = - \sum_{m=j+1}^q \alpha_{im} \quad j = 1, 2, 3, \dots, q-1$$

$$\beta_{ij}^* = - \sum_{m=j+1}^q \alpha_{im} \quad j = 1, 2, 3, \dots, q-1$$

$$\Omega_{ij}^* = - \sum_{m=j+1}^q \Omega_{im} \quad j = 1, 2, 3, \dots, q-1$$

The ϕ_i is speed of adjustment parameter. The speed of adjustment parameter must be non-zero. If $\theta_i = 0$, then there would be no long-run relationship. This parameter is expected to be negative sign with statistical significance under the assumption of bringing back the variables to the long-run equilibrium. But more recently Pesaran, Shin and Smith (1997, 1999) propose a PMG estimator which combines both averaging and pooling the residuals. This test incorporates the intercept, short-run coefficients, and different error variances across the groups (like the MG estimator). However, it holds the long-run coefficients to be equal across the groups (like FE estimators).

$$\hat{\phi} = N^{-1} \sum_{i=1}^N \hat{\phi}_i \dots \dots \dots (7)$$

With the variance

$$\hat{\Delta}_{\hat{\phi}} = \frac{1}{N(N-1)} \sum_{i=1}^N (\hat{\phi}_i - \hat{\phi})^2 \dots \dots \dots (8)$$

The Eq. (6) can be estimated by three different estimators such as mean group estimator of Pesaran and Smith (1995), pooled mean group estimator developed by Pesaran et al. (1999) and dynamic fixed effects estimator. According to Pesaran and Shin (1999), Panel ARDL can be applied even if the variables follow different order of integration, i.e. $I(0)$ and $I(1)$ or a mixture of both.

3.4.5: Results

The traditional unit root tests do not address the cross-sectional dependence which might lead to an incorrect interpretation towards the stationary properties large panel data. To address this problem, the present study has applied CD (Pesaran, 2004) test to check cross section interdependence among Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD) Financial Development (FD) and Institutional Quality Index (IQ). The CD test is based on the average of the pair correction coefficients of OLS residuals regression. CD test result rejects the null hypothesis of no cross-dependence among the variables (Table 3.3). It means there is high dependence among Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD), Financial Development (FD) and Institutional Quality Index (IQ) in the mineral-rich districts of Odisha.

Table 3.3: Pesaran Cross-section Dependency tests

Test	Statistics	P-value
CD	31.260	0.0000

After confirming cross sectional dependence among the variables, the present study has employed Pesaran Cross Sectional Augmented Dickey-Fuller (PCADF) unit root tests to check stationary properties of variables. In order to test the panel cointegration among variables, the first step is to examine the unit roots properties of the data, because the variables must be integrated of the same order. The results show that NDDP, TMP, INT, HRD, FD, and IQ follow I (0) and I (1) orders respectively (Table 3.4).

Table 3.4: Pesaran's Cross-sectional Augmented Dickey-Fuller (CADF) test results

variables	Constant		Constant & Trend	
	T Bar	P-value	T Bar	P-value
lnNDDP	-1.428	0.908	-2.290	0.534
lnTMP	-1.986	0.165	-2.414	0.327
lnINT	-2.188	0.036	-2.471	0.244
lnHRD	-1.918	0.244	-2.295	0.527
lnFD	-3.970	0.000***	-4.546	0.000***
lnIQ	-1.544	0.802	-2.060	0.859
Δ lnNDDP	-3.574	0.000***	-3.652	0.000***
Δ lnTMP	-3.377	0.000***	-3.430	0.000***
Δ lnINT	-3.091	0.000***	-3.194	0.000***
Δ lnHRD	-3.679	0.000***	-3.781	0.000***
Δ lnFD	-4.909	0.000***	-4.854	0.000***
Δ lnIQ	-3.502	0.000***	-4.152	0.000***

Note: The critical values are -2.340, -2.170, and 2.070 at 1%, 5%, and 10% respectively with constant. 2.880, -2.690, and -2.590 at 1%, 5%, and 10% respectively with constant and trend. The ***, **, and * indicate 1%, 5%, and 10% level of significance.

**Table 3.5: Panel ARDL Model Results (Pooled Mean Group and Mean Group Estimates)
(Dependent Variable: $\Delta \ln \text{NDDP}$)**

	Pool Mean Group		Mean Group		Dynamic Fixed Effects	
Variables	Coefficients	Std. error	Coefficients	Std. error	Coefficients	Std. error
Long-run						
$\ln \text{TMP}$	0.072***	0.009	-0.038	0.065	0.029*	0.014
$\ln \text{INT}$	0.220***	0.000	0.452	0.268	0.177*	0.096
$\ln \text{HRD}$	0.170	0.163	-0.929	2.333	0.206	0.268
$\ln \text{FD}$	-0.010	0.014	-0.460	0.390	-0.084*	0.036
$\ln \text{IQ}$	-0.019	0.030	0.183	0.090	-0.110	0.072
Error Correction	0.173**	0.061	0.278**	0.083	0.305*	0.184
Short-run Coefficients						
$\Delta \ln \text{TMP}$	-0.006	0.004	-0.016	0.012	-0.004	0.002
$\Delta \ln \text{INT}$	0.114	0.636	0.121*	0.054	0.027	0.027
$\Delta \ln \text{HRD}$	0.085	0.117	0.179	0.117	0.055	0.080
$\Delta \ln \text{FD}$	-0.002	0.018	0.023	0.048	-0.018***	0.005
$\Delta \ln \text{IQ}$	-0.069*	0.030	-0.033	0.0352	-0.034*	0.019
Intercept						
No. of Districts						
Observations						

Note: Δ is first difference operator; ***, **, and * indicate 1%, 5%, and 10% level of significance; PMG means pooled mean group; MG means mean group; EC is error correction term.

The results of the pooled mean group (PMG), mean group (MG) and dynamic fixed effects (DFE) are reported in Table 3.5. According to PMG estimator, TMP has a positive and significant impact on NDDP in the long-run. However, in the short-run, although TMP has a negative coefficient but it is not statistically significant. INT has positive impact on NDDP in the long-run. According to MG estimator, TMP has a negative coefficient, but it is not significant. In the short-run, although TMP has negative coefficient but it is not statistically significant. INT has positive impact on

NDDP in the short-run. DFE estimators show positive effect of TMP on NDDP in the long-run. FD has negative effect on NDDP in the long-run. In the short-run, FD and IQ have negative impact on NDDP. However, in order to measure efficiency and consistency among the estimators (PMG, MG and DFE) the Hausman test has been applied. The results of the Hausman test are reported in Table 3.6.

**Table 3.6: Hausman Test
(Dependent Variable: lnNDDP)**

	MG	PMG			MG	DFE		
	Coefficients	Coefficients	Difference	S. E	Coefficients	Coefficients	Difference	S. E
lnTMP	-0.038	0.072	-0.110	0.098	-0.038	0.029	-0.068	0.727
lnINT	0.452	0.220	0.232	0.408	0.452	0.177	0.275	3.000
lnHRD	-0.929	0.170	-1.099	3.540	-0.929	0.206	-1.136	26.056
lnFD	-0.460	-0.010	-.045	0.593	-0.460	-0.084	-0.375	4.364
lnIQ	0.183	-0.019	0.202	0.134	0.183	-0.110	0.294	1.011
Chi-2	3.23	P-Value	0.6648		Chi-2	0.14	P-value	0.9996

The Hausman test results accept the null hypothesis of homogeneity restrictions on the long-run regressors. This indicates that PMG is a more efficient estimator than MG or DFE. From the overall panel ARDL model, we found that there is a positive relationship between natural resource abundance and economic growth in the long-run. The results do not support the existence of natural resource curse hypothesis in the mineral-rich districts of Odisha.

3.4.6: Comparison of ARDL Model results of two time periods

In this section the ARDL model results of two time periods have been compared. One time period is from 1995 to 2015 and another time period is from 1995 to 2018. When time period is taken from 1995 to 2015, the coefficient term of total mineral production (TMP) is negative according to pool mean group (PMG) estimator. This finding supports the existence of resource curse hypothesis in the mineral-rich districts of Odisha. It means that mining-rich districts are experiencing low economic growth (Tandi and Mishra, 2020). On the other hand, if the time period is taken from 1995 to 2018, the PMG estimator shows a positive coefficient of TMP variable (Table 3.7). It implies that resource curse theory is not noticed. For the sample of 1995-2015 the

resource curse finding is due to the rampant illegal mining activities in the state. The Union Ministry of Mines had set up Shah Commission in 2010 to look into the illegal mining of manganese and iron ore in the state. In its first report, the commission stated that Odisha has incurred losses of Rs 59,203 due to rampant illegal extraction, sale and export of iron ore. In 2009, Odisha government took steps to verify the documents of the mines in the state. During the verification it was found that most of the mines had not renewed their licenses violating the environmental and forest clearances.

For the sample of 1995-2018, resource curse theory is not observed in the mining districts of Odisha. This is due to strict actions taken by both Odisha government and Supreme Court. The Odisha government suspended the operation of 128 mines, mostly iron ore and manganese as offensive against illegal activities. Again, the Supreme Court in 2017 directed to the miners to pay a compensation of Rs 17, 576 crores for producing output beyond the quantum fixed under the environmental clearances. All these steps taken by the state government and the Supreme Court might have forced the miners in the state to exploit the natural resources rationally and efficiently. Perhaps due to this reason resource curse theory is not found in the mining-rich districts after 2015.

Table 3.7: Panel ARDL Model Results of 1995-2015 and 1995-2018
(Dependent Variable: $\Delta \ln \text{NDDP}$)

	Panel ARDL Model Results of 1995-2015							Panel ARDL Model Results of 1995-2018					
	Pooled Mean Group		Mean Group		Dynamic Fixed Effects			Pooled Mean Group		Mean Group		Dynamic Fixed Effects	
Variables	Coefficients	Std. error	Coefficients	Std. error	Coefficients	Std. error	Variables	Coefficients	Std. error	Coefficients	Std. error	Coefficients	Std. error
Long-run							Long-run						
lnTMP	-0.217**	0.084	0.009	0.069	-0.016	0.025	lnTMP	0.072***	0.009	-0.038	0.065	0.029*	0.014
lnINT	0.200	0.121	0.466**	0.248	0.213**	0.070	lnINT	0.220***	0.000	0.452	0.268	0.177*	0.096
lnHRD	-0.435	0.597	-0.663	0.538	0.371	0.291	lnHRD	0.170	0.163	-0.929	2.333	0.206	0.268
lnFD	-0.022	0.0683	0.005	0.234	0.017	0.021	lnFD	-0.010	0.014	-0.460	0.390	-0.084*	0.036
lnIQ	0.106	0.141	0.807	0.424	0.173	0.066	lnIQ	-0.019	0.030	0.183	0.090	-0.110	0.072
Error Correction	0.011	0.058	0.323***	0.089	0.396	0.214	Error Correction	0.173**	0.061	0.278**	0.083	0.305*	0.184
Short-run Coefficients							Short-run Coefficients						
ΔlnTMP	-0.010	0.008	-0.065	0.056	-0.010	0.007	ΔlnTMP	-0.006	0.004	-0.016	0.012	-0.004	0.002
ΔlnINT	0.115	0.091	0.113	0.089	0.049	0.035	ΔlnINT	0.114	0.636	0.121*	0.054	0.027	0.027
ΔlnHRD	0.048	0.312	0.000	0.108	0.041	0.105	ΔlnHRD	0.085	0.117	0.179	0.117	0.055	0.080
ΔlnFD	0.001	0.010	0.089	0.100	-0.003	0.009	ΔlnFD	-0.002	0.018	0.023	0.048	-0.018**	0.005
ΔlnIQ	-0.023	0.022	0.184	0.203	0.015	0.026	ΔlnIQ	-0.069*	0.030	-0.033	0.035	-0.034*	0.019
Intercept							Intercept						
No. of Districts	16						No. of Districts	16					
Observations	320						Observations	368					

Note: Δ is first difference operator; ***, **, and * indicate 1%, 5%, and 10% level of significance; PMG means pooled mean group; MG means mean group; EC is error correction term.

3.5: Conclusion

Thus, from the above analysis it is clear that mining is playing an important role in the economy of Odisha as well as in Keonjhar district. Mining sector has contributed immensely to the economic development of Odisha and Keonjhar district in terms of production, employment and export earnings. But now the question arises whether this sector has benefited the mining-rich districts of Odisha? The ARDL model results show that resource curse findings are sample sensitive. When the sample period is taken from 1995 to 2015, resource curse theory is observed in the mining-rich districts of Odisha. On the other hand, sample time period from 1995 to 2018 indicates that resource curse theory is not found in the mining-rich districts of Odisha. The large-scale illegal mining activities in the state have resulted in resource curse. It points towards the importance of institution in the state. The mining-rich districts of Odisha must improve their quality of institutions because it is through institutions the natural resource rents are transformed into developmental activities. They must take steps to check extensive rent seeking behaviours which is the outcome of poor institution.

Chapter 4

Iron ore Mining and Livelihoods in Keonjhar

4.1: Introduction

Conventional perspective advocates that mineral reserves favourably affect the economic development of a country. However, in recent times this conventional view has been challenged. It is demonstrated that natural resource abundance has become a curse than blessings for economic development (Davis and Tilton, 2005). In this backdrop, the present chapter aims at discussing the effect of iron extraction on the subsistence of the communities of Keonjhar district, which is considered as the mineral centre of Odisha. A comparative approach is used to analyse the effect of Serajuddin & Co. on the native people. Mining affects local communities in various ways. For example, when a mine is opened it affects the livelihood of the people. Similarly, when mining operation starts it creates various types of environmental pollution such as air, water, noise etc. Finally, when a mine is closed it results in sudden economic halt. In this chapter an attempt has been made to estimate the effect of iron ore mining on the subsistence of native people.

There are several frameworks proposed in the literature to analyze livelihoods. They are the Sustainable Livelihood Frameworks (SLF) (Carney, 1998, 1999; Scoones, 1998), Capitals and Capabilities Framework of Bebbington (1999), the Framework for Thinking about Diverse Livelihoods (Ellis, 2000), and the United Nations Development Programme's (UNDP, 1999) "These frameworks have different emphases, rather than fundamental differences. They all attempt to integrate assets, constraints and human capabilities in a logical and comprehensive manner to analyze the status, form, nature and condition of livelihoods over space and time (Chimhowu and Hulme, 2006). Among these frameworks, the SLF has been the most popular, partly because of its robust analytical ability and also because of its widespread promotion by donor agencies (Chimhowu and Hulme, 2006)".

The present study has adopted the sustainable livelihood framework, according to which there are five kinds of capital or asset such as natural capital, human capital, physical capital, financial capital and social capital. These five capitals affect the livelihoods of the households. "It identifies vulnerability as a key factor that households seek to manage. There are five key features, which

make the framework very relevant. Firstly, it views households as making a living in a variety of ways of which farming is just one (Francis, 2001; Murray, 2002). Secondly, the framework sees land as just one asset among a group of other assets. Thirdly, it places the interaction between the various capitals within a broader policy environment. Fourthly, it allows investigating livelihood dynamics in a given geographical and physical context (Murray, 2002). Fifthly, the focus on risk and vulnerability is appropriate”.

4.2: The Sample Villages

M/s Serajuddin & Co. Iron Mine of Balda block is selected in the study to analyse its impact on the livelihoods of local people. Two villages from mining area namely Balda, Kundaposi and one village from non-mining area namely Chaka is selected in the study.

Table 4.1: Main characteristics of sample villages

Characteristics	Mining Villages		Non-mining Village
	Balda	Kundaposi	Chaka
Distance from mines(km)	Less than 1km	1km	82km
Total population	323	259	454
Livelihoods strategies	Mine employee, Private service, Government service, business, wage labour, others	Mine employee, Private service, business, wage labour, other business, cultivation, goatary and animal rearing,	Cultivation, Wage labour, Private service, Government service, Business, Others
Education	Ashram school	Primary school	High school, upper primary school,
Electricity	Company	Company	Government
Drinking water	Company	Company	Well, Tube well,
Health	Hospital constructed by Mining company, ASHA employees	ASHA employees	ASHA employees

Source: Field survey (2019)

The main characteristics of the sample villages and its demographic characteristics are presented in Table 4.1 and 4.2. It can be seen from the above table that the key features of mining villages are different from that of non-mining village. The main livelihood strategies of mining villages are to work in the mine whereas people in the non-mining area adopt cultivation as their livelihood strategies. In the mining area, electricity, drinking water and health facilities are provided by the mining company whereas in the non-mining area, these facilities are supplied by the government. With regard to educational facilities there is an ashram school up to 10th class, primary school and aanganwadi centre in the mining villages. Ashram schools are established in tribal sub plan areas funded by central government to provide educational facilities for tribal children. on the contrary, non-mining area has comparatively a greater number of schools than mining villages.

Table 4.2: Demographic features of sample villages

Features		Mining Villages		Non-mining Village
		Balda	Kundaposi	Chaka
Population	Male	158	151	247
	Female	165	108	207
	Total	323	259	454
Total Households Sample		75	75	100
Sample households (No.)	ST	67 (89.3%)	73 (97.3%)	27 (27%)
	SC	4 (5.3%)	0 (0%)	5 (5%)
	OBC	2 (2.7%)	2 (2.7%)	67 (67%)
	General	2 (2.7%)	0 (0%)	1 (1%)
	Total	75	75	100

Source: Field survey (2019)

Balda village consists of people from all caste. However, majority of people belong to the ST category. Similarly, in the Kundaposi village majority of population belong to the ST category. Some households are OBC. Thus, it can be said that mining villages consist of more than 80% of ST households. The non-mining village also comprises of all categories of people. However, OBC people dominate the non-mining village (Table 4.2).

4.3: Diversified Rural Livelihoods

Agricultural activities do not offer adequate livelihoods opportunities for the existence of rural households. As a result, they have to go for diversification of livelihood as a survival strategy in developing countries (Hussein and Nelson, 1998). According to Ellis (1998) livelihoods diversification is “the process by which households construct a diverse portfolio of activities and social support capabilities for survival and in order to improve their standard of living”. In the developing countries like Asia and Africa, most of the people go for diversification of livelihoods in major parts of rural areas (Adams, 1994; Freudenberger, 1994). Among these diversification strategies, non-agricultural activities are one of the important constituents. Many scholars have verified that rural people expatiate in crop and livestock production as well as other occupations (Dercon and Krishnan, 1996; Unni, 1996; Mishra, 2010).

In the mining villages, employment in the mine is the main occupation of the sample household. Out of the total households, 55 per cent of households have employment in the mines (Figure 4.1). This is because of displacement of their agricultural land. In return they have job in mines as a part of compensation. Wage labour (20 per cent) and business (13 percent) comes in the second and third place. This is followed by others (10 per cent), cultivation (1 per cent), government sector (1 per cent). Others in the mining village include goatary & animal rearing, private job, selling of forest product, liquor business. on the contrary, in the non-mining area, the main occupation of the people is cultivation and 79 per cent of people depend on agricultural activities (Figure 4.2). Government service (11 per cent) comes in the second place. This is followed by business (3 per cent), wage labour (1 per cent) and others (6 per cent). Here others comprise of goatary & animal rearing, private job, selling of forest products, construction of house, roads.

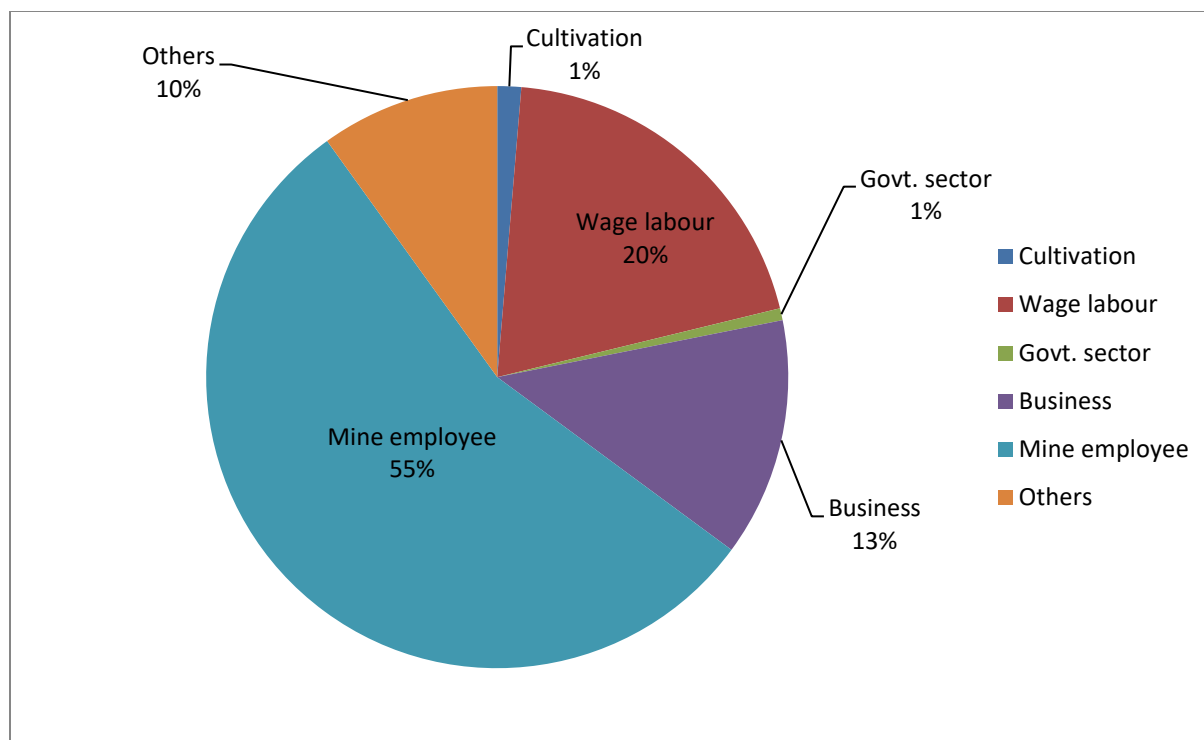


Figure 4.1 Primary occupation in Mining Villages

Source: Field survey (2019)

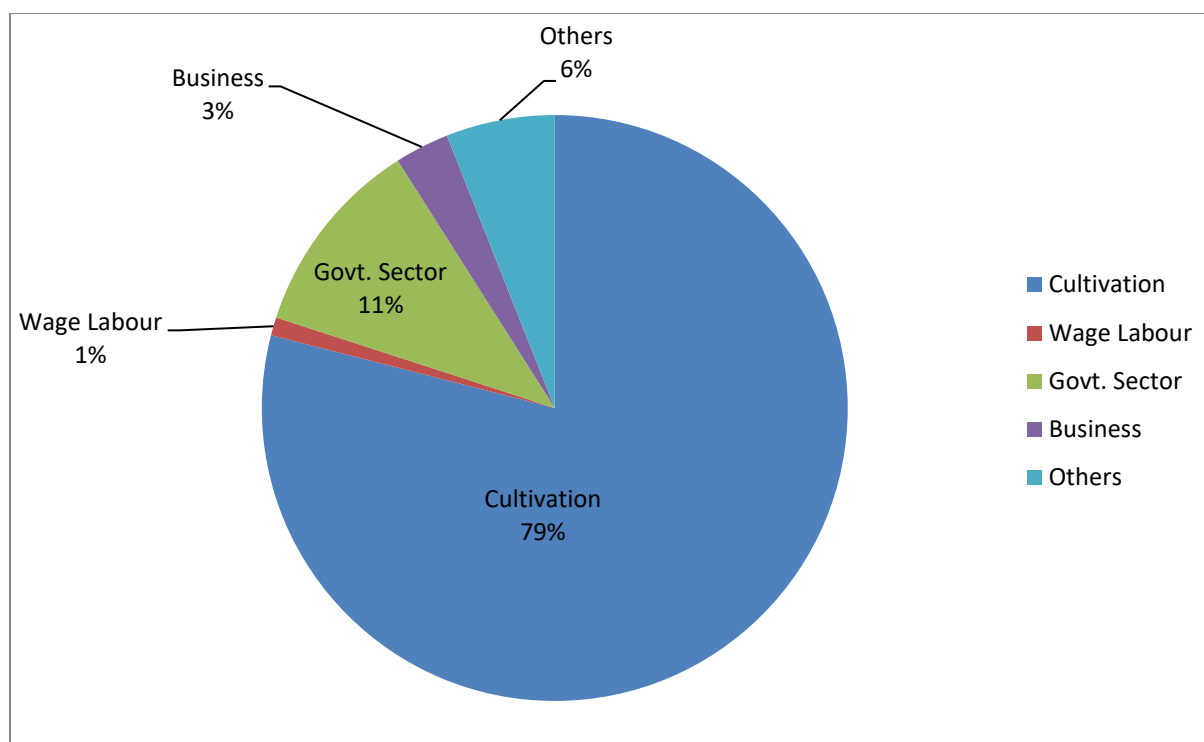


Figure 4.2 Primary occupation in Non-mining Village

Source: Field Survey (2019)

To calculate the diversification of income, the Herfindahl Index has been employed in this study. The Herfindahl Index is a measure of the size of firms in relationship to the industry and an indication of the amount of competition among them. It is calculated by taking the sum of the squares of the market shares of each individual firm (Mishra, 2009).

$$\text{Formula: } H = \sum (S_i^2) \dots \dots \dots (4.1)$$

Where S_i is the market share of firm i in the market. The Herfindahl Index (H), is otherwise known as Herfindahl-Hirschman Index (HHI). It has a value that is always smaller than one. If the Herfindahl index falls, it normally shows a loss of pricing power and a rise in competition. On the other hand, if the index rises, it suggests monopoly. Herfindahl index can be used to calculate diversification. The diversification index is calculated as:

$$D_1 = 1 - H$$

Where, H represents Herfindahl index (Mishra, 2009). In this study, the source of income is considered as the determinants of HI. The sources include mining, wage labour, cultivation, business, government service, private service, goatary, animal rearing and others.

Table 4.3 Herfindahl Index for income diversification

Villages	Herfindahl Index	Diversification
Mining Villages	0.3638	0.6362
Non-mining village	0.6398	0.3602

Source: Field study (2019)

It is found that non- mining village is less diversified than the mining villages. This is because in the non-mining area majority of the people go for cultivation activities due to availability of canal facilities. As a result, they don't have to search for additional sources of income. On the other hand, in the mining village most of the people work in mines as a compensation of their land. Whatever land is left with them, sometimes very few people do cultivation for home consumption only. However, they do not prefer for cultivation due to soil pollution and land degradation as caused by mines operation. Half of people are absorbed in mining and other half in other activities.

4.3.1: Livelihoods Diversification: A Gender Dimension

It is validated from the literature that many occupations have gender gap. In many cases cultural limitations play an important role in creating gender gap (Hussein and Nelson, 1998; Mishra, 2010). Gender wise occupational distribution of primary economic activities in mining and non-mining areas is presented in Table 4.4. In mining villages, employment in mine is the livelihood strategies of majority households. Around 50 percent of households work as mine employee. This is followed by wage labourer and business. Others comprise of selling of local alcohol (handia), collecting fuelwood for selling, goatary & animal rearing, private sector jobs. In the mining villages, all the primary economic activities are dominated by men and women have less participation.

Table 4.4: Primary Economic Activities in Mining and Non-mining Villages

Economic Activities	Mining Villages			Non-Mining Village		
	Male	Female	Total	Male	Female	Total
Cultivation	2 (1.2%)	0 (0%)	2 (1.2%)	118 (59.9%)	54 (27.4%)	172 (87.3%)
Wage Labourer	26 (15.6%)	6 (3.6%)	32 (19.2%)	1 (0.5%)	1 (0.5%)	2 (1%)
Government Sector	1 (0.6%)	1 (0.6%)	2 (1.2%)	9 (4.6%)	3 (1.5%)	12 (6.1%)
Business	17 (10.2%)	4 (2.4%)	21 (12.6%)	4 (2%)	0 (0%)	4 (2%)
Mine Employee	78 (46.7%)	16 (9.6%)	94 (56.3%)	0	0	0
Others	11 (6.6%)	5 (3%)	16 (9.36%)	5 (2.5%)	2 (1%)	7 (3.5%)
Total	135 (80.8%)	32 (19.2%)	167 (100%)	137 (69.5%)	60 (30.5%)	197 (100%)

Source: Field study (2019)

On the contrary, in non-mining area, the main occupation of most of people is cultivation. More than 80% of people depend on cultivation. This is followed by government service, others and business. Like mining villages, here also all activities are mostly performed by male as compared to their female counterpart. Thus, it is clear from the occupational distribution that in mining as well as non-mining areas there exist gender gap. In both mining and non-mining areas, all the primary activities are dominated by male.

There are very less number of secondary economic activities in mining as well as non-mining areas. In mining village, business is the second main occupation of the households. This is followed by wage labourer and cultivation. This cultivation is mainly for home consumption. It is found that all the secondary economic activities in the mining village are dominated by women. In non-mining village, agricultural wage labourer is adopted as the second main source of income by the

people. This is followed by wage labourer and diary. Unlike mining villages, here women don't have equal opportunities.

4.4: Mining and Livelihood Assets

The main objective of the sustainable livelihood framework is to ensure productive livelihoods results of the people. To ensure this objective, it states that people need varieties of assets. A particular category of asset is not enough to secure this objective. According to this framework, the livelihoods of the people is based on five types of assets (Ellis and Mdoe, 2003; Mishra, 2010). So, this section is interested to study on the following five categories of assets.

4.4.1: Impact on Financial Capital

“Financial capital denotes the stocks and flows of financial resources that people use to achieve their livelihood objectives” (DFID, 1999). In the present research, it is found that mining has a favourable effect on the financial capital of households. Differences between average household income and average per capita income in both mining as well as non-mining areas makes clear that average household income of the mining region is more than the non-mining region (Table 4.5). Majority of the households in the mining villages work in the mines and so they have a greater level of income. In the non-mining village, most of the people carry out cultivation works.

Table 4.5: Status of Financial Capital

Villages	Mean Annual Income (in Rs)	Mean Household Size	Mean Per Capita Income (in Rs)
Mining Villages	1,14,286.66	3.88	29,455.32
Non-mining Village	71,409.6	4.54	15,728.99

Source: Field study (2019)

4.4.2: Impact on Physical Capital

“Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods. Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive. Producer goods are the tools and equipment that people use to function more productively (DFID, 1999). The main constituents of infrastructure according to sustainable Livelihoods Framework are affordable transport, secured shelter and

buildings, adequate water supply and sanitation, clean affordable energy and access to information (communication) (DFID, 1999)”.

4.4.2.1: Housing Condition

Housing is considered as the physical capital for the household. In the mining village, 78% of households own a house (Table 4.6). The remaining households stay in company quarter (11%), relatives house (9%) and rented house (2%). This indicates that people from nearby areas migrate to mining village in order to avail employment opportunities. On the other hand, a different picture is found in the case of non-mining village. 100% of households live in their own house in the non-mining village.

Table 4.6: Distribution of households according to the ownership of house

Ownership of House	Mining Villages	Non-mining Village
Own	117 (78%)	100 (100%)
Rented	3 (2%)	0 (0%)
Relative	14 (9.33%)	0 (0%)
Company Quarter	16 (10.67%)	0 (0%)
Total	150 (100%)	100 (100%)

Source: Field Survey (2019)

4.4.2.2: Types of Houses

The type of house reflects the standard of living of the people. There are three types of houses viz. Kutcha, semi-pucca and pucca. In mining area half of the sample households have (51%) pucca houses followed by semi-pucca (40%) and Kutcha (9%) (Table 4.7). In contrast, in non-mining region a greater number of people live in Kutcha houses (56%) and semi-pucca houses (37%). Only very few households have a pucca house (7%). The proportion of people staying in the semi-

pucca house is 37%. A comparison of mining areas to that of non-mining area with respect to the types of house reveals that comparatively more households live in pucca house in the mining villages than non-mining village. This might be due to higher income in mining villages. Thus, it can be said that living condition of families in the mining regions is relatively better to that of non-mining region, according to the types of houses.

Table 4.7: Allocation of households as per the kind of houses

Kind of House	Mining Villages	Non-mining Village
Kutcha	13 (8.7)	56 (56%)
Semi-pucca	60 (40%)	37 (37%)
Pucca	77 (51.3%)	7 (7%)
Total	150 (100)	100 (100%)

Source: Field Survey (2019)

4.4.2.3: Sanitation

For a healthy life of people, better hygiene and sanitation facilities act as a principal part. In the absence of such facilities people suffer from various communicable and non-communicable diseases. Therefore, adequate toilet and bathroom facilities are considered as essential for a healthy society. Table shows the distribution of latrine facilities among the households in mining as well as non-mining regions.

In the mining villages, 39% of households do not have toilet facilities. 8.67% of households have temporary latrine facilities whereas 52.67% have pucca latrine facilities (Table 4.8). In non-mining village, 80% of households don't have latrine facilities. 11% of households have only pucca latrine facilities whereas only 9% households have temporary latrine. None of the villages are performing better as far as sanitation conditions are concerned. Government of India launched Swachh Bharat Abhiyan in the country for promoting better sanitation facility. Because of this program the sanitation facility should have improved in the villages. However, the percentage of open

defecation is still very high in these villages. Few households have constructed latrine and do not prefer the use of latrine. This is because they have been habituated for open defecation since the long.

Table 4.8: Availability of Latrine facilities in the sample villages

Availability of Latrine Facilities	Mining Villages	Non-mining village
No Latrine	58 (38.7%)	80 (80%)
Temporary	13 (8.7%)	9 (9%)
Pucca	79 (52.7%)	11 (11%)
Total	150 (100%)	100 (100%)

Source: Field Survey (2019)

With regard to the availability of bathroom facilities 49.33% of households do not have bathroom facilities in the mining villages. They go to nala, ponds, tube well for bathing purpose. 50.67% of households have only pucca bathroom facilities whereas none of the households in mining villages have built any temporary bathroom (Table 4.9). On the other hand, 91% of households do not have bathroom facilities in non-mining village. Most of the people used to bath in the dam as it is a dam area. Some others bath in the tube well and ponds. Only 5% of households have pucca bathroom facilities.

Table 4.9: Availability of Bathroom facilities in the sample villages

Availability of Bathroom Facilities	Mining Villages	Non-mining Village
No Bathroom	74 (49.33%)	91 (91%)
Temporary	0 (0%)	4 (4%)
Pucca	76 (50.67%)	5 (5%)
Total	150 (100%)	100 (100%)

Source: Field Survey (2019)

4.4.2.4: Access to Electricity

Access to electricity is indispensable for human society. Electricity helps in lighting, and running of household's appliances. Table 4.10 depicts the distribution of households according to the accessibility to electricity. Access to electricity is higher in mining villages (94.67%) than non-mining village where it is only 49%. The reason for more access to electricity in mining villages is that electricity is provided by the mining company. 51% of households in non-mining village don't have access to electricity. Electricity is provided by government in non-mining village. The accessibility to electricity in non-mining village is low because the income of the people is low as compared to mining village.

Table 4.10: Electricity Access in Sample Villages

Villages	Availability of Electricity		
	Yes	No	Total
Mining Village	142 (94.7%)	8 (5.3%)	150 (100%)
Non-mining Village	49 (49%)	51 (51%)	100 (100%)

Source: Field Survey (2019)

It is clear from the table that 95% households in mining villages opined that they have access to electricity. This has been possible because of provision of electricity facility by mining company. However, 5% households reported that they don't have access to electricity. This is due to the conflict between households and mining company. Whenever there is conflict between mining company and household, the company cut the electricity connection. Thus, it can be said that situation is better in mining villages than non-mining village on the basis of access to electricity.

4.4.2.5: Cooking Technology

There are different sources of cooking such as firewood, cow dung, LPG, stove, heater. Different sources of cooking of mining along with non-mining regions are represented in Table 4.11. In mining-villages, the major source of cooking is firewood. 48.7% of households depend on firewood as their major source of cooking. This people have more access to firewood because it is a forest area. LPG and stove are the second source of cooking in mining villages. Besides, heater is another source of cooking in the mining villages. In non-mining village, stove is the major source of cooking (33%) followed by firewood (27%). 20% of people use cow dung to do cooking and 5% people depend on LPG.

Table 4.11: Sources of Cooking in Sample Villages

Villages	Sources of Cooking				
	LPG	Stove	Firewood	Cow dung	Heater
Mining Villages	32 (21.3%)	32 (21.3%)	73 (48.7%)	0 (0%)	13 (8.7%)
Non-mining Village	5 (5%)	33 (33%)	27 (27%)	20 (20%)	0 (0%)

Source: Field Survey (2019)

4.4.2.6: Livestock

Livestock is one of the important assets of poor people in the rural areas. Livestock provides different types of advantages to the rural people. It acts as a source of food, cash income, manure, savings and insurance, draft power and hauling services, social capita and social status.

Table 4.12: Distribution of Households according to the ownership of Livestock

Villages	Buffalo/Cow / Bull	Goat	Sheep	Poultry Birds	Others (Pig)
Mining Villages	0 (0%)	32 (21.3%)	3 (2%)	58 (38.7%)	28 (18.7%)
Non-Mining Village	74 (74%)	37 (37%)	13 (13%)	22 (22%)	0 (0%)

Source: Field Survey (2019)

In the mining villages 38.7% of household owns poultry birds followed by goats (21.3%) and others (18.7%). Not a single household own buffalo/cow/bull in mining villages. Thus, poultry birds, goat and others (pig) are the main livestock asset in the mining areas (Table 4.12). On the contrary, in non-mining area more than 74% of households own buffalo/cow/bull. Similarly, 37%, 22% and 13% of households own goat, poultry birds and sheep respectively. Thus, livestock in non-mining village consists of cow, bull, buffalo, goats, sheep and poultry birds.

Thus, in the mining villages households don't have cow/bull/buffalo. This is because in the mining areas cultivation is not a source of income for people. On the contrary, more than 70% of households in non-mining have bull/cow/buffalo. This has been possible because non-mining area is an agrarian area and the main profession of the people is agriculture. Agricultural operations are carried out with the help of these animals. Thus, households in non-mining village own more livestock than mining villages.

4.4.2.7: Land holding

Land plays a very important factor of production in an agrarian country like India. Mining villages have more landless households to that of non-mining region (Table 4.13). In mining regions 48% of households do not have land. Similarly, mining villages have less proportion of household having marginal, small land and semi-medium. This is 32.7%, 6.7% and 12.7% respectively. Mining villages have no medium land ownership.

Table 4.13: Ownership of Land Holding in the Sample Villages

Village Name	Size of land holding ¹					
	Landless	Marginal Land	Small Land	Semi-Medium Land	Medium Land	Total
Mining Villages	72 (48%)	49 (32.7%)	10 (6.7%)	19 (12.7%)	0 (0%)	150 (100%)
Non-mining Village	0 (0%)	77 (77%)	13 (13%)	6 (6%)	4 (4%)	100 100%

Source: Field Survey (2019)

The number of landless is more in the mining villages because mining company has acquired most of the land in the area. Further people in the mining villages do not prefer cultivation of land due to various reasons. The operation of mine produces soil pollution which in turn reduces the productivity of land. Similarly, mines have destroyed soil surface and the nutrient status of land and thereby causing land degradation. Another reason why people do not go for cultivation is the higher wages paid by the mining company. Finally, there is risk of crops destruction by elephant. Thus, all these factors have made the land uncultivable and forced the people in the mining areas not to go for cultivation even though some land is left with them.

Non-mining village is an agrarian economy. That's why there are no landless households in case of non-mining region. Non-mining region has higher proportion of households having marginal and small land households (77% and 13%). Non-mining village has 4% of medium land owner.

¹ The Classification of Land Holding Ownership is done according to Household Ownership Holding in India, NSSO, 2006. Marginal - Below or equal to 1 hectare/2.47 acre/247 decimal
Small - 1 & below 2 hectare/2.47 & below 4.94 acre/ 247 & below 494 decimal Semi-medium - 2 & below 4 hectare /4.94 & below 9.88 acre/499 & below 988 decimal Medium - 4-10 hectare/ 9.88 & below 24.70 acre /988 & below 2470 decimal Large - Above 10 hectare /24.7 acre/ 2470 decimal

4.4.2.8: Consumer Durables

The standard of living of a household can be judged by looking at their ownership of consumer durables. Table 4.14 shows the distribution of households according to the ownership of consumer durables in the sample villages.

Mining villages are having highest percentage of consumer durable items like TV, fridge, mobile and motorcycle (64%, 34%, 83% and 66%) in comparison to the non-mining village. Non-mining village owns 47%, 14%, 47% and 48% of TV, fridge, mobile and motorcycle respectively. With regard to consumer durable items like mattress, pressure cooker, chair, bed, and clock, fan mining regions as well as non-mining region have approximately same percentage of these consumer durable items. Thus, mining villages own more percentage of items like TV, fridge and mobile compares to non-mining village. Further mining villages have more percentage of households owning motorcycle than non-mining village. Income is more in mining villages. This may be the reason behind owning of more motorcycle by the mining villages. Besides, mining villages have more heavy vehicles like dumpers/tipper than non-mining village because these are used for the transportation of iron ore.

Non-mining village households have more productive assets like plough, pump-sets diesel (73% and 16%). Tractor and power tiller are also used by some households which are economically better off. This is because agriculture is the main source of income in non-mining village and these items are used to carry out agricultural operations. On the other hand, mining villages don't have such productive items because agriculture is not a source of income for the mining village people.

Table 4.14: Ownership of Consumer Durables in Sample Villages

Consumer Durables	Mining Villages	Non-Mining Village
Mattress	31 (20.67%)	16 (16%)
Pressure	53 (35.33%)	27 (27%)
Chair	128 (85.33%)	80 (80%)
Cable	93 (62%)	48 (48%)
Bed	125 (83.33%)	96 (96%)
Fan	90 (60%)	80 (80%)
Radio	8 (5.33%)	4 (4%)
Clock	144 (96%)	96 (96%)
Pump Sets-diesel	0 (0%)	16 (16%)
Plough	0 (0%)	73 (73%)
TV	96 (64%)	47 (47%)
Mobile	125 (83.33%)	47 (47%)
Fridge	52 (34.67%)	14 (14%)
Motorcycle	99 (66%)	48 (48%)

Source: Field Survey (2019)

4.4.3: Impact on Human Capital

“In the livelihood framework, human capital is taken as a livelihood asset, or as a means of achieving livelihood outcomes. It represents the skills, knowledge, ability to work and good health that together enable people to pursue different livelihood strategies and achieve their livelihoods objectives”. Ill health and lack of education are considered by many people as primary cause of poverty. Thus, to overcome these conditions may be one of their primary livelihood objectives. The economic development of a country depends on the quantity and quality of man power. The efficiency and productivity of the work force is called the quality of man power. Of the many important factors, the efficiency of labour force depends on the level of education. The distribution of family members according to level of education and literacy rate is depicted in the Table 4.15.

Table 4.15: Distribution of family members according to level of education

Educational Status	Mining Villages		Non-Mining Village			
	Male	Female	Male	Female	Male	Female
Illiterate	27.7%	35.2%	17.8%	31.4%		
Primary	38.2%	27%	24.3%	23.7%		
Upper Primary	18%	19.4%	23.1%	18.4%		
Secondary	12%	16.2%	27.9%	19.3%		
Higher Secondary	3%	1.9%	2%	4.3%		
Graduation	0%	0%	4.9%	2.9%		
Professional Qualification	1.1%	0.3%	0%	0%		
Total	100%	100%	100%	100%		
	Mining Villages		Non-Mining Village		Keonjhar District	
	Male	Female	Male	Female	Male	Female
Literacy Rate	72.3%	64.8%	82.2%	68.6%	78.1%	58.3%
					81.6%	64%

Source: Field Survey (2019) and Census (2011)

In mining regions as well as non-mining region female literacy rate is very low. Female illiterate percentage varies from 31 percent to 35 percent. Male illiterate percentage varies from 17 percent to 27 percent. In all categories men's performance is better than women except in upper primary, secondary in the mining villages. Same picture is found in the non-mining village. Here also male have performed better than female in all categories except in higher secondary. There is no graduate person in the mining villages. On the other hand, there are graduate person in the non-mining village and it is high among male.

Table 4.15 also compares the literacy rate of mining and non-mining village with the district and state literacy rate. It can be observed that male literacy in mining villages is lower than the district and state literacy. But the female literacy rate is higher than the district and state literacy rate. On the other hand, both the male and female literacy rate in non-mining village is higher than the district and state rate. It indicates that female from both mining and non-mining village have performed better than the district and state in term of literacy rate.

4.4.3.1: Impact of mining on the health of people of mining region

Different diseases suffered by family members during the last year are demonstrated in Table 4.16. People of mining villages are suffering from different types of diseases such as waterborne disease (dysentery, diarrhea, jaundice, typhoid), Acute Respiratory Infection (ARI), malaria, body/joint pain, tuberculosis, cold/fever and skin problems.

Table 4.16: Distribution of family members according to disease suffered in the last year

Disease Suffered	Mining Villages	Non-Mining Village
Waterborne	435 (74%)	262 (57%)
ARI	69 (11%)	4 (0.87%)
TB	23 (3%)	0 (0%)
Malaria	561 (96%)	342 (75%)
Cold/Fever	558 (95%)	452 (99%)
Skin Problems	106 (18%)	28 (6%)
Body/Joint Pain	132 (22%)	57 (12%)
Total	582 (100%)	454 (100%)

Source: Field Survey (2019)

Most of people in mining regions mostly suffer from diseases like malaria (96%), cold/fever (95%) and waterborne diseases (74%). Water and waste etc. are accumulated at different places in the villages that breeds mosquitoes. This is the main reason behind suffering from malaria. High turbidity, less free residual chlorine, high TDS, high concentration of iron, low sulphate and magnesium in underground water that is used for drinking and trace of coliform bacteria in the surface water of mining villages are responsible for high occurrence of waterborne diseases. In mining villages people are facing different skin problems like scabies, eczema (18%). In mining villages, 22% of people are found to be suffering from disease like body/joint pain. Normally body/joint pain disease is due to old age. But during the field survey it is found that people belonging to the age group of 16-40 years also suffer from this disease. Intake of drinking water having low calcium and high concentration of iron and fluoride might be responsible for this. Even the diseases like ARI, TB are also found in the mining villages. These

diseases are more common among the working age groups. This might be due to working in mines.

On the contrary, people in the non-mining region are better than mining villages with respect to health status. 57% of people in non-mining village suffer from waterborne disease which is less than mining villages. Further people reported that body/joint pain are mainly due to old age. This problem was not related to old age in the mining villages. Rather deficiency in calcium and magnesium in drinking water is the reason behind body/joint pain in mining villages. Since people in non-mining village are not working in mines the occurrence of disease like TB, ARI are not found. Thus, both mining and non-mining villages are suffering from disease malaria, cold/fever etc. but health status in non-mining village is better than mining villages.

A health index is constructed with the help of Principal Component Analysis Technique by taking three variables such as number of times disease suffered by family members in the last 12 months, working days lost and expenditure on medicines and hospitalization in the last 12 month. By taking the weighted average of all principal components, a health index has been constructed. The expression is given in the following equation.

$$HI = (\lambda_1 P_1 + \lambda_2 P_2 + \lambda_3 P_3) / (\lambda_1 + \lambda_2 + \lambda_3)$$

Where HI represents health index for same household, k is number of welfare parameters, λ_1 to λ_k are Eigen values of the 3*3 correlation matrix of the welfare parameters and P_1 to P_k are factor loading of variables on component. Here, $\lambda_1 > \lambda_2 > \lambda_3$ and $var P_1 = \lambda_1$... $var P_3 = \lambda_3$.

Table 4.17: Component matrix of health index

Variables	Components
Number of times disease suffered by family members in the last 12 months	0.6875
Working days lost	-0.7166
Expenditure on medicines and hospitalization in the last 12 month	0.1179

Source: Field Survey (2019)

The strength of each variable is indicated by the factor loadings. It can be called as the coefficients term which can explain the association between the factor and the variable. If the loadings are higher (negative or positive) (), it indicates that it is more important to that factor. The value of number of times disease suffered by family members in the last 12 months variable is greater than 0.5 and is positive which indicate that it has a powerful loading for the factor. Similarly, working days lost variable has powerful loading for the factor. Its value is negative which indicates that variable has negative association to rest of the component (Table 4.17).

Table 4.18: Eigen values of health index

Component	Eigen Values	Difference
1	2.03758	1.12938
2	.908199	.853979
3	.0542201	-

Source: Field Survey (2019)

With the help of following equation, a regression has been run.

$$HI = \alpha_1 + \beta_1 Y + \beta_2 TA + \beta_3 LH + \beta_4 SDW + \beta_5 C + \varepsilon$$

Where **HI** = Health Index

Y = Annual Income

TA = Total Assets

LH = Land Holding

SDW = Source of Drinking Water

C = Control Variables (category, religion, gender, age, marital status, educational qualification, ownership of house, type of houses, access to electricity, source of cooking)

ε = Error term that fulfill all the assumptions of the classical linear regression model

Table 4.19: Regression result for Health Index

Dependent Variable = Health Index (HI)	
Independent Variables	Coefficient
Annual Income (Y)	7.21* (2.06)
Total Assets (TA)	-.023 (-0.46)
Land Holding (LH)	-.242 (-1.76)
Source of Drinking Water (SDW)	-3.836* (-2.55)

Source: Field Survey (2019)

Note: * denotes 1% significance level

‘t’ value is shown in figure in the parenthesis

The coefficient term of source of drinking water is negative and statistically significant (Table 4.19). That means 1% increase in source of drinking water will result in 3.836% decrease in health status of households living in the mining villages. There is high turbidity, less free residual chlorine, high TDS, high concentration of iron, low sulphate and magnesium in underground water that is used for drinking and trace of coliform bacteria in the surface water of mining villages. These might be responsible for different types of waterborne diseases and

consequently result in reduction of welfare of people. The coefficient term of annual income is positive and statistically significant. 1% increase in annual income will bring about 7.21% increases in welfare of the people. This is because mining company is providing employment opportunities to the people.

4.4.3.2: Economic Burden of illness

According to WHO (2009) people's welfare depended on three things such as their state of health, their consumption of goods and services and amount of leisure time. When a person becomes ill, it can affect these three components either separately or jointly. For example, if a person's health is poor, it will reduce his or her welfare. They have to incur medical and related expenses to cure their ill health. In this way they have to sacrifice their other non-health goods and services like food, housing or education. If they were not ill, they would have spent their medical expenses money on other non-health goods and services. Thus, ill health will reduce the economic welfare. Cost of illness is the most commonly used method to measure the economic impact of illness. The present study has employed this method to measure economic loss due to ill health caused by mining pollution.

Cost of illness evaluate the highest quantity that could possibly be stored or earned if an illness is to be cured. Thus, cost of illness measures the economic burden of a disease. According to this measure, it creates two types of costs of diseases viz. direct cost and indirect cost. Direct cost is measured by the opportunity cost of illness used for curing a particular illness. On the other hand, indirect costs are the value of resources sacrificed because of a specific disease. Direct cost is measured by costs and an expense incurred for treatment of disease and indirect cost is measured by lost earning due to illness in the present study. The cost of illness is given in the following equation.

Cost of Illness of a household = Average cost of medical expenses of household (direct cost) + average cost lost earning due to illness of household (indirect cost)

Cost of medicine, doctor cost and disease test cost are the components of average cost of medical expenses. Lost earning due to illness is the monetary value of loss of working days due to illness. Average lost earning of working members of a household is only taken into account in the calculation of the indirect cost. Here earning lost from primary and secondary sources in a day are taken into account. To measure the loss of working hours of non-paid

workers in a household no appropriate method is available. That's why the lost earning of non-paid workers such as housewife, old persons, and unemployed are not taken into account while calculating the average lost earning of a household. The average lost earning of a household is given in the following equation.

$$\text{Average lost earning due to illness of a household} = \sum W_i M_i / M_n$$

Where, $\sum W_i M_i / M_n$ = wage earned by the first member × total work days lost + wage earned by second member × total work days lost + + wage earned by the i^{th} member × total work days lost and M_n = total number of working members in the household (Sahoo, 2015).

The economic burden of illness/cost of illness in the sample villages is shown in Table 4.20. The mining company makes the provision of free medicine and free doctor consultation service to the people of mining villages. The average medical expenditure as shown in the table does not take into account medical services provided by mining company. Similarly, the mining company makes the provision of compensatory leave for the employees working in the company when they become ill. Two types of leaves are provided to the people working in the mining company. These two leaves are Earned Leave (EL) and Sick Leave (SL). A person can take 1 EL for every 20 days and 1 SL for 18 days. These leaves can be called as the compensation given by the mining company to a person. Therefore, now actual earning lost due to illness is equal to the total earning lost due to illness minus the compensation paid by the mining company.

Table 4.20: Total and Actual Cost of Illness in Sample Villages

Sample villages	Annual average value of (in Rs)				
	Medical Expenditure (1)	Workday earning lost due to illness (2)	Total cost of illness (1) +(2) = (3)	Compensation by Mining Company (4)	Actual Cost of Illness (3)-(4) = (5)
Mining Villages	72,600	20,008	92,608	9975	82,633
Non-Mining Village	17,952	5068	23,020	0	23,020

Source: Field Survey (2019)

The mining villages have the highest annual medical expenditure (Rs. 72600) as well as highest total earning lost (Rs. 20008) due to sickness. This is because mining villages are situated near to the mining company. After deducting the compensation provided by mining company from the total cost of illness, the actual cost of illness in mining villages is Rs. 82,633 (Table 4.20).

On the other hand, the annual medical expenditure and total earning lost in non-mining village is (Rs. 17952 and Rs. 5068) respectively. There is no compensation to a person suffering from illness in the non-mining village. This is because most of the people are engaged in agriculture which is self-occupation. Hence, in the non-mining village actual cost of illness is same as total cost of illness. Thus, it is clear from the table that people of mining villages are incurring more medical expenditures than non-mining village. This is because of higher incidence and frequency of different diseases caused by the operation of mining.

Now in order to find out whether there is difference between Actual Cost of Illness in mining and non-mining villages, the present study has done t-test. Therefore, the null hypothesis is

H_0 = Households in mining villages do not bear higher actual economic burden of illness than in non-mining village

H_a = Households in mining villages bear higher actual economic burden of illness than in non-mining village

Table 4.21: Independent test for actual earning lost due to sickness in mining as well as non-mining regions

		t-test for equality of means				
		t-value	df	P-value (one-tailed)	Mean difference	Std Error Difference
Actual Earning Lost due to Sickness	Equal variances assumed	4.425	248	0.00*	18266	4127
	Equal variances not assumed	4.384	205	0.00*	18266	4166

Source: Field Survey (2019)

Note: * 1% level of significance

One-tailed t-test is done at 1% level of significance in order to test the null hypothesis. Table 4.21 makes it evident that that p-value is 0 which is less than critical p-value = 0.01 for both equal variances assumed and not assumed. As a result, the study has discarded the null hypothesis and accepted the alternative hypothesis. That means households in mining villages bear significantly higher economic burden of illness than in non-mining village. Households in mining villages bear Rs. 18266 more Actual Burden of Illness than no-mining households.

4.4.4: Impact on Natural Capital

“Natural capital can be defined as the stock natural resources and environmental assets, including water, soils, air, flora, fauna, minerals, and other natural resources for the rural people. Natural capital is important because they derive all or part of their livelihood from farming, fishing and collecting forest products. In this study mining has its worst impact on natural assets”.

4.4.4.1: Source of drinking Water

Just like adequate latrine and bathroom facilities, safe and pure water facilities also play a very important role for good health of the society. Lack of safe water is responsible for different types of diseases. Thus, the study of water facility is very essential.

Table 4.22: Sources of Drinking Water in Sample Villages

Source of Drinking Water	Mining Villages	Non-mining Village
Tube Well	0 (0%)	60 (60%)
Pond/River	0 (0%)	0 (0%)
Mining Company Supply	149 (99.3%)	0 (0%)
Well	1 (0.7%)	40 (40%)

Source: Field Survey (2019)

Households in the mining areas depend on water supplied by mining company. Mining company supplies 99% of water to the people of mining villages. The mining company has constructed an overhead tank in mining villages. Bore well water is stored in the overhead tank and then the stored bore well water is supplied to villagers through water taps installed at different point in villages. Water is also supplied to the people through mobile water tankers. The use of tube well and stream as the source of water is very rare in mining villages. During summer tube well get dried up. As a result, the mining villages people have to face lot of problem. That's why people have to depend on water supplied by mining company. Government has taken no step to supply water facility to the people in these areas.

On the contrary, there is a different situation in non-mining region. People in the non-mining area mainly depend on tube well water for drinking purpose (60%). Some people have their own well (40%) which they use for both drinking as well as agricultural purposes. There is no government supply of water in the non-mining village.

4.4.4.2: Perception of respondents about awareness of mining pollution

The perception of the people about awareness of mining pollution living in mining villages is represented in Table 4.23. The table makes it evident that people in mining villages are well aware about the environmental pollution caused by the operation of mining company. 87% respondents in mining villages have the perception of environmental pollution affected by mining.

Table 4.23: Perception of respondents about awareness of mining pollution

Village	Awareness of mining pollution		
	Yes	No	Total
Mining Villages	131	19	150
	87.3%	12.7%	100%

Source: Field Survey (2019)

4.4.4.3. Perception of respondents on intensity of mining pollution

The perception of respondents on intensity of mining pollution is shown in the Table 4.24. 67% of the respondents are of the view that mining operation in the region has resulted in human health problem. 32% of respondents are of the opinion that mining operation has created water pollution.

Table 4.24: Perception of respondents on intensity of mining pollution

Village	Intensity of mining pollution						
	Water	Human Health	Agriculture	Livestock	Livelihoods	Others	Total
Mining Villages	49	101	0	0	0	0	150
	32.7%	67.3%	0%	0%	0%	0%	100%

Source: Field Survey (2019)

Thus, there has been deterioration in the overall quality of environment as confirmed by people of mining villages. People opined that the on-going mining activity is responsible for deterioration of environmental quality.

4.4.4.4: Respondent's perception on impact of crops

People in mining villages are not interested to do farming. In the mining villages 94% of people opined that crop are destroyed due to dust and contaminated water produced by operation of mines while only 6% of people said that some others reasons are responsible for crop destruction. People in the mining regions stated that they had farming land. However, Majority of the people had to leave farming activities as a result of working of mines. Soil pollution caused by mining operation has reduced the productive capacity of the land with the passage of time. This is the reason why people have left cultivation. Again, mining has caused land degradation resulting in destruction of soil surface and decline in the nutrient status of agricultural land.

4.4.4.5: Respondent's perception on first notice of agricultural pollution

In the mining villages 80% of respondents have the perception that mining is affecting agricultural production in the past 40 years ago. The first mining lease was granted in the year 1946. Similarly, only 5% respondents opined that they are experiencing the effect of mining on agricultural production in the recent years.

4.4.4.6: Respondent's perception on awareness of water pollution and sources of water pollution

In the mining villages 100% of people are well aware about water pollution and have perception on sources of water pollution. Respondents have cited various reasons for the degradation of the environment. Most of them said that the major reason for pollution and degradation of environment in the mining villages is the use of heavy machine like dumpers for transportation of iron ore etc. 100% respondents opined that they are aware about water pollution and sources of water pollution. Some other people are of the opinion that the poor quality of environment is due to deforestation. Further, some others opined that the use of toxic material during mining process is another reason for pollution.

4.5: Impact on Social Capital

According to some respondent people from different parts of Odisha and even from outside Odisha have migrated to the mining areas either to work in the mines or to carry out other business related to mines. This type of in-ward migration is not found in the non-mining area. This migration of the people to the area has created conflicts among inhabitants and outsiders, disturbing the social harmony of the village. Another social problem created by the mines is the conflict between the mining company and households. Most of the people have lost their land due to mining operation. People who lost their land have received compensation from the mining company in terms of either cash or jobs in mines. Most of the households opined that they have not yet received compensation from the company. Some others opined that they have received inadequate amount of compensation. This is because of some legal issues relating to the ownership of land.

It is found that mining villages have more social evils like alcoholism than the non-mining village. The labourers class of the village drink liquor (Handia) in the evening after they return from their works. This might be because of high income earned from mining works. The mining activities have also increased gender disparities. Women have a very low participation in the work. Male members of the house are not allowing their female counterparts to work because they earn high amount of income from mining. This reflects that women are not in a good position in the mining villages. Thus, it is clear that mining activities have a negative effect on the social capital.

4.6: Conclusion

Thus, it is clear from the above analysis that mining activities have unfavourably affected the natural environment. The living of people is directly linked with the environment. Various pollutions created through mine operation affects the health of inhabitants and result in different types of diseases. Mining villages have more frequency of diseases than non-mining village. As a result, the mining area people have to bear more actual economic burden of illness in comparison to the non-mining area people. Mining as well also negatively affected the social capital of mining villages. In spite of all these negative effects, mine has positively affected the financial capital and physical capital of inhabitants. It has created multiple job opportunities in the region which have a direct effect on the livelihood of the people.

Chapter 5

Conclusion

5.1: Introduction

Odisha is rich with various types of natural resources and therefore, occupies a leading position as mineral-rich state in the country. Odisha's economy is contributed significantly by the mining sector. The sector has increased Gross State Domestic Product, foreign exchange earnings, mineral production and employment in the state. Now the question arises have the mineral-rich districts of Odisha been able to raise their economic growth from their natural resources? Have the tribal and unprivileged people of mining area benefited where most of the resources are located? The present study is an attempt to study the association between abundance of natural resource and economic growth in Odisha.

To understand the relationship between natural resource abundance and economic growth in Odisha, the present study has formulated two main objectives which are as follows.

- (a) To test the Resource Curse Hypothesis in mining-rich districts of Odisha.
- (b) To examine the impact of iron ore mine on the livelihoods of people in Keonjhar district of Odisha.

To address the first objective the present study has selected sixteen mineral rich districts of Odisha. These districts are Angul, Bargarh, Dhenkanal, Bolangir, Ganjam, Jajpur, Kalahandi, Jharsuguda, Keonjhar, Mayurbhanj, Koraput, , Nuapada, Rayagada, Sundargarh, Sambalpur and Subarnapur and. To answer the second objective the study has selected two blocks namely Joda and Keonjhar Sadar. Joda which has a high concentration of mines and Keonjhar Sadar which has no mines but is potentially affected by mining in neighboring blocks. Balda gram panchayat coming under Joda block has been selected for the current study. Again, in Balda panchayat, two villages such as Kundaposi and Balda have been selected with the help of lottery method which come under simple random sampling method. Further, M/s Serajuddin and Co. iron ore mine has been selected with the same method to study the externalities of mining iron on people coming under mining areas. Under Keonjhar Sadar, Chaka village coming under Raghunathpur gram Panchayat has been selected with the aid of lottery method

coming under simple random sampling method. 250 households have been chosen as the total sample size of the present research. Out of which 150 households are selected from mining village (75 households from Balda region and rest 75 from Kundaposi region) and 100 households are selected from non-mining village.

Each objective is addressed by using a different methodology. To address the first objective chapter 3 has used Panel Autoregressive Distributed Lag Model (P-ARDL). To test the cross-sectional dependence among the variables, Pesaran Cross Sectional Dependence Test is used. After that to test the stationary properties of variables Pesaran's Cross-sectional Augmented Dickey-Fuller Test is used. After doing all these tests, P-ARDL has been employed to estimate the long-run relationship among variables. To meet the second objective, chapter 4 has used cross tabular analysis to analyse the social and economic conditions of people staying in mining regions as well as non-mining region. Different statistical methods like averages, percentages, t-test, principal component analysis, regression analysis analyzing the data wherever it is found to be appropriate.

5.2: Findings

The main objective of chapter 3 is to test the Resource Curse Hypothesis in mineral rich districts of Odisha. From the panel ARDL model, the study found that there is a positive relationship between natural resource abundance and economic growth in the long-run. The results do not support the existence of natural resource curse hypothesis in the mineral rich districts of Odisha. Again, the study has compared the ARDL model results of two time period (from 1995-2015 and from 1995-2018) and found that resource curse finding is time sample sensitive. When time period is taken from 1995 to 2015, there is evidence of resource curse hypothesis in the mineral-rich districts of Odisha. On the contrary, between time sample 1995 and 2018, resource curse theory is not observed. Between time sample 1995 and 2015, the resource curse finding is due to the rampant illegal mining activities in the state. The Union Ministry of Mines had set up Shah Commission in 2010 to look into the illegal mining of manganese and iron ore in the state. In its first report, the commission stated that Odisha has incurred losses of Rs 59,203 due to rampant illegal extraction, sale and export of iron ore. In 2009, Odisha govt. took steps to verify the documents of the mines in the state. During the

verification it was found that most of the mines had not renewed their licenses violating the environmental and forest clearances.

For the sample of 1995-2018, resource curse theory is not observed in the mining districts of Odisha. This is due to strict actions taken by both Odisha government and Supreme Court. The Odisha government suspended the operation of 128 mines, mostly iron ore and manganese as offensive against illegal activities. Again, the Supreme Court in 2017 directed to the miners to pay a compensation of Rs 17, 576 crores for producing output beyond the quantum fixed under the environmental clearances. All these steps taken by the state government and the Supreme Court might have forced the miners in the state to exploit the natural resources rationally and efficiently. Perhaps due to this reason there is no observation of resource curse theory in the mining rich districts after 2015.

Chapter 4 aims at examining the effect of iron ore mining on the livelihoods of Keonjhar district of Odisha using Sustainable Livelihood Frameworks. The effects of iron ore mining on five kinds of capital or assets such as physical capital, financial capital, human capital social capital and natural capital have been examined. The evidences show that mining iron favourably affects the financial capital of households. Mean household income as well as mean per capita income of the mining villages are greater than non-mining village. Further, within the mining villages, the per capita income of a household depends on the closeness of the region to the mine area. If the region is closer to the mine area, more is its per capita income. For example, Balda village which is situated closer to the mine area enjoys the per capita income of Rs. 400 followed by Kundaposi village. This may be due to high level of income received by the people by working in mining company as mining officer, mining worker and bonus given by the company to people.

The effect of iron ore mining on the physical capital of people is mixed.-It is found that 78% of sample households in the mining areas own houses. On the contrary, in non-mining village 100% of households own houses. This is because mining company provided quarter to some households in the mining villages and some others live in the house of their relatives and rented house. Majority of households in the mining villages (51.33%) are having pucca houses where as this figure is 7% in non-mining village. Further, in the mining villages, fewer households are having livestock than non-mining village. This is because, majority of land is occupied by the company. Thus, mining regions have no land which can be used for grazing purposes.

Mining villages mostly own goats, poultry birds, and pigs. On the other hand, non-mining village being an agrarian village, the owning of cow/bull is more (74% of households).

Households in the mining villages own more durable goods like fan, motor cycle (dumper, truck) and mobiles than non-mining village. This is possible because income of the people has been favourably affected by the working of mine. Whereas in the non-mining village, households possess more of plough and pump set. This is because agriculture is the main occupation of non-mining village and these assets are mostly used for agricultural activities. Similarly, households of mining villages use more of LPG (21.3%) than non-mining region (5%). This is again due to the better economic condition of households in mining villages. Another physical asset of households is the ownership of land. 48% of people are landless in mining villages than non-mining village. This is because mining company has acquired most of the land for mining activities. Further whatever land is there, mining has rendered them infertile.

The progress of rural economy deepens on the availability of adequate provision of infrastructure. There is no pucca road in the mining villages. Only roads are pucca because they are used for iron ore transportation and also connect to mining offices with colonies. There is no frequent running of buses in the mining areas. While non-mining area have much better transport and communication conditions. The mining company provides free electricity in the area. Because of this 95% of households have accessibility to electricity connection, while it is 49% in non-mining village. With regards to the availability of latrine facilities, mining village is better than non-mining village. The company is providing 24 hours water facilities by constructing overhead water tanker in all the mining villages.

Though mining has increased financial capital, it has severely affected human capital of the people. The educational and health services provided by the company do not reach to the larger community. Mining villages have more percentage of illiterate persons than non-mining village. Similarly, it is found that health status is worse in mining areas as compared to the non-mining area. The mining areas have more percentage of people suffering from different diseases than non-mining village.

It is found from the regression result that the source of drinking water has negative impact on health index. There is high turbidity, less free residual chlorine, high TDS, high concentration of iron, low sulphate and magnesium in underground water that is used for drinking and trace of coliform bacteria in the surface water of mining villages. This might be responsible for different types of waterborne diseases and consequently result in reduction of welfare of people. The cost of illness method shows that the mining villages have higher value of annual total economic burden of illness (₹92608) and annual actual economic burden of illness (₹82633).

Mining operation in the region has resulted in human health problem opined by 67% of respondents. 32.% of respondents are of the opinion that mining operation has created water pollution. In mining villages crops are destroyed due to dust and contaminated water produced by operation of mines. 100% of people in all the mining villages are well aware about water pollution and have perception on sources of water pollution. Most of them said that the major reason for pollution and degradation of environment in the mining villages is the use of heavy machine like dumpers for transportation of iron ore.

According to some respondent people from different parts of Odisha and even from outside Odisha have migrated to the mining areas either to work in the mines or to carry out other business related to mines. This type of in-ward migration is not found in the non-mining area. This migration of the people to the area has created conflicts among inhabitants and outsiders, disturbing the social harmony of the village. Another social problem created by the mines is the conflict between the mining company and households. Most of the people have lost their land due to mining operation. People who lost their land have received compensation from the mining company in terms of either cash or jobs in mines. Most of the households opined that they have not yet received compensation from the company. Some others opined that they have received inadequate amount of compensation. This is because of some legal issues relating to the ownership of land.

It is found that mining villages have more social evils like alcoholism than the non-mining village. The mining activities have also increased gender disparities. Women have a very low participation in the work. Male members of the house are not allowing their female counterparts to work because they earn high amount of income from mining. This reflects that woman are

not in a good position in the mining villages. Thus, it is clear that mining activities have a negative effect on the social capital.

5.3: Policy Implications

The study has proposed policy suggestions for both the mining company and government to address the problems faced by the mining region.

5.3.1: Responsibility of the mining company

- 1) The local people are suffering from different types of diseases. Though the company is providing health services, but they are not sufficient. Therefore, the company must take steps to improve the existing situation.
- 2) Different types of training programmes must be supplied by the company to the local people to build their capacity. It will help local people to move from low paying jobs like mining labours or low-grade employees to higher grade jobs in mines.
- 3) The use of capital-intensive technology has given rise to unemployment problem in the area resulting in social tension. Therefore, the mining company should take steps how these unemployed people can get employment in mines.
- 4) The educational facilities provided by the mining company to the local people are not sufficient. Some wealthy families are sending their children to nearby town private schools. Adult education is also very low. Therefore, the mining company should address these issues seriously.
- 5) The mining company must take steps to make people not to depend on mine keeping in view the limited life span of mine. The mining company should make arrangement for other economic activities. Training on tailoring, computer learning is being provided by the company to make people self-employed. But these activities are not yet linked to the market. The company should take step in this direction.
- 6) The mining company must use eco-friendly technology to address the adverse effect of mining operation on environment.
- 7) The mining company must adopt the afforestation programmes to protect the environment.

5.3.2. Responsibility of the Government

- 1) It is found from the literature that mineral-rich economies are performing poor due to lack of diversification. Therefore, the government must take step to explore other alternative sources of value added by reducing the importance of the mineral sector. Countries like Australia, Canada and the USA are able to avoid 'curse' by adopting diversification policy.
- 2) An important reason behind why some countries is able to avoid 'curse' is the macro-economic policy adopted by their respective governments. In this connection, the government can create a stabilization fund (natural resource fund) and the large revenue windfall generated from the resource sector can be channeled into this fund. The accumulated money in the fund can act as the future asset and can be utilized as and when the needs arise. Countries like Chile and Indonesia are the example of successful funds. Following are benefits of stabilization funds
 - a) Corruption and rent seeking activities can be avoided with the help of such funds
 - b) The future generation can be benefited from the accumulation of assets in the funds
 - c) The fiscal policy of the government can be improved. The revenue accumulated in the resource fund can be used by the government during the time of inflation.

5.4: Limitations of the Study

The main limitation of the study is collecting primary data. There was problem of respondents' bias. The respondents were reluctant to provide the information. They opined that agencies are coming and conducting similar interviews every time. However, they have not yet benefited from these interviews. It was very difficult on the part of individual researcher to win the confidence of the respondents. After explaining the academic intention of the study and with the help of contact persons, some respondents were willing to give information. With regard to the secondary data analysis, the present study has captured only one aspect of institutions (i.e. incidence of crimes in a district). It would be interesting if the future researchers can test the association between abundance of natural resource and economic success at the micro level by taking other aspects of institutions like corruption and industrial disputes.

5.5: Conclusion

Thus, from the above analysis it is clear that the mining-rich districts are not suffering from resource curse after 2015 due to strict actions taken by the state government and Supreme Court. It suggests that mining-rich districts must improve their quality of institutions because it is through institution the natural resource rents get translated into developmental activities. From the sustainable livelihood framework, it is clear that though iron ore mine increases the financial resources but it fails to ensure a sustainable livelihood to the mining village households. It has affected the environment and created various types of diseases which in turn has affected the health of the mining villages people. Therefore, the existence of natural resources is not important. What is more important is how these natural resources are utilized efficiently so as to cause least damage to the environment. It again points towards the role of institutions. Therefore, Environmental Impact Assessment and Social Impact Assessment report must be prepared by an independent body before license is given to a mine. In this connection the government must make it compulsory to submit these reports.

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Appendix 1

Questionnaire for Mining and Non-Mining Villages

Household Details:

1. Individual information

Sl. No.	Name start with head of Household)	Relation with HH	Sex		Age	Marital status	Education	
			male	female			Year of schooling	Educated or not
1								
2								
3								
4								
5								
6								
7								
8								

2. Religion:

Hindu Muslim Christian others (specify)

3. Caste:

ST SC OBC general

4. What is your origin? a) native

b) migrant

5 a) If migrant, since when? -----

b) Where have you been from?

Same district Other district of Odisha outside Odisha
Outside India

6. Household assets:

I Do you own the house now you are living in?

Yes.....

No.....

If yes, what is the area of this house plot? -----

If no, whose home are you living in?

Rented friend /relative company quarter

Others specify -----

II Type of house:

Kuccha Semi-pucca pucca

III i) Does your family have electricity?

ii) Who provides the electricity?

iii) Source of cooking fuel?

7. What is the source of drinking water?

Tube well tape /government supply pond /river

Mining company supply well

8. Do you have toilet and bathroom facility? (Yes/no)-----

i) If yes then

Types	latrine	bathroom
Kutcha/temporary		
pucca		

1. Household composition (Include members who stay permanently)

Sl. No.	Name (Start with head of Household)	Main Occupation	Subsidiary Occupation	Type of Worker	No. of days work/week	Current Annual Income (Rs)	Average Wage Rate	Season (Specify Month)
1								
2								
3								
4								
5								
6								
7								
8								

Codes used:

Relationship with HoH (Column 3): Self-HoHH-1/Spouse-2/Father-3/Mother-4/Father-in-law-5/Mother-in-law-6/Uncle-7/Aunt-8/Brother/Brother-in-law-9/Sister/Sister-in-law-10/Son/Son-in-law-11/Daughter/Daughter-in-law-12/Nephew-13/Niece-14/Own grandchildren-15/Sibling's grandchildren-16/Cousin (brother)-17/Cousin (sister)-18/Live-in domestic help-19/Others (specify)-20

Marital Status (Column 6): Married (1), Unmarried (2), Divorcee (3), Widow/Widower (4), Separated/Deserted (5)

Educational Qualification (Column 7): Illiterate (1); Literate (2); Primary (3); Middle (4); Matriculate (5); Intermediate (6); Graduate and above (7); Professional qualification (Specify)(8); other (Specify)(9)

Occupation (Column 9 & 10): Cultivation-1/Dairy-2/Fishery-3/Goatary & other animal rearing-4//Daily Wages-Agricultural Labourer-5/Skilled Wage Labourer-6/Semi or Unskilled Wage Labourer-7/Service-Private Sector-8/Service-Government-9/Trade/Business-from fixed premises-10/Permanent employee in Mine-11/Temporary Employee in Mine-12/Others (Specify)-13

Type of Worker (Column 11): Main worker-1/Marginal worker-2 (Main worker>180 days engagement/year; Marginal worker<180 days engagement/year)

2. Ownership of Asset

Particulars	Number
House	
Livestock	
Furniture	
Tractor	
Pump sets-diesel/elec	
Plough	
TV	
Fridge	
Motorcycle	
Others	

3. Awareness of Pollution

1. Are you aware of mining pollution? Yes / No
2. When did you first notice the pollution and in what form?
3. Describe the impact of pollution: (in order of intensity)
1. Water
 2. Human Health
 3. Agriculture
 4. Livestock
 5. Livelihoods
 6. Others

4. Impact on Agriculture

1. Explain how pollution from mines has affected crops?
2. Describe the problems faced
3. When did you first notice the problems and in what form?
4. Changes in cropping pattern due to mining pollution

5. Land Holding Particulars

Area Owned	Area (in Acres)

6. Impact on Water

1. Is there water pollution? If yes when it started?
2. What are the sources of water pollution?

3. Facility of Water

Use of Water (Put codes)	Period	Source of Water-Season wise*			Distance of water source**		
		Rainy	Winter	Summer	Rainy	Winter	Summer
Drinking	Before						
	After						
Washing/Bathing	Before						
	After						
Cattle/Livestock use	Before						
	After						

* Own well-1/Community well-2/Own Tube well/Hand pump-3/Community Tube well/Hand pump-4/Stream-5/River-6/Tank-Pond-7/Other (specify)-8

** Within house-1/Less than 100 meters-2/100-250 meters-3/250-500 meters-4/500 metres-1 Km-5/1 Km – 2 Km-6/2 Km – 5 Km-7/More than 5 Km-8

7. Impact on Livestock

1. What types of problems livestock are facing?

- (a) Diseases
- (b) Weakness
- (c) Decline in productivity
- (d) Decline in quality and quantity of manure
- (e) Death
- (f) Any other

2. When did you first notice the problems first and in what form?

3. How did it start?

- (a) Grazing contaminated grass
- (b) Drinking polluted water
- (c) Any others

4. How much you are spending on their health?

5. Was there any cattle diseases in the region during past years? Yes/No

6. Do you think that the livestock health is linked with water quality?

Ownership of Livestock

Livestock	Before (No.)	After (No.)	Assets	Before (No.)	After (No.)
Cow			Goat		
Buffalo			Sheep		
Ox			Poultry birds		
Others (Specify)			Others (Specify)		

7. Which of the following disease family members suffer from in the last 12 months?

Family members	Water borne disease	Acute respiratory infection	TB	Malaria	Cold/fever	Skin disease	Body/joint pain	Any other

8. Number of times family members suffers the following disease in the last 12 months?

Family Members	Water borne disease	Acute respiratory infection	TB	Malaria	Cold/fever	Skin disease	Body/joint pain	Any Other

9. Working days lost due to illness in the last 12 months

Family members	How many working days lost	Distance from the village	Transportation cost	Out of pocket cost

10. Are you accessing any medical facilities to address your health needs?

11. What is your monthly expenditure on medicines and hospitalization? Rs.

12. What is your expenditure on medicines and hospitalization in the last 12 months?

Questionnaire for Mining Company

1. Expenditure incurred by the mining company for employment of the workers

Types of workers	No. of workers employed	Expenditure (Rs) per month
Workers employed in office		
Mining labourers		
Total		

2. Does the company pay any bonus and share of the mine's profits to the workers?

If yes, how much it pays? Rs. _____

3. What is the total monthly iron-ore production? _____

4. Is the mining company is doing anything to address health problems of the working community? ☐ (a) Yes ☐ (b) No ☐

5. Has the mining company built any dispensary/health Centre inside or outside the campus?

(a) Yes ☐ (b) No ☐

ABOUT MITIGATION

1. Was there any collective effort in the village to protest against pollution?

2. If yes did you participate in the movement?

3. Who initiated the people's movement?

4. Is the people's movement effective in your opinion?

5. Is project authority taking any initiatives?

6. If yes what do they do? Explain details

7. Are you satisfied with the way they are working?

8. Have you taken the problems to the notice of the Government?

9. What are the Government's responses to the problems so far?

10. Are you aware of Pollution Control Board's activities in your village?

11. If yes what do they do? Explain in details



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Certificate

This is to certify that Mr. SHAKTI MOHAN TANDI has participated/presented a paper on " _____ " in the two-day International Seminar on "Natural Resource and National Accounts in South Asia" organized by the Centre for Ecological Economics and Natural Resources of the Institute for Social and Economic Change, Bangalore held during February 5-6, 2015.

M. Balasubramanian

M Balasubramanian
Convener

Director In-Charge

Director In-Charge
ISEC

Certificate



55th Annual Conference of The Indian Econometric Society (TIES)

Mumbai School of Economics & Public Policy, University of Mumbai & National Institute of Securities Markets

8th, 9th and 10th January, 2019

This is to certify that *Shakti Mohan Tandi*

has presented a paper titled *Are Resources a Curse or Blessings? Evidence from ARDL Model*

Co-authored with

at the 55th Annual Conference of The Indian Econometric Society (TIES) held during 8-10 January, 2019 at the NISM Campus, Patalganga.

A blue ink signature of Dr. Neeraj Hatekar.

Dr. Neeraj Hatekar

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A blue ink signature of Dr. Latha Chari.

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Are resources a curse or blessings? Evidence from panel ARDL model

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Abstract. *The present study investigates the resource curse hypothesis in mining-rich districts of Odisha by taking variables such as natural resource abundance, economic growth, investment, human resource development, financial development and institutional quality over the period 1995-2015. The panel ARDL model is applied in order to estimate the long-run relationship among variables based on three alternative estimators such as MG, PMG and DFE. The study finds that there is a negative relationship between natural resource abundance and economic growth in the long-run. The results confirm the existence of natural resource curse in Odisha possibly because of weak institutions and lack of appropriate policies.*

Keywords: natural resource abundance, economic growth, panel ARDL, Odisha.

JEL Classification: Q2, O47, C23

1. Introduction

Whether natural resources are curse or blessing for economic development has become a subject of debate over the last two decades (van der Ploeg, 2011). Prior to the late 1980s, most of the economists and geographer advocated a positive relationship between natural resource abundance and economic development. For example, geographer Ginsburg argued that “the procession of a sizeable and diversified natural resource endowment is a major advantage to any country embarking upon a period of rapid economic growth” (Rosser, 2006). According to development theorists Rostow (1961) “the natural resource endowments would enable developing countries to make the transition from underdevelopment to industrial take-off”. Similar positive arguments are put forward by neoliberal economists such as Balassa (1980), Krueger (1980) and Drake (1972). However, after the late 1980s, a large number of literatures has challenged this conventional wisdom and demonstrated that natural resource abundance has become a curse rather than a blessing for economic development (Davis and Tilton, 2005).

The concept of resource curse was first introduced by Richard Auty in 1993. Resource curse or the “Paradox of plenty” is a phenomena where the countries well endowed with rich natural resources experience stagnant growth or even negative economic growth. Many African countries such as Angola, Nigeria, Sudan, and the Congo are rich in oil, diamonds and other minerals, yet they have become development failures in terms of per capita income and quality of life. On the other hand, the East Asian economies Japan, Korea, Taiwan, Singapore and Hong Kong have performed well despite their rocky islands and no exportable natural resources (Frankel, 2010). Between 1960 and 1990, the resource poor countries were able to raise their per capita incomes two to three times faster than the per capita income of resource abundant countries (Auty, 2001). The whole OPEC countries have experienced on average 1.3 percent declines in their gross national product per capita from 1965 to 1998. In contrast to it rest of the developing countries have been able to attain on average 2.2 percent per capita growth (Gylfason, 2001).

The distribution of natural resources varies across different Indian states. For example, the states like Odisha, Jharkhand and Chhattisgarh are endowed with rich natural resources that together account for 70 percent of India’s coal reserves, 80 percent of high-grade iron ore, 60 percent of bauxite and almost all the chromites reserve (Centre for Science and Environment, 2008). These three states also contribute significantly to the total royalties on minerals in the country. Further, these states are endowed with rich forest resources and ground water. However, it is observed that the resource-rich states have performed less well both in terms of per capita income and rate of growth of state domestic product compared to the resource-poor states like Kerala, Tamil Nadu, Maharashtra, and Punjab (Behera and Mishra, 2012). The extent of poverty is low in many of the resource-poor states whereas the problem is quite alarming in Odisha and Chhattisgarh. Further, it is reported that the benefits from resource extraction are not reaching to all sections of society within a resource-rich state. Half of rural tribal people in Bihar, Chhattisgarh, Madhya Pradesh, Jharkhand and Odisha live below the poverty line and the ratio is higher than the national average.

Odisha is a mineral-rich state which is richly endowed with large varieties of metallic and non-metallic minerals such as chromite, bauxite, graphite, iron ore, manganese ore, coal etc. it is reported that about 93 per cent of Chromite and Nickel, 52 per cent of bauxite, 44 per cent of Manganese, 33 per cent of Iron Ore, 24 per cent of Coal deposits of India are found in Odisha. The contribution of mining and quarrying sector in the Gross State Domestic Product of Odisha is about 6.3 per cent in 2014-2015. In recent years, Odisha ranks highest in India in terms of value of output of minerals. The share of Odisha in total value of mineral output in India is 11.16 per cent (Odisha Economic Survey, 2014-2015).

In spite of all its rich mineral resources Odisha is considered to be one of the most underdeveloped states in India. Though the real per capita Net State Domestic Product for Odisha has increased from 2004-05 to 2014-15, still Odisha lags far behind compared to other faster growing states and national average (Odisha Economic Survey, 2014-2015). Further, in terms of Human Development Index Odisha performs very poorly in comparison to other states (Human Development Report, 2004, Government of Odisha). For example, Odisha has a human development index (HDI) index of 0.404 while Kerala, a resource-poor state has a HDI of 0.638. Most of the mining-rich districts of Odisha such as Jaipur, Keonjhar, Sundergarh, Angul, Koraput, Jharsuguda and Mayurbhanj perform very poorly. Most of them are tribal dominated except Jaipur and Angul. More than 50 per cent of the populations are tribals in Sundergarh, Koraput and Mayurbhanj. Keonjhar alone accounts for more than 44 per cent of the tribal population. Human Development Report of the State shows that between 1993-94 and 1999-2000, the poverty ratio has increased in the southern and northern regions of the state that includes mining districts like Koraput, Sundergarh, Keonjhar, Angul and Mayurbhanj. It is reported that 75 per cent of the state's poor live in these southern and northern regions. 62 per cent of the population lives below the poverty line in Keonjhar, the most mined district of Odisha. In Koraput which is known as the bauxite capital of India, the figure is higher at 79 per cent (Centre for Science and Environment, 2008).

The performances of the mining districts in terms of HDI are disappointing. Jaipur, Keonjhar and Koraput have HDI rank of 22, 24 and 27 respectively. However, some of the mining districts have performed well. Jharsuguda ranks 2, Sundergarh ranks 4th and Angul ranks 6th respectively. The reason for these differences in HDI ranking among mining districts is that Angul and Jharsuguda are coal-rich districts and coal mines in the state are under the public sector while in other mining districts mining is in the hands of the private sector. The per capita incomes of these coal-rich districts are higher than other mining districts. All the mineral-rich districts have occupied a place in the list of the 150 most backward districts of the country (Centre for Science and Environment, 2008).

Structuralists, dependency theorists, and some Marxist theories of imperialism have advocated their views on resource-led growth. In the 1940s and 50s, the Structuralists such as Prebisch and Singer (1950) argued that the resource-based growth alone would be ineffective because the world prices of primary exports relative to manufacturers show a deep tendency towards secular decline. Further, Hirschman (1958), Seers (1964), and Baldwin (1966) opined that primary exports have small forward and backward linkages to the rest of the economy. According to dependency theorists, if foreign multinationals are

allowed to dominate resource extraction then natural resources will fail to stimulate economic growth. Marxists, such as Paul Baran opined that local elites dominated the governments in poor economics and they joined their hands with foreign multinationals instead of promoting national development (John, 2011).

At the macro/country level Sachs and Warner, 1995 study is considered as the pioneering work that find a negative correlation between resource abundance and GDP growth. Using the similar methodology, Leite and Weidmann (1999); Gylfason et al. (1999); Sala-i-Martin (1997) finds similar results. However, the results are not conclusive. The recent empirical works by Alexeev and Conrad (2011); Alexeev and Conrad (2009); Brunnschweiler and Bulte (2008), Brunnschweiler (2008); van der Ploeg and Poelhekke (2009) find a positive relationship between growth and resource abundance. The basic difference between these two categories of literature lies in the proxy of natural resource abundance taken by them. Those studies who find resource curse evidence have taken ratio of resource exports to GDP as the proxy while latter studies that do not find resource curse evidence have taken stock-based proxy of resource abundance such as reserve in the ground.

The cross-country studies have several limitations. First problem is related with the export-based proxy of natural resource abundance taken by the previous studies. It is argued that the export-based proxy suffers from the endogeneity problems. When natural resource exports are expressed as shares of GDP, the denominator measures the magnitude of other economic activities in the economy. Therefore the numerator variable is dependent on the economic policies and the institutions that produce them (Brunnschweiler and Bulte, 2008). Second, the empirical work will suffer from omitted variable biases. Different countries are endowed with different history, culture, geography, institutional quality and macroeconomic policies. It is very difficult to measure all these differences. Third reverse causality is another problem suffers by cross-country studies. Any measure with GDP in the denominator is subject to reverse causality. Suppose a country has low GDP due to some reasons that are not related to natural resources. But it would seem that low GDP and other problems related to low GDP are the result of large natural resource wealth while in reality it is the low GDP that causes natural resource wealth to appear to be high (Alexeev and Conrad, 2011). Fourth the impacts of resource abundance at the national level are different to that of local level. For example, the impact of extractive industries demand for inputs can be felt in particular local markets.

In the recent time few studies have focused on the within-country studies. Among the within-country study Papyrakis and Gerlagh (2007) study is considered as the first study. They find that resource abundance put negative effect on growth by lowering levels of investment, schooling, Openness and research and development and increasing corruption in US. Employing similar method James and Aadland (2011) find similar negative effects of resource abundance on growth in US countries. Douglas and Walker (2013) again find similar results in US countries by using similar methodology and more disaggregated data. Shuai and Zhongying (2009) examined the relationship between energy exploitation and economic growth in China over 1991-2006. They find that energy exploitation

impeded growth through indirect transmissions channels by lowering human capital input and R & D, and weakening institution. Zuo and Jack (2014) also find the same results in Chinese and tested two transmission channels such as crowding-out and institutional channels. They find resource curse evidence which is transmitted through crowding-out channel rather than institution channel. Education and R & D are two main crowding-out channels. However, the former Chinese 10 western provinces while the latter study focuses on all Chinese provinces.

Black et al., 2005 in US, Marchand, 2012 in Western Canada, Fleming and Measham, 2014 in Australia, Michaels, 2011 in Southern US find that resources boom generate positive employment spillovers and don't crowd other industries (manufacturing). Recently Jacobsen and Parker, extend Black et al.' study to Western US and Allcott and Keniston, 2013 extend Michaels (2011) study to rural countries in the entire US and find the same results.

The above within country studies suffer from two important limitations. First they provide limited information about the effects on real income or other measures of welfare. Second these studies have focused on developed countries such as the US, Canada, Brazil and Peru. Recent works by Caselli and Michaels, 2013 in Brazil, Aragon and Rud, 2013 in Peru, Brollo et al., 2013, Kotsadam and Toloren, 2014, Loayza et al., 2013 have started to fill up this gap in the literature. Within this literature, the present study is closely related to Zuo and Jack (2014) and Shuai and Qi (2009). Thus like the cross-country studies the local resource curse literature also provide the conflicting results on resource curse.

Most of the resource curse studies have focused on cross-country analysis and comparisons because of better availability of data. However, only a few studies have examined the resource curse hypothesis across states or regions within a country. Whatever within country evidence are available that have concentrated on a few countries, such as the US, Canada, Brazil and Peru. Research in other resource-rich contexts such as Asia is needed to increase the external validity of these results and to better inform policy-makers and practitioners. In India it is still a research question. Although Damania and Gupta (undated) and Behera and Mishra (2012) have tried to examine the resource curse phenomena in Indian states, the methodology, measurement of the variables and coverage of the resource base they have taken require serious scrutiny. Therefore, the present study attempts to fill up these gaps.

4. Modeling framework, methodology and data source

4.1. Testing Pesaran cross section dependence test

In order to test the validity of Resource Curse Hypothesis in the Odisha context, the present study has followed Pesaran (2004). The first empirical work of the present study is to check the cross-sectional dependence among Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD), Financial Development (FD) and Institutional Quality Index (IQ).

Pesaran (2004) proposed CD test which is based on the average of the pair correlation coefficients $(\rho)_{ij}$ of OLS residuals regressions. Pesaran (2004) considered the following model.

$$y_{it} = \mu_i + \beta_i x_{i,t} + u_{i,t} \quad (1)$$

where:

μ_i – intercept of the individual district i ;

β_i – slope coefficient of individual district i ;

$t = 1, 2, 3, \dots, T$ is the total time period;

$i = 1, 2, 3, \dots, 16$ Corresponding 16 districts;

$x_{i,t}$ is vector of observing time varying regressions;

y_{it} follows iid $(0, \sigma_i^2)$ for all i, t .

Pesaran (2004) proposed following CD statistic

$$CD_p = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{P}_{i,j} \quad (2)$$

Where: e_{it} the OLS are estimates of $u_{i,t}$, $\hat{P}_{i,j}$ is the sample estimate of the pair-wise correlation of residuals.

$$\hat{P}_{i,j} = \hat{\rho}_{i,j} = \frac{\sum_{t=1}^T e_{i,t} e_{j,t}}{(\sum_{t=1}^T e_{i,t}^2)^{1/2} (\sum_{t=1}^T e_{j,t}^2)^{1/2}} = \frac{\sum_{t=1}^T e_{i,t} e_{j,t}}{(\sum_{t=1}^T e_{i,t}^2)^{1/2} \sum_{t=1}^T (e_{j,t}^2)^{1/2}}$$

4.2. Pesaran's cross-sectional augmented Dickey-Fuller (CADF) test

After confirming cross-sectional dependence, in order to understand the stationary properties of the variables we have applied Pesaran CADF test (Pesaran, 2007). The presence of cross sectional dependence among the variables can be solved by augmenting the standard Dickey-fuller regression with cross sectional average of lagged levels and first differences of the individual series (Pesaran, 2007). The main Pesaran CADF equation follows as

$$\Delta y_{i,t} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i \bar{y}_{t-1} + Q_i \Delta \bar{y}_t \varepsilon_{i,t} \quad (3)$$

where the unit root test hypothesis will be tested based on the OLS results derived from Eq. (3) with t ratio by $t_i(N, T)$. The Pesaran CADF test is

$$CADF = t_i(N, T) = \frac{\Delta y_i' \bar{M}_w y_{i-1}}{\hat{\delta}(y_{i-1}' \bar{M}_w y_{i-1})^{1/2}} \quad (4)$$

Where:

$$\Delta y_i = (\Delta y_{i,1}, \Delta y_{i,2}, \dots, \Delta y_{i,2}, \dots, \Delta y_{i,T})', y_{i-1} = (y_{i,0}, y_{i,1}, \dots, y_{i,T-1})', \tau_T = (1, 1, \dots, 1)'$$

$$M_w = I_T - \bar{W}(\bar{W}'\bar{W})^{-1}\bar{W}', \bar{W} = \tau(\Delta \bar{y}), \bar{y}_{-1}$$

$$\Delta \bar{y} = (\Delta \bar{y}_1, \Delta \bar{y}_2, \dots, \Delta \bar{y}_T)', \bar{y}_{-1} = (\bar{y}_0, \bar{y}_1, \dots, \bar{y}_{T-1})'$$

$$\hat{G}_i^2 = \frac{\Delta y_i' M_{i,w} \Delta y_i}{T-4} M_{i,w} = I_t - (G_i(G_i' G_i))^{-1} G_i' \text{ and } G_i = (\bar{W}, y_{i-1})$$

4.3. Panel Autoregressive Distributed Lag Model (P-ARDL)

The present study has applied panel autoregressive distributed lag model in order to estimate the long-run relationship among variables based on three alternative estimators such mean group estimator (MG), pooled mean group estimator (PMG) and dynamic fixed effects (DFE). According to Pesaran et al. (1999), an ARDL dynamic heterogeneous panel regression can be written by using ARDL (p, q) approach where “p” is the lags of dependent variable and “q” is the lags of independent variables. The equation can be written as

$$PNDDP_{it} = \sum_{j=1}^p \lambda_{ij} PNDDP_{i,t-j} + \sum_{j=0}^q \delta'_{ij} TMP_{i,t-j} + \sum_{j=0}^q \alpha'_{ij} PNT_{i,t-j} + \sum_{j=0}^q \beta'_{ij} HRD_{i,t-j} + \sum_{j=0}^q \psi'_{ij} FD_{i,t-j} + \sum_{j=0}^q \phi'_{ij} IQ_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

Where: $i = 1, 2, 3, \dots, N$ number of cross sectional (Here $i = N = 16$);

$t = 1, 2, 3, \dots, T$ total time period ($T = 17$);

$TMP_{i,t}, PNT_{i,t}, HRD_{i,t}, FD_{i,t}, IQ_{i,t}$ are $k \times 1$ vector of the explanatory variables; $\delta'_{ij}, \alpha'_{ij}, \beta'_{ij}, \psi'_{ij}, \phi'_{ij}$ are the $k \times 1$ coefficient variables; λ_{ij} are the scalars; and μ_i is the cross-section effects. If the variables in Eq. (5) are $I(1)$ and cointegrated, then the error term should follow $I(0)$ order in all cross-sections to have long-run equilibrium relationship between the variables. The principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. This explain that an error correction model in which the short-run dynamics of the variables in the system can be influenced by the deviation from equilibrium. Here it is necessary to reparametrize Eq. (5) into an error correction equation.

$$\Delta PNDDP_{it} = \phi_i (PNDDP_{i,t-1} - \theta_i PMT_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta PNDDP_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta TMP_{i,t-j} + \sum_{j=0}^{q-1} \psi_{ij}^* \Delta PNT_{i,t-j} + \sum_{j=0}^{q-1} \alpha_{ij}^* \Delta HRD_{i,t-j} + \sum_{j=0}^{q-1} \beta_{ij}^* \Delta FD_{i,t-j} + \sum_{j=0}^{q-1} \Omega_{ij}^* \Delta IQ_{i,t-j} \quad (6)$$

Where:

$$\begin{aligned} \phi &= - \left(1 - \sum_{j=1}^p \lambda_{ij} \right), \theta_i = \frac{\sum_{j=0}^q \delta_{ij}}{(1 - \sum_{j=1}^p \lambda_{ij})} \\ \lambda_{ij}^* &= - \sum_{m=j+1}^p \lambda_{im}, \\ j &= 1, 2, \dots, p-j \\ \delta_{ij}^* &= - \sum_{m=j+1}^q \delta_{im} \quad j = 1, 2, 3, \dots, q-1 \\ \psi_{ij}^* &= - \sum_{m=j+1}^q \psi_{im} \quad j = 1, 2, 3, \dots, q-1 \\ \alpha_{ij}^* &= - \sum_{m=j+1}^q \alpha_{im} \quad j = 1, 2, 3, \dots, q-1 \\ \beta_{ij}^* &= - \sum_{m=j+1}^q \beta_{im} \quad j = 1, 2, 3, \dots, q-1 \\ \Omega_{ij}^* &= - \sum_{m=j+1}^q \Omega_{im} \quad j = 1, 2, 3, \dots, q-1. \end{aligned}$$

The ϕ_i is speed of adjustment parameter. The speed of adjustment parameter must be non-zero. If $\theta_i = 0$, then there would be no long-run relationship. This parameter is expected to be negative sign with statistical significance under the assumption of bringing back the variables to the long-run equilibrium. But more recently Pesaran, Shin and Smith (1997, 1999) propose a PMG estimator which combines both averaging and pooling the residuals. This test incorporates the intercept, short-run coefficients, and different error variances across the groups (like the MG estimator). However, it holds the long-run coefficients to be equal across the groups (like FE estimators).

$$\hat{\phi} = N^{-1} \sum_{i=1}^N \hat{\phi}_i \quad (7)$$

With the variance

$$\hat{\Delta}_{\hat{\phi}} = \frac{1}{N(N-1)} \sum_{i=1}^N (\hat{\phi}_i - \hat{\phi})^2 \quad (8)$$

The Eq. (6) can be estimated by three different estimators such as mean group estimator of Pesaran and Smith (1995), pooled mean group estimator developed by Pesaran et al. (1999) and dynamic fixed effects estimator. According to Pesaran and Shin (1999), Panel ARDL can be applied even if the variables follow different order of integration, i.e. $I(0)$ and $I(1)$ or a mixture of both.

The present study has collected annual data covering the period 1995-2015 for 16 districts of Odisha. Data on Net District Domestic Product (NDDP) has been collected from the income cell department of the Directorate of Economics and Statistics Odisha. Data on total mineral production (TMP) has been collected from the Directorate of Mine Odisha. Data on human capital investment (HRD), financial development (FD), investment (INV), and institutional quality (IQ) have been collected from the various publication of District Statistical handbook of the Directorate of Economics and Statistics Odisha, Bhubaneswar. An institutional quality index is constructed as the proxy of institutional quality by taking incidence of crimes such as murder, dacoity, robbery, burglary, theft, rioting, swindling and cheating, rap, kidnapping and miscellaneous through Principal Component Analysis. Data on all variables are available up to 2015. All the variables are transferred into natural logarithm.

5. Results and discussions

The traditional unit root tests do not address the cross sectional dependence which might lead to an incorrect interpretation towards the stationary properties large panel data. To address this problem, the present study has applied CD (Pesaran, 2004) test to check cross section interdependence between Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD) Financial Development (FD) and Institutional Quality Index (IQ). The CD test is based on the average of the pair correlation coefficients of OLS residuals regression. CD test result is reported in Table 1 which rejects the null hypothesis of no cross-dependence between the variables. It means there is high dependence between Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD), Financial Development (FD) and Institutional Quality Index (IQ) in the districts of Odisha.

Table 1. Pesaran Cross-section Dependency tests

Test	Statistics	P-value
CD	32.457	0.0000

After confirming cross sectional dependence among the variables, the present study has employed Pesaran Cross Sectional Augmented Dickey-Fuller (PCADF) unit root tests to check stationary properties of variables. In order to test the panel cointegration among variables, the first step is to examine the unit roots properties of the data, because the variables must be integrated of the same order. The PCADF test results are reported in Table 2. The results show that NDDP, TMP, INT, HRD, FD, and IQ follow I (0) and I (1) orders respectively.

Table 2. Pesaran's Cross-sectional Augmented Dickey-Fuller (CADF) test results

variables	Constant		Constant & Trend	
	T Bar	P-value	T Bar	P-value
lnNDDP	-1.489	0.859	-2.416	0.324
lnTMP	-2.714	0.000***	-3.078	0.000***
lnINT	-2.330	0.008**	-2.639	0.079
lnHRD	-2.121	0.063	-2.147	0.759
lnFD	-3.825	0.000***	-4.437	0.000***
lnIQ	-1.766	0.474	-2.035	0.882
Δ lnNDDP	-3.088	0.000***	-3.062	0.001**
Δ lnTMP	-4.057	0.000***	-4.332	0.000***
Δ lnINT	-3.103	0.000***	-3.135	0.000***
Δ lnHRD	-3.034	0.000***	-3.087	0.001**
Δ lnFD	-4.525	0.000***	-4.266	0.000***
Δ lnIQ	-2.860	0.000***	-3.115	0.000***

Note: The critical values are -2.340, -2.170, and 2.070 at 1%, 5%, and 10% respectively with constant. 2.880, -2.690, and -2.590 at 1%, 5%, and 10% respectively with constant and trend. The ***, **, and * indicate 1%, 5%, and 10% level of significance.

The results of the pooled mean group (PMG), mean group (MG) and dynamic fixed effects (DFE) are reported in Table 3.

Table 3. Panel ARDL Model Results (Pooled Mean Group and Mean Group Estimates)
(Dependent Variable: Δ lnNDDP)

Variables	Pool Mean Group		Mean Group		Dynamic Fixed Effects	
	Coefficients	Std. error	Coefficients	Std. error	Coefficients	Std. error
Long-run						
lnTMP	-0.217**	0.084	0.009	0.069	-0.016	0.025
lnINT	0.200	0.121	0.466**	0.248	0.213**	0.070
lnHRD	-0.435	0.597	-0.663	0.538	0.371	0.291
lnFD	-0.022	0.0683	0.005	0.234	0.017	0.021
lnIQ	0.106	0.141	0.807	0.424	0.173	0.066
Error Correction	0.011	0.058	0.323***	0.089	0.396	0.214
Short-run Coefficients						
Δ lnTMP	-0.010	0.008	-0.065	0.056	-0.010	0.007
Δ lnINT	0.115	0.091	0.113	0.089	0.049	0.035
Δ lnHRD	0.048	0.312	0.000	0.108	0.041	0.105
Δ lnFD	0.001	0.010	0.089	0.100	-0.003	0.009
Δ lnIQ	-0.023	0.022	0.184	0.203	0.015	0.026
Intercept						
No. of Districts	16					
Observations	320					

Note: Δ is first difference operator; ***, **, and * indicate 1%, 5%, and 10% level of significance; PMG means pooled mean group; MG means mean group; EC is error correction term.

According to PMG estimator, TMP has a negative and significant impact on NDDP in the long-run. However, in the short-run, although TMP has a negative coefficient but it is not statistically significant. According to MG estimator, TMP has a positive coefficient, but it is not significant. INT has positive impact on NDDP in the long-run. In the short-run, although TMP has negative coefficient but it is not statistically significant. DFE estimators do not support any short-run and long-run causality between variables. INT has positive and significant impact on NDDP.

However, in order to measure efficiency and consistency among the estimators (PMG, MG and DFE) the Hausman test has been applied. The results of the Hausman test are reported in Table 4.

Table 4. Hausman Test
(Dependent Variable: $\ln NDDP$)

	MG	PMG	Difference	S.E	MG	DFE	Difference	S.E
	Coefficients	Coefficients			Coefficients	Coefficients		
$\ln TMP$	0.009	-0.217	0.227	0.083	0.009	-0.016	0.025	0.832
$\ln INT$	0.466	0.200	0.266	0.409	0.466	0.213	0.252	2.999
$\ln HRD$	-0.663	-0.435	-0.227	0.704	-0.663	0.371	-1.034	6.487
$\ln FD$	0.005	-0.022	0.027	0.397	0.005	0.017	-0.012	2.832
$\ln IQ$	0.807	0.106	0.701	0.715	0.807	0.173	0.633	5.123
Chi-2	47.38	P-Value	0.0000		Chi-2	0.11	P-value	0.9998

The Hausman test results accept the null hypothesis of homogeneity restrictions on the long-run regressors. This indicates that PMG is a more efficient estimator than MG or DFE. From the overall panel ARDL model, we found that there is a negative relationship between natural resource abundance and economic growth in the long-run. However, in the short-run, although TMP has a negative coefficient but it is not statistically significant. The results confirm the existence of natural resource curse in the mineral-rich districts of Odisha.

6. Conclusion and policy implications

This study investigates the presence of resource curse hypothesis in mineral-rich districts of Odisha, India. Pesaran (2004) CD test has been employed by the present study to check the cross-sectional dependence among variables and the results of this test shows that there is high dependence among variables. After confirming cross sectional dependence among the variables, the next step is to check stationary properties of variables and for this the present study has employed Pesaran Cross Sectional Augmented Dickey-Fuller (PCADF) unit root test. The results show that NDDP, TMP, INT, HRD, FD, and IQ follow I (0) and I (1) orders respectively.

After that the ARDL model has been applied in order to estimate the long-run relationship among variables based on three alternative estimators such mean group estimator (MG), pooled mean group estimator (PMG) and dynamic fixed effects (DFE). The study finds that there is a negative relationship between natural resource abundance and economic growth in the long-run. The results confirm the existence of natural resource curse in the mineral-rich districts of Odisha. Government should launch

environmental friendly policies to explore natural resources & attain maximum benefit. Financial development and trade openness should be used as policy tools to exploit natural resources which in turn, will enhance domestic production and hence economic growth.

The study suggests that further in depth research is needed to understand the relationship between natural resource abundance and economic growth at the micro level. Further, a deeper understanding of determinants of the relationship or the so-called transmission channels with adequate focus on policies and institutions is required. In this regard as suggested by Behera and Mishra (2012) the development of a more comprehensive index of natural resource abundance that can adequately capture the various proxies such as, share of mining production in GDP, land per capita, share of natural resources export in GDP, share of labour force in the primary sector and mining employment might be a problem. To avoid this problem the future research can take into consideration of all the proxies which are used to measure natural resource abundance in a principal component analysis to make a single comprehensive index of natural resource abundance.

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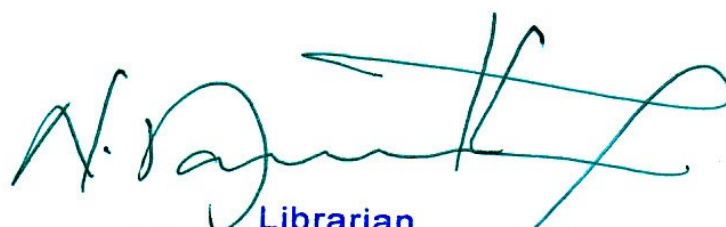
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