

RESEARCH BULLETIN



THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

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The Institute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally.

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CMA P. Raju Iyer

President

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FOREWORD

I am in high spirits to bring forth the present volume of the Research Bulletin of the Institute. The publication contains well-researched and thought provoking articles on a variety of relevant issues for researchers, academicians and professionals.

From an outright ban on cryptocurrencies in 2016 to an upcoming Bill for regulation—the government’s stance on digital assets has changed considerably over the past few years. The union government is likely to introduce The Cryptocurrency and Regulation of Official Digital Currency Bill 2021 in the Parliament during the ongoing winter session, beginning from today. Many crypto players are eagerly waiting to see the positive decision from the government that could allow investing and trading in cryptocurrencies with some restrictions.

As of now, the noise around the Crypto Bill has been both positive and negative. The bill looks to create a facilitative framework for the creation of the official digital currency to be issued by the Reserve Bank of India. It also seeks to prohibit all private cryptocurrencies in India. As per the inputs, the bill allows for certain exceptions to promote the underlying technology of cryptocurrency and its uses. Further, in November 2021, the Standing Committee on Finance, met representatives of crypto exchanges, Blockchain and Crypto Assets Council (BACC), and came to the conclusion that cryptocurrencies should not be banned, but regulated.

In this edition, a wide array of topics based on blazing issues— like Bitcoin, Cryptocurrency, Stock Market, Bilateral Trade, Working Capital Management, etc. have been inserted. Hope this would encourage readers to board on a lifelong journey of learning and enriching their knowledge base.

CMA P. Raju Iyer

President

The Institute of Cost Accountants of India

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CHAIRMAN'S COMMUNIQUÉ

I feel privileged to place before you the present volume of Research Bulletin, Vol.47, Nos. I & II. Our Research Bulletin mainly highlights on pragmatic research articles and has a much wider reader base consisting of academicians, researchers, industry professionals and practitioners.

With consistently high rates of economic growth and enormous potential, the Indian economy has truly taken global centre-stage. Despite the economic devastation caused by the coronavirus, India's agile response has been commendable. In addition to protecting its own population, India has also acted in the world's best interest by providing medical supplies and equipment across the globe and placing a critical supply of the COVID-19 vaccine on the world market. Indeed, the pandemic is an inflection point for India to introspect on its potential as a global leader, especially coming at a time when the country is celebrating 75 years of independence.

In the past few years, major structural reforms have been launched by the Indian government to boost the long-term outlook of the economy. The government's vision to catalyze India's transformation is evident in the launch of several initiatives including the Gati Shakti National Master Plan and the Atmanirbhar Bharat mission. This wide-ranging development agenda supports initiatives across multiple sectors including reforms to consolidate multiple and disparate labour laws, drafting of the Insolvency and Bankruptcy Code, and banking reforms. India must maintain the momentum of these laudable initiatives and continue to enhance the robustness and vitality of its economy.

The readers are invited to tender their valuable feedback towards enrichment of Research Bulletin. Suggestions for improvement of this Bulletin shall be highly cherished.

CMA (Dr.) K Ch. A V S N Murthy

Chairman

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The Institute of Cost Accountants of India

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EDITOR'S NOTE

Greetings!!!

Armed with necessary macro and micro growth drivers, the stage is all set for India's investment cycle to kickstart and catalyse its recovery towards becoming the fastest growing economy in the world. Aatmanirbhar Bharat Mission encapsulating key structural reforms continues to play a critical role in shaping India's economic recovery, both through the signaling of business opportunities and expansion of spending channels.

In response to the COVID-19 shock, the Government and the Reserve Bank of India took several monetary and fiscal policy measures to support vulnerable firms and households, expand service delivery (with increased spending on health and social protection) and cushion the impact of the crisis on the economy. India has undertaken significant structural reforms to turn the crisis into an opportunity and emerge stronger.

Among the most notable reforms, PLI schemes to boost manufacturing, and National Infrastructure Pipeline complemented by the National Monetization Pipeline and PM Gati Shakti would help enhance India's global competitiveness and set a strong foundation for sustaining India's post Covid economic growth. India's recovery has been robust and resilient with government's efforts focused on having economic growth that is sustainable. Thanks in part to these proactive measures, the economy is expected to rebound - with a strong base effect materializing in 2022 - and growth is expected to stabilize thereafter.

It is our pleasure to launch the current volume of the *Research Bulletin, Vol.47 Nos. I & II, April & July, 2021* issue, an offering of the Directorate of Journal & Publications of the Institute.

The Research articles incorporated here constitutes varied issues of socio-economic aspects. Thus our endeavour is to draw attention to the vitality in environmental, social,

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economical and market-related issues, so that the society can explore the surroundings, become accustomed to the change in an effective manner and can take decisions deliberately. Further look forward to present the next issue of Research Bulletin Vol.47 No.III, October 2021 which will be a Non-theme too.

We look forward to constructive feedback from our readers on the articles and overall development of the Research Bulletin. Please send your mails at *research.bulletin@icmai.in*. We thank all the contributors and reviewers of this important issue and hope our readers enjoy the articles.

Warm regards,

CMA (Dr.) Debaprosanna Nandy

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Analysis of Energy Substitution vis-à-vis Security Policy Trade-off with the Emissions Embodied in Bilateral Trade: An Index Decomposition Approach

Avik Ghosh
Suvajit Banerjee

Abstract:

The trade-off between climate protection and energy security is more striking for the developing countries those are having fewer resources to combat the risk of sudden supply disruptions of energy, however, its reflection in the literature is not found sufficient. This paper aims at exploring this trade-off by uniquely representing the India-UK bilateral trade and applies a spatial index-decomposition exercise of the emissions embodied in the net export. The calculated emission imbalance implied in India-UK bilateral trade is decomposed into the contributions from five important drivers. The study compares the policy trade-offs under three hypothetical scenarios where India is adopting prudent policy measures imitating the UK. Based on these scenario experiments, the study suggests a decision trick where India is adopting a lower energy intensity of input use by altering its energy consumption level keeping the employment of inputs unchanged.

Key Words: Climate Protection; Energy Security; Trade-off; India-UK Bilateral Trade; Spatial Decomposition; Hypothetical Policy Scenario

1. Introduction

The uneven allocation of carbon mitigation obligations induced from the Kyoto Protocol (came into force in February 2005) left the developing countries to bear an everlasting allegation by the obligated developed countries for their random and rampant emissions without implementing prudent curative policies (Banerjee, 2019; 2021a; 2021b). However, the developing countries have their own obligations with regard to macroeconomic priorities, like economic growth, employment generation, industrialization, infrastructure building, etc. Despite that, countries like India and China initiated a huge amount of climate conservation measures in the last couple of decades (Qi and Wu, 2013; Saryal, 2018; Banerjee et al., 2021). In addition to the macroeconomic priorities, the adoption of a lop-sided policy to control the emissions of GHGs has another big concern with regard to energy security (Brown and Huntington, 2008). Rearranging the composition of energy supply towards lesser emission intensity could have a bearing on ‘energy security’.

Kuik (2003) examined two alternative climate change policy scenarios for the European Union (EU) by applying CGE modeling based on the GTAP-E dataset. In the first scenario, the EU is controlling both carbon emissions and energy dependence by actively promoting indigenous production and the uses of renewable energies. In the second scenario, the EU is promoting Soviet

cooperation to ensure a low emission-intensive energy supply, particularly of natural gas. The results from these analyses confirm policy trade-offs in achieving economic efficiency, energy security, and carbon dependency for the EU. At the individual country-level analysis, the study of Chalvatzis and Hooper (2009) evaluated this policy trade-off for Germany, Greece, Poland, and the UK on the electricity sector independence at a national level. They used a multi-parametric analysis of the fuel-mix data and found that Germany and Greece increased their natural gas import to substitute domestic solid fossil fuels, while both the countries increased their share of renewable energy resources in the fuel-mix for the national electricity generation. Poland was found as the only country in this set that improved its energy security and complemented its climate change mitigation objective. Germany found keeping its energy dependence unchanged, whereas, the UK and Greece showed a sharp increase in energy dependence. Bang (2010) showed in the case of the USA how political institutions and their structured interactions help to shape a balanced energy policy deviating from the status quo that could address agendas of climate mitigation and energy security simultaneously.

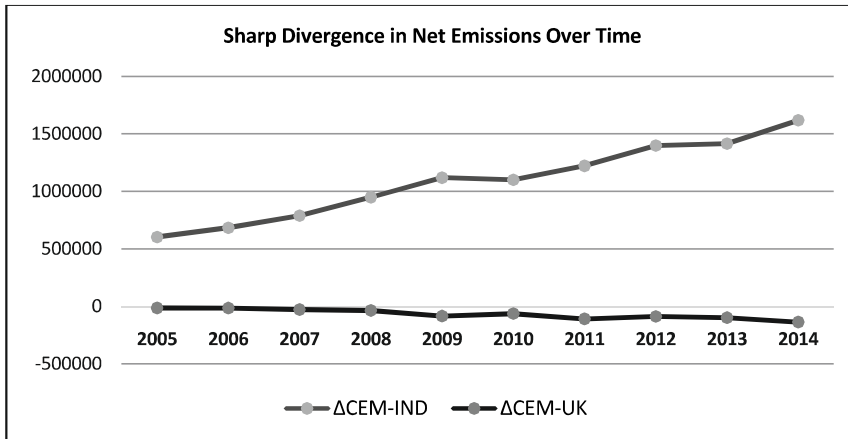
Interestingly, the trade-off between climate protection and energy security is particularly more striking for the developing and emerging economies those are having fewer resources to combat the risk of sudden

supply disruptions of energy resources, however, its reflection in the literature is rare (Cao, 2003). Bambawale and Sovacool (2011) tested a set of seven hypotheses related to China's energy security concerns and provided new insights on the use of renewable energy resources and local environmental issues. Wu et al. (2012) found complementarity in the energy policy for China on the issues of emission reductions and energy savings during the period of 1996-2009. Rasul and Sharma (2015) focused on these trade-offs and synergies under a water-energy-food security context in the Hindu Kush Himalayan region. They introduced a nexus approach, proposed linkages with the climate change adaptation plans, and recommended enhanced energy use efficiency and greater policy coherence.

Based on this background, the present study proposes a unique way of looking at the nexus between emission mitigation and the changing energy consumption patterns through analyzing embedded carbon emissions in the bilateral trade between emission-obligated and non-obligated economies. In this regard, the study considers India and the UK as the country pair for comparing the relevant policy trade-offs. The present study extends the analysis of Banerjee (2020a; 2020b) where India and the UK were taken as a developing-developed country pair for analyzing the emissions embodied in bilateral trade. United Kingdom stands as

the fifth largest trading partner for India and the largest export destination among the 43 Annex-I countries including the EU which ratified the Kyoto Protocol before the treaty came into force. However, as far as the issue of carbon emission is concerned, the position of India and the UK is substantially different. This feature can be best illustrated with Figure 1 below where the net emissions of India and the UK for the years 2005-2014 over and above their corresponding 1990 benchmark levels are shown graphically. It is clearly visible from this figure how India and the United Kingdom moved sharply in the opposite direction in terms of their net carbon emissions. This is because the UK excessively uses low emission-intensive natural gas, while, India has an over-dependence towards high emission-intensive coal as a source of energy. Moreover, India has a higher impulse of using combustible fuels than do the UK for its electricity generation (Banerjee, 2020b).

In this study, some hypothetical policy scenarios are portrayed where India is assumed to adopt prudent policy measures imitating the emission-obligated UK. Through this modeled approach, the study analyses how India can satisfy the emission-energy objectives under energy substitution vis-à-vis security policy trade-off. The paper is structured as follows. The next section explains the methodology and database used in this study. Section 3 discusses the results. Finally, section 4 concludes the paper.



Note: Year 1990 as the benchmark year according to the provisions under the Kyoto Protocol. This means for example, $\Delta CEM_{2014} = CEM_{2014} - CEM_{1990}$.

Source: Annual time-series data on carbon dioxide emission is collected from the World Development Indicators.

Figure 1: Net CO2 Emissions from India and UK over 1990 Benchmark level

2. Methodology and Data

2.1. Input-Output Analysis

The study adopts input-output analysis under ‘emission embodied in bilateral trade (EEBT)’ approach and uses ‘single regional input-output (SRIO)’ tables for India and the UK to look for the domestic supply chain of the concerned regions for the manufacturing of total traded commodities. The basic input-output model is modified as following below in the form of equations (1.1) and (1.2):

$$EEEX = E^{IN} (1 - A^{IN})^{-1} EX \quad \dots (1.1)$$

$$EEIM = E^{UK} (1 - A^{UK})^{-1} IM \quad \dots (1.2)$$

Here, E^{IN} and E^{UK} represents the row vectors of CO₂ emission coefficients consisting of ‘n’ number of different sectors (E1, E2, ..., En) of India and the UK respectively. Emissions embodied in the production of Indian export (EX) to the UK (i.e., EEEX) is expressed in equation (1.1) and calculated by multiplying the emission coefficient vector (E^{IN}) with the vector of total production to facilitate the manufacturing of this export in India. Similarly, emissions embodied in the production of import (IM) from the UK to India (i.e., EEIM) is

expressed in equation (1.2) and calculated by multiplying emission coefficient vector (E^{UK}) with the vector of total production to facilitate the manufacturing of this import in the UK.

2.2. LMDI Exercise

The study conducts a spatial index-decomposition of the gap between the emissions embodied in the production of Indian export to the UK and that embodied

in Indian import from the UK into five most important contributing factors. This paper uses the concept of ‘logarithmic mean divisia index (LMDI-I)’ for this purpose. The LMDI-I as an ‘index decomposition’ technique possesses many important advantages over other alternative methods (Ang and Liu, 2001; Ang et al., 2009). This study adopts the additive form of LMDI formulae and conducts the decomposition in the following way:

$$\begin{aligned}
 & EEX \\
 &= EX \times \left(\frac{EEX}{EX} \right) \times \left(\frac{TEM_{IND}}{GDP_{IND}} \right) \\
 &= EX \times \left(\frac{EEX}{EX} \right) \times \left(\frac{TEM_{IND}}{ENU_{IND}} \right) \times \left(\frac{ENU_{IND}}{GDP_{IND}} \right) \\
 &= EX \times \left(\frac{EEX}{EX} \right) \times \left(\frac{TEM_{IND}}{ENU_{IND}} \right) \times \left(\frac{ENU_{IND}}{Inputs_{IND}} \right) \times \left(\frac{1}{\frac{GDP_{IND}}{Inputs_{IND}}} \right) \\
 & \dots (2.1)
 \end{aligned}$$

$$\begin{aligned}
 & EEIM \\
 &= IM \times \left(\frac{EEIM}{IM} \right) \times \left(\frac{TEM_{UK}}{GDP_{UK}} \right) \\
 &= IM \times \left(\frac{EEIM}{TEM_{UK}} \right) \times \left(\frac{TEM_{UK}}{ENU_{UK}} \right) \times \left(\frac{ENU_{UK}}{GDP_{UK}} \right) \\
 &= IM \times \left(\frac{EEIM}{IM} \right) \times \left(\frac{TEM_{UK}}{ENU_{UK}} \right) \times \left(\frac{ENU_{UK}}{Inputs_{UK}} \right) \times \left(\frac{1}{\frac{GDP_{UK}}{Inputs_{UK}}} \right) \dots (2.2)
 \end{aligned}$$

Here, *TEM* and *GDP* stand as the economy-wide total emission and gross domestic product. *ENU* and *Inputs* are representing the total energy consumption in the economy and total input use.

The emissions embodied in either bilateral export or import is primarily represented in terms of five contributing factors as follows:

- Firstly, the final emission level depends on the volume of bilateral trade flows which creates a scale effect of increased economic activities due to trade.
- Secondly, the specialization level of the two trading partners towards emission-intensive activities also affects their overall emission levels those are represented in these equations as the emission-intensity of the direct export

relative to the emission-intensity of total output.

- Thirdly, the emission-intensity of energy-mix represents the use of quality of energy in the production processes.
- Fourthly, the energy-intensity of input-use reflects the practice of emission-bounded technological uses in a country, hence, considered as the emission regulation effect.
- Fifthly, the total factor productivity (TFP) represents the maximum efficient use of energy resources in the production process. Here, the reciprocal of the TFP is termed the production efficiency effect.

Now, by subtracting equation (2.2) from (2.1), we get the emissions embodied in the bilateral trade balance (EEBTB) as follows:

$$\begin{aligned}
 EEBTB &= EEEX - EEIM \\
 &= EX \times \left(\frac{EEEX}{EX} \right) \times \left(\frac{TEM_{IND}}{GDP_{IND}} \right) \times \left(\frac{ENU_{IND}}{Inputs_{IND}} \right) \times \left(\frac{1}{GDP_{IND}} \right) \\
 &\quad - IM \times \left(\frac{EEIX}{IM} \right) \times \left(\frac{TEM_{UK}}{GDP_{UK}} \right) \times \left(\frac{ENU_{UK}}{Inputs_{UK}} \right) \times \left(\frac{1}{GDP_{IND}} \right) \\
 &= EX \times DSP_{IND} \times EMEN_{IND} \times REG_{IND} \times EFF_{IND} - IM \times DSP_{UK} \times EMEN_{UK} \times REG_{UK} \times EFF_{UK} \\
 &\quad \dots (3)
 \end{aligned}$$

In the above equations, *DSP*, *EMEN*, *REG* and *EFF* stands as the ‘degree of dirty-specialization’, ‘emission-intensity of energy-use’, the ‘energy-intensity of input-use’ and the ‘production efficiency’ respectively. Therefore, the value of *EEBTB* expresses the amount of unbalanced emissions embodied in the bilateral trade flows. *EEBTB* is decomposed applying the LMDI formula in the following way:

$$\Delta TB = \omega \times Ln \left(\frac{EX}{IM} \right)$$

$$\Delta DSP = \omega \times Ln \left(\frac{DSP_{IND}}{DSP_{UK}} \right)$$

$$\Delta EMEN = \omega \times Ln \left(\frac{EMEN_{IND}}{EMEN_{UK}} \right)$$

$$\Delta REG = \omega \times Ln \left(\frac{REG_{IND}}{REG_{UK}} \right)$$

$$\Delta EFF = \omega \times Ln \left(\frac{EFF_{IND}}{EFF_{UK}} \right)$$

Here, *TB* represents the amount of trade balance which is the value of net exports and ‘ ω ’ stands as the value of the weight, associated with the concerned ratio. This weight is used here as a common factor according to the LMDI formulae since the decomposition is done at the aggregated level and not at a sectoral level. This ‘ ω ’ is calculated as following below:

$$\omega = \left(\frac{EEEX - EEIM}{Ln \left(\frac{EEEX}{EEIM} \right)} \right)$$

2.3. Hypothetical Scenario Experiments

Drivers are assumed to contribute to creating a gap in the emissions embodied in Indian export to the UK to that embodied in Indian imports from the UK. This study conducts few hypothetical experiments with some scenarios where India adopts policies following the UK as the benchmark standard. In these cases, India is assumed to take some policies which will push the contribution from any one of the drivers at the zero level. In this way, the study attempts to evaluate the importance of different drivers for carbon emission mitigation and energy-saving objectives. Additionally, this

study evaluates these reductions in emission levels as a result of these hypothetical policy experiments in terms of change in aggregated final energy consumption from all production sectors. Table 1 shows these experiments where India is adopting policies that will push India's emission-intensity of energy-mix, energy-intensity of input-mix, and production efficiency gradually at the level in which the UK is already operating with. Here, this model assumes no multiplier effect of these experiments which implies that the reduction in emission is considered only due to policy change-oriented towards one specific driver while the other drivers would adjust accordingly.

Table 1. Hypothetical Scenario Experiments

	Scenario 1	Scenario 2	Scenario 3
	India is adopting a new emission intensity of energy-mix	India is adopting a new energy intensity of input-mix	India is adopting a new production efficiency
	$(EMEN_{IND})^H = EMEN_{UK}$	$(REG_{IND})^H = (REG_{UK})$	$(EFF_{IND})^H = (EFF_{UK})$
	$\left(\frac{TEM_{IND}}{ENU_{IND}}\right) = \left(\frac{TEM_{UK}}{ENU_{UK}}\right)$	$\left(\frac{ENU_{IND}}{Inputs_{IND}}\right) = \left(\frac{ENU_{UK}}{Inputs_{UK}}\right)$	$\left(\frac{1}{GDP_{IND} / Inputs_{IND}}\right)$ $= \left(\frac{1}{GDP_{UK} / Inputs_{UK}}\right)$

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Exogenous	Energy Consumption	Total Emissions	Energy Consumption	Input Use	Input Use	GDP
Endogenous	Total Emissions	Energy Consumption	Input Use	Energy Consumption	GDP	Input Use

Note: 'H' as the superscript indicating the hypothetical or imitated number.

2.4. Climate Protection Policy Evaluation

All the hypothetical policy experiments would represent a change in overall carbon emission levels and a change in energy use levels. This study propose to average these

two changes by giving equal weights to both the objectives of climate protection and energy saving. This average may be termed as the decision trick which could be applied to evaluate the policy alternatives mentioned above.

$$Decison\ Trick = 0.5 \left(\frac{Fall\ in\ Total\ Emissions}{Total\ Emissions} \right) + 0.5 \left(\frac{Fall\ in\ Energy\ Use}{Total\ Energy\ Use} \right) \dots (4)$$

2.5. Data Collection and Processing

The input-output tables (IOTs) used in this study are the aggregated form of the collected input-output tables from the OECD database for the year 2015 where only the domestic productions of commodities are taken into account. For this study, the IOTs are modified and aggregated according to the demand-side component of the standard energy-commodity balance tables. These energy-commodity balance tables show the information on sector-wise consumption of energy inputs and are collected from the United Nations Energy Statistics Year book 2015 for the year 2015. The carbon emission coefficient of the broad energy groups mentioned according to the IEA energy balance tables are not found available in an aggregated form, hence calculated based on disaggregated energy items from each group. The bilateral trade volume data are also collected from the OECD database for the year 2015. The present study only focuses on merchandise

exports and related carbon emissions, hence, the emissions embodied in services export is not considered in the analysis.

3. Results and Discussions

3.1. Carbon Emissions Embodied in India-UK Trade

The calculated emissions embodied in the India-UK bilateral trade is shown in Table 2 below. From Table 2, it can be clearly observed that the carbon emissions embodied in Indian exports to the UK (8314.45 Kilo Tonnes) is much higher than the emissions embodied in Indian imports from the UK (685.80 Kilo Tonnes) that implies India is a net exporter of embodied carbon-dioxide at least as far as the India-UK bilateral trade is concerned. From these calculations the surplus emissions due to Indian exports over that of Indian imports found around 7628.65 kilo tonnes. This amount may be termed as the emission imbalance in India-UK lateral trade.

Table 2. CO2 Emissions Embodied in India-UK Trade

Emissions Embodied (In Kilo Tonnes)		
Indian Exports to UK (EEEX)	Indian imports from UK (EEIM)	Emission Imbalance in Bilateral Trade (EEBTB)
8314.4541	685.8013	7628.6528

Source: Author’s own calculation

3.2. Spatial Decomposition Analysis

The result of the decomposition exercise is portrayed in the form of Table 3 below. As is shown in the table, the total emission imbalance is contributed from India’s trade surplus over the UK and due to the differences in the degree of emission-intensive or ‘dirty’ specialization, the emission-intensity of energy-mix, the energy-intensity of input-use and the total factor productivity between India and the UK. Here all the drivers except the ‘degree of dirty specialization’ are found contributing positively. This aspect implies that India’s emission-intensity of export to the UK is less dirty relative to the emission-intensity of total Indian output than India’s emission-intensity of import from the UK relative to the emission-intensity of the UK’s total output. This is because of the composition of Indian export to the UK which is less emission-intensive compared to the composition of Indian imports from the UK.

Although the emission intensity of the energy mix is an important driver for determining

the differences in the final emission among India and the UK and usually draws more attention from the policymakers, the energy intensity of produced output also found to create a much higher impact. Therefore, this energy intensity of production is further decomposed into the energy intensity of the input-use effect and the production efficiency effect. Here, both the drivers are found contributing to the emission imbalance in the India-UK bilateral trade, and the energy intensity of input-use is found dominating in its contribution over the production efficiency effect.

The results from the index-decomposition could be better visualized in Figure 2 below where the contributions from all five drivers in the emission imbalance in India-UK bilateral trade for 2015 are shown in terms of their percentage share. It can be interpreted from the figure that the emission imbalance in the India-UK bilateral trade is appearing because of the trade balance effect, the emission-intensity of energy-mix effect, the regulation or energy-intensity of input-use effect, and the production efficiency effect those are contributing by around 25.77, 13,

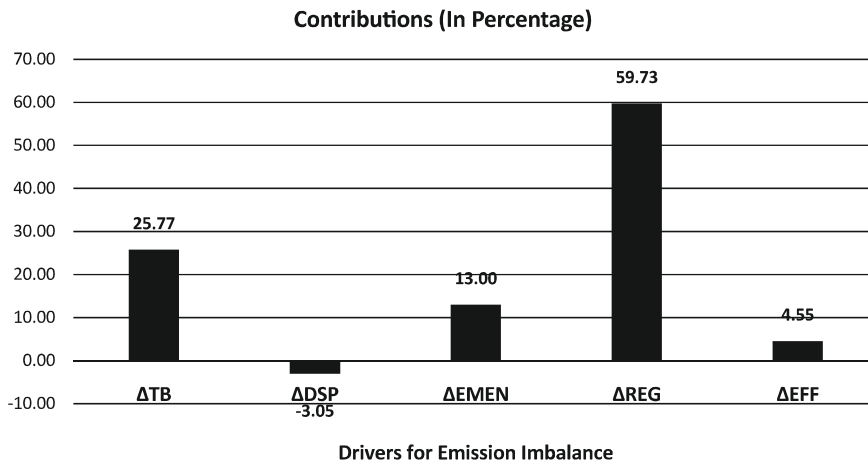
59.73 and 4.55 percent respectively. On the other hand, the degree of dirty specialization effect helps reduce this imbalance slightly by 3 percent only. These results roughly

portray the importance of the five drivers in the creation of ultimate imbalance in this case of Kyoto-obligated and non-obligated bilateral trade.

Table 3. Result of Spatial Decomposition using LMDI (In Kilo Tonnes)

		Spatial Decomposition
Trade Balance Effect	ΔTB	1966.081
Degree of Dirty Specialization Effect	ΔDSP	-232.832
Emission Intensity of Energy-Mix Effect	$\Delta EMEN$	991.7767
Energy Intensity of Input Use Effect	ΔREG	4556.358
Production Efficiency Effect	ΔEFF	347.2693
Total Emission Imbalance		7628.653

Source: Authors' own Calculations



Source: Author's Elaboration

Figure 2. Spatial Decomposition into Five Contributing Drivers

3.3. Hypothetical Policy Analysis

The study adopts a modelled approach to experiment under different policy scenarios for taking care of the problems of increased emissions and excessive demand for energy that may create additional risk of supply disruptions. Here, India assumed to

undertake programmes imitating the UK which already showed tremendous success in decoupling its macroeconomic priorities from the increased carbon emissions. Table 3 is showing the total results from the hypothetical scenario experiments as directed in Section 2.3.

Table 3. Hypothetical Scenario Experiments

	Original Model	Hypothetical Emission Intensity of Energy-mix		Hypothetical Energy Intensity of Energy Use		Hypothetical Production Efficiency	
		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Emissions Imbalance	7628.65	6636.88	6636.88	2386.49	2386.49	7281.38	7281.38
Fall in Emissions Embodied in Exports		991.78	991.78	5242.16	5242.16	347.27	347.27
Fall in Total Emissions		0.00	495653.95	1386052.74	0.00	192104.49	0.00
Fall in Energy Use		-6030802.13	0.00	12192599.09	0.00	1689872.90	0.00

Source: Author's Calculations

In the first experiment, under Case 1, India assumed to adopt a new emission-intensity of energy-mix by increasing its energy consumption keeping the level of aggregate emission unchanged. This implies that the consumption of less emission-intensive energy resources would be consumed at a higher proportion. This creates uncertainty around the issue of India's 'energy independence'. If this additional demand for cleaner energies is

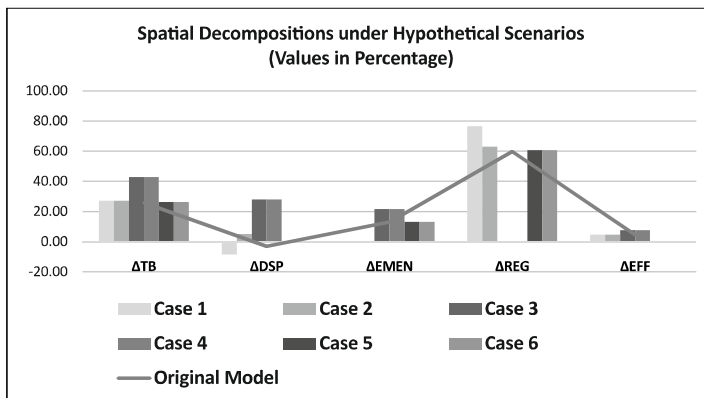
complemented from indigenous sources, maybe through combustible bio-energies, or non-combustible solar, nuclear, wind energies, etc. India's energy security would be preserved, otherwise would get worse if India starts importing higher amounts of natural gas or petroleum fuels (Banerjee and Ghosh, 2021). Under Case 2, India mitigates the total sectoral emissions while total energy consumption remaining unchanged. This policy strategy helps to reduce both

carbon emissions as well as domestic energy consumption by the industries. However, the reduction in overall energy consumption, in this case, cannot ensure any reduction in fuel import.

In the second experiment, India is adopting the same energy intensity of input-use in which the UK is operating. Because this driver is the largest contributor according to the spatial decomposition exercise of the original model the impact from this policy shock will be maximum for both the reduction in total emissions and total energy use. However, this expectation is met under Case 3 only when India is pushing its energy consumption down keeping the volume of input use at the original level. Otherwise, Case 4 is not found to ensure any change in either emissions or energy consumption because this study does not consider any multiplier effect from this policy shock readjustment.

In the third experiment, India is adopting

the UK's total factor productivity (TFP). To increase this TFP under Case 5, India restructures its employment of inputs. Under Case 6, on the other hand, India expands its output keeping the employment of inputs unchanged. With Case 5 initiatives, India able to witness some drop in emissions as well as energy use. However, similar to Case 4, in Case 6 also, the reduction neither in emissions nor in energy use could be achieved if the assumption of no multiplier effect is maintained. Because the contribution of production efficiency is found minimum in the original model, the reduction in emissions and energy use even under Case 5 was also found much lesser compared to under Case 3. There is another possible policy trade-off under Case 5 concerning the macroeconomic priority of unemployment. This is because of the possible technological shift induced from this policy experiment with more installations of innovative and labor-saving technology.



Source: Author's Elaboration

Figure 3. Drivers of Emission Imbalance under Hypothetical Scenarios

Spatial decomposition under six hypothetical cases is shown in Figure 3 where the contribution of five drivers to the aggregate bilateral emission imbalances is illustrated with column bars of different colors. The calculated contribution of these five drivers in the original model is shown with an orange color line. The figure is indicating internal adjustments of the five contributors on the final emission imbalances in the India-UK bilateral trade due to any specific policy shock in the absence of any multiplier effect. Comparing the contributions in the original model most of the drivers under hypothetical scenarios are found performing consistently under different cases. Only the driver of ‘degree of dirty specialization’ contributing inconsistently, because in the original model it helped to reduce the emission imbalance implied in the bilateral trade flows between India and the UK with a minor negative impact, however, started contributing positively under Case 3, Case 4 and Case 5. Therefore, the driver is acting as a ‘shock absorber’ for the hypothetical policy changes. Because its contribution is minimum in the original model it is found behaving with minimum inconsistencies. The study did not undertake any hypothetical scenario where India is adopting a ‘degree of dirty specialization’ equal to that of the UK’s, since this driver is already performing better for India in

order to mitigate emission imbalances. This study also did not conduct any policy experiment with the trade balance effect. This is because the trade balance depends upon a lot of external conditions, like factor endowments, trade barriers, and facilitators, etc.

Keeping the dual policy objective into mind, where a prudent energy policy needs to take care of both emission reduction with a decent level of exposure to the risk of energy supply disruptions this study suggested a decision trick that gives equal importance to the outcomes from both ends. Table 4 showing this decision trick from a simple calculation for all the six hypothetical cases. The values of this decision trick indicating the best outcome under Case 3 where India is adopting a lower energy-intensity of input-use by altering its energy consumption level keeping the input-use unchanged. With this trick, India could bring a maximum reduction in carbon emissions as well as in energy consumption. This criterion could be met through a restructure of the productive network in the economy with enhanced energy efficiencies in the production by reducing energy wastage, investing more in energy-intensive apparatus, upgrading skill and consciousness to the employees to handle energy resources, etc. Despite being influential in reaching other macroeconomic

objectives, Case 4 and Case 6 may be discarded from the analysis because they have no contribution under energy-emission trade-offs.

If India adopts a low-level emission-intensity of energy-mix the best strategy would be under Case 2 by reducing emissions with the original level of energy use because under Case 1 thing would get worse with additional aggregate energy consumption. Besides, under Case 5 India accomplishes a very good outcome. Reducing a small gap

in the production efficiency by adjusting the level of inputs, India successfully reduces emission levels as well as relieves pressure from energy consumption. According to the decision trick, as shown in Table 4, achievements under Case 5, with a much little effort are found very close to that from Case 2 that suggests the prudence of this trick. This may be done with higher investments to improve the quality of inputs, skill formation of the labor force, and technological developments.

Table 4. Calculation of Energy Policy Decision Trick

	Rate of Emission Fall	Rate of Fall in Energy Use	Decision Trick
Case 1	0.000	-0.383	-0.192
Case 2	0.277	0.000	0.139
Case 3	0.775	0.775	0.775
Case 4	0.000	0.000	0.000
Case 5	0.107	0.107	0.107
Case 6	0.000	0.000	0.000

Source: Author's calculation

4. Conclusion

In this study, different available policy options for India are evaluated to address a combined objective of reducing carbon emissions and energy dependence applying

some unique hypothetical experiments based on the spatial decomposition of the emission imbalance implied in the bilateral trade flows between India and a well-recognized Kyoto-Protocol obligated

developed country the UK. Two caveats should be worth mentioning for this analysis. Firstly, the outcomes from these hypothetical experiments are based on an assumption of no multiplier effect from these policy shocks to measure the exact impact from the corresponding drivers. Now, this may seem restrictive, however, this study only portrays the intention and direction of those policy shocks and never intend to judge their macroeconomic effectiveness. Secondly, the fall or rise in the volume of energy consumption from the Indian industrial sectors due to any policy shock does not necessarily imply increased energy dependence or independence. Rather increased energy security and reduction in fuel imports require some additional policy interventions where the low emission-intensive domestic combustible fuels, coupled with renewable energies from solar, wind, hydro, and nuclear sources would aggressively supplement India's external demand for energy resources. This study exhibits the conditions under which a high reduction in the economy-wide overall energy use increases the possibility of the indigenous energy supply to not only supplement but also to substitute the energy imports from outside.

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Note: 'Views expressed in the paper are those of the authors alone and do not, in any way, represent the views of the institutions they are employed with'.

Bitcoin Price Forecast – A prediction using ARIMA Model

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Nabilah Haniph

Abstract:

The investors in India are pouring to cryptocurrencies in unprecedented numbers, and the trend may indeed be hazardous. Many experts say that more investors would rush to digital currency in the coming years. While this has been a cause to rejoice for the crypto-exchanges in India, which has also attracted financing from international investors, the surge is taking place in the absence of rigorous regulations from the part of central bank or the state. Due to the obvious fact of Indian government's previous connection with cryptocurrencies, this would be particularly troublesome. Apart from the government's viewpoint, the lack of laws exposes Indian investors to further dangers. The most significant regulatory risk is that bad players may enter the market. For the time being, Bitcoin exchanges and investors appear to have taken the RBI's new notice as a green light. This might be an oversimplification, and the magnitude of the risk, given the size of the investments, could be disastrous. Therefore, the study evaluates if the investment in bitcoins is risky or not with the ARIMA analysis to examine the price of Bitcoin in Indian Rupee up to a projected period of 20-07-2021.

Key Words: Bitcoin, Crypto-currency, Forecasting, ARIMA Analysis, Block-chain, Indian investors

Introduction

Bitcoin, a type of cryptocurrency, was created by an unknown individual or group of persons under the pseudo name Satoshi Nakamoto in the year 2008, is among the most frequently digitally traded wallets. It is indeed a decentralized cryptocurrency that may be transmitted from one user to another over the Bitcoin network system where it is traded peer to peer, without the use of middlemen, with transactions taking place over a public ledger which is known as a block chain that handle information of the users anonymously. Bitcoin is the most commonly used and approved digital money in the world today. Nakamoto describes it as a mechanism for electronic transactions devoid of reliance on trust, despite the fact that Bitcoin is often considered to as a cryptocurrency. Other forms of digital payments need the use of a trusted third party, for instance a bank or an automated unit, to authenticate a transaction. Rather than depending on a single trustworthy source the Bitcoin system depends on a huge number of powerful “miners” to validate transactions and transmit them (Nakamoto, 2008). Bitcoin uses cryptography to regulate and manage units of currency. Traditional online transactions have transaction costs that are higher than Bitcoin transaction fees. Besides they are fully virtual coins that are self-contained because of their worth. A bank is not required to move or keep money. Because bitcoins really aren’t present

physically, amounts are stored only on a public cloud wallet. A tremendous amount of processing power is used to verify every Bitcoin transaction. Wallet is a personal database that you may save on your PC, on your phone, on one’s tablet, or on the cloud. Bitcoins are sent from one person’s wallet to another. By passing a comprehensive Digital Currency Bill this year, India has found a sweet spot for stimulating development and innovation. Despite reports of a possible ban on cryptocurrency in India, authorities who grasp the actual potential of cryptocurrency and its influence on our economy should examine a variety of use cases. Given that our country’s success over the last 30 years has been based on Information Technology enabled services, we can, not at all disregard the 1.7 trillion Dollar market for cryptocurrencies if we want to attain a 5 trillion Dollar market (Krishna Kant, 2018). A forward-thinking crypto strategy can help us improve our whole economic base, protect the economic security, prevent financial crime, improve the monetary policy’s framework, draw international finance, provide more job opportunities, and maintain our talent pool of techies to accelerate technology growth and propel the country toward becoming a worldwide superpower.

HOW DOES BITCOIN WORK?

Individuals may utilize Bitcoins to pay other people or businesses without the need for a third party to validate the transaction, such as a banking institution or other financial

intermediaries. Rather, the blockchain is used to clear and validate transactions within the system. Blockchain technology underpins most cryptocurrencies. To put it in simple words, it is a mechanism for transferring and storing data or information produced during bitcoin transactions. The blockchain is a digital ledger that keeps track of all the Bitcoin transactions and displays them publicly. The recent transactions are permanently recorded in a block. The blockchain, which spans back to the initial Bitcoin transaction, is made up of blocks of data gathered that stack upon each other. The blockchain's transparency is critical for safeguarding the validation process since it enables the network to monitor and self-supervise the transactions. Besides it enables the verification of both spenders and receivers ensuring that a Bitcoin cannot be spent twice. When a person establishes a Bitcoin wallet for storing Bitcoin, they will be given both a public and private key. The public and private keys are a long series of digits and letters that function similarly to a user's username and password. If users wish to transfer money to others, they'll need only their public key. As a result, Bitcoin users remain anonymous. However, the private key is kept hidden. An individual user's identification on the blockchain is the private key and it is needed to utilise the bitcoin. If the private key is hacked or seen by anyone, they might steal the bitcoins from the wallet (Nakamoto, 2008).

BITCOIN'S LEGAL STATUS IN INDIA

The legal position of Bitcoin and similar crypto instruments differs widely from nation to nation. Although the majority of nations do not prohibit the use of Bitcoin, its status as a currency (or commodity) differs, resulting in different regulatory repercussions. In the European Union, there doesn't exist an approved explicit legislation regarding Bitcoin's status as a currency, while it has declared that VAT/GST applies to the conversion of traditional currency to Bitcoin. Bitcoin has legal status in more than 50 countries world over including USA, South Africa, Brazil, Russia, France etc: while is considered illegal in countries like Saudi Arabia, China, Nepal, Pakistan Indonesia etc: However, Bitcoin is legal in India, Canada, Jordan, Vietnam, and Thailand, but banking is prohibited (Pieters & Vivanco, 2017). Bitcoins have been accessible in India since 2012. The Reserve Bank of India issued a notice in April 2018 directing banks to ensure that customers transacting in cryptocurrencies do not have accessibility to banking services. After years of doubts among the RBI officials regarding the legality of digital currencies created by private parties, the circular was released (Naved, 2020). The central bank has frequently cautioned investors and the financial system about the potential threats such private currencies which are unregulated pose. The 2018 notice was perceived as an effort to prevent citizens from acquiring cryptocurrency.

The RBI essentially barred any major rupee investment in cryptocurrencies by prohibiting banks from assisting transactions including cryptocurrencies. But in March 2021, the order was overturned by the honourable Supreme Court and stated that banks should no longer mention the order, as the Supreme Court believed that the RBI can't impose excessive limitations on cryptocurrency trading as there is no legislation prohibiting the purchase or sale of cryptocurrencies. The court decided that such limits would infringe on people's basic freedom to engage in any lawfully permitted trade. The central bank, on the other hand, has ordered banks to pursue their due diligence process on crypto-dealers abiding by the rules related to anti-money laundering and anti-terrorism (Jani, 2018).

BITCOIN'S FUTURE IN INDIA:

While dismissing the RBI order, the Supreme Court merely noted that there is no legal justification for imposing severe limitations on cryptocurrencies at this time. But, once a legislation prohibiting the use of cryptocurrency is approved in Parliament, the court's stance may change. However, the RBI was forced to offer the present explanation because the 2018 notice that is presently invalid was recently referenced by a few banks to restrict crypto dealings. Furthermore, the Centre is debating whether or not to outrightly prohibit cryptocurrencies. It's worth mentioning that the Centre's inter-disciplinary panel suggested a ban on cryptocurrency trade and possession

in 2017. In India, virtual currencies are not illegal, but the issue is that they are unregulated. This means, you may trade or hold Bitcoin like any other investment, but there is still no governmental agency to oversee or safeguard it. The lack of a legal structure to regulate cryptocurrencies offers a lot of room for fraudulent acts and scams, which is crucial to keep in mind for investors. Anyone can set up a digital platform or develop a crypto-currency which poses heavy risks to the investors. Cryptocurrency sceptics argue that there is a sound justification to expect that governments all around the globe might prohibit all cryptocurrencies at some point. They claim that governments and central banks would never ever allow their monopolistic power over money to be diluted. On this issue, the government of India has been sending confusing indications. In March 2021, Finance Minister of India, Nirmala Sitharaman stated that cryptocurrency will not be completely banned in the nation. The Centre, on the other hand, is expected to launch the Cryptocurrency and Regulation of Official Digital Currency Bill of 2021, that is reported to include measures that entirely prohibit the usage of all cryptocurrencies (Bhadeshiya, 2021). As a result, cryptocurrency's future in India remains uncertain.

WHAT CAN CRYPTO BE USED FOR? CAN IT REPLACE CURRENCY?

It's the most crucial question. The crypto industry has risen at an exponential rate in

recent years, yet the reality is that that these digital currencies can't be used for anything. Isn't it true that a Bitcoin can't just get you a burger? So, what can it be used for? In the actual world, most likely it will buy you nothing. However, as a store of value, it might be rather valuable. It can be equated to gold or silver etc: as a commodity. People have utilised such costly metals as a form of payment over these years. Often, they are purchased in return for money, with the expectation that their value would increase over time. Though the bitcoins have numerous advantages such as User anonymity, transparency, peer to peer networking, no inflation, coins cannot be copied or spent twice, no mediators, boundary-less transactions, absence of central authority or decentralisation, low operation costs, easy to start an account, speed of transaction etc: it also possesses many limitations.

Bitcoin transactions are final and cannot be reversed: Traditional forms of payment like credit card fees, personal cheques etc: benefit from the banks' insurance and reversibility. When it comes to Bitcoins, the result is irrevocable each time they exchange and change wallets. One's Bitcoin wallet, on the other hand, is not safeguarded by insurance. If it's lost, it'll be lost forever.

Wallets can't be seized, blocked, or audited by banks or law enforcement: Bitcoin wallets can't be seized, frozen, or inspected

by banks or law enforcement. Expenditure and withdrawal limitations cannot be placed on Bitcoin wallets. The owner of the Bitcoin wallet is the only one who can decide how the money is managed.

Bitcoin isn't really user-friendly: For those who aren't technically proficient, private and public keys, creating and utilising a wallet, and so on are complicated. When we wish to give someone money, we must input a long string of numbers and characters into the system. Bitcoin have to become simple to use so that it can be used even by a common man.

Technical flaw - confirmation time delay: Bitcoins might be twice spent in rare cases at the time of confirmation delay. It takes a little time for getting a transaction verified across the network. This chance can be used by a dishonest individual by rapidly clicking, and submitting a double payment of the same coins to another person. So, the second person loses his goods as well as money before the dishonest transaction is confirmed by the server.

Another important reason that forces India to abandon cryptocurrency payment is a lack of crypto knowledge. According to several research, digital assets, particularly crypto and bitcoin, are vulnerable to security threats. While this rumour can sometimes be regarded as incorrect, crypto start-ups and finance companies that deal with cryptocurrency are working to address the downsides (Jurik, 2016).

NEED AND SIGNIFICANCE OF THE STUDY

The Indian investors in record numbers are flocking to cryptocurrency, and the trend may indeed be hazardous. Till May-2021, Indian investors have invested almost 6.6 billion dollars (around Rs49,189 crore) in cryptocurrencies, compared to approximately 923 million dollars till April of 2020. According to blockchain research company Chain analysis, out of the 154 countries which has adopted Cryptocurrency, the country ranks 11 (Mimansa Verma, 2021). Many experts feel that this is just the beginning, and that many more investors would rush to digital currency in the coming years. The Indian population is around 1.39 billion people, the majority constituting young age group that is considered to be more tech-savvy and open to cryptocurrency savings. While this has been a reason to celebrate for India's crypto-exchanges, which has also attracted financing from international investors, the surge is taking place in the absence of rigorous regulations from the part of central bank or the state. Due to the obvious fact of Indian government's previous connection with cryptocurrencies, this would be particularly troublesome. Apart from the government's viewpoint, the absence of laws exposes Indian investors to more dangers. The most significant regulatory risk is that bad actors may enter the ecosystem. Bitcoin exchanges and investors appear to have regarded the RBI's

latest notice as a green signal for the time being. This might be an oversimplification, and the magnitude of the risk, given the size of the investments, could be disastrous. Therefore, it is necessary to evaluate if the investment in bitcoins is risky or not.

STATEMENT OF THE PROBLEM

According to the World Bank, the overall market capitalization of the worldwide crypto market is 2.6 trillion dollars, which is the same as the gross domestic product (GDP) of India, for the entire year of 2020, which was 2.6 trillion dollars. A majority of this increase happened in the last year, while investors were seeking to diversify their portfolios in the wake of the COVID-19 pandemic's uncertainty. The same may be said about India. Therefore, there is a lot of scepticism and uncertainties regarding the performance of Bitcoin world over. So, it is indeed necessary to evaluate the performance of Bitcoin especially during the pandemic period.

OBJECTIVE OF THE STUDY

The objective of this study is to examine the future trend of Bitcoins in India till a period of 20-07-2021, based on the data (Price of Bitcoin) for the period 20-09-2019 to 04-07-2021, to check if there is volatility in the prices.

LIMITATION OF THE STUDY

The study purposely avoided the prediction of Bitcoin Price in India for a longer period

of time as it is not rational to make such a prediction due to the very fact that the economic performance of an asset depends on manifold factors which are beyond unpredictable or beyond the control of the factors included by the researcher in this study. Therefore, the trend predicted might or might not reverse in future.

RESEARCH METHODOLOGY

The paper is based on secondary data pertaining to price of Bitcoin in Indian Rupee during the period from 20-09-2019 to 04-07-2021. ARIMA analysis has been used to examine the price of Bitcoin in Indian Rupee up to a projected period of 20-07-2021. Auto Regressive Integrated Moving Average (ARIMA) is a type of model that explains a time series on the basis of its past values, such as lags and forecast errors, due to which the equation could be used to anticipate future values. The alternate statistical method available is ARMA (Auto Regressive Moving Average) which is also a model used for prediction, but due to the auto-correlation nature or effect of the data used in the study, this method is not opted and for the same reason the former statistical method has been opted for the prediction.

DISCUSSION OF FINDINGS

As on 20-09-2019, the price of one Bitcoin was Rs. 724993.94. After then, till 25-07-2020, a negative growth rate with an unswerving volatility was noted on the performance of Bitcoin in Indian Rupee.

The percentage of growth rate was either one digit or two digits (maximum of 23%) till 02-09-2020. From 03-09-2020 to 07-10-2020, the percentage of growth rate in the price of one Bitcoin was remains one digit. From 08-10-2020 onwards, there has been a continuous growth rate in the percentage was seen and on 16-12-2020, the price of one Bitcoin was Rs. 1568584.75, with a corresponding growth rate of 116.36%. This means, exactly after 1¼ years from 20-09-2019, the growth rate was 116.36% on the price of one Bitcoin in Indian Rupee. The trend was high encouraging for the investors and on 02-01-2021; the price of one Bitcoin was Rs. 2348254.25, with a corresponding growth rate of 223.9%. The change was remarkably amazing for the investors, especially during the pandemic periods of Covid 19. The trend was elevated and heartening for the investors and on 08-02-2021; the price of one Bitcoin was Rs. 3369115, with a corresponding growth rate of 364.71%. On 17-02-2021, the price of one Bitcoin was Rs. 3796127, with a corresponding growth rate of 423.61%, one of the cardinal wonders of the world, especially under the clutches of black hands of the pandemic spread all over the world. On 09-04-2021, a rise in price was seen on one Bitcoin, which amounted to Rs. 4352631.5, with a corresponding growth rate of 500.37%. The all-time high value for one Bitcoin was Rs. 4774301, with a corresponding growth rate of 558.53% on 13-04-2021. On 18-04-2021 onwards, by evaluating the price of one Bitcoin, a

drastic lessening in value was noted and on 04-07-2021; the price of one Bitcoin was Rs. 2570830.25, with a corresponding growth rate of 254.6%. In this direction, an

attempt has been done to examine the current scenario of Bitcoin and an examination on the price of Bitcoin in Indian Rupee up to a projected period of 20-07-2021.

Figure 1.1
Price of Bitcoin in Indian Rupee

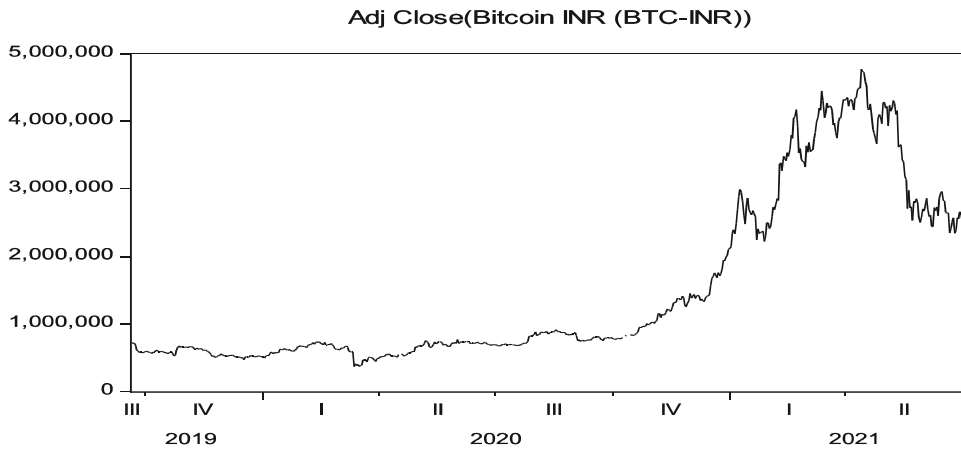


Table 1.1
Descriptive analysis of Price of Bitcoin in Indian Rupee

	BITCOIN
Mean	1503801.
Median	775410.6
Maximum	4774301.
Minimum	370008.6
Std. Dev.	1256833.
Skewness	1.156584
Kurtosis	2.853968
Observations	650

Source: Secondary data

The average price of Bitcoin in Indian Rupee was Rs. 1503801±1256833. The lowest possible price determined was Rs.370008.6 whereas, the highest reached to Rs.4774301. The skewness reported during the period was 1.16 and the Kurtosis reported during the period was 2.85. A total of 650 observations were considered for the present study.

In order to test the stationarity of the data Augmented Dickey-Fuller test statistic has been used and a classic example of this test is the Unit Root test. Here the null hypothesis is, ‘there is no significant stationarity in the data’ or in other words ‘there is unit root in the data’.

Table 1.2
Test for Unit root of price of Bitcoin in Indian Rupee -first difference

Null Hypothesis: D(BITCOIN) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag = 19)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-27.35901	0.0000
Test critical values:		
1% level	-3.440307	
5% level	-2.865824	
10% level	-2.569109	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(BITCOIN,2)

Method: Least Squares

Date: 07/04/21 Time: 08:09

Sample (adjusted): 9/22/2019 7/04/2021

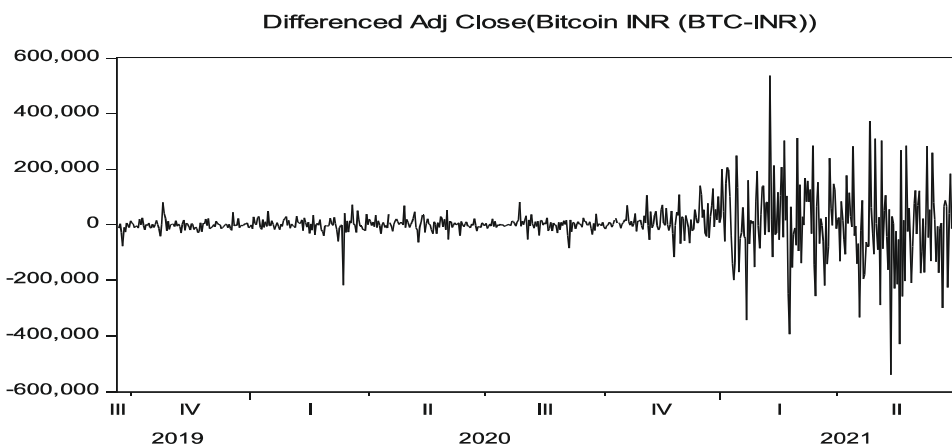
Included observations: 642 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BITCOIN(-1))	-1.078484	0.039420	-27.35901	0.0000
C	3028.368	3380.676	0.895788	0.3707
R-squared	0.539076	Mean dependent var		175.7732
Adjusted R-squared	0.538356	S.D. dependent var		126011.6
S.E. of regression	85617.86	Akaike info criterion		25.55629
Sum squared resid	4.69E+12	Schwarz criterion		25.57019
Log likelihood	-8201.568	Hannan-Quinn criter.		25.56168
F-statistic	748.5152	Durbin-Watson stat		1.995287
Prob (F-statistic)	0.000000			

Source: Secondary data

The Test statistic of Augmented Dickey-Fuller is -27.35901 and the Asymptotic p-value 0.0000 (P value < 1%), showing the null hypothesis is rejected. This implies price of Bitcoin in Indian Rupee has no Unit root or there is significant stationarity in the data and hence price of Bitcoin in Indian Rupee is stationary at first difference.

Figure 1.2
Price of Bitcoin in Indian Rupee -First difference



ARIMA model has been used to predict the bitcoin price in the future period. The null hypothesis here is 'the model is not fit'.

Table 1.3

Regression for price of Bitcoin in Indian Rupee using ARIMA Maximum Likelihood

Dependent Variable: D(BITCOIN)

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 07/04/21 Time: 08:18

Sample: 9/21/2019 7/04/2021

Included observations: 646

Convergence achieved after 59 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2759.440	3681.589	0.749524	0.4538
AR (6)	-0.570746	0.128780	-4.431941	0.0000
MA (6)	0.669540	0.118988	5.626979	0.0000
SIGMASQ	7.20E+09	1.72E+08	41.81636	0.0000
R-squared	0.014617	Mean dependent var		2797.841
Adjusted R-squared	0.010013	S.D. dependent var		85551.69
S.E. of regression	85122.32	Akaike info criterion		25.54817
Sum squared resid	4.65E+12	Schwarz criterion		25.57585
Log likelihood	-8248.059	Hannan-Quinn criter.		25.55891
F-statistic	3.174471	Durbin-Watson stat		2.147321
Prob(F-statistic)	0.023752			
Inverted AR Roots	.79+.46i	.79-.46i	.00-.91i	-.00+.91i
	-.79+.46i	-.79-.46i		
Inverted MA Roots	.81-.47i	.81+.47i	.00+.94i	-.00-.94i
	-.81-.47i	-.81+.47i		

Source: Secondary data

The Anova test value of price of Bitcoin in Indian Rupee is 3.17 and the corresponding p value is 0.024 (P value < 5%), showing null hypothesis is rejected. This implies, the model is fit for prediction. That means, with the change in time; change in price of Bitcoin in Indian Rupee is noticed. In the current ARIMA model, the lag of AR (6) is significant 1% and the lag of MA (6) is significant 1%. The SIGMASQ is also significant, showing high volatility at the price of Bitcoin in Indian Rupee from 9/21/2019 to 7/04/2021. The R-squared value is 1.46% and the Adjusted R-squared value is 1%. Durbin-Watson stat is 2.14, found, there is no auto correlation at price of Bitcoin in Indian Rupee.

In order to check if there is mis-specification error in the data, the Ramsey RESET Test has been used. Here the null hypothesis is ‘there is no significant mis-specification error in the data.’

Table 1.4
Price of Bitcoin in Indian Rupee – Ramsey RESET Test

Ramsey RESET Test

Equation: UNTITLED

Specification: D(BITCOIN) C AR (6) MA (6)

Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	2.194899	641	0.0285
F-statistic	4.817581	(1, 641)	0.0285
Likelihood ratio	4.973780	1	0.0257
WARNING: the MA backcasts differ for the original and test equation.			
Under the null hypothesis, the impact of this difference vanishes asymptotically.			
F-test summary:			
	Sum of Sq.	Df	Mean Squares
Test SSR	3.47E+10	1	3.47E+10
Restricted SSR	4.65E+12	642	7.25E+09
Unrestricted SSR	4.62E+12	641	7.20E+09
LR test summary:			
	Value	Df	
Restricted LogL	-8248.059	642	
Unrestricted LogL	-8245.572	641	

Unrestricted Test Equation:

Dependent Variable: D(BITCOIN)

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 07/04/21 Time: 08:29

Sample: 9/21/2019 7/04/2021

Included observations: 646

Convergence achieved after 42 iterations

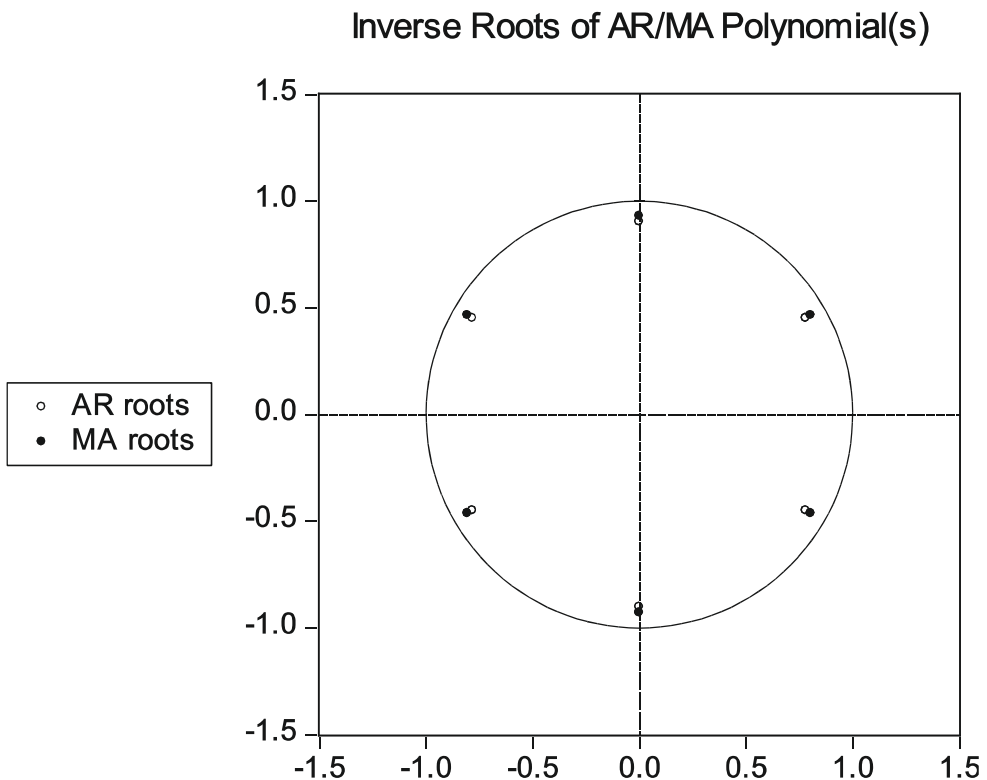
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-110.9607	4549.750	-0.024388	0.9806
FITTED^2	2.64E-05	1.04E-05	2.531987	0.0116
AR (6)	-0.542100	0.200067	-2.709586	0.0069
MA (6)	0.617442	0.188361	3.277966	0.0011
SIGMASQ	7.15E+09	1.78E+08	40.23181	0.0000
R-squared	0.021968	Mean dependent var		2797.841
Adjusted R-squared	0.015865	S.D. dependent var		85551.69
S.E. of regression	84870.35	Akaike info criterion		25.54357
Sum squared resid	4.62E+12	Schwarz criterion		25.57817
Log likelihood	-8245.572	Hannan-Quinn criter.		25.55699
F-statistic	3.599406	Durbin-Watson stat		2.132247
Prob(F-statistic)	0.006509			
Inverted AR Roots	.78+.45i	.78-.45i	.00-.90i	-.00+.90i
	-.78+.45i	-.78-.45i		
Inverted MA Roots	.80-.46i	.80+.46i	.00+.92i	-.00-.92i
	-.80-.46i	-.80+.46i		

Source: Secondary data

The residual diagnosis of price of Bitcoin in Indian Rupee for Ramsey RESET Test adjusted for D(BITCOIN) C AR (6) MA (6) is done and as per the F-statistic, the p value (0.0285) is statistically significant at 5%. Thus, H_0 is rejected. This indicates that the functional form is not correct and our model suffers from omitted variables and the impact of this difference vanishes asymptotically.

Figure 1.3



The above figure shows that the data is within the control as it is lying inside the circle.

Table 1.5

Price of Bitcoin in Indian Rupee up to a period 7/20/2021- Forecasted

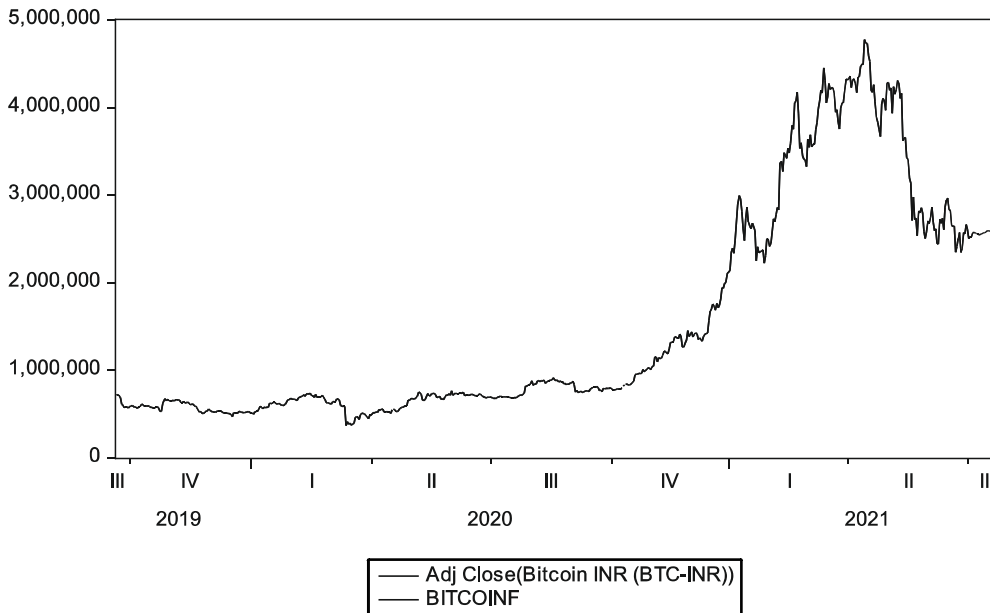
7/05/2021	2575449.12
7/06/2021	2564824.45
7/07/2021	2560289.79
7/08/2021	2559871.23
7/09/2021	2539427.82
7/10/2021	2555189.55
7/11/2021	2556994.79
7/12/2021	2567039.21
7/13/2021	2573791.97
7/14/2021	2578319.96
7/15/2021	2593671.44
7/16/2021	2589453.94
7/17/2021	2592779.95
7/18/2021	2591652.67
7/19/2021	2592304.55
7/20/2021	2594158.91

Source: Secondary data

The above table shows the prediction at the price of Bitcoin in Indian Rupee for a time period up to 7/20/2021. The projected price of Bitcoin in Indian Rupee is predicted to be Rs. 2592779.95 on 17-07-2021. The predicted price of Bitcoin in Indian Rupee will be Rs. 2591652.67 on 18-07-2021. The predicted price of Bitcoin in Indian Rupee will be Rs. 2592304.55 on 19-07-2021. Finally, on 20-07-2021, the predicted price of Bitcoin in Indian Rupee will be Rs. 2594158.91.

Figure 1.4

Price of Bitcoin in Indian Rupee up to a period 7/20/2021- Forecasted



Conclusion:

The price of bitcoins is showing a downward trend. From the highest value marked on 13th April 2021, merely after 3 months the value shows a high percentage of downfall that is approximately 46% nose-dive in value as projected on 20th July 2021. As a result, it is not advisable for investors to take a risk during this bearish phase. However, if the investors find the current price to be satisfactory after comparing it to the price they paid when they first acquired it, it is the perfect moment for them to sell it. On the other hand, if investors are viewing this as a long-term investment and believe that a bullish trend will emerge in the near future, it may be kept as such. If potential or aspiring investors are considering investing in bitcoins, it is recommended that they evaluate both short- and long-term price volatility before making a purchase, as the data shows that the positive and negative changes in bitcoin are at extreme end of the scale during specific times. The graph above shows that there is a lot of volatility or variation in the price of bitcoins. So, before investing in Bitcoins, Indian investors should examine the future trend, as well as the fact that crypto currencies are currently unregulated in India, with no government body to

supervise or protect them. As a result, investors should take this as a cautionary indication before embarking on the Bitcoin roller coaster ride!

PRACTICAL IMPLICATION OF THE STUDY

The studies of this sort i.e., prediction related to Bitcoin or other Cryptocurrencies are useful to analyze the trend in future as it is turning out to be one of the most popular investment avenues for the Indian investors. Therefore, the study is beneficial for prospective investors as well as researchers who are keen about cryptocurrencies like Bitcoin.

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Centralization of State Deposit Lockers-For Cluster of Branches

(Time and Motion Study & Cost-Benefit of Locker House)

Sunil Dasari

Abstract:

The drain on the Revenues of Commercial Banks resulting from the present below-Cost Pricing of Safe Deposit Locker Service is enormous. The Banks are losing around ₹10 lakhs per year for every 500 Cabinets in Metros, Cities and Urban Areas. The Consequences of the Faulty Pricing of Lockers seem more alarming when it is realised that the benefit goes to the Section of the Society which, being relatively more affluent, does not deserve it. The way to overcome this problem is Centralization of Safe Deposit Lockers by the Commercial Banks instead of Safe Deposits Lockers provided at each and every Branch of the Commercial Banks.

This 'Research Article' is based on 'Time and Motion Study' of Safe Deposit Lockers of Banks and also Cost-Benefit-Analysis of Safe Deposit Lockers of Banks. Centralization of Safe Deposit Lockers is a Good Strategy to the Commercial Banks to increase revenue on Locker Product instead of the present system of providing Lockers at each and every Branch.

Key Words: Security, Safe Deposit Locker (SDL), Value Added Services, Locker House, RFID and GSM Technology, Digital Banking, Time and Motion Study, Cost-Benefit-Analysis

Introduction

Safe Deposit Locker (SDL) facility is one of the ‘Value Added Services’ provided by the Banks to its Customers. Bank provides specially designed Lockers purchased from reputed Manufactures which are kept at specially built Strong Rooms at Bank Branches for keeping the Valuable of Hirers.

Safe Deposit Locker (SDL) facility is available at various Bank Branches across India. Lockers of Different Sizes to suits the needs of the Bank Customers. Banks are providing ‘Safe Deposit Lockers’ at the following Centres:

- ✓ Metros.
- ✓ Cities.
- ✓ Urban Areas.
- ✓ Semi-Urban Areas.
- ✓ Rural Areas.

Safe Deposit Locker facility can be availed by:

- ✓ Individuals-Either Singly or Jointly.
- ✓ Partnership Firms.
- ✓ Companies.
- ✓ Associations and
- ✓ Clubs.

Rent for Safe Deposit Lockers is Annually and is payable in Advance by the Hirer. Locker Hirers have the Option to pay 3 Years Rent in Advance. Locker Rent vary depending on Location of Bank Branch i.e., Rural / Semi-urban / Urban / Metro and also Size of Locker.

At Metro and City Places, Number of Bank Branches are more due to Business Potential. Density of Branches in Tier-1, Tier-2 and Tier-3 Centres are more, when compare Tier-4, Tier-5 and Tier-6 (Semi-urban and Rural Areas).

“RFID and GSM Technology”

Smart Bank Locker Security System



“Smart Bank Locker Security System” is based on RFID, Biometric Fingerprint, Password and GSM Technology. In this

system only the authentic person can open the lock and collect the important documents, jewellery from the lockers.

In this Security System RFID, Biometric Fingerprint, Pass Word and GSM Technology Systems are used.

During Login Operation user first swipe RFID tag on the RFID reader if it is ok then Finger Print of Authentic Person will be Scanned. If the Finger is Correct of that Particular Person, then it will allow and Display Finger is matched and if the Finger is not matched of that particular person, then it will give the Signal to the Siren and will play some time and then message goes to the User that the Unauthorized Entry is there, Please Check.

And if the Finger Print is matched then it will give the signal to do Next Step to Enter the Password, then the Authorized Person will Enter the Password.

Safe Deposit Locker System - Process:

Process of the Safe Deposit Locker System and Time to complete the total process based on “Time and Motion Study” is as follows:

- a) **Opening of Safe Deposit Locker Account and its Operations:**
Whenever Customer wishes to avail Safe Deposit Locker from Bank

Branch, the following are the various Steps in while Opening / Operate the Safe Deposit Locker System:

Step-1: Fill-up the Standard Application designed by the Bank for the SDL and Affix the Photograph and duly signed by the Customer.

Step-2: Submit KYC Documents along with the Standard Application Form.

Step-3: Fill-up the Pay-in-Slip for the Locker Rent i.e., for the Proposed Locker (to be taken by the Hirer).

Step-4: Fill-up the ‘Fixed Deposit Form’ along with Pay-in-Slip for Annual Rent of the Safe Deposit Locker (Interest on the Fixed Deposit to be used for Annual Rent as per the Standing Instruction of the Customer).

Step-5: Fill-up the “Locker Agreement by the Customer” affix the required Stamps as per Indian Stamp Act.

Step-6: (Step-1 to Step-5) All documents are to be verified by “Locker Authorised Official” as per extent Banks’ Systems and Procedures.

Step-7: Enter all details / particulars of documents of proposed Locker Hirer are to be entered in relevant Registers as per the Banks’ Systems and Procedures.

Step-8: Then, the Locker Authorised Official enter the relevant particulars of the Hirer in ‘Core Banking System’ under “Locker Module”.

Step-9: Handover the “Locker Key” to the Hirer after Scrutiny of all documents and Locker Rent Payment, Standing Instructions on Fixed Deposit Interest for Annual Locker Rent of Hirer etc.

Step-10: Take the Signature(s) of the Customer(s) in the ‘Locker Access Register’ by mentioning Date, Time and Locker Number and duly verified and Signed by the “Locker Authorised Official” to access the ‘New Locker’ allotted to the Hirer.

Step-11: Proceed the Locker Room and show the allotted Locker to the Hirer (Locker Customer) through Opening of Master Key (Bankers’ Key) along with Locker Holder Key.

Step-12: Once the Operations of Locker Completed by the Customer, the Concerned Official has to verify the Locker, whether the Hirer is “**Properly Locked or Not**” and ‘Certify’ the same in the Locker Access Register (On the

Same Page of Locker Access Register as mentioned in **Step No.10**).

Step-13: Enter the particulars like Time and Date of Accessing Locker in Core Banking System and CBS System will generate ‘SMS to the Registered Mobile’ of the Customer. Like SMS to the Registered Mobile of the Customer in case of Debit / Credit Transactions in Deposit Accounts.

Total Process Time: For ‘Safe Deposit Locker (New Locker Account)’ - One Locker Hirer:

- o **Step-6 to Step-13** will take around 1 Hour (60 Minutes) -This time is subject to other factors like Distance from “Banking Hall to Locker Room in the Branch”, Number of Persons to for each Locker (i.e., in case of Joint Hirers / E or S etc.), Hirers like Companies, Trustees or Societies etc. (Will take more time to Scrutiny the Documents and Process Time etc.).

Total Process Time: For Existing Locker Holder – For Each Locker Operation:

- o **Step-10 to Step-13** will take ~ 20 Minutes - This is subject to the Distance from Banking Hall to the Locker Room etc.

Number of Locker Hirers Visit per day at Bank Branches: It is very difficult forecast by Bank Branches to predict the How Many Customers Will Operate Locker on Day-To-Day Basis and it depends on number factors like:

- o Need / Urgency of the Customer to ‘Take or Deposit’ the Important Documents or Jewellery from / to Locker.
- o Before or After various Festivals, normally the Locker Operations will be more.
- o During Functions that are happen at Hirer House or Friends & Relatives.
- o During Marriages Season, the Locker Operations are more when compare to other Days.
- o To avail Loan on Gold (To Pledge to Bankers) or Take Loan on Security Documents (By way of Mortgage) etc.

Due to the above reasons / factors, Bank Branches may not provide “Full Fledge Official” for Locker Operations at the Branch. Particularly where ‘Average Lockers at the Branches’ are in the range of ~ 600 or ~1,000 Lockers.



Time and Motion Study of Locker Operations

(Pioneered by: **F.W Taylor** - Scientific Management)

If the Bank Branch allocate the Additional Duty to the ‘Official’ along with other Bank Operations, the following are the Challenges to General Customers (including Locker Customers) and the Bank Officials:

- ✓ When the Locker Customer wishes to ‘Operate his / her Locker’ at the Branch, he has to approach the Designated Official at the Branch. If the official assigned “Multiple Tasks” by the Branch Manager, attending to ‘Locker Operations’ of Hirers of the Branch is an Interruption to the official while he is attending to other Customers like Deposit Customers, Borrowers, Remittance Products etc. Thereby, he may not provide adequate attention/ instant service to the Locker Hirer requests i.e., Operations of the Lockers.

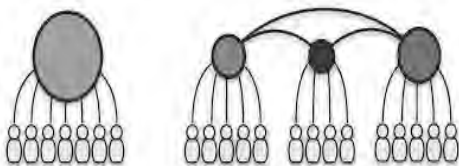
- ✓ If Bank Official attend for Locker Customer, delay in providing service to the Non-Locker Customers. Thereby:
 - Both Customers (Locker and Non-Locker) will feel Bad on account of ‘Additional Charge / Multiple Tasks’ handling by the Bank Official.
 - Multiple Tasks Creates not only inconvenience to both type Customers, but also scope to increase Errors and thereby it increases the ‘Operational Risks’ of the Bank Branch.
 - If number of Locker Operated Customers are High in a particular Day, he may not provide adequate attention / time to Serve the Non-Locker Customers. Thereby Customer Complaints will increase as Each Locker Operation for Locker Customers is take a Minimum of 20 to 30 Minutes. Due to the following Operations:
 - Verify the Locker Customer Credentials like Photograph / Signature in the Core Banking System (Locker Module in CBS).
 - Obtain the Locker Hirer Signature, by mentioning the Date and Time and Signature attestation of the Customer etc. in Locker Access Register.
- Go to Safe Deposit Locker Room and to Operate the Master Key of the Locker and to give access to the Locker Hirer to open his locker.
- Once, Locker operation is over, the same official has to verify once again whether the Locker Hirer properly locked the locker or not and he has to certify in the Locker Access Register (This System is followed by most of the Banks).
- If the Bank Branch is having 600 to 1,000 Lockers, and if 6 Customers are visit to the Branch to operate the Lockers per day. The Official has to spent a minimum of **3 Hours** for Locker Operation Services.
- Due to Cost Control measures / Austerity measures / Optimum utilisation of Manpower etc. some of the Banks are adopting the Strategy like assign ‘Locker-in-Charge’ as additional charge / duty to the Officials who are handling Deposits / Advances/ Remittance etc.

Centralization Vs. De-centralization of Locker Product: The following are the Disadvantages in the ‘Distributed System of Locker Facility’ i.e., Locker Facility in all Branches:

- ✓ Inconvenience to both Non-locker and Locker Customers if Locker-in-charge and tasks assigned to the Single Official. Thereby it interrupts not only the Customer Service but also Increase in Complaints.
- ✓ Creation of 'Locker House / CPCs' will increase the Productivity of the Bank Officials and also decreases the Errors in Bank Operations.

'Cluster-Wise' Centralization of Locker Services (For a Group of 10 to 20 Branches):

Centralization Vs. Decentralization



In Metros, Cities, Urban Areas (Tier-1 to Tier-3), Concentration / Density of Bank Branches are more when compare to Semi-Urban and Rural Areas (Tier-4 to Tier-6). In Metros, Cities and Urban Areas on an Average the 10 to 20 Branches are situated within a proximity of distance / radius of 100 to 200 Meters. This is due to Mobilize the Potential of Business.

The following are the Advantages of 'Cluster-Wise' Centralization of Locker Product of the Bank i.e., Opening of 'Locker Houses' instead Locker's facility in all Branches.

Advantages of Opening of 'Locker Houses' - 'Cluster' of Bank Branches:

As the Commercial Banks are focusing on "Cost Optimization" with regard to Bank Transactions Costs / Overheads / Manpower Costs etc., Centralization of "Safe Deposit Lockers" gives not only Cost Optimization but also other Visible Benefits will accrue to the Banks. And it also improves the Customer Service and Customer convenience.

The following are the Monetary and Non-monetary benefits to the Banks on account of Centralization of Safe Deposit Lockers i.e., Creation of 'Locker Houses':

- a) **Premises:** A Locker Room requires a minimum of 200 to 300 Square Feet (depends on the number of Locker Cabinets) for the following:
- ✓ A Minimum of 400 to 600 Lockers (In Metros, Cities and Urban Areas).
 - ✓ Dressing Table with Mirror and Carpet in Locker Room.
 - ✓ Free Movement / Passage of Locker Hirer in Locker Room.
 - ✓ Adequate Space between TWO Locker Cabinets.
 - ✓ Provide Adequate Space for easy Cleaning of Locker Room on Daily Basis.

Due to Centralization, Wastage of Space will not arise due to proper Design / Lay Out of "Locker Houses".

After shifting of Lockers from the existing Branches, the Branches can utilize the ‘Locker Room Space’ in an optimum manner or De-hire (Excess Carpet Area) or Hire a suitable premises with less Carpet Area by taking into account of Business Potential, Coverage of more Customers etc.



As Digital Banking Grows, Branches Get Smaller (Reduction in Real Estate Cost):

Banks are Re-modelling their Branches to make them more Tech-driven.

Kerala-based Federal Bank, for Example, has Shrunk the Size of its Newly Built Branches from 1,200 - 1,800 Square Feet to 800 - Odd Square Feet.

b) Optimum Utilization of Manpower:

For Cluster of Branches, if Banks open ‘Locker House’, it not only optimises the Manpower Costs but also other overheads and it improves the Customer Service of the Bank to a large extent. Number of Lockers to be placed in

‘Locker House is around 4,000 to 5,000 (Depends on the Potential / Demand for Safe Deposit Lockers) and additional lockers based on Potential / Demand. Due to ‘New Business Model’, the following are the other benefits:

- ❖ Non-stop Services can be provided by the Banks (from 9 am to 9 pm) to the Locker Hirers.
- ❖ Two Officers and One Executive is sufficient to handle 4,000 to 5,000 Lockers in ‘Locker House’ (Based on the Historical Data, only 2 to 3% of the Locker Hirers will Operate the Lockers out of Total Lockers. Thereby, it optimises the Manpower Costs.
- ❖ Further scope to increase “Locker Business”, if exclusive “Locker Houses” are opened by Banks. Thereby it increases the Non-Interest Income to the Bank.
- ❖ Creation of ‘Locker House’ is a Specialised Function of the Bank. Thereby it increases the efficiency / productivity of Locker Operations and reduces Errors. It mitigates the Operational Risk due to Specialized Function.
- ❖ The other visible benefits to the Banks are reduction in overall Electricity Costs, other Overheads and Reduction Rent (when compare

to lockers are scattered / distributed in Bank Branches).

- c) Real Estate Cost:** The Locker House location may be identified a mid-point of the Cluster of Branches and Non-Commercial Place where the Public Movement is Moderate due to Security Reasons. At these places the Rent (Real Estate Cost) is Cheaper when compare to Commercial or Prime Localities. Most of the Locker Hirers are located / scattered far away from the Branches and staying in Residential localities / places and are far away from Commercial Places.

During the Tender System, Bank may put conditions to the prospective Landlords that ‘Locker House’ is to be constructed as per the “Bank Design / Layout / Specifications”.

- d) Image Building:** One of the strategies to increase Number of Locker Customers to avail “Locker Facility of the Bank” is through Image Building Process or ‘USP’. To create Image Building, the following measures to be taken by the Banks while selecting the **Premises for ‘Locker Houses’** i.e.,

- Adequate Space to be created for Car Parking at “Locker House” for Car Parking of Locker Hirers. This type of facility is not possible

at Branches where the Branches are located in Commercial / Prime Areas. As Most of the Locker Holders are either ‘High Net-Worth Customers’ or ‘Elite Customers’ using OWN Vehicles while Visiting to the Bank Branches to access the Lockers. They are feeling inconvenience on account of Non-availability of Car Parking Facility at the Branches and also feeling insecurity to carrying the Gold Ornaments / Valuable from the Lockers. Exclusive Locker Houses, give comfort and convenience to the Elite Customers of the Bank.

- ‘Good Lounge’ Facility for Sitting of ‘Elite Customers’ and also to be placed Electronic Token System etc. The following infrastructure to be placed in the Lounge to attract / Mobilize further business from the Elite Customers i.e., Locker Hirers.
 - “Advertisement Material of Bank Products” like Housing Loans, Car Loans are to be displayed in the Lounge including ‘Third Party Products’ and ‘Wealth Management Services’ of the Bank etc.
 - To Built-up ‘Relationship Management’ of ‘High Net worth’ or ‘Elite’ Customers

gives further business to the Bank Books. This is possible by creating ‘Locker Houses’ by the Banks. Due to Technology Developments in the Bank Products, Bank Operations and also Increase in Alternate Delivery Channels of the Banks, the Foot Falls of the Customers are gradually decreasing particularly in Metro, City and Urban Places. Customers are Visiting to the Bank Branches for few transactions i.e., to avail the Various Type of Loans or to access the Lockers etc. (In some Banks, the prospective borrowers who wish to avail either Retail Loans, MSME Loans, are visiting to Central Processing Centres instead of Branches).

- Locker Facility offered by the Bank Branches is one Product to interact with the Customer (Locker Hirer). If Locker Facility is provided at the Branches, focused attention of High-Net-Worth Customers is not possible. Hence, creation of ‘Locker Houses’ give huge benefits to the Banks instead of Locker facility provide by the Banks through their Branches.

Decentralization (within the Branch) Vs. Centralization (Locker Bank)

(Cost-Benefit-Analysis)

1. Average Cost of the Locker Cabinet: **₹.2.40 Lacs.**

Remarks: Cost of the Locker Cabinet depends on the Company, Brand, Number of Lockers in a Cabinet, Size of each Locker, mixing of different Sizes of Locker within the Cabinet, Transportation Costs (Based on the location of the Bank Branch), Installation Costs (Ground Floor or 1st Floor or 2nd Floor of the Branch Premises etc.)

2. Average Number of Lockers for each Cabinet: **75.**

Remarks: It depends on the Length, Breadth and Height of the Locker Cabinet. Some companies are manufacturing Locker Cabinets as per the requirements of the Banks (Tailor made).

3. Average Minimum Space Occupied by One Locker Cabinet: **20 Square Feet.**

Remarks: It depends on the Size of the Locker, particularly the Length and Breadth of the Locker cabinet.

4. Average Locker Room Size of a Bank Branch: **200 Square Feet.**

Remarks: It depends on the number of Locker Cabinets installed at the Branch. If the Branch is having good potential the number of Lockers to be placed in the Locker Room, more space will be required. Then the Locker Room Size proportionately increase.

5. Average Square Feet of Locker Room Rent (Real Estate Cost): **The Locker Room Rent is in the Range of ₹.100/- to ₹.200 per Square Feet.**

Remarks: It differs from place to place. In Metros, Cities the Real Estate Cost (Square Feet Cost of Locker Room

Rent) is High when compare to Urban, Semi-urban and Rural Areas.

6. Reputed Manufactures of Locker Cabinets: **Godrej, Steelage, Chubbsafes, Minimax etc.** Basic Standards / Benchmarks for Safety and Security as prescribed by Bureau of Indian Standards (BIS).

Remarks: The Price of the Locker and GST depends on the reputation of the Company, Brand and also the quality of material used, the functionalities (like double locking system for each locker etc.) by the Companies.

**Average Cost per Branch per month
(Based on 5 Locker Cabinet Installed)**

Elements Cost	Amount (₹.)
Depreciation Per annum @ 10% on ₹.2.40 Lacs. (Per Month) × 5 Locker Cabinets	10,000.00
Rent per Month (200 Sq. Ft. x ₹.150/- Sq. Ft.)	30,000.00
Electricity per Month (For 200 Sq. Ft. – At Commercial Rates)	2,000.00
Sweeping & Maintenance Cost Per Month	2,000.00
Total Overheads	44,000.00
Manpower Cost (Official / Executive) per day 2 Hours Spent ₹.80,000/- Average Salary per month (Total Hours 8 Hours) – 25%.	20,000.00
Lockers Access Register / Records, System Usage, Documentation etc.	4,000.00
Total Cost Per Month – Per Month – Per 5 Locker Cabinets – 75 Lockers Per Cabinet – 200 Sq. Ft. Room – Daily 2 Hours Spent by Bank Official etc.	68,000.00
Average Rent Revenue to the Branch for 400 Lockers (Hired Lockers 70%) ₹.3,000/- x 280 Lockers / 12 Month.	70,000.00
Loss (Per Month) Per Branch	2,000.00

Cost-Benefit-Analysis of Creation of “Locker House”

- 1. Average Cluster of Branches:** Exclusive Locker Branch / Locker House / Centralization of Lockers to be opened by the Bank for Cluster of Branches i.e., where the number of Branches is 10 or more.
- 2. Average Number of Lockers in Locker House:** Average number of Lockers of Different Sizes are in the Range of 4,000 to 5,000 Lockers in one Locker House. With suitable Car Parking, Security

Systems, Good Ambiance and Adequate Space for Wealth Management Counter/ Third Party Products / Bank Credit Products for mobilization of business from the Elite / High Net-worth Customers (Locker Hirers).

- 3. Distance Coverage:** The “Locker House” should be centrally located amongst the Cluster of 10 or above Branches in Metro, City, Urban areas with a radius of 10 km from North, East, West and South directions of the Metro / City / Urban.

Centralization of Lockers (Locker House) (With 50 Locker Cabinets with 2,500 Sq. Ft Premises)

Elements Cost	Amount (₹.)
Depreciation Per annum @ 10% on ₹.120 Lacs. (Per Month)	1,00,000.00
Rent per Month (2,500 Sq. Ft. x ₹.100/- Sq. Ft.)	2,50,000.00
Electricity per Month (For 5,000 Sq. Ft. – At Commercial Rates)	20,000.00
Sweeping & Maintenance Cost Per Month	40,000.00
Total Overheads	4,10,000.00
Manpower Cost (2 Officials / 1 Executive) ₹.80,000/- + ₹.40,000/- Average Salary per month.	2,00,000.00
Lockers Access Register / Records, System Usage, Documentation etc.	10,000.00
Total Cost Per Month – Per Month – 50 Locker Cabinets – 100 Lockers Per Cabinet located in 2,500 Sq. Ft. Room etc.	6,20,000.00
Average Rent Revenue for 4,000 Lockers (Hired Lockers 80%) ₹.4,000/-(Average Rent from Small to Extra Large Locker) x 3,200 Lockers / 12 Month.	10,66,666.00
Surplus (Per Month)	4,46,666.00

Success Story – Centralization of Lockers

ICICI Bank has introduced the most Advanced, First-of-its-kind Locker Service in India, the ‘Smart Vault’. It safeguards Locker Hirer Valuables and provide the Convenience of accessing them Any Time, Any Day.

It is the Best in Convenience and Safety; the Smart Vault is designed with State-of-the-Art Robotic Technology and High-end Security.

The Smart Vault is powered by revolutionary Robotic Technology that minimizes Human Intervention while Operating the Locker. The Advanced Radio Frequency Identification (RFID) enabled mechanism Scans the Customer request and retrieves Customer Locker using Robotic Arm from Bank’s Robust and Secure Vault.

Customer Locker is made available to the Customer Conveniently at a Kiosk. After Customer Work with the Locker is complete, The Robotic Arm Also Retracts Customer Locker Back to its Secured Location.

Link: <https://www.youtube.com/watch?v=3CZJVku5ym4>

To Conclude, Time and Motion Study and Cost-Benefit-Analysis of Non-Financial Product of the Banks i.e., Hiring Lockers is gives visible benefits to the Commercial Banks by creating ‘Locker Houses’. The following are the visible benefits to the Banks.

✓ ‘Specialized Service’ is possible to ‘High Net Worth / Elite Customers’ in Banks.

✓ Creation of “Locker Houses” for Cluster of Branches gives Cost Advantage to the Banks like:

- Reduction in ‘Real Estate Cost’ i.e., Rent, other Overheads.
- Optimum Utilisation of Manpower/ Reduction in Manpower Costs.
- It Improves Customer Service

at Bank Branches (Depositors / Borrowers etc.)

- It minimizes the Operational Risks at Bank Branches. And specialized Service to the Elite Customers through “Locker Houses” of the Bank.

As the Bank Branch Customers are Scattered Across the City due the expansion of Cities / Metros / Urban Areas in Four Sides of the City, this is the right time for the Banks to create “Locker Houses” at Strategic Places.

Thereby it is WIN Situation to the Bank and their Customers (Locker Hirers).

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- (c) RBI/2021-2022/86 DOR.LEG.REC/40/09.07.005/2021-22 dtd: August 18, 2021.

Cryptocurrencies in India : A Perspective

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Abstract:

Cryptocurrencies came into existence in last one decade, and have gained a lot of attention from investors' community. Legendary investors like Warren Buffett are not in favour of these currencies due to non-existence of intrinsic value. Concepts such as 'Internet of Value', 'decentralization of finance', and 'application of blockchain technology' have contributed to the emergence of this new phenomenon. This chapter is about Cryptocurrency market in India. It covers underlying objectives behind emergence of cryptocurrencies across the world and in India, their use, controversies associated with their use, trading platforms for their trading in India, and risks associated with cryptocurrencies. Suggestive framework for appropriate development in the domain, i.e., cryptocurrencies in India has been proposed at the end.

Key Words: Cryptocurrency, Internet of Value, Blockchain, Bitcoin, Intrinsic Value

“In terms of cryptocurrencies, generally, I can say almost with certainty that they will come to a bad ending. Now, when it happens or how, or anything else, I don’t know.”

- Warren Buffett in an interview on CNBC

(Quoted in Fortune magazine dated January 11, 2018)

Introduction

Crypto- as prefix to cryptocurrency stands for ‘cryptography’. It is backed by a technology which keeps information safe and hidden from attackers. The first established cryptocurrency is ‘Bitcoin’. A person named Satoshi Nakamoto (real identity unknown till date) posted a paper titled, ‘Bitcoin – A Peer to Peer Electronic Cash System’. First time, it was traded in 2010 when 10,000 units were swapped for two pizzas. Due to popularity of Bitcoin over a period, alternative cryptocurrencies, known as ‘altcoin’ appeared. Emphasis of ‘altcoin’ is on increasing the speed, anonymity attached, or any other advantage. By January 07, 2021 total market capitalization of cryptocurrencies touched \$1 trillion. Among all cryptocurrencies, the leading one is Bitcoin.

Legendary investor, Warren Buffett (called ‘Oracle of Omaha’) has argued that bitcoin (a cryptocurrency) has ‘no intrinsic value’. On valuing bitcoin, he argued that bitcoin is ‘not a value-producing asset’. To quote his words: ‘You buy something like Bitcoin or some crypto-currency; you don’t really have anything that has produced anything. You’re just hoping the next guy pays more.’

He considers that investment in cryptocurrencies is merely a speculative ‘game’ and a ‘gamble’ which ‘no one knows exact what it is. In an interview on January 2018, he went on to suggest that ‘crypto-currencies will come to a bad end’. He swore that he would never buy Bitcoin. Renowned economist Nouriel Roubini and prominent American stock broker Peter Schiff have also viewed bitcoin as a speculative asset with no intrinsic value.

In contrast to this, many crypto-currencies have come into existence. Bitcoin, the largest and the oldest, which was launched in 2009, has touched a level of \$41,793.73 a unit on January 8, 2021 from less than \$50 a unit in 2009. Just in 2017, it touched a level of \$20,000 in December from about \$1,000 for a unit in the beginning of the year. Total market value of cryptocurrencies crossed \$1 trillion on January 07, 2021 out of which Bitcoin alone forms two-third of cryptocurrency market value followed by Ethereum to the tune of almost 14%.

Cryptocurrencies versus Fiat Money:

Central banks of countries control the issue of currency. Crypto-currencies are anti-thesis to this control as crypto is decentralized and open source. The world’s

largest and oldest crypto currency is Bitcoin, others being Ripple, Ethereum, etc., around more than 7,800 cryptocurrencies very recently. A major difference between cryptocurrencies and fiat money is that value of cryptocurrencies is not anchored to any fundamentals as is the case of fiat currencies for which one can assess fair value by using variables such as inflation rate, data on Current Account or Capital Account, growth or decline of the GDP, data on import-export, etc.

Underlying Objectives behind the launch of Cryptocurrencies: Decentralization of finance’ remained a key objective behind launch of Bitcoin. Further, it was designed to act as a secure peer-to-peer (P2P) decentralized payment system. It is using C++ programming. The vision behind the launch of Ethereum was to facilitate ‘smart contracts’ or ‘contracts written in code’, which have the potential to club cryptocurrency with the instruments of conventional finance. Ripple (or XRP) was created for payments and remittances, and its manner of working is similar to that of SWIFT. Bitfinex, a cryptocurrency exchange owns Tether Limited. USD tether (or USDT) attempts to mirror the US dollar on a 1:1 basis. In addition to USD pegging, there ‘tether cryptos’ are available which are pegged to the Euro and Chinese Yuan.

Connected Terms: ‘Internet of Value’ (IOV), ‘decentralized finance’, and ‘cryptocurrencies’ are connected terms. ‘Internet of Value’ enables “the exchange

of any asset that is of value to someone, including stocks, votes, frequent flyer points, securities, intellectual property, music, scientific discoveries, and more”. Decentralized Finance (DeFi) is a new monetary and financial system built on public blockchains.

‘Mining’ of Bitcoin (a dominant cryptocurrency): Creation of bitcoin (called ‘mining’) in absence of any underlying asset, is the most controversial as it entails ‘wastage of energy resources’. Broadly, energy resources can be divided into ‘hydro regions’ (due to abundance of hydro-power) and ‘non-hydro regions’ (using fossil, nuclear, wind generation, or solar). Carbon footprint of cryptocurrency network is huge. The main producers of specially designed chips which are used in mining rigs, are Samsung Electronics Co and Taiwan Semiconductor Manufacturing Co.

Factors contributing to the growth of Cryptocurrencies: - There are certain factors which contributed to the growth of Crypto-currencies. Major factors are as follows:-

1. **Decentralized Finance:** - Concentration of power to issue currency notes with the central banks and demands for de-centralization of this power is one major contributor to the growth of crypto-currencies.
2. **Printing of currency notes by governments and de-linking the**

same from underlying asset, i.e., gold with the use of fiat money: - Some of the currencies lost significant value that residents have lost trust in their currency in certain countries, e.g., in Venezuela, use of Bitcoin by farmers despite its more volatility than most conventional currencies, because of the fact that Bitcoin was considered more stable than Venezuela's Bolivar (the Economist, November 21, 2019).

3. **Scams, e.g., London Inter-Bank Offer Rate (LIBOR) Scam and erosion of Trust in Central Banks:** - Scams result into erosion of trust in governments and central banks. For example, LIBOR scam came to the light in recent past. Now, it is going to be abolished from December 31, 2021. The rise of Bitcoin is partly attributed to the lack of trust in governments.
4. **Trend towards regulation instead of Banning Cryptocurrencies:** - Most countries have not enforced any ban on crypto currencies. Instead of banning, rather tax is imposed on gains to increase revenue of the government. This has also encouraged the use of cryptocurrencies.
5. **Governments interested in launch of digital currency:** - More and more governments are showing their willingness towards launch of digital currency. For example, in October 2020, Chinese government in Shenzhen handed over \$1.5 mn (10 mn yuan) worth of digital currency, and allowed

the recipients to spend it at more than 3,000 merchant establishments.

6. **Interest of Big Corporations in Cryptos:** - Facebook was readying to launch cryptocurrency (Libra) in January 2021 itself. Regulatory concerns were expressed worldwide on the entry of players like FB or Google as it was feared that by creating their cryptocurrencies, these organizations can control our lives. Due to this reason, 'Libra Association' was renamed as the 'Diem Association'.
7. **Availability of Digital Foundational Infrastructure:** - Availability of Digital Foundational Infrastructure has contributed to the growth of cryptocurrencies. For example, in India, Aadhaar, GSTN, UPI and PM-JAY are notable examples. This seems to be a main reason behind 8-10 mn accounts dealing in cryptocurrencies.

Recent developments regarding Cryptocurrencies across the world: - Many developments in recent past, are expected to give more visibility to Crypto-currencies. Some of these developments are as follows:-

1. Certain governments of various countries, e.g., Chinese government, are planning to create its own digital currency. China carried out a major trial in October 2020;
2. A cryptocurrency index is expected to be launched by S&P Global to track over 550 different cryptocurrencies;

- | | |
|---|---|
| <ol style="list-style-type: none"> 3. Managed crypto investment services are being offered by almost half a dozen global investment management firms. 4. More than 7800 cryptocurrencies were in existence till first week of December 2020. The number of such currencies, is going up at a fast pace. 5. JP Morgan Chase & Co. is bullish and sees the upside potential in Bitcoin and | <p>expects that it has potential to reach \$146,000 in the long-term.</p> <ol style="list-style-type: none"> 6. In the last quarter of the year 2019, China unbanned bitcoin mining. One study (The Bitcoin Mining Network, June 2019) found that almost 60 % of bitcoin hash rate originates from one country, i.e., China, which shows China’s dominance in bitcoin mining, and is considered a sign of worry. |
|---|---|

Table 1: Top Five Currencies, their Creators and Year of Launch

Name of Cryptocurrency	Creator/Launched by	Date/Year of Launch
Bitcoin	Satoshi Nakamoto (otherwise, an unknown person)	January 03, 2009
Ethereum	Vitalik Buterin, a Russian-Canadian programmer	July 30, 2015
Ripple (or XRP)	Ripple Labs Inc., a US company	January 2013
USD tether (or USDT)	Brock Pierce, Reeve Collins, and Craig Sellars (of Tether Ltd.)	2014
Litecoin	Charlie Lee	2011

Source: Borate, Neil (2020, December 18). How the top 5 cryptocurrencies fared in 2020. *Mint*. Harm, Julianne et al. Borate, Neil (2020, December 28). Tether changed the way we look at cryptocurrencies. *Mint*.

Seismic events associated with Cryptocurrencies: Even though there are numerous seismic events associated with Cryptocurrencies. Some of the recent ones are listed below: -

- (1) In 3rd week of January 2021, Bank of America termed bitcoin the ‘mother-of-all-bubbles’.
- (2) On December 22, 2020, a US lawsuit was filed against Ripple Labs Inc. in

- which the US Securities and Exchange Commission (SEC) argued that Ripple (or XRP) is not a currency. Rather, it has to be treated as a security. Hence, prior approval of SEC is required to launch it. The complaint against Ripple was that it raised almost \$1.3 bn through an unregistered digital asset securities offering.
- (3) In 2020, a huge amount has been stolen from global crypto exchanges

by hackers, such as \$280 mn from Seychelles-based KuCoin, \$5.4 mn from Eterbase, €1.2 mn from 2gether, and \$3.1 mn from crypto-friendly neo-bank Cashaa

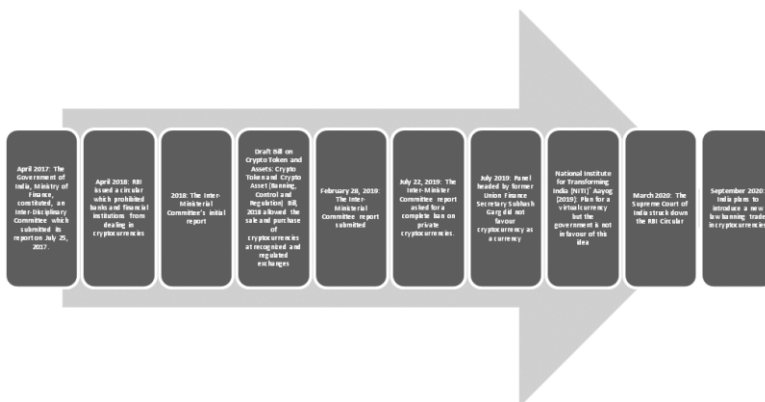
- (4) As per a report (Bloomberg, November 18, 2020), just 2% of the anonymous ownership accounts control almost 95% of the digital asset. In this situation, just one trade can affect the price of cryptocurrency to a great extent.
- (5) In February 2019, Gerald Cotton, 30-year-old founder of Quadriga CX, Canada’s largest cryptocurrency exchange, died. With his death, whereabouts of about C\$180 mn (\$135 mn) went with him in grave.
- (6) In Year 2014, MtGox, one of the

world’s biggest online cryptocurrency exchanges, shut down. In the process, nearly 850,000 Bitcoins (valued at \$0.4 bn) were lost.

- (7) Crypto trading is blamed for many adverse consequences for an economy, e.g., Bitcoins were used to bypass restrictions imposed by the European Union (EU) on currency conversion at the time of Cyprus financial crisis in 2012.

A prominent Russia-based cyber security firm, Kaspersky, has warned of increase in Bitcoin theft in this year. Underlying reason stated is that pandemic will affect some economies badly and real-world currencies are expected to fall, so it will encourage theft of Bitcoin, because of its higher valuation, and its popularity.

Cryptocurrencies and India: A Timeline



Landmark case decided on March 04, 2020: - The Honorable Supreme Court in the case of Internet and Mobile

Association of India Vs. RBI paved the way for cryptocurrencies (referred as Virtual Currencies in the verdict). It was noted in

this case that the RBI issued public notices on December 24, 2013, February 01, 2017 and December 05, 2017, to caution various stakeholders comprising users, holders and traders of virtual currencies, by citing the associated risks. It also cited the raids of Enforcement Directorate on Ahmedabad-based Bitcoin trading firms namely, rBitco.in and buysellbitco.in on December 27, 2013. It also cited examples on usage of virtual currencies by terrorist organizations. In defence, the RBI quoted the warning of the Bank for International Settlements (BIS) that “cryptocurrencies have become a combination of bubble, a Ponzi Scheme and an environmental disaster, and calls

for public policy responses. Judgement used analogy of Vedic analysis of negation “neti neti” to capture the essence of that to which no other definition applies, for virtual currencies. The judgement also cited emergence of the idea of digital cash by quoting various examples, e.g., Digicash launched by David Lee Chaum (an American computer scientist and cryptographer) in 1990 and then filing of bankruptcy in 1998. It was observed that virtual currencies do not qualify as money due to non-fulfillment of four characteristics of money, i.e., a medium of exchange, a unit of account, a store of value and a final discharge of debt. Hence, the ban imposed by the RBI was treated as disproportionate restrictions.

Table 2: Cryptocurrency Exchanges in India and their founders/CEOs

Name of Cryptocurrency Exchange	Name and Title of Founder/Co-founder/CEO	Year of Inception of Cryptocurrency Exchange
WazirX	Nischal Shetty and Siddharth Menon	2017
CoinDCX	Neeraj Khandelwal and Sumit Gupta	April 7, 2018
Bitbns	Gaurav Dahake	
CoinSwitch	Ashish Singhal, Govind Soni, and Vimal Sagar Tiwari	2017
ZebPay	Sandeep Goenka, Mahin Gupta, and Saurabh Agrawal	2014
Unocoin	Sathvik Viswanath and Harish B V	2013

Source: Top 5 Best Cryptocurrency Exchanges in India 2020 (2020, August 25). The Week; Dutta, Vishal (2018, April 9). CoinDCX starts cryptoexchange in India; firm says complying with all regulations; Mandavia, Megha (2021, January 13). CoinSwitch raises Rs. 109 crore in Series A funding. *Economic Times*. Palande, Praveen (2017, October 26). Zebpay and its big bet on bitcoins. *Forbes India*. First Indian bitcoin company Zebpay raises \$1 million (2016, January 7). *Financial Express*. Chitra, Rachel (2018, October 19). After arrests of Unocoin founders, India’s crypto scene in turmoil. *Times of India*. <https://zebpay.com/in>

There are more than a dozen cryptocurrency exchanges in India. Mumbai-based WazirX is presently the largest crypto exchange by volumes in India. It has been acquired by Binance, a prominent global cryptocurrency exchange. CoinSwitch Kuber, India exclusive crypto platform was launched by CoinSwitch in June 2020. Unocoin is India’s first entrant in this space. Paxful is another leading player. ZebPay claims that 2/3rd of Indians bought their first bitcoin on their platform. Other cryptocurrency exchanges are BuyUcoin, Giotuss, etc.

Market size and Players: India has traded Bitcoins worth \$94,794,948 between 2015 and 2020. With this amount of trading, India has become the second largest crypto trading market in Asia. Penetration level has gone up by the first week of January 2021 and now, there are 8-10 mn accounts as per one estimate. Another estimate is that more than 1.7 mn Indians are trading in digital assets. An estimate quoted by a business daily, put the number of Bitcoins in India at 8,000-10,000 which are held in Individuals’ account. This excludes those bitcoins which are traded on regular basis, or which are lying for trading in wallets maintained with exchanges.

Offerings from Crypto-currency Exchanges in India: Crypto-currency exchanges have the following offerings in India which vary from exchange to exchange otherwise-

- Spot trading, where exchanges act as intermediaries between a seller

and a buyer and traders exchange cryptocurrencies

- Over-the-counter (OTC) service where buyers buy cryptocurrencies from the exchange itself
- Derivatives
- Systematic Investment Plan (SIP) for regular purchases

These exchanges are charging a small percentage of transaction amounts as the fee. A loading fee is also charged by these exchanges. More and more offerings are coming up, e.g., now, investors can trade a millionth part of a bitcoin, called Satoshi. One can start trading with a minimum value of almost Rs. 150. For storing crypto-currencies, there are two alternatives. One can store it in a personal wallet on one’s device. One has to take good care of the same as otherwise, one can lose the cryptocurrencies. Alternatively, one can keep it in ‘custodial wallet’, i.e., keeping crypto-currencies with the exchange’s wallet.

Table 3: Daily value of Cryptocoins with Top Exchanges as reported on January 04, 2021

Volume	\$ mn
WazirX	58.4
Zebpay	44.8
BitBNS	37.2

Source: Bhayani, Rajesh (2021, January 5). Cryptocurrency trade may be more action-packed in 2021. *Business Standard*.

Banking Services to Crypto-currency Exchanges in India: Banks were prevented by the RBI, from providing banking services to crypto-exchanges. It offered opportunities in this space. A private entity, Cashaa, took advantage of the situation and by the first week of January 2021, it was providing banking services to almost 90% of India's crypto exchanges. Cashaa has also started providing loans against Bitcoin as collateral with a Loan-to-Value (LTV) ratio of 50-70%. It has also allowed holders of Bitcoin and other cryptocurrencies to buy products and avail services. It also entered into collaboration with Jaipur-based The United Multistate Credit Co-Operative Society that has 43 branches, to launch UNICAS. UNICAS became the world's first crypto-friendly financial institution with physical branches. UNICAS also allows the conversion of crypto-currencies into Indian rupees to pay merchants. It has plans to scale it up to 100 branches across the country by the year 2022.

Demand aspect in Indian context: From March 2020 to the first week of January 2021, trading volumes of Bitcoin increased almost eight times, as the Supreme Court of India set-aside the circular of the RBI that disallowed banks to deal with cryptocurrency exchanges. In India, crypto-currency exchanges allow those

who are above 18 years to invest. Non-traditional banking services specifically targeted at cryptocurrency business, are likely to become another important area. In that way, the network to encourage usage of cryptocurrencies is likely to become bigger. Evidence also exists on the use of cryptocurrencies by the global poker fraternity and underlying objective is to evade taxes and to side-step regulations. Global remittances market is expected to use it extensively as use of cryptos will result into savings due to the fact that brokerage fees are less in comparison to bank charges. In recent past, a media report (*Mint*, Dec. 02, 2020) revealed that retail investors aged between 25 and 40 years are spending millions on trading in the cryptocurrency in India every day. The report cited sources from two of the top cryptocurrency exchanges in India, i.e., WazirX and CoinDCX.

Regulatory Mechanism for Cryptocurrencies in India: In India, there is no specific law that regulates cryptocurrencies. In December, 2017 Unocoin, Zebpay, Search Trade and CoinSecure came together to form a self-regulatory organization in the name of 'Digital Asset and Blockchain Foundation of India' (DABFI). It is yet to make a credible presence.

Complaints, court cases, allegations of frauds related to Cryptocurrencies in

India: - In recent past, many complaints, court cases, and allegations of fraud have been observed. Some of these are as follows:-

- (1) A case of Amit Bhardwaj was in news as the person has been accused of a scam involving \$300 mn. He used to promise a monthly return of 10 % on investments in Bitcoin under multi-level marketing (MLM) schemes.
- (2) In a recent court case, Achin Sharma sued IQ Option Europe, an online cryptocurrency trading platform, as he was charged exorbitant amount of hidden facilitation fees, and he was not able to withdraw his own money that he deposited. IQ Option Europe countered this claim and stated that they have more than 40 mn registered accounts across the world.
- (3) Hackers stole about \$3.1 mn from neo-bank Cashaa in July 2020
- (4) In December 2017, raids were conducted by the Income Tax Department at nine Bitcoin exchanges across the country, under the command of the Bengaluru investigation wing.

The surveys were conducted in Gurugram, Delhi, Bengaluru, Kochi and Hyderabad to ascertain the identity of investors, traders, transactions undertaken, identity of counterparties, bank accounts used for transactions, etc.

- (5) In December 2017, the Income Tax department issued notices to 400,000-5,00,000 High Net Worth individuals (HNIs) thereby asking them to disclose details of their transactions regarding bitcoins or other cryptocurrencies.
- (6) On December 27, 2013 the Enforcement Directorate officials raided the premises of two virtual currency exchanges, i.e., rBitco.in and buysellbitco.in. This was the first such bitcoin raid in India and it was the second globally after Federal Bureau of Investigation (FBI) conducted the raid in October 2013.

It has been observed that in India, cyber frauds around cryptocurrencies are related to 'initiation of fake crypto investment platforms', 'fake crypto wallet scams', 'malware targeting lesser-known cryptocurrencies', 'crypto-jacking', among others.

Suggested framework for appropriate development in this domain:

The following suggestions may be considered:

1. **Regulation Needed:** No specific law exists that regulates cryptocurrencies in India. The draft Banning of Cryptocurrency & Regulation of Official Digital Currency Bill 2019 has not been taken up yet. This is a grey area that needs regulation, as the Supreme Court has not banned cryptocurrencies and the proposed draft bill is stipulating that there will be punishment with a fine or imprisonment of up to 10 years on the use of cryptocurrency. In contrast to this, the Inter-Ministerial Committee's initial report in 2018, along with a draft Bill – Crypto Token and Crypto Asset (Banning, Control and Regulation) Bill, 2018 allows the sale and purchase of cryptocurrencies at recognized and regulated exchanges. In this background, regulatory framework is the need of the hour.
2. **Specific Law Needed:** - There are different legislations which provide protection in one way or the other. For example, Consumer Protection Act, Criminal laws and FEMA provide some protection. But the specific law can

provide better protection.

3. **Need to regulate service providers:**
- Crypto-asset intermediaries (crypto-currency exchanges, providers of 'wallets', technology providers, traders, etc.) need to be regulated.
4. **Needs clarity on taxation:** - Former Union Finance Secretary Sh. S.C. Garg opined that crypto-currencies could be categorized as commodities. In that case, it will be subject to Goods and Services Tax (GST) on sale and purchase. The Government is exploring a proposal on imposition of 18% GST on cryptocurrency transactions.
5. **Framework to deal with cryptocurrencies' vulnerability to money laundering and terrorist financing activities:** - Cryptocurrencies because of their inherent anonymous nature, makes them vulnerable to money laundering and terrorist financing activities. Hence, it is pertinent to put in place a mechanism to deal with this new threat due to financial innovation.
6. **Need to create awareness among investors on risks due to absence of 'underlying asset' and 'intrinsic value':** - Bitcoin prices have seen wide fluctuations. In Rupee terms, Bitcoin

was trading close to Rs. 22 lakh per unit on January 04, 2021.

Table 4: Bitcoin Price on different dates to indicate Price-fluctuation

Date	Bitcoin Price in USD
January 06, 2016	430.8
December 27, 2020	28,000.0
January 03, 2021	34,500.0
January 04, 2021	30,329.2
January 8, 2021	41,973.0
January 11, 2021	33,447.0

Source: Prices compiled from different sources listed in references

There was 280 % return for investors in the year 2020 itself and price has gone up from USD 430.8 to USD 30,329.2 in five years. Bitcoin touched the level of \$41,973 apiece on January 8, 2021, and it dropped about 21% in the worst two-day decline since March 2020 to reach at \$33,447 apiece on January 11, 2021. Such fluctuations in price of Bitcoin and higher valuations have raised the level of curiosity among investors. It acts as prompt for ‘get quick rich’ attitude, which make investors a prey for scamsters who notice the greed among investors. Investors need to know and understand the risks associated with cryptocurrencies.

Concluding Remarks: Cryptocurrencies are new instruments projected as a part of ‘Internet of Value’, promising ‘decentralized finance’ but it has a long-way to go in replacement of fiat-money. Absence of ‘intrinsic-value’ makes it riskier for investors. Wide-fluctuations in prices of major cryptocurrencies do not present a good picture. Millions of investors in India have already joined the ‘bandwagon’ in the hope of ‘easy money’ without understanding the risks associated with these instruments. Self-regulatory mechanism will not be sufficient in this background. For appropriate development of this domain, appropriate regulatory framework is required so that investors are protected and at the same time, innovation is also nurtured.

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Efficiency in Working Capital Management of Maharatana Central Public Sector Enterprises in India : An Empirical Analysis

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Abstract:

Management of Working Capital (WC) has always been a facilitating subject from the academic point of view and it must be admitted that in real world situation the genesis of success of a business firm lies in the efficiency of managing its funds employed in business operations including WC. So, the importance of WC management (WCM) even in the Central Public Sector Enterprises (CPSEs) cannot be ignored. In fact, it is recognized as a crucial area of financial management of all business firms belonging to both public and private sectors. A firm should neither have too high or too low investment in WC because both of them adversely affect its profitability. Efficient management of WC facilitates an entity in running its business wheel uninterruptedly as well as reaching profitability at optimal level by utilizing suitable amount of investment in WC. In the present paper a modest effort was made to analyse the WCM of all the ten Maharatana CPSEs during the period 2004-05 to 2018-19.

Key Words: Working Capital, Working Capital Management, Central Public Sector Enterprises

Introduction

The opening of the economy has changed the market dynamics in which private sector plays a key role in shaping the industrial landscape of the country. As a consequence, the Central Public Sector Enterprises (CPSEs) have been exposed to competition from domestic and multinational corporations. Some CPSEs have been able to reorient their business strategies and benchmark their performance with the best practices while others have failed to do so. The central government had identified the profit making CPSEs and empowered them by granting operational and financial autonomy in order to equip them to react proactively to market forces. Based on an assessment applying selected criteria, some CPSEs were awarded the status of “Maharatana” on 24th December, 2009. These CPSEs had been forced to re-orient their strategies for managing their working capital (WC) efficiently. Management of WC has always been a facilitating subject from the academic point of view and it must be admitted that in real world situation the genesis of success of a business firm lies in the efficiency of managing its funds employed in business operations including WC. So, the importance of WC management (WCM) even in the CPSEs cannot be ignored. In fact, it is recognized as a crucial area of financial management of all business firms belonging to both public

and private sectors. A firm should neither have too high or too low investment in WC because both of them adversely affect its profitability. Efficient management of WC facilitates an entity in running its business wheel uninterruptedly as well as reaching profitability at optimal level by utilizing suitable amount of investment in WC. Till now (July 2020) there are 10 CPSEs with “Maharatana” Status. They are (i) Bharat Heavy Electricals Limited (BHEL), (ii) Bharat Petroleum Corporation Limited (BPCL), (iii) Coal India Ltd (CIL), (iv) Gas Authority of India Limited (GAIL), (v) Hindustan Petroleum Corporation Limited (HPCL), (vi) Indian Oil Corporation Limited (IOCL), (vii) National Thermal Power Limited (NTPC), (viii) Oil & Natural Gas Corporation Limited (ONGC), (ix) Power Grid Corporation of India Limited (PGCIL), and (x) Steel Authority of India Limited (SAIL). The CPSEs account for over 22 per cent of the country’s GDP, contribute around 6 per cent to the total employment in the organized sector and make a contribution of around 20 per cent to the national exchequer by way of payment of direct and indirect taxes.

Numerous studies have been carried out addressing the different financial aspects of CPSEs. But no significant study on the issue associated with the WCM of Maharatna CPSEs has been made in the recent past. In this backdrop, the present paper makes a modest effort to analyse the WCM of all the

ten Maharatana CPSEs during the period 2004-05 to 2018-19.

Review of related literature

Jafar & Sur (2006) conducted a study in order to examine the efficiency of WCM in NTPC Ltd during pos-liberalization era. The study revealed that the selected companies which were taken into consideration was able to achieve a higher level of efficiency in managing its working capital during the post-liberalization era by adapting its various activities and itself as per the requirements of new environment emanated from liberalization, globalization and competitiveness. The study also showed that the competition arise out of globalization provides an opportunity to perform in well manner to survive in the competitive environment.

Nandi (2012) in his study attempted to analyze the trends in liquidity management and its impact on profitability of Bharat Heavy Electricals Ltd. (BHEL) over the period 1999–2000 to 2009–2010. The study revealed a strong evidence of negative association between the selected profitability measure (Return on capital employed) and the selected liquidity indicators (Current Ratio and Quick Ratio). The regression analysis as made in the study found that the efficiencies in managing inventory, debtors and cash had significant positive influence on the selected profitability indicators during the period under study.

Sur et.al (2013) conducted a study to analyze the liquidity as well as extent of relationship between liquidity and profitability of BHEL during the period 2000-01 to 2011-12 .For analyzing the data, the technique of ratio analysis, simple statistical tools like mean, statistical techniques like analysis of trend movement, analysis of Pearson's simple correlation, Spearman's rank correlation analysis, Kendall's correlation analysis, analysis of Kendall's coefficient of concordance etc. were used. The t-test and Chi square test were applied at appropriate places. The study showed that there was a clear deterioration in the overall liquidity of the company in the second half of the study period. Another notable outcome of the study was that there was a significant degree of negative association between liquidity and profitability of the company during the study period. Thus the company was able to manage its business in such a way as to ensure lower liquidity-higher profitability blend during the period under study.

Sur.et.al. (2014) carried a study to make a comparison between the efficiency in working capital management of NTPC Ltd., a premier public sector power generating company in India, in the pre-liberalization and post-liberalization periods. The study revealed that NTPC Ltd. moved in the right direction of facing all the challenges emanated from the liberalization measures adopted in India. The company was able to improve its status notably in terms of liquidity in the post-liberalization period as

compared to that in the pre-liberalization period under study. The average working capital turnover ratio of the company in the post-liberalization period was slightly higher than that in the pre-liberalization period under study indicating an improvement in the efficiency of working capital management of the company during the post-liberalization period.

In the study conducted by **Sur and Yadav (2014)** a cross-sectional analysis of the Maharatna CPSEs in respect to the efficiency of their asset management during the period 2004–2005 to 2013–2014 was made. The fixed asset turnover ratio, inventory turnover ratio (ITR), receivable turnover ratio and cash turnover ratio (CTR) were used in measuring the efficiency of asset management in this study. The net outcome derived from the study indicated that GAIL and IOCL jointly bagged the best award in respect of asset management and they were followed by ONGC, BHEL, CIL, SAIL and NTPC respectively in that order during the study period.

Venkatachalam and Karupaiah (2015) in their study assessed the liquidity and profitability of BHEL as well as the association between them during the period 2007-08 to 2013-14. The study used the ratio analysis and simple statistical tools and techniques at appropriate places. The outcome of the analysis showed that the liquidity of BHEL was alarming during the study period. The study also revealed a negative association between liquidity and

profitability of BHEL during the period under study.

Saha (2020) conducted a study to analyse the impact of WCM on profitability of selected CPSEs in Indian Power Sector during the period 2003-04 to 2017-18 using ratio analysis technique. The relation between WCM and profitability was measured using Pearson's correlation coefficient. The study revealed that there was negative correlation between WCM and profitability of the selected CPSEs during the period under study.

Objectives of the study

The present study has the following objectives:

1. To analyse the liquidity and the efficiency of WCM of the Maharatna CPSEs using some selected ratios.
2. To measure the liquidity status of the Maharatna companies more precisely applying an appropriate comprehensive rank test.
3. To evaluate the relationship between the liquidity and value generating capability of the Maharatna CPSEs.
4. To assess the WC financing pattern adopted by the Maharatna companies.

Data Source and Methodology of the Study

The study is based on all the Maharatna CPSEs. The data of these CPSEs used in

the study were collected from secondary sources, i.e. Capitaline Corporate Database published by the Capitaline Publishers (I) Ltd., Mumbai. In analysing the liquidity of the Maharatna companies, two important liquidity ratios, namely current ratio and quick ratio were used. If a company keeps adequate liquidity, it will definitely have a positive impact on the company's WCM efficiency. So, these two liquidity indicators were used in this study. The efficiency of WCM of the selected companies was directly assessed applying four selected efficiency indicators, such as working capital turnover ratio, inventory turnover ratio, debtors turnover ratio and cash turnover ratio. Theoretically, it is argued

that the higher the value of a turnover ratio, the higher is the efficiency. Thus, these four turnover ratios were also considered while measuring the efficiency of WCM of the selected companies. For the purpose of ascertaining the liquidity status of the Maharatna companies more precisely, Motaal's test was adopted. At the time of evaluating the relationship between the liquidity and value generating capability of the Maharatna CPSEs, Spearman's rank correlation coefficient was used and in order to examine whether the extent of the said relationship was significant or not, t test was applied. The WC financing pattern adopted by the Maharatna CPSEs was analysed by using relevant proportions of short term and long term funds.

Empirical Results and Discussion

Table 1: Analysis of Selected Ratios relating to Working Capital Management of Maharatna Central Public Sector Enterprises during the period 2004-05 to 2018-19

Company	CR			QR			DTR			CTR			ITR			WCTR		
	Avg	CC	Slope	Avg	CC	Slope	Avg	CC	Slope	Avg	CC	Slope	Avg	CC	Slope	Avg	CC	Slope
BHEL	1.599	7.559	0.034***	1.290	5.773	0.041***	1.680	4.278	(-0.055)***	8.368	0.925	(-0.820)	3.900	8.093	(-0.019)	1.810	2.573	(0.110)***
BPCL	0.717	7.517	0.006	0.511	3.794	(-0.006)	63.180	5.137	(-1.175)	545.833	0.674	105.644**	13.610	4.146	0.262	30.480	0.432	(-11.383)***
CIL	2.003	2.812	(-0.070)	1.997	2.795	(-0.070)	282539.480	0.268	(-15562.986)	1.027	0.755	(-0.02)	14.460	1.535	0.228	0.380	0.384	0.100**
GAIL	1.065	5.435	(-0.036)***	1.002	5.432	(-0.035)***	18.780	13.215	0.024	80.497	1.251	(-10.012)***	50.830	1.571	(-6.083)***	11.960	0.133	(-3.653)
HPCL	0.730	4.564	(-0.032)***	0.429	3.472	(-0.004)	52.200	7.146	(-1.262)***	2957.416	0.804	403.945	12.200	4.765	0.263*	(-61.49)	(-0.197)	16.043
IOCL	0.748	8.523	(-0.012)**	0.505	3.626	(-0.011)	41.460	6.026	1.059***	1609.086	0.791	357.585***	8.830	9.931	(-0.079)	(-232.48)	(-0.246)	(-96.642)**
NTPC	1.833	2.861	(-0.111)***	1.677	3.203	(-0.083)***	15.090	2.348	(-1.083)***	45.735	0.918	(-6.476)**	20.500	2.010	(-2.004)***	4.330	1.586	0.476***
ONGC	1.125	3.394	(-0.069)***	1.055	4.092	(-0.054)***	13.820	4.178	(-0.416)**	370.485	0.508	(-94.883)**	64.710	0.893	(-13.787)***	1.190	0.047	(-0.592)
PGCIL	0.640	5.895	0.003	0.670	5.209	0.002	7.490	4.021	0.220**	372.247	0.290	(-113.36)	22.410	5.374	0.866***	(-3.12)	(-1.089)	0.120
SAIL	1.072	2.720	(-0.070)***	0.809	2.139	(-0.055)***	13.400	5.061	(-0.107)	100.188	1.135	8.455	4.980	2.220	(-0.435)***	(-35.79)	(-0.134)	(-11.830)

Source: Compiled and computed from Capitaline Corporate Database of Capital Market Publishers (I) Ltd., Mumbai.
 ***=Significant at 0.01 level, **=Significant at 0.05 level, *=Significant at 0.10 level

In Table 1 an attempt was made to analyse the working capital management of the Maharatna CPSEs in India during the period 2004-05 to 2018-19 using six selected ratios, namely current ratio (CR), quick ratio (QR), debtors turnover ratio (DTR), cash turnover

ratio (CTR), inventory turnover ratio (ITR) and working capital turnover ratio (WCTR). While doing so, the average (Avg), consistency coefficient (CC) and linear trend equation of these selected ratios were analyzed. The following paragraphs present

the discussion on the results obtained from the analysis of the selected ratios of the CPSEs under study.

Current Ratio (CR): It is a basic measure of liquidity of a company. The higher the CR, the greater is the company's ability to meet its short term obligations. In Table I an attempt was made to make an analysis of CR of the selected companies during the period under study. Table 1 shows that based on the average CR, CIL captured the top most position and it was followed by NTPC, BHEL, ONGC, SAIL, GAIL, IOCL, HPCL, BPCL and PGCIL respectively in that order. In respect of consistency coefficient score of CR, IOCL proved itself as the most consistent performer in meeting short term obligations followed by BHEL, BPCL, PGCIL, GAIL, HPCL, ONGC, NTPC, CIL and SAIL respectively in that order. The linear trend equation fitted to the CR series depicts an upward trend in BHEL which was found to be statistically significant during the study period while a significant declining trend was observed in GAIL, HPCL, IOCL, NTPC, ONGC and SAIL, during the same period.

Quick Ratio (QR): It measures the ability of a company to meet its immediate obligations. The higher the QR, the higher is the immediate debt paying capability of the company. In Table 1 an effort was made to make an analysis of QR of the selected companies during the period under study. Table 1 discloses that based on the average QR, CIL occupied the first rank and it

was followed by NTPC, BHEL, ONGC, GAIL, SAIL, PGCIL, BPCL, IOCL and HPCL respectively in that order. On the basis of the consistency score of QR, BHEL established itself as the most consistent performer in meeting very short term obligations and it was followed by GAIL, PGCIL, ONGC, BPCL, IOCL, HPCL, NTPC, CIL and SAIL respectively in that order. The linear trend equation fitted to the QR series reveals that an upward trend was noticed in BHEL which was found to be statistically significant during the period under study while a significant declining trend was observed in GAIL, NTPC, ONGC and SAIL, during the same period.

Debtors Turnover Ratio (DTR): This ratio indicates how well receivables are turning into cash. It reflects the efficiency of the credit and collection policies adopted by the company. Usually, a high value of DTR is preferred as it indicates the company's efficiency to collect its receivables. A higher DTR implies that the company is collecting cash more frequently and has a good quality of debtors. So, the higher the DTR, the higher is the efficiency of debtors management and the higher the efficiency of debtors, the higher is the liquidity of the company. Table 1 depicts that the average efficiency of receivable management was the highest in CIL and it was followed by BPCL, HPCL, IOCL, GAIL, NTPC, ONGC, SAIL, PGCIL and BHEL respectively in that order. Based on the consistency coefficient score of DTR,

GAIL proved itself as the most consistent performer in respect of credit management, followed by HPCL, IOCL, BPCL, SAIL, BHEL, ONGC, PGCIL, NTPC and CIL receptively in that order. The linear trend equations fitted to the DTR series reveal that an upward trend was observed in IOCL and PGCIL and the slopes of the equations in these two CPSEs were found to be statistically significant while a significant declining trend in DTR series was noticed in BHEL, HPCL, NTPC and ONGC during the period under study.

Cash Turnover Ratio (CTR): It measures the efficiency of a company in managing its cash. Generally, a high CTR implies a high degree of efficiency in cash management whereas a low ratio reflects inefficiency in managing cash. The higher the efficiency of cash management, the more favourable is the status of the company from the viewpoint of its liquidity. Table 1 exhibits that the average efficiency of cash management was the highest in HPCL and it was followed by IOCL, BPCL, PGCIL, ONGC, SAIL, GAIL, NTPC, BHEL and CIL receptively in that order. On the basis of the consistency coefficient score of CTR, GAIL established itself as the most consistent player in respect of cash management, followed by SAIL, BHEL, NTPC, HPCL, IOCL, CIL, BPCL, ONGC and PGCIL respectively in that order. The linear trend equations fitted to the CTR series show that an upward trend in BPCL and IOCL and a declining trend in GAIL, NTPC and ONGC were observed

which were found to be statistically significant during the period under study.

Inventory Turnover Ratio (ITR): This ratio measures how fast the inventory is moving through the company and generating sales. So, it can be treated as a liquidity indicator of the company. A high ITR ratio is good from the liquidity point of view and implies sound inventory management whereas a low ratio signifies excessive inventory level than warranted by volume of operation indicating poor liquidity as well as inefficiency in the inventory management. Table 1 shows that the average efficiency of inventory management was the highest in ONGC and it was followed by GAIL, PGCIL, NTPC, CIL, BPCL, HPCL, IOCL, SAIL and BHEL receptively in that order. The analysis of consistency coefficient of ITR indicates that BHEL established itself as the most consistent performer in respect of inventory management which was followed by PGCIL, IOCL, HPCL, BPCL, SAIL, NTPC, GAIL, CIL and ONGC receptively in that order. The linear trend equation fitted to ITR series reveals that an upward trend, which was found to be statistically significant, was noticed in HPCL and PGCIL during the study period while a significant declining trend was observed in GAIL, NTPC, ONGC and SAIL during the same period.

Working Capital Turnover Ratio (WCTR): This ratio shows the efficiency of working capital management of the company. The higher the value of WCTR, the higher is the efficiency of managing

WC of the company. Table 1 discloses that based on the average WCTR, BPCL established itself as the best performer and it was followed by GAIL, NTPC, BHEL, ONGC, CIL, PGCIL, SAIL, HPCL and IOCL respectively in that order. In respect of consistency coefficient score of WCTR, BHEL was the most consistent performer in managing working capital efficiently,

followed by NTPC, BPCL, CIL, GAIL, ONGC, SAIL, HPCL, IOCL and PGCIL respectively in that order. The straight lines fitted to WCTR series depict that an upward trend which was found to be statistically significant was observed in CIL and NTPC while a noticeable downward trend was revealed in BHEL, BPCL and IOCL, during the period under study.

Table 2: Motaal's Test Results of Maharatna Central Public Sector Enterprises during the period 2004-05 to 2018-19

YEAR	BHEL	BPCL	CIL	GAIL	HPCL	IOCL	NTPC	ONGC	PGCIL	SAIL
2004-05	9	14	10.5	12.5	2.5	1	13.5	6	9	5.5
2005-06	13	12	5	10.5	8	4	15	8	15	10
2006-07	8	4.5	14.5	14	15	2.5	10.5	11.5	14	7.5
2007-08	12	8	6.5	6.5	10	2.5	7	8	12	3
2008-09	15	4.5	13	2	5.5	5.5	8	11.5	13	9
2009-10	14	6	12	8	14	11	4.5	13	1.	5.5
2010-11	10	15	2	1	12	8.5	3	2	2	1
Average	11.57	9.14	9.07	7.79	9.57	5.00	8.79	8.57	9.43	5.93
2011-12	11	2	1	15	5.5	10	1.	1	3	2
2012-13	6	1	3	3	4	7	2	3	10	7.5
2013-14	3	11	4	4	1	5.5	4.5	4	5	4
2014-15	4	9	6.5	10.5	13	14	6	5	11	11
2015-16	5	7	8.5	6.5	8	12	9	8	8	14
2016-17	2	13	8.5	9	8	15	13.5	10	6	15
2017-18	1	10	14.5	5	2.5	13	10.5	14	7	13
2018-19	7	3	10.5	12.5	11	8.5	12	15	4	12
Average	4.00	7.71	7.93	7.21	6.79	10.71	8.17	8.43	7.29	10.93

Source: Compiled and computed from Capitaline Corporate Database of Capital Market Publishers (I) Ltd., Mumbai.

In Table 2 an attempt was made to measure the liquidity status of the selected CPSEs more precisely by applying Motaal’s test. In this test, a process of ranking was used for arriving at a more comprehensive measure of liquidity in which the ranks of three ratios, namely working capital to current assets ratio, inventory to current assets ratio and liquid assets to current assets ratio were combined in a composite score. In case of working capital to current assets ratio or liquid assets to current assets ratio, a high value indicates better position in terms of liquidity and ranking was done in that order whereas as inventory is a non-liquid current asset, a low value of inventory to current assets ratio implies relatively favourable liquidity position and ranking was done accordingly. Ultimate liquidity ranking was done on the basis of sum of scores of each ratio’s separate individual ranking by following the principle that the lower the composite score (sum of individual ranks), the more favourable is the liquidity and vice versa. Table 2 shows that the liquidity of BHEL was the best in 2017-18 whereas It was the worst in 2008-09. Similarly, BPCL, CIL, GAIL, HPCL, IOCL, NTPC, ONGC, PGCIL and SAIL consolidated their best position in terms of liquidity in 2012-13, 2011-12, 2010-11, 2013-14, 2004-05, 2011-12, 2011-12, 2009-10 and 2010-11 respectively while the poorest liquidity was shown by them in 2010-11, jointly in 2006-07 and 2017-18, in 2011-12, 2016-17, 2005-06, 2018-19, 2005-06 and 2016-17 respectively. Table 2 also discloses that the

average liquidity rank in the second half of the study period was much higher in BHEL, BPCL, CIL, HPCL and PGCIL as compared to the first half of the same period while it was considerably lower in IOCL and SAIL in the second half of the period under study as compared to the first half of the study period. No significant change in the average liquidity rank of GAIL, NTPC and ONGC was noticed in the second half as compared to the first half of the period under study.

Table 3: Analysis of Spearman’s Rank Correlation Coefficient between Liquidity and Value Generating Capability of Maharatna Central Public Sector Enterprises during the period 2004-05 to 2018-19

Company	
BHEL	0.639*
BPCL	-0.114
CIL	0.102
GAIL	-0.052
HPCL	0.056
IOCL	-0.347
NTPC	0.473
ONGC	0.540*
PGCIL	0.335
SAIL	0.533*
*= Significant at 0.05 level	
**= Significant at 0.01 level	

Source: Compiled and computed from Capitaline Corporate Database of Capital Market Publishers (I) Ltd., Mumbai.

In Table 3 it was attempted to analyse the nature and extent of relationship between liquidity and value generating capability of each of the Maharatna CPSEs by using Spearman's rank correlation coefficient during the period 2004-05 to 2018-19. In order to examine whether the computed values of Spearman's rank correlation coefficient were statistically significant or not 't' test was made. In this analysis of rank correlation the final liquidity ranks (as measured in Table 2 by applying Motaal's Test) were considered as the liquidity indicator while the ranks of the value added to capital employed ratio (VACE) were recognized as the measure of value generating capability. The measures for assessing the corporate performance are several, the most common ones being net profit ratio, return on capital employed, return on owners' equity etc. When the performance of a company is measured using any of these conventional yardsticks, the implied premise is that the company exists, operates and grows only for its owners. But this concept does not match with the philosophy of the public sector enterprises (PSEs). In fact, the contribution made by a CPSE to the society and community cannot be assessed through the traditionally used accounting profit-based measures of financial performance. Thus, in the analysis of correlation between liquidity and corporate performance of the Maharatna CPSEs the VACE was used as the true measure of their corporate performance. Table 3 shows that the rank correlation

coefficient between liquidity and value generating capability was positive in seven CPSEs, out of which only in BHEL, ONGC and SAIL it was found to be statistically significant while the rank correlation coefficients in the remaining three CPSEs were negative which were not found to be statistically significant.

In Table 4 an attempt was made to analyse the financing pattern of WC of the Maharatna CPSEs during the study period. While doing so, the average percentage of WC financed through short term fund as well as that financed through long term fund in each of the selected CPSEs were assessed. This table shows that the maximum average percentage of WC financed by short term sources was observed in GAIL and PGICL (100 per cent), followed by BPCL (99.85 per cent), HPCL (99.72 per cent), ONGC (99.69 per cent), IOCL (98.56 per cent), NTPC (88.77 per cent), SAIL (81.18 per cent), BHEL (65.95 per cent) and CIL (64.02 per cent) respectively during the period under study. So, on an average less than 80 per cent of the WC was financed by short term funds only in BHEL and CIL whereas in the remaining Maharatna CPSEs the average percentage of WC financed through short term sources was more than 80 per cent. It indicates that almost all the Maharatna CPSEs except BHEL and CIL relied mostly on short term sources in financing their working capital while BHEL and CIL used a substantial portion of long term funds for the purpose of financing WC

during the study period. Table 4 also depicts that the highest average percentage of long term fund for financing WC was observed in BHEL (49.38 per cent) , followed by CIL (11.29 per cent) and SAIL (6.54 per cent) respectively whereas the average percentage of long term fund for financing WC was negligible (either less than 1 per cent or slightly higher than 1 per cent) in BPCL, HPCL, IOCL and ONGC and it was zero in GAIL and PGCIL. It implies that BHEL, the only Maharatna CPSE, gave a considerable emphasis on long term sources by utilizing almost half of its long term funds in financing WC capital during the study period. So, based on this analysis, it can be said that though BHEL and CIL took less risk as compared to the other selected CPSEs, BHEL showed special interest in using long term sources while financing its working capital during the period under study.

Concluding observations

1. Based on the liquidity ratios used in the present study, it can be concluded that only BHEL among the ten Maharatna CPSEs was able to adopt a significant positive liquidity trend during the study period while a notable declining trend in it was noticed in GAIL, NTPC, ONGC and SAIL during the same period.
2. A noticeable upward trend in the efficiency of debtors management was observed in IOCL and PGCIL whereas BHEL, HPCL, NTPC and ONGC

followed significant downward trend in it during the period under study.

3. A strong evidence of rising trend in the efficiency of cash management was noticed in BPCL and IOCL while a sharp deterioration in it was found in GAIL, NTPC and ONGC during the study period.
4. Only HPCL and PGCIL were able to establish a significant growing tendency in the efficiency of managing their inventory during the study period. However, a noticeable downward track was followed by GAIL, NTPC, ONGC and SAIL in respect of the efficiency of inventory management during the same period.
5. A significant increasing tendency in the overall efficiency of managing WC was observed in CIL and NTPC while a convincing evidence of completely reverse trend in it was revealed in BHEL, BPCL and IOCL during the period under study.
6. On the basis of the mean liquidity rank as ascertained by applying Motaal's test, BHEL, BPCL, CIL, HPCL and PGCIL established themselves as better performer in terms of liquidity in the second half of the study period as compared to the first half of the same period whereas the overall liquidity of IOCL and SAIL was much lower in the second half in comparison with the first half of the period under study. However,

no considerable change in respect of liquidity was noticed in GAIL, NTPC and ONGC in between the two halves of the study period.

7. The analysis of Spearman's rank correlation as made in the study reveals that strong evidence of positive relationship between liquidity as measured by applying Motaal's test and corporate performance as expressed in terms of value generating capability and indicated by VACE was noticed in BHEL, ONGC and SAIL during the period under study.
8. GAIL and PGCIL were entirely dependent and the other Maharatna CPSEs except BHEL and CIL gave much emphasis on short term sources in financing their working capital during the study period. Another notable outcome of the study is that BHEL established itself as a risk-averse by utilizing almost half of its long term funds (49.38 per cent) for the purpose of financing WC during the period under study.

Limitations of the study

1. All the Maharatna CPSEs under study do not belong to the same sector. So, it is a hard task of making proper comparison among them.
2. The Maharatna status was not earned by all the companies under study at the same point of time. Thus, difference

among these CPSEs in respect of WCM is quite natural. It is, therefore, very difficult for the researchers to make comparison in true sense.

Implications for practice

The main aim in this study was to address the almost total lack of research evidence on the WCM of the Maharatna CPSEs in India. The study did so by analysing the liquidity status, the efficiency of managing WC, the relationship between liquidity and value generating capability, and the WC financing practices of the Maharatna CPSEs during the period 2004-05 to 2018-19. Accordingly, the first major practical contribution of the present study is that it provides much needed empirical results on the liquidity status and the efficiency of WCM of the Maharatna CPSEs. These outcomes are important because the only other comparable studies do not consider all the Maharatna CPSEs. The present study will definitely guide policy-makers to design initiatives and actions based on what the Maharatna CPSEs actually do and where they are now in terms of their practice. A second important implication of the study emanates from the findings on the assessment of the relationship between the liquidity and value generating capability of the Maharatna CPSEs. The study revealed that only in three companies out of the ten considered in the study the relationship was positive as well as significant. These findings will help the concerned policy-

makers to formulate suitable policies to convert the adverse results into favourable ones in future. Finally, another implication of the study derives from the finding on the analysis of WC financing pattern adopted by the Maharatna CPSEs. The study indicated that only BHEL established itself as risk-averse by putting much emphasis on long term funds in financing WC while the other CPSEs under study (except CIL) clearly showed their preference in favour of short term funds. It will obviously provide guidance to the policy-makers to frame appropriate WC financing policies for the CPSEs taking into consideration their risk preference.

Directions for future research

The present study creates a number of opportunities for future research, both in terms of refinement of the theoretical issues and the validation of the related concepts. First, while conducting the study, no comparison in respect of the WCM of the Maharatna CPSEs between the pre-Maharatna and post-Maharatna periods was made. So, a study considering such comparison can be conducted. Secondly, the impact of the financing pattern adopted by the Maharatna CPSEs on their profitability was not analysed in the present study. Thus a study considering such analysis can be carried out. Finally, in the present study Motaal's test was used in measuring the liquidity status of the Maharatna companies. Further research can be conducted to construct a more comprehensive model for

ascertaining the liquidity status of a CPSE considering different aspects of liquidity.

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Exploring the dynamic linkage between gold price, exchange rate and stock market indices : Evidence from an Emerging Economy, India

Paromita Dutta

Abstract:

This paper examines the dynamic linkage between gold price, exchange rates and stock market indices in an emerging market context, India. Consumption of gold is mostly common in household sector of India. Moreover, it can also be contemplated as an alternative investment route mainly to safeguard against financial risk obligations. The study considers 232 monthly observations of each of these variables from 1st January 2000 to 30th April 2019. Using Johansen Co-integration, we find a long run co-integration among gold price, exchange rate and stock market indices. The Vector Error Correction Model (VECM) shows the unilateral causality from stock market index and exchange rates to gold prices. Pairwise Granger causality exhibited bidirectional causality between exchange rate and gold prices. Our findings have important implications for financial market analysts, investors, regulators and policy makers in understanding the role of monthly stock price movement and exchange rates on gold prices in India.

Key Words: Gold Price, Nifty, Johansen co-integration, Vector Error Correction Model (VECM), Granger causality, India

Introduction

Indian financial and commodity markets had experienced a volatile situation in the recent past in terms of crude oil prices, gold prices, stock market index etc. followed by continuous fall in the value of rupee against dollars. Various rules and regulations were stipulated to govern the overall activities of stock market as; it usually gets affected by various domestic and other factors such as rise in gold and crude oil prices (Phoong, Ismail and Sek, 2013).

While forming a portfolio, gold is considered as one of the most valuable element (Bilal, Talib, Haq, Khan and Naveed, 2013). Gold is usually treated as an investment especially for regular investors. If the economy of a country is improving, it means demand for gold is also increasing. Official gold reserves maintained by central bank of a country helps to protect against financial risk obligations.

Gold can also be used to hedge against inflation risk mainly, for an import-dependent country like India. Another most important factor that affects gold price is the real interest rates, which is the opportunity cost of holding gold after deducting inflation. If real interest rates are low, people will be more willing to invest in gold. In 2008 financial crisis, the economic scenarios of US and the debt market in European countries suffered a lot which in turn, causes a hike in prices of gold unrestrictedly.

Factors considered in this study and reciprocity between them:

Gold Price and Exchange Rate:

There exist an inverse relationship between gold price and exchange rates. Prices of gold are usually determined by US dollar fluctuations. With the decrease in US dollar, people of other countries of different currencies start investing in gold (as gold is priced in US dollar) and vice-versa.

Gold Price and Stock Market Indices:

Gold price has the most significant impact on stock market indices both in long - run as well as in short - run. Gold is considered as a very good and a traditional substitute of stock because of its availability and a hedging tool against inflation. An increase in the gold price might instigate investors to withdraw their money from stock market which leads to a decrease in stock index.

Exchange Rate and Stock Market:

Volatility in stock market may cause problems with regard to foreign investment especially in small developing economies. With the increase in international competitiveness, export gets increased thus; exchange rates can have a positive impact on stock prices. But volatile exchange rates make international trade and investment decisions more difficult hence, leads to a greater exchange rate risk. Inflation trends, factors affecting industry and various other sectors and depreciation in exchange rates may have a significant impact on stock prices and volatility.

Although there are studies on the relationship between gold prices, oil prices, stock market indices and USD rate both on global and Indian economy but, very few studies have tried to explore the relationship between gold prices, stock market indices and USD rate specially, where a greater part of gold demand is met through imports in a developing (or emerging) economy like India which further affects USD rate. Moreover, many researchers have used autoregressive methods, moving average methods, mixed autoregressive moving average methods to study this relationship. But using these models or methods is sometimes not suitable to estimate accurately financial or economic data due to various non-linear properties such as asymmetry, volatility, clustering etc. In this backdrop, the article empirically examines a long or short- run relationship between gold prices, stock market indices of BSE 500, S&P CNX NIFTY (NSE) and USD/INR exchange rate. The findings of the study will be helpful for financial market analysts as well as investors to better understand as to how stock market indices and exchange rates influence gold prices in Indian perspective.

The paper is designed as follows. Second section outlines the literature review, third section highlights data and methodology, fourth section explains research analysis and empirical results and finally, fifth section concludes the paper.

LITERATURE REVIEW

Gold is one of the precious metals from ancient times. People who invest in stock markets use gold as prime collaterals in case of unfavorable market conditions.

Gold Price vs Stock Index

Dirk and Baur (2010) examined that, gold is considered to be a haven in case of any turbulence in the financial market. When the stock market condition deteriorates, then the investors try to come out of risky assets such as shares, debentures, and invest in gold (Narang and Singh, 2012).

Many studies have been conducted in Asian countries to study the impact of gold prices on stock prices by taking weekly or monthly data. Johansen's multivariate co-integration test and Vector Error Correction Model (VECM) are usually used to determine Causality. The Indian stock market is influenced mainly by domestic macroeconomic factors and less by global factors, especially in the long run (Srivastava, 2010). Shahzadi and Chohan (2012) studied the relationship between gold prices and the index of the Karachi Stock Exchange over five years from 2005 to 2010. The result showed that, there is a negative and long-term relationship between the two. Sindhu (2013) reported interdependence between gold prices and the inflation rate and also showed that, there is an inverse relationship between gold prices and USD. Horng and Huang (2013) studied the bi-variate asymmetric IGARCH

to understand the impact of the gold market on the financial market. The result showed that, if any positive change happens in the gold market, it makes a significant impact on the risk and return of both Thailand and Malaysian markets. Sreekanth and Veni (2014) focused on various econometric tools that have been considered to study the causal relationship between gold prices and stock index for 9 years from 2005-2013. The study revealed that gold prices are explaining both the long and short-run movements of S&P CNX Nifty.

Stock Index vs other macro economic variables

Saxena and Bhadauriya (2012) focused on the causal relationship between international crude oil prices and various other macro-economic variables. The study revealed that balance of payment (BOP) and foreign exchange reserves are having a significant impact on international crude oil prices but, none of the macroeconomic variables are making any significant impact on crude oil prices. Tripathy and Seth (2014) had taken various macroeconomic variables such as inflation, interest rate, exchange rate etc and many market performance indicators such as sensex, market capitalization and market turnover and tried to find out a causal relationship between stock market performance and other macro-economic variables from July 1997 to June 2011 by using monthly data. The study revealed that, the stock price movement not only affected by the actions of macroeconomic variables, but some of the macroeconomic variables

also get affected by the movement of stock prices. Tomar and Singh (2016) studied bidirectional causality for the stock market and exchange rate and gold prices and crude oil. Ingallhalli, B.G., and Reddy (2016) tried to find a causal relationship between oil, gold, stock prices, and exchange rate. Granger causality results showed that, oil prices make a positive impact on gold prices and exchange rates. On the other hand, the exchange rate is affected by changes in oil prices and the stock price index. Singh and Sharma (2018) analyzed co-integration and causality between crude oil prices and other macroeconomic variables across the global financial crisis of 2008. The authors concluded that, the co-integration and causality relationship is dynamic, and the global financial crisis of 2008 made an effect on this relationship.

DATA AND METHODOLOGY

The stock market in India is mainly represented by National Stock Exchange of India Ltd. (NSE Ltd.) and Bombay Stock Exchange Ltd. (BSE Ltd.). The NSE Ltd. is formed in 1992 and at present, is the largest stock exchange in India. The data set in the present study relate to BSE and NSE Ltd and represents, the monthly closing prices of BSE 500¹ and S&P CNX NIFTY² indices. Gold prices are procured from World Gold

¹ = S&P BSE 500 index is designed to be a broad representation of the Indian market. It consists of top 500 companies listed at BSE Ltd.

² = The Standard and Poor's CNX Nifty stock index is composed of 50 of the largest and most liquid stock found on the National Stock Exchange of India.

Council. The USD/INR exchange rates are procured from www.oanda.com. The gold price data are converted into Indian currency per troy ounce. The sample consists of 232 monthly observations of each of the variables, ranging from 1st January, 2000 to 30th April, 2019.

We have done natural logarithms of data to obtain their growth figures and to examine the economic relationship among gold prices, BSE 500, S&P CNX NIFTY and USD/INR exchange rate. Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) test is conducted to eliminate the unit root from the dataset. Johansen co-integration model is also used to verify the number of co-integrating relationships among dependent and independent variables. VECM and WALD's coefficient test is done to make a proper estimation of long run and short run causality among the variables. Problem of serial correlation and heteroskedasticity are taken care of by conducting Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey test of heteroskedasticity. Pairwise Granger causality test is also exhibited to determine causality relationship among the variables.

RESEARCH ANALYSIS AND EMPIRICAL RESULTS

Unit Root Test Results

The most important thing in time-series analysis is to make the data free from unit root or random walk, which means that the mean, variance and covariance remain constant over time for all t. The testing procedure of ADF test has been prescribed by Elliot, Rothenberg and Stock (1996) where, t is the time or trend variable, change in Y_{t-1} is the lagged difference terms and null hypothesis is $\delta = 0$. The actual reason for inclusion of lagged difference terms is to find out that error terms are serially independent (Dickey and Fuller, 1981).

$$\Delta Y_t = \beta_1 + \beta_2 + \delta Y_{t-1} + \alpha \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t \quad \dots(1)$$

The ADF or unit root test has been conducted for intercept (constant) and trend and intercept (time trend) at level and first difference to convert the data into stationary.

Table 1 show the trending behaviour of the data which varies according to different situations and economic theories.

Table 1: Different situations in Augmented Dickey-Fuller unit root test based on Constant and Time Trend

Situations	Possibilities under Null Hypothesis (H_0)	Equation
1	Pure Random Walk	$Y_t = Y_{t-1} + \varepsilon_t$
2	Random Walk with drift	$Y_t = \alpha + Y_{t-1} + \varepsilon_t$
3	Deterministic Trend	$Y_t = \alpha + \beta_t + \varepsilon_t$
4	Random Walk with drift and deterministic trend	$Y_t = \alpha + Y_{t-1} + \beta_t + \varepsilon_t$

Situation 1: Y_t is the value at time t , Y_{t-1} is the last period value and ε_t is a stochastic component which is independent and identically distributed with mean and variance.

Situation 2: A constant or drift (α) is added here.

Situation 3: The value at time t is regressed on a time trend β_t .

Situation 4: This situation depicts an increasing time trend. It shows that value at time t is regressed on a drift (α), last period's value (Y_{t-1}), a trend (β_t) and a stochastic component (ε_t).

Phillips-Perron (PP) test which is a non-parametric correction is also conducted to verify that time-series is integrated of order 1. The PP test can be robust with unspecified

autocorrelation and heteroskedasticity in the entire process of test equation (Phillips and Perron, 1988).

The hypotheses are constructed as follows:

Intercept & Trend and Intercept (At Level)

H_0 : Gold Price has unit root ($\alpha = 0$).

H_A : Gold Price does not have unit root ($\alpha < 0$).

Table 2 and 3 show that null hypothesis cannot be rejected. The values of test statistic are also lower than critical values at 1%, 5% and 10% level of significance which depicts that, data is not stationary both at intercept (constant) and trend and intercept (time trend) at level. Therefore, we can conclude that, our dependent variable i.e., gold price has unit root.

Table 2: Stationary test for unit root (Intercept at Level); H_0 : Data has a unit root

Level Data	Test Critical Values				
ADF test statistic	t-Statistic	1%	5%	10%	Prob.
Gold Price	-0.2118	-3.4584	-2.8738	-2.5733	0.9827
BSE 500	-0.5839	-3.4584	-2.8738	-2.5733	0.8869
S&P CNX Nifty	-0.5745	-3.4584	-2.8738	-2.5733	0.8796
USD/INR Exchange Rate	-1.4176	-3.4584	-2.8738	-2.5733	0.6577
Level Data	Test Critical Values				
PP test statistic	t-Statistic	1%	5%	10%	Prob.
Gold Price	0.0864	-3.4584	-2.8738	-2.5733	0.9637
BSE 500	-0.1343	-3.4584	-2.8738	-2.5733	0.9341
S&P CNX Nifty	-0.3411	-3.4584	-2.8738	-2.5733	0.9245
USD/INR Exchange Rate	-0.9642	-3.4584	-2.8738	-2.5733	0.8488

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

Table 3: Stationary test for unit root (Trend and Intercept at Level); H_0 : Data has a unit root

Level Data	Test Critical Values				
ADF test statistic	t-Statistic	1%	5%	10%	Prob.
Gold Price	-0.3321	-4.5526	-3.7837	-3.3173	0.9943
BSE 500	-0.4439	-4.5526	-3.7837	-3.3173	0.8732
S&P CNX Nifty	-0.5342	-4.5526	-3.7837	-3.3173	0.9291
USD/INR Exchange Rate	-1.3976	-4.5526	-3.7837	-3.3173	0.7873
Level Data	Test Critical Values				
ADF test statistic	t-Statistic	1%	5%	10%	Prob.
Gold Price	0.1155	-4.5526	-3.7837	-3.3173	0.9422
BSE 500	-0.1448	-4.5526	-3.7837	-3.3173	0.8344
S&P CNX Nifty	-0.3815	-4.5526	-3.7837	-3.3173	0.9122
USD/INR Exchange Rate	-0.9758	-4.5526	-3.7837	-3.3173	0.8677

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

The model fit summary is given in table 4, specifying therein the coefficient of determinants (R^2) and adjusted coefficient of determinants (adjusted R^2) for Intercept and Trend and Intercept. Moreover, associated prob (F-statistic), Akaike Info criterion, Schwarz criterion and Hannan-Quinn criterion are also considered to

give an overview of model fit summary. The model fit summary shows that, the R^2 and adjusted R^2 result is very much dissatisfactory and the probability value of F-statistic is not significant at 1% level hence, we can conclude that, the null hypothesis will be accepted which means Gold Price (dependent variable) has unit root and the data is not stationary in nature.

Table 4: Model fit summary

Particulars	Summary for	
	Intercept	Trend and Intercept
R-squared	0.1286	0.4145
Adjusted R-Squared	0.1303	0.3231
Log Likelihood	-20.9651	-16.9313
F-statistic	3.4912	3.1744
Prob(F-statistic)	0.1724	0.1446
Akaike Info Criterion	2.0899	2.5216
Schwarz criterion	2.1443	2.1342
Hannan-Quinn Criterion	2.1172	2.0448

Source: Authors own findings

Intercept & Trend and Intercept (At First Difference)

First differencing of the gold price both for intercept (constant) and trend and intercept (time trend) is done to eliminate the unit root.

The hypotheses are constructed as follows:

H_0 : Gold Price has unit root ($\alpha = 0$).

H_A : Gold Price does not have unit root ($\alpha < 0$).

Table 5 and 6 shows that, the values of test statistic are higher than the critical values at 1%, 5% and 10% level of significance which depicts that, data is stationary both at intercept (constant) and trend and intercept (time trend) at first difference. Therefore, we can conclude that, our dependent variable i.e., gold price does not have unit root.

Table 5: Stationary test for unit root (Intercept at First Difference)

H_0 : Data has a unit root

First Differenced Data	Test Critical Values				
	t-Statistic	1%	5%	10%	Prob.
Gold Price	16.4397	-3.4585	-3.0299	-2.6551	0
BSE 500	13.4255	-3.4585	-3.0299	-2.6551	0
S&P CNX Nifty	12.5944	-3.4585	-3.0299	-2.6551	0
USD/INR Exchange Rate	10.2342	-3.4585	-3.0299	-2.6551	0

First Differenced Data	Test Critical Values				
ADF test statistic	t-Statistic	1%	5%	10%	Prob.
Gold Price	16.4942	-3.4585	-3.0299	-2.6551	0
BSE 500	13.7128	-3.4585	-3.0299	-2.6551	0
S&P CNX Nifty	13.8632	-3.4585	-3.0299	-2.6551	0
USD/INR Exchange Rate	10.5829	-3.4585	-3.0299	-2.6551	0

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

Table 6: Stationary test for unit root (Trend and Intercept at Level)

H₀: Data has a unit root

First Differenced Data	Test Critical Values				
ADF test statistic	t-statistic	1%	5%	10%	Prob.
Gold Price	16.2461	-4.9983	-3.4293	-3.1381	0
BSE 500	14.2178	-4.9983	-3.4293	-3.1381	0
S&P CNX Nifty	13.4369	-4.9983	-3.4293	-3.1381	0
USD/INR Exchange Rate	10.3874	-4.9983	-3.4293	-3.1381	0
First Differenced Data	Test Critical Values				
ADF test statistic	t-statistic	1%	5%	10%	Prob.
Gold Price	16.3855	-4.9983	-3.4293	-3.1381	0
BSE 500	14.0923	-4.9983	-3.4293	-3.1381	0
S&P CNX Nifty	13.0481	-4.9983	-3.4293	-3.1381	0
USD/INR Exchange Rate	10.5827	-4.9983	-3.4293	-3.1381	0

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

Table 7 shows that, R^2 and adjusted R^2 of Intercept (Constant) and Trend and Intercept (Time Trend) are above 60% which is quite satisfactory. The result also shows that, the p-value of F-statistic is significant at 1% level. Therefore, we can accept the alternative hypothesis which highlights the fact that, gold price is stationary in nature, which means the mean and variance will remain constant overtime at first difference.

Table 7: Model Fit Summary at First Difference

Particulars	Summary for	
	Intercept	Trend and Intercept
R-squared	0.7559	0.7328
Adjusted R-Squared	0.6786	0.6955
Log Likelihood	-18.1412	-18.0643
F-statistic	20.5293	20.7431
Prob(F-statistic)	0	0
Akaike Info Criterion	2.4417	2.3244
Schwarz criterion	2.4021	2.3911
Hannan-Quinn Criterion	2.2622	2.3532

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

Determination of Lag Order Intervals

We have checked the lag selection process before moving on to long run co-integration. Based on vector auto regression (VAR) and

lag selection criteria, we have selected lags of 3 order intervals. The lags are selected on the basis of LR test, SIC and Hannan-Quinn information criteria.

Table 8: Determination of Lag Order Intervals

Lag	LL	LR	FPE	AIC	SIC	HQ
0	-4126.384	NA	3.277e+20	61.455	61.297	61.322
1	-4021.692	2371.562	3.198e+14	45.128	46.098	45.056
2	-3987.543	878.784	3.122e+14	44.241	44.331	43.087
3	-3841.422	49.876**	2.988e+14	44.441	44.409**	43.139**
4	-3754.401	45.611	2.723e+14	44.522	44.558	43.568

Notes: * represents lag order intervals selected by the information criteria
 LR: Sequential modified LR test statistic (at 5 percent level of significance); LL: Log Likelihood; FPE: Final Prediction Error; AIC: Akaike Information Criterion; SIC: Schwarz Information Criterion; HQ: Hannan-Quinn Information Criterion.

Source: Authors own Findings

Once we have determined the number of lags, next step will begin with testing the co-integration amongst the variables.

Johansen Co-integration Test Results

Johansen Co-integration test is usually used to assess the existence of long run co-integration among the variables, Johansen and Juselius (1992) and Johansen and Juselius (1994). In Johansen Co-integration test, the eigen values are arranged in a descending order which is shown below:

$$\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \lambda_4 \dots \geq \lambda_n \quad \dots\dots\dots(2)$$

The test statistic depicts that, λ_{max} test usually examines the null hypothesis against the alternative hypothesis and the co-integration rank equal to r against the co-integration rank which is equal to r +

1 (Johansen, 2000). The equation is given below:

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \lambda_{r+1}) \quad \dots\dots(3)$$

In the equation above, λ is the eigen value. The test is repeated for $r = 1, \dots, k$ until one fails to reject the null hypothesis.

The λ_{trace} test examines the null hypothesis against the alternative hypothesis that, the co-integration rank is equal to r against the co-integration rank which is equal to k or greater than r. The equation is given below:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^k \ln(1 - \lambda_i) \quad \dots\dots(4)$$

In the equation above, $r = k, k-1, k-2, \dots, 0$ and λ_i is the estimated value for the i^{th} ordered eigen value from the Π matrix.

Therefore, the entire econometric equation of Johansen Co-integration Test is given below:

$$X_t = \mu + \varphi D_t + \Pi_p X_{t-p} + \dots + \Pi_1 X_{t-1} + e_t \quad \dots\dots\dots (5)$$

Where, $t = 1, \dots, T$;

X_t = the function of X_0 to X_k ;

D_t = Deterministic dummies, which may have a constant, a linear term or seasonal dummies (Johansen, 2000).

The number of lags or lag intervals included in the hypothesis is (1 3) which depicts the proportion of dependent and independent variables explained by the lag interval and

also determines a long run relationship in the multivariate model.

H_0 : There exist co-integrating relationships between dependent and independent variables.

H_A : There exist no co-integrating relationships between dependent and independent variables.

Table 9 shows that, the trace statistics at $r = 1$ and 3 are 29.78095 and 5.2104 are more than the critical values of 29.39707 and 3.8414 and are also significant at 5% and 10% level whereas, the trace statistics at $r = 2$ of 10.44704 is less than the critical value of 15.49471. The result depicts that, the null hypothesis of co-integrating equations at $r = 1$ and 3 is rejected and at $r = 2$ is accepted. Therefore, it can be concluded that, there are at most two co-integrating equations between dependent and independent variables that affects gold price.

Table 9: Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Trace Statistic	Critical Value	Sig. Value (Prob.)
At most 1*	29.7809	29.397	0.0848***
At most 2	10.447	15.4947	0.2479
At most 3*	5.2104	3.8414	0.0249**

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

We have also conducted maximum eigen value test statistics to determine the co-integrating relationships between dependent and independent variables. Table 10 depicts that, the max-eigen statistic at r = 1 and 3 are 23.93391 and 5.2104 is more than the critical values of 21.2426 and 3.6324 respectively and at r = 2, max-eigen statistic is 10.44694 which is less than the critical value of 14.2646 and at the same time not statistically significant. The probability

values at r = 1 and 3 is significant at 10% and 5% level. This result shows a rejection of null hypothesis at r = 1 and 3 and acceptance of null hypothesis at r = 2, which means there are at most two co-integrating relationships between dependent and independent variables. Hence, it can be concluded that, there is a long run relationship between gold prices, BSE 500, S&P CNX NIFTY and USD/INR exchange rate at most level 2.

Table 10: Unrestricted Co-integration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistic	Critical Value	Sig. Value (Prob.)
At most 1*	0.6057	23.9339	21.2426	0.0705***
At most 2	0.4576	10.4469	14.2646	0.1842
At most 3*	0.3439	5.2104	3.6324	0.0249**

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own findings

Vector Error Correction Model

In this study, we have used Vector Error Correction Model to examine the relationship between gold prices, S&P CNX NIFTY, BSE 500 and USD/INR exchange rate. If two variables are co-integrated then, the relationship between such two variables can be defined as Error Correction Model i.e., ECM (Gujrati, 2005). Therefore,

VECM model incorporates error correction features to a multi factor model such as VAR. The VECM equation can be written as follows:

$$\Delta X_t = \mu + \varphi D_t + \Pi X_{t-p} + \Pi_{p-1} \Delta X_{t-p+1, \dots} + \dots + \Pi_1 \Delta X_{t-1} + e_t \tag{6}$$

Where, t = 1.....T

Table 11: Results of Vector Error Correction Estimates

Independent Variables	Gold Price (DLOGGP)
DLOGGP (-1)	1.000000
DLOGS&P CNX NIFTY (-1)	0.000000
DLOG BSE500 (-1)	- 0.2742
	(0.0833)
	[-3.2917]
DLOGEXC (-1)	-0.8336
	(0.2749)
	[-3.0323]
C	-0.0062
Error Correction	D(DLOGGP)
Standard Errors () and t-statistic []	
Co-integration Equation 1	-0.8579**
	(0.0653)
	[-13.1378]
DLOGGP (-1))	-0.0648
	(0.0696)
	[-0.9310]
DLOGGP (-2))	-0.0833
	(0.0709)
	[-1.1748]
DLOGGP (-3))	-0.0484
	(0.0716)
	[-0.6759]
DLOGS&P CNX NIFTY (-1))	-0.8946**
	(0.0634)
	[-14.1104]
DLOGS&P CNX NIFTY (-2))	-0.4083**
	(0.0296)
	[-13.7939]

DLOGS&P CNX NIFTY (-3))	1.1648
	(0.2143)
	[5.4353]
DLOG BSE500 (-1))	0.5986
	(1.6199)
	[0.3695]
DLOG BSE500 (-2))	2.4754**
	(0.1629)
	[-15.1958]
DLOG BSE500 (-3))	-0.4726
	(1.5821)
	[-0.2987]
DLOGEXC (-1))	-0.6519**
	(0.0477)
	[-13.6667]
DLOGEXC (-2))	-0.1844
	(0.1529)
	[-1.2060]
DLOGEXC (-3))	-0.1937
	(0.1462)
	[-1.3248]
C	-0.0005
	(0.0023)
	-0.2173
R-squared	0.5221
Adj. R-squared	0.4778
F-statistic	18.1200
Akaike AIC	-3.4785
Schwarz SC	-3.3734
Notes: * implies that values are significant at 1 per cent level (critical value: 2.58). ** implies that values are significant at 5 per cent level (critical value: 1.96). *** implies that values are significant at 10 per cent level (critical value: 1.65). () signifies co-efficient; [] signifies standard error	

Source: Authors own Findings

We have applied three lags in VECM. Table 11 demonstrates that, CNX Nifty shows a unilateral causality and also has negative and significant impact on gold prices at 5% level of significance at both first and second order lag intervals. However, BSE 500 has unilateral causality towards gold prices only at second order lag intervals at 5% level of significance. In case of USD/INR exchange rate, it is integrated at first order lag period at 5% level of significance. The adj R² value is 0.4778, which explains that there is a variation of 48 percent in this study. Moreover, R² is 0.5221, which is not so high that means, the model is explaining 52% of the variability of the response data around its mean. However, the causality in

VECM is further verified by using ordinary least square (OLS) method of regression.

Ordinary Least Square Regression

Dependent Variable: D(DLOGGP)

$$\begin{aligned}
 D(DLOGGP) = & C(1) * (DLOGGP(-1) - 0.2742 * DLOGBSE500(-1) - 0.8336 * DLOGEXC(-1) - 0.0062) + \\
 & C(2) * DLOGGP(-2) + C(3) * DLOGGP(-3) + \\
 & C(4) * DLOG S\&P CNXNIFTY (-1) + C(5) * DLOG S\&P CNXNIFTY (-2) + \\
 & C(6) * DLOG S\&P CNXNIFTY (-3) + C(7) * DLOG BSE500 (-1) + C(8) * DLOG \\
 & BSE500 (-2) + C(9) * DLOG BSE500 (-3) + C(10) * DLOGEXC (-1) + C(11) * DLOGEXC \\
 & (-2) + C(12) * DLOGEXC (-3) + C(13)
 \end{aligned}
 \tag{7}$$

Table 12: Results of Ordinary Least Square Regression

	Co-efficient	Standard error	t-statistic	Prob.
C(1)	-0.8579	0.0653	-13.1378	0.043**
C(2)	-0.0648	0.0696	-0.9310	0.4653
C(3)	-0.0833	0.0709	-1.1748	0.1438
C(4)	-0.0484	0.0716	-0.6759	0.6563
C(5)	-0.8946	0.0634	-14.1104	0.027**
C(6)	-0.4083	0.0296	-13.7939	0.030**
C(7)	-1.1648	0.2143	-5.4353	0.5231
C(8)	-0.5986	1.6199	-0.3695	0.113
C(9)	-2.4754	0.1629	-15.1958	0.022**
C(10)	-0.4726	1.5821	-0.2987	0.139
C(11)	-0.6519	0.0477	-13.6667	0.034**
C(12)	-0.1844	0.1529	-1.2083	0.114
C(13)	-0.1937	0.1462	-1.3248	0.219

R-squared	0.5221		Durbin-Watson stat	2.0245
Adj. R-squared	0.4778		S.E of regression	0.0388
F-statistic	18.1200		Sum squared resid	0.2846
Akaike AIC	-3.4785		Log-likelihood	342.4110
Schwarz SC	-3.3734		Mean dependent var	-0.0002
			S.D. dependent var	0.0544
Notes: * implies that values are significant at 1 per cent level (critical value: 2.58). ** implies that values are significant at 5 per cent level (critical value: 1.96). *** implies that values are significant at 10 per cent level (critical value: 1.65).				

Source: Authors own Findings

Table 12 shows that, C(1) depicts the long run association ship among the co-integrating vectors and it is the co-efficient of co-integrating equation which is an error correction term. In the study, the value of C(1) is -0.8579 which is negative and statistically significant at 5% level. Therefore, we may conclude that, there is long run causality having a speed of adjustment with 85.79 percent that flows from CNX Nifty, BSE 500 and USD/INR exchange rates towards gold prices in India. The F-statistic represents existence of long run causality between CNX Nifty, BSE

500, USD/INR exchange rates towards gold prices in India and measures the overall significance of the model.

Moreover, C(2) shows a long run impact of CNX Nifty, BSE 500, USD/INR exchange rate on gold prices for various series (Dutta and Chatterjee, 2019).

Wald Test

Wald test is a F-test that measures the significance of all the independent variables used in the study that is, log BSE 500, log S&P CNX NIFTY and log USD/INR exchange rate. The wald test depicts the

following hypotheses:

$$H_0 = \beta_{BSE500} = \beta_{s\&p\ cnx\ nifty} = \beta_{exc} = 0$$

$$H_A = \text{At least some are non-zero}$$

Null hypothesis states that, all independent variables are equal to zero which means, there is no short run causality flows

from DlogS&PCNXNifty, DlogBSE500, DlogExchangeRate towards gold prices in India.

Wald's Co-efficient Test

$$\text{Wald Test: } C(5) = C(6) = C(7) = C(8) = C(9) = C(10) = C(11) = C(12) = C(13) = 0$$

Table 13: Results of Wald Test

Test Statistic	Value	Probability
F-statistic	5.956123	0.0000*
Chi-square	36.63720	0.0000*

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).
 ** implies that values are significant at 5 per cent level (critical value: 1.96).
 *** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own Findings

Table 13 shows that, the value of Chi-square is 36.63720 with a probability of 0.000 which means there is an acceptance of alternative hypothesis and rejection of null hypothesis.

Table 14: Null Hypothesis Summary

Normalized Restriction	Value	Std. Error
C(5)	-0.8946	0.0634**
C(6)	-0.4083	0.0296**
C(7)	-1.1648	0.2143
C(8)	-0.5986	1.6199
C(9)	-2.4754	0.1629**
C(10)	-0.4726	1.5821
C(11)	-0.6519	0.0477**
C(12)	-0.1844	0.1529
C(13)	-0.1937	0.1462

Restrictions are linear in co-efficients

Notes: * implies that values are significant at 1 per cent level (critical value: 2.58).

** implies that values are significant at 5 per cent level (critical value: 1.96).

*** implies that values are significant at 10 per cent level (critical value: 1.65).

Source: Authors own Findings

Table 14 depicts that, in terms of short run causality, BSE 500 and USD/INR exchange rate is weakly significant towards gold prices in India whereas, S&P CNX Nifty adjusts itself towards gold prices in the short run.

Serial Correlation

Serial Correlations occurs in time series as the errors associated with a given time period can be taken over into future time periods (Shiva and Sethi, 2015). For example: The correlation between two time series such as

x_1, x_2, \dots, x_{10} and y_1, y_2, \dots, y_{11} , where x and y are two different time-series can be called as *serial correlation* (Gujarati, 2005). Hence, when error terms from different time periods are correlated, we can conclude that, they are serially correlated. The presence of serial correlations has been checked through Breusch-Godfrey Serial Correlation LM test and the hypotheses are constructed as follows:

H_0 : There is no serial correlation among the variables.

H_A : There is serial correlation among the variables.

Table 15 shows that, the Breusch-Godfrey Serial Correlation Lagrange Multiplier test has an observed R^2 value of 4.054 and F-statistic has a value of 2.3186 with a probability of 0.12423 and 0.11358, which shows a rejection of alternative hypothesis and acceptance of null hypothesis at 5% level of significance. Therefore, the model is free from serial correlations.

Table 15: Results of Serial Correlation

F-statistic	2.3186	Prob (F-statistic)	0.12423
Observed R square	4.054	Prob (Chi-square)	0.11358
Notes: * implies that values are significant at 1 per cent level (critical value: 2.58). ** implies that values are significant at 5 per cent level (critical value: 1.96). *** implies that values are significant at 10 per cent level (critical value: 1.65).			

Source: Authors own Findings

Test of Heteroskedasticity

The problem of heteroskedasticity exists as error variance changes proportionally with a variable. In a time-series regression model, if the dependent variable (i.e, gold prices) changes significantly from beginning to the end of the series, then we can conclude

that, there is heteroskedasticity in regression analysis. Breusch-Pagan-Godfrey test is used for checking heteroskedasticity. The hypotheses for this test are constructed as follows:

H_0 : Residuals are not heteroskedastic

H_A : Residuals are heteroskedastic

Table 16: Results showing Heteroskedasticity among residuals

F-statistic	2.4434	Prob (F-statistic)	0.13223
Observed R square	4.6852	Prob (Chi-square)	0.11466
Notes: * implies that values are significant at 1 per cent level (critical value: 2.58). ** implies that values are significant at 5 per cent level (critical value: 1.96). *** implies that values are significant at 10 per cent level (critical value: 1.65).			

Source: Authors own findings

From table 16, it can be observed that, the F-statistic and observed R-square are 2.4434 and 4.6852 with a p-value of 0.13223 and 0.11466, which shows a rejection of null hypothesis and acceptance of alternative hypothesis at 5% level of significance. Hence, it can be concluded that residuals are not heteroskedastic.

Pairwise Granger Causality Tests

In the study, we have conducted Granger causality test to explore the short-term causal relationship between gold price, stock price indices and exchange rates of India. Granger causality signifies whether the past values of x significantly predict the future values of another variable y, then x is considered to Granger cause y and vice-versa (Granger, 1969). The equation for testing Granger causality is given below:

$$X_t = \alpha_1 + \sum_{k=1}^n \beta_{1k} X_{t-k} + \sum_{k=1}^n \gamma_{1k} Y_{t-k} + \epsilon_{1t} \quad \dots\dots\dots (8)$$

$$Y_t = \alpha_2 + \sum_{k=1}^n \beta_{2k} X_{t-k} + \sum_{k=1}^n \gamma_{2k} Y_{t-k} + \epsilon_{2t} \quad \dots\dots\dots (9)$$

Where;

x_t and y_t = variables to be tested;

t= time period;

k = number of lags;

n = maximum number of lagged observations;

e_{1t} and e_{2t} = white noise error terms that mutually uncorrelated.

Testing null hypothesis (H_0): $\gamma_1 = \gamma_2 = \dots = \gamma_n = 0$ for all lags, against γ_1 is not equal to γ_2 is not equal to γ_n is not equal to 0 for some lags. If both γ_1 and γ_2 are significant then, bi-

directional causality runs; if coefficients of γ_1 are significant but γ_2 not then, y granger causes x and vice-versa; if γ_1 and γ_2 are not statistically differs from 0, then both x and y are independent in nature. Table 17 shows that, there exist a short run causal relationship between gold prices and S&P CNX Nifty and gold prices and BSE 500 at 1 and 10 percent level of significance. However, bidirectional causality exhibited between exchange rate of USD/INR and gold prices; S&P CNX Nifty and exchange rate of USD/INR and BSE 500 and exchange rate of USD/INR.

Table 17: Results of Pairwise Granger Causality Test

Sample: 2000-2019 (Monthly data)				
Lags: 3				
Hypotheses	Null	F-Statistic	Probability	Decision
DGP does not Granger cause DS&P CNX NIFTY	$r = 1$ $r \leq 1$	4.3584	0.0148	Reject*
DGP does not Granger cause DBSE500	$r = 1$ $r \leq 1$	2.6909	0.0889	Reject***
DEXC does not Granger cause DGP	$r = 1$ $r \leq 1$	2.8235	0.0624	Reject***
DGP does not Granger cause DEXC	$r = 1$ $r \leq 1$	6.7505	0.0002	Reject*
DBSE500 does not Granger cause DEXC	$r = 1$ $r \leq 1$	2.1138	0.0993	Reject***
DEXC does not Granger cause DBSE500	$r = 1$ $r \leq 1$	3.0084	0.0311	Reject**

DS&P CNX NIFTY does not Granger cause DEXC	r = 1 r ≤ 1	2.5632	0.0556	Reject**
DEXC does not Granger cause DS&P CNX NIFTY	r = 1 r ≤ 1	2.4024	0.0685	Reject***
Notes: * implies that values are significant at 1 per cent level (critical value: 2.58). ** implies that values are significant at 5 per cent level (critical value: 1.96). *** implies that values are significant at 10 per cent level (critical value: 1.65).				

Source: Authors own Findings

CONCLUSION

Using ‘time-series regression’, the study examines causal relation between gold prices, S&P CNX Nifty, BSE 500 and USD/INR exchange rates from 1st January, 2000 to 30th April, 2019. The findings of the study reflect a significant relationship between gold prices, S&P CNX Nifty, BSE 500 and USD/INR exchange rates with an adjusted R² of 47.78. Gold has a long term perspective. The Johansen Co-integration test shows that, there is a long run equilibrium relationship between independent and dependent variables. Moreover, the speed of adjustment with which the financial markets (inclusive of banks and financial institutions) adjust itself with gold prices is high both in long and short run scenario. In the short run we have seen that, gold prices are highly influenced by S&P CNX Nifty in comparison to BSE 500 and exchange rates of USD/INR. Hence, short run strategies can be formed after making proper evaluations of USD/INR exchange rates to make an impact on gold prices. The Granger Causality test

also reflects the existence of unidirectional causality between gold prices and stock price indices and bidirectional causality between gold prices and exchange rates of USD/INR; S&P CNX Nifty and exchange rate of USD/INR and BSE 500 and exchange rate of USD/INR. Hence, the study provides an insight about the price discovery mechanism of gold prices in Indian economy where, Indian stock market plays a salient role both in short and long term. In India, gold is mostly used by household sector either for meeting up social or cultural demands or as alternative saving method. The involvement of Indian financial markets, consist of financial institutions and banks on holding gold are not so remarkable. In our study, we can observe that, in long run, the speed of adjustment with which the stock markets and exchange rates adjust themselves with gold prices in India is considerably high while, short term strategies can be designed after proper assessment of USD/INR exchange rates preponderating in the present market framework. On the other hand, in the current global condition

especially in US and European markets, the global investors prefers equity and other riskier assets instead of holding ‘gold’ as a ‘port in a storm’.

Our study provides meaningful insights about the linkage between gold prices, stock market indices and exchange rate of USD/INR in Indian context. However, this study will also provide a large platform to budding researchers to further highlight other important variables that may affect the gold price or can use larger samples or larger time period or alternative methodologies with respect to India or any other Asian countries.

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Impact of Goods and Services Tax on Petroleum Products to Curb Prices in India – A Study

Sankar Paul

Abstract:

Prices of Petroleum Products i.e. Petrol and Diesel have gone up day by day. Still, petroleum products are out of the regime of Goods and Services Tax. Excise Duty, VAT and Dealers Commission are presently the three taxes in Petroleum Products. In our Study, we have seen that excise duty per litre of petrol and diesel increases by 248% and 793% in seven years. Collection of Excise Duty and VAT also increase over the years. So, in order to curb petrol and diesel prices, there is a huge need to include petrol prices under the regime of GST. In our study, we have found that if petrol and diesel come under the ambit of GST, then projected price per litre will come down. Similarly, State's exchequer will lose revenue if petrol and diesel will come under the highest slab in GST. So, Govt. of India through the Ministry of Petroleum and Natural Gas has taken some initiatives to include the petroleum products under the regime of GST in order to curb the price hike.

Key Words: Goods and Services Tax, Petroleum and Diesel, Excise Duty, Value Added Tax

Introduction

Petroleum Products like Petrol, Diesel, Jet fuel and Natural Gas have not included still in Goods and Services Tax. Introduction of Goods and Services Tax (GST) on 1st July, 2017 was the biggest indirect tax reform in India. Almost all the goods are included in the purview of Goods and Services Tax except Petroleum products. The hike in Petroleum products like Petrol and Diesel over the days is mainly because of not including the

Petroleum products in Goods and Services Tax (GST). In order to give relief to the consumers, Govt. of India through the initiatives of Ministry of Petroleum and Natural Gas took a decision to include the Petroleum products in GST. But the State Governments do not agree with the proposal of Ministry of Petroleum and Natural Gas because if Petroleum products have included in Goods and Services Tax, then States' revenue in the form of collection of Value Added Tax (VAT)/ Sales Tax will be less.

Table 1: Daily Retail Selling Price of Petrol and Diesel in the Month of January, 2021 for 4 Metro Cities

January 2021	Delhi		Mumbai		Kolkata		Chennai	
	RSP of Petrol (Rs./Litre)	RSP of Diesel (Rs./Litre)	RSP of Petrol (Rs./Litre)	RSP of Diesel (Rs./Litre)	RSP of Petrol (Rs./Litre)	RSP of Diesel (Rs./Litre)	RSP of Petrol (Rs./Litre)	RSP of Diesel (Rs./Litre)
1	83.71	73.87	90.34	80.51	85.19	77.44	86.51	79.21
2	83.71	73.87	90.34	80.51	85.19	77.44	86.51	79.21
3	83.71	73.87	90.34	80.51	85.19	77.44	86.51	79.21
4	83.71	73.87	90.34	80.51	85.19	77.44	86.51	79.21
5	83.97	73.87	90.34	80.51	85.19	77.44	86.51	79.21
6	84.2	74.12	90.6	80.78	85.44	77.7	86.75	79.46
7	84.2	74.38	90.83	81.07	85.68	77.97	86.96	79.72
8	84.2	74.38	90.83	81.07	85.68	77.97	86.96	79.72
9	84.2	74.38	90.83	81.07	85.68	77.97	86.96	79.72
10	84.2	74.38	90.83	81.07	85.68	77.97	86.96	79.72
11	84.2	74.38	90.83	81.07	85.68	77.97	86.96	79.72
12	84.45	74.38	90.83	81.07	85.68	77.97	86.96	79.72
13	84.7	74.63	91.07	81.34	85.92	78.22	87.18	79.95

14	84.7	74.88	91.32	81.6	86.15	78.47	87.4	80.19
15	84.7	74.88	91.32	81.6	86.15	78.47	87.4	80.19
16	84.7	74.88	91.32	81.6	86.15	78.47	87.4	80.19
17	84.95	74.88	91.32	81.6	86.15	78.47	87.4	80.19
18	85.2	75.13	91.56	81.87	86.39	78.72	87.63	80.43
19	85.2	75.38	91.8	82.13	86.63	78.97	87.85	80.67
20	85.2	75.38	91.8	82.13	86.63	78.97	87.85	80.67
21	85.45	75.38	91.8	82.13	86.63	78.97	87.85	80.67
22	85.7	75.63	92.04	82.4	86.87	79.23	88.07	80.9
23	85.7	75.88	92.28	82.66	87.11	79.48	88.29	81.14
24	85.7	75.88	92.28	82.66	87.11	79.48	88.29	81.14
25	86.05	75.88	92.28	82.66	87.11	79.48	88.29	81.14
26	86.3	76.23	92.62	83.03	87.45	79.83	88.6	81.47
27	86.3	76.48	92.86	83.3	87.69	80.08	88.82	81.71
28	86.3	76.48	92.86	83.3	87.69	80.08	88.82	81.71
29	86.3	76.48	92.86	83.3	87.69	80.08	88.82	81.71
30	86.3	76.48	92.86	83.3	87.69	80.08	88.82	81.71
31	86.3	76.48	92.86	83.3	87.69	80.08	88.82	81.71

***RSP stands for Retail Selling Price**

Source: Petroleum Planning & Analysis Cell, Ministry of Petroleum and Natural Gas

Table 1 shows the retail selling prices of Petrol and Diesel of four Metro Cities in the month of July, 2021. At the time of inception of Goods and Services Tax i.e. on 1st July, 2017, Petrol and Diesel price was Rs. 63.09 and Rs. Rs. 53.33 per litre in Delhi. But on 1st January, 2021 the price per litre of petrol and diesel go up to Rs. 83.71 and 73.87 respectively. So near about 33% hike in petrol price per litre and 39% hike in diesel price per litre with in 4 years from the

inception of GST. Similarly, at the time of inception of GST i.e. on 1st July, 2017, the petrol and diesel prices per litre in Mumbai was Rs. 74.30 and Rs. 58.63 respectively. So, 22% hike in petrol price per litre and 37% hike in diesel price per litre within 4 years from 2017 to 2021. Similarly, in Kolkata, the petrol and diesel price per litre on 1st July, 2021 was Rs. 66.32 and 55.62 respectively. So, an increase of 28% in petrol price per litre and 39% in diesel price

per litre over 4 years from 2017 to 2021. Lastly, In Chennai, the petrol and diesel price per litre was Rs. 65.46 and Rs. 56.13. So, an increase of 32% in petrol price per litre and 41% in diesel price per litre over 4 years from 2017 to 2021.

Objectives of the Study

- To highlight the existing tax structure available on petrol and diesel in India
- To show the revenue earned through Excise Duty (in case of Central Govt.) and Value Added Tax (VAT)/ Sales Tax (in case of respective States) on petroleum products i.e. petrol and diesel.
- To show the projected petrol and diesel prices under various slabs of Goods and Services Tax (GST).
- To highlight the initiatives taken by Govt. of India through Ministry of Petroleum and Gas for inclusion of Petroleum products in Goods and Services Tax (GST).

Methodology

The entire study is exploratory and empirical in nature. Data has been collected from secondary sources like Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Department of Industrial

Policy and Promotion, Govt. of India, Department of Commerce and Industry, Govt. of India, IOCL, BPCL, HPCL.

Data Analysis, Presentation and Findings

1. To highlight the existing tax structure available on petrol and diesel in India

At present situation petrol and diesel are out of the ambit of Goods and Services Tax. Generally, customers pay three major taxes on petrol and diesel in India. These three taxes are Excise Duty (charged by Central Govt.), Value Added Tax (VAT)/ Sales Tax (charged by respective States) and Dealers' Commission. The recognised oil companies supply petrol and diesel to all the dealers excluding Excise Duty and VAT. It is the imposition of Excise Duty and Vat/ Sales Tax to increase the price of petrol and diesel.

1.1 Excise Duty on Petrol and Diesel

Excise Duty on unbranded petrol and diesel per litre was Rs. 9.48 and Rs. 3.56 respectively just before Narendra Modi came to power. Excise Duty from Rs. 9.48 per litre of petrol on 1.4.2014 to Rs. 32.90 on 1.1.2021 in Delhi increasing over 248% in 7 years. Similarly Excise Duty from Rs. 3.56 per litre of diesel on 1.4.2014 to Rs. 31.80 on 1.1.2021 in Delhi increasing over 793% in 7 years. This huge collection of Excise Duty on petrol and diesel helped the government to bridge the budget deficit.

Table 2: Price Buildup of Petrol at Delhi as on 1st June, 2021

Elements	Rs. / Litre
Base Price	35.63
Freight etc.	0.36
Price charged to Dealers (Excluding Excise Duty and VAT)	35.99
Add: Excise Duty	32.90
Add: Dealers Commission (Average)	3.79
Add: VAT (VAT on Dealer Commission)	21.81
Retail Selling Price at Delhi	94.49

Source: IOCL

Table 3: Price Buildup of Diesel at Delhi as on 1st June, 2021

Elements	Rs. / Litre
Base Price	38.16
Freight etc.	0.33
Price charged to Dealers (Excluding Excise Duty and VAT)	38.49
Add: Excise Duty	31.80
Add: Dealers Commission (Average)	2.59
Add: VAT (VAT on Dealer Commission)	12.50
Retail Selling Price at Delhi	85.38

Source: IOCL

2. To show the revenue earned through Excise Duty (in case of Central Govt.) and Value Added Tax (VAT)/ Sales Tax (in case of respective States) on petroleum products i.e. petrol and diesel

Central Government's tax collection on petroleum products i.e. petrol and diesel have jumped over 300% in last six years. The Central Govt. collected Rs. 29279 crores from excise duty on petrol and Rs. 42881 crores on diesel in 2014-15. Then the collection of tax rose to Rs. 2.94 lakh crore in 2020-21 according to information furnished by Anurag Thakur in the parliament. He also said that tax collected on petrol, diesel and natural gas as a percentage of total revenue have gone up from 5.4% in 2014-15 to 12.2% in 2020-21.

Similarly, The VAT/Sales Tax collection on Petrol and Diesel increased only marginally in the States. From Rs. 129045 crores in 2013-14, it increased to Rs. 166378 crores in 2016-17. VAT/ Sales Tax revenue on petro products have remained at 1.1% of GDP from 2013-14 to 2016-17.

3. To show the projected petrol and diesel prices under various slabs of Goods and Services Tax (GST)

If GST is applied on petro products, then it will subsume both Central Excise Duty and VAT/ Sales Tax. In order to give relief to the

consumers, there is a high need to include petrol and diesel in GST. If, 4 tax slabs of GST i.e., 5%, 12%, 18%, 28% is applicable to petro products, then it will automatically come down the price. However, highest slab of GST rate can be of 40% in order increase the tax revenue by the government under present GST law and to any limit after amendment to GST Act is approved by the parliament. Below, we have shown the projected petrol and diesel price under various GST slabs.

Table 4: Projected Per Litre Petrol Price under various GST Slabs at Delhi as on 01.06.2021

Actual Price @ IOCL Bunks	Projected Price (Rs. / Litre)			
	@ 12% GST	@ 18% GST	@ 28% GST	@ 40% GST
94.49	44.55	46.94	50.92	55.69

Table 4: Projected Per Litre Diesel Price under various GST Slabs at Delhi as on 01.06.2021

Actual Price @IOCL Bunks	Projected Price (Rs. / Litre)			
	@ 12% GST	@ 18% GST	@ 28% GST	@ 40% GST
85.38	46	48.47	52.58	57.51

From the above two tables, it has been seen that if GST has been imposed on petrol and diesel prices, then it would curb the price hike. So, if GST has been imposed on petrol products, States will lose revenue. In the above two tables, it has been seen that if highest tax slab of GST i.e. 40% is applicable to petrol, then per litre petrol price will come down to Rs.55.69. Previously VAT on per litre of petrol price was 21.81 at Delhi and 42% of Excise Duty has been collected by the States. So, total States exchequer was Rs.35.628 per litre of petrol. But now, if highest tax slab of GST i.e. 40% is applicable to per litre of petrol price, States will get 20% as SGST amounting to Rs. 7.956. So, State's exchequer will lose Rs. 27.672 as revenue per litre of petrol. Now, if, highest GST slab rate would be considered as 28%, then State Government's exchequer will lose by extra Rs. 2.386 per litre of petrol.

Moreover, it has been seen that if highest tax slab of GST i.e. 40% is applicable to diesel, then per litre diesel price will come down to Rs.57.51. Previously VAT on per litre of petrol diesel was 12.50 at Delhi and 42% of Excise Duty has been collected by the States. So, total State's exchequer was Rs.25.86 per litre of diesel. But now, if highest tax slab of GST i.e. 40% is applicable to per litre of diesel price, States will get 20% as

SGST amounting to Rs.8.216. So, State's exchequer will lose Rs. 17.644 as revenue Per litre of diesel. Now, if, highest GST slab rate would be considered as 28%, then State Government's exchequer will lose by extra Rs. 2.465 per litre of disel.

4. To highlight the initiatives taken by Govt. of India through Ministry of Petroleum and Gas for inclusion of Petroleum products in Goods and Services Tax (GST)

According to the news under GST as on 13th September, 2017, The union Minister for Petroleum and Natural Gas Sri Dharmendra Pradhan plans to bring petroleum products under the ambit of GST as it could be beneficial for the national economy. Finance Minister on 19th December, 2017 also made statement in this regard that the Centre is in favour of bringing petroleum products under Goods and Services Tax regime, but is waiting for a consensus to emerge among States. But bringing petroleum products under GST also involves politics. As we all know that GST council which comprises of the representatives from different states can take the decision to include petroleum products under GST regime. So, States' exchequer in terms of collection of revenue will come down if petroleum products will come under the ambit of GST. Presently State Government has freedom to decide

VAT rate to increase tax revenue. Under GST, State Governments will have to follow the GST rate as determined by GST Council and they will have no freedom in increasing revenue which will make them totally dependent on the Central Government. For different reasons, Govt. of India thinks to include petroleum products under GST i.e. uniform tax collection, abolition of different tax available on petro products, checking of inflation rates after the implementation of GST on petro products etc.

Further, price of petroleum mainly depends on international crude prices on which Central or State Governments have no control. So, whenever the price of international crude will come down, it will reflect in the price of petrol and diesel

Conclusion:

From the above study, it has been found that prices of petroleum products like petrol and diesel has gone up day by day. The consumers suffer a lot by the hike in petrol and diesel. This study primarily focusses on the impact of Goods and Services Tax on Petroleum Products i.e. petrol and diesel. In our study, it has been seen that at present, three types of taxes like Excise Duty, VAT and Dealers' Commission available on petrol and diesel. From the year 1.4.2014 to 1.1.2021 excise duty per litre of petrol and diesel has gone up by 248% and 793% respectively. Moreover, we have seen

that excise duty collection on petrol and diesel over 300% in just six years. States' revenue in terms of VAT/ Sales Tax has also increased over the years. So, petroleum products need to include under GST. Now, in this study, if prices per litre of petrol and diesel will come under the various slabs of GST, then the price per litre of petrol and diesel will come down and states' exchequer will lose its revenue. So, Govt. of India through the ministry of petroleum and Natural Gas has taken initiatives to include petrol and diesel under GST regime. It will help to curb the price hike and give relief to the consumers.

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Trends in Profitability of Maharatna Central Public Sector Enterprises in India during the Post-Liberalization Era

Sunil Kumar Yadav

Abstract:

The liberalization of the economy in 1991 has changed the market dynamics with private sector playing a greater role in shaping the industrial landscape. As a consequence, the Central Public Sector Enterprises (CPSEs) have exposed to competition from domestic and overseas companies. Some CPSEs have been able to reorient their business strategies and benchmark their performance with best practices while others failed to do so. As a result, there has been a significant change in the profitability trend of these companies during the post-reform period. This paper attempts to make a comparative analysis of profitability of Maharatna CPSEs during the post-reform period. The issue addressed in the present study has used appropriate statistical tools and technique as per requirement. The study discloses that GAIL and ONGC jointly proved themselves as highest profit earners during the period under study by skirmishing all the obstacles emanated from liberalization, globalization and competitiveness.

Key Words: Globalization; Liberalization; Profitability; Market Dynamics; Post-reform

Introduction

The Central Public Sector Enterprises (CPSEs) in India have played a vital role in developing the nation on global road map. Its contribution towards growth, development and welfare of economy as well as in formation of strong human capital and intellectual property rights needs no emphasis. It contributes for social well being of the society by playing multi-dimensional role of invention, development, production and distribution of quality products to the people of society is equally notable.

Since beginning, the CPSEs have been the core of the Indian economy and were set up with the mandate to serve the broad macro-economic objectives of higher economic growth, achieve self-sufficiency in production of goods and services, facilitate long-term equilibrium in balance of payments and ensure the stability in prices and create benchmarks for prices of essential items.

While it is true that the main motive behind establishment of PSEs is service and not earning profit but in order to survive in this competitive environment every business firm has to earn satisfactory amount of profit. A firm must earn profit to remain in existence for long period of time. It is essential for survival of business, its growth and expansion over time. It also acts as inspiration to take the responsibility of setting up a new business. It is the indicator

of improved national income, economic progress and rising standard of living.

The term profitability means ability of a firm to generate revenue in excess of expenses incurred in the process of earning those revenues. It acts as a yardstick of measuring operating efficiency of the firm. Profitability analysis is an essential part of financial analysis. The profitability analysis sheds light on the aspects like – good performance of business enterprise, what effort it had deployed to achieve this performance or what level of capital the company operates with to achieve this level of profit, etc. Analysis of profitability ratios is very good way to analyze the profitability of a business enterprise. Profitability ratios are divided into two types, (i) profitability ratios in relation to sales, i.e. gross profit ratio (GP Ratio), net profit ratio (NP Ratio), operating profit ratio (OP Ratio) etc. (ii) profitability ratio in relation to investment i.e. return on capital employed (ROCE), return on net worth (RONW), etc.

A considerable number of studies have been carried out on the analysis of financial performance of PSEs in India in which along with other aspects of financial performance the profitability has been considered. However, the matter related with profitability specifically of all Maharatna CPSEs has not yet been addressed, in this backdrop the present paper seeks to make profitability analysis of Maharatna Central Public Sector Enterprises in India during the period 1999-2000 to 2018-2019. The

remainder of the paper is divided into different sections: Section II deals with the objectives of the study. Section III narrates the methodology adopted in this study. Section IV is concerned with the empirical results and discussions and in Section V enumerates concluding observations.

II. Review of related Literature

Before stepping into the empirical study, a quick look through the existing literature on the issue addressed in the study seems desirable. During the last few decades, significant numbers of studies have been conducted in India on different aspects of Maharatna CPSEs. A good number of these studies were associated with analyzing the profitability of Maharatna companies in India. The following paragraphs provide a brief explanation of some of notable studies made on this issue.

Chakraborty (2014) carried out a study to analyze the relationship between assets management efficiency and profitability of ten selected CPSEs in India during the study period 1997-1998 to 2011-2013 by applying correlation and regression techniques. The study inferred that in most of the cases efficient management of fixed assets and inventory made a positive as well as significant contribution towards enhancing the earning capability of the selected CPSEs during the study period.

Sur and Yadav (2014) in their study made a cross-sectional analysis of Maharatna CPSEs in respect of the efficiency in asset

management during the period 2004-2005 to 2013-2014. While measuring the efficiency of the asset management in this study, various ratios like fixed assets turnover ratio, debtors turnover ratio, cash turnover ratio, inventory turnover ratio and receivable turnover ratio were used. The study revealed that the GAIL and IOCL jointly captured the best position in respect of assets management, followed by ONGC, BHEL, CIL, SAIL, and NTPC respectively in that order during the period under study.

Sur and Panja (2014) in their study made a comparative analysis of profitability of NTPC Ltd; the only Maharatna CPSE in the Indian power sector during the pre-liberalization and post-liberalization periods. In this study the profitability performance of the company was assessed on the basis of certain aspects, such as average, consistency, trend etc. of some of the selected profitability ratios using relevant statistical tools and techniques. The study showed that the NTPC Ltd. was able to prove itself as a better performer in terms of earning capability in the post-liberalization period as compared to the pre-liberalization era by combating various obstacles emanated from liberalization, globalization and various kinds of competitiveness arising out of opening up of the economy.

Vijaykumar and Jayachitra (2014 and 2015) conducted a research study to investigate the profitability performance of twelve CPSEs in India in both the pre-disinvestment and post-disinvestment

periods. In this study companies belonging to the manufacturing sector such as Fertilizer, Heavy Engineering, Medium and Light Engineering, Petroleum (Refinery & Marketing) and Transportation Equipment were considered. The study revealed that 58 per cent of the sample companies were able to enhance profitability notably during the post-disinvestment period. The study concluded that in majority cases disinvestment policy had positive impact on the profitability performance of the companies.

Further, they made a comparative study of financial and operating performance of some selected CPSEs in India during the pre-disinvestment and post-disinvestment periods using some suitable statistical techniques. The CPSEs were selected for study from the different manufacturing industries like Heavy Engineering, Fertilizer, Medium and Light Engineering, Transportation Equipments, Petroleum Refinery and Marketing. The study concluded that companies belonging to the heavy engineering sector showed the most significant improvement in performance during the post-disinvestment period while the performance of the companies belonging to the transportation equipments was far from the level of satisfactory in the same period.

Apara (2015) carried out a study on Steel Authority of India (SAIL) to analyze the impact of determinants such as size, growth, liquidity, leverage and productivity on the

profitability of the company by applying correlation and regression techniques. The study revealed that size, leverage and productivity were negatively associated with profitability while growth and liquidity were positively correlated with profitability. The outcome derived from the regression analysis also showed that the productivity and size were prominent variables in explaining the profitability of the SAIL during the study period.

Sur and Chakraborty (2015) conducted a research study considering all major dimensions of financial performance of BHEL, the only 'Maharatna' CPSE in Indian power equipment manufacturing sector. The secondary data collected from the Capitaline Corporate Database for the period 2004-2005 to 2013-2014 were analyzed by using relevant statistical tools. The study indicated no describable trend in most of the selected dimensions of financial performance of BHEL during the study period while a strong evidence of upward trend only in earning capability of the company was found during the period under study. Another notable outcome derived from both the partial correlation analysis and multiple regression analysis as made in this study reflects that the working capital management of BHEL made a noticeable contribution in enhancing its value generating capability during the study period while the company's fixed asset management failed to establish itself as a significant contributor towards wealth

generation in the same period.

Singh and Sur (2016) in their study assessed the profitability of the Maharatna CPSEs using data envelopment analysis. In this study, in order to make a comparison among the Maharatna CPSEs in respect of the consistency of their profitability, the ratio of mean to standard deviation (SD) of technical efficiency score was used. For identifying the nature of the trend in the efficiency scores of each of the companies under study during the study period linear trend equations were fitted. The study revealed a wide variation in the level of technical efficiency score across the Maharatna CPSEs during the study period. ONGC and BHEL proved themselves as the most consistent performers in terms of profitability as measured by consistency coefficient of TES whereas NTPC and SAIL were placed in the last two ranks during the period under study

Adekola et al. (2017) in their study examined the role of working capital management in driving corporate profitability based on the data of 50 selected Nigerian-quoted non-financial services companies during the period 2002 to 2011. The outcomes as derived from the ANOVA reflected that current ratio (CR) and both gross and net operating profits reinforced each other in some sectors through a positive relationship while trade-offs existed between them in other sectors. The study also revealed that the relationship between profitability and liquidity was neither concave nor linear and

the relationship was influenced by the sector within which the company operated

III. Objectives of the Study

1. To analyze the profitability of the selected sample companies using most significant profitability ratios.
2. To analyze the status of the profitability of the Maharatna CPSEs based on comprehensive score.
3. To analyze the nature and extent of relationship between efficiency of fixed assets management and profitability as well as between the efficiency of working capital management and profitability of the Maharatna CPSEs under study.
4. To identify the factors which impacting the overall profitability of the companies under study.

IV. Methodology

Study Period: The period 1999-2000 to 2018-2019 was taken into consideration for the study. Though the liberalization, globalization process started in India during 1991-92. The actual impact of this process was felt during the year 1999-2000. So, in

this study the financial year 1999-2000 was considered as the initial year of the study period.

Collection and Analysis of Data: The study is based on eight Maharatna companies namely i) Bharat Heavy Electricals Limited (BHEL), ii) Bharat Petroleum Corporation Limited (BPCL), iii) Coal India Limited (CIL), iv) GAIL (India) Limited (GAIL), v) Indian Oil Corporation Limited (IOCL), vi) NTPC Limited (NTPC), vii) Oil and Natural Gas Corporation (ONGC), and viii) Steel Authority of India Limited (SAIL). The data of the selected companies for the period 1999-2000 to 2018-19 used in this study, were collected from secondary sources i.e. Published Annual Financial reports of the Maharatna Companies, Capitaline Corporate Database of Capital Market Publisher (I) Pvt. Ltd., Mumbai. As the liberalization process started in India, during the financial year 1991-1992, it is quite obvious that the effect of it could not be reflected immediately just after its inception. Thus, in this study, the year 1999-2000 has been considered as initial year of post-liberalization period. For measuring the 'overall profitability' and 'profitability from the Owner's' viewpoint' Return on Capital Employed (ROCE) and Return on Net Worth (RONW) were used. These are two most important measure of profitability. In operational terms, overall profitability of a company is influenced by the efficiency with which fixed assets and working capital are managed. The fixed assets turnover ratio

(FATR) and working capital turnover ratio (WCTR) are considered as most reliable measures of efficiency in fixed asset management and efficiency in working capital management respectively. So, in this study FATR and WCTR were used to judge the efficiency with which these assets are utilized. While analyzing the profitability in this study, simple statistical tools like simple arithmetic mean (AM) and standard deviation (SD), statistical techniques, such as Pearson's simple correlation analysis, Spearman's rank correlation analysis, Kendall's correlation analysis, analysis of multiple correlations and, multiple regression analysis and statistical test like t test and F test were applied at appropriate places.

V. Empirical Results and Discussion

1. In Table 1 and Table 2, an attempt was to analyze the profitability of Maharatna CPSEs using ROCE and RONW. In these tables, for measuring the average values of ROCE and RONW of the companies under study, simple AM and for ascertaining the consistency coefficient scores of ROCE and RONW series, the ratio of AM to SD were used. For identifying the nature of trend in both ROCE and RONW of each of the companies during the period under study, linear trend equation were fitted and in order to examine whether the slopes of the trend lines were

statistically significant or not t test was used.

Table 1 discloses that the highest value of ROCE (85.890 %) was achieved by CIL in the year 2016-17 while it was the least (-4.780 %) in 2001-2002 in the case of SAIL. Based on the average ROCE, CIL Captured top most position and it was followed by ONGC, GAIL, BHEL, SAIL, BPCL, IOCL, and NTPC respectively. It is observed in the table that the consistency coefficient scores of ROCE, NTPC was able to establish itself as the most consistent performer followed by GAIL, ONGC, IOCL, BPCL, BHEL, CIL and SAIL respectively in that order. The linear trend equation fitted to the ROCE series revealed that an upward trend which was found to be statistically significant, was noticed in CIL during the period under study while a declining trend, which was found to be statistically significant, was observed in GAIL, NTPC and ONGC whereas a declining trend which was not found to be statistically significant was noticed in BHEL, BPCL, IOCL and SAIL respectively during the study period.

2. Table 2 shows that the highest value of RONW (101.300 %) was achieved by CIL in the year 2016-2017 while it was least (-75.320) in 2001-2002 which was earned by SAIL. Based on average RONW, CIL established itself as the best performer by capturing

top-most position and it was followed by ONGC, GAIL, BPCL, BHEL, IOCL, SAIL and NTPC respectively in that order. In respect of consistency coefficient scores of RONW NTPC was considered as most consistent performer followed by GAIL, ONGC, BPCL, IOCL, BHEL, CIL and SAIL respectively in that order. The linear trend equations fitted to RONW series disclosed that CIL followed an upward trend which was found to be statistically significant during the period under study while GAIL, IOCL, NTPC and ONGC adopted declining trends which was found to be statistically significant during the study period whereas an insignificant declining trends was observed in BHEL and SAIL only.

3. For the purpose of ascertaining the profitability status of the Maharatna CPSEs more precisely, a comprehensive rank test was applied considering both the average and consistency aspects of ROCE and RONW in Table 3. While conducting such test, comprehensive ranks were determined on the basis of the average values of selected profitability measures (ROCE & RONW) and consistency coefficient scores of (ROCE & RONW). In this test, a process of ranking was applied to arrive at more comprehensive measure of profitability in which average values of selected ratios, namely ROCE and RONW and values of consistency

coefficients of ROCE and RONW were combined in a composite score. Ultimate profitability ranking, based on sum of scores of each of the company's separate individual ranking under the average and consistency coefficients of ROCE and ROWN, was made on the principle that lower the composite score, higher the profitability and vice versa. Table 3 exhibits that based on the combined score, GAIL and ONGC captured the top-most position in respect of profitability and was followed by CIL, NTPC, BPCL, BHEL, IOCL and SAIL respectively in that order.

4. In Table 4 and Table 5 for ascertaining the nature and extent of relationship between the FATR and ROCE and that between WCTR and ROCE of the companies under the study, an effort has been made through correlation coefficients between the selected efficiency and overall profitability measures taking into consideration their magnitudes by Pearson's simple correlation coefficients, rankings of their magnitudes by Spearman's rank correlation coefficient and nature of their associated changes by Kendall's correlation coefficient. These correlation coefficients were by |t| test.

Table 4 shows that out of twenty four correlation coefficients between FATR and ROCE, fifteen were positive, of which twelve were observed to be statistically significant, whereas nine

coefficients were negative which were not found to be statistically significant.

Theoretically a high degree of positive association between FATR and ROCE is expected. The results obtained from table 4 indicate that in most of the cases the outcome support the theoretical arguments.

Table 5 discloses that out of twenty four correlation coefficients between WCTR and ROCE, eight were positive, of which two were found to be statistically significant while remaining sixteen were negative, of which two were found to be statistically significant. It is generally accepted principle that the higher the efficiency of working capital management, the higher is the profitability. The correlation analysis made in table 5 reflects that in most of the cases outcome does not support the theoretical argument.

5. In Table 6 an attempt was made to identify the factors making significant contribution in enhancing the overall profitability of the Maharatna CPSEs by applying multiple regression analysis technique. While adopting the technique it was assumed that $ROCE = f(FATR, WCTR)$. At the time of carrying out such exercise, the regression model which was fitted is:

$$ROCE = \alpha + \beta_1 \cdot FATR + \beta_2 \cdot WCTR + e$$

α is the intercept term, FATR and WCTR are the partial regression coefficients and e

denotes the error term. The joint influence of FATR and WCTR on ROCE was also measured in each of the selected companies using the analysis of multiple correlations (R). In order to examine whether the partial regression coefficients and multiple correlation coefficients were statistically significant or not |t| test and F test were applied respectively. Table 6 shows that for one unit increase in FATR, the ROCE increased by 3.649 units, 56.974 units and 32.078 units in BHEL, ONGC and SAIL respectively which were found to be statistically significant. When WCTR increased by one unit, ROCE stepped up by 15.584 units in BHEL which was found to be statistically significant while with increase in WCTR by one unit ROCE stepped down by .018 unit and .459 unit in BPCL and NTPC respectively which were found to be statistically significant. Table 6 also discloses that the multiple correlation coefficient of ROCE on FATR and WCTR (R) in selected companies was found to be statistically significant in five companies. It indicates that that joint influence of efficiency in managing fixed assets as well as the working capital management on overall profitability was notable in 62.5 per cent of sample companies during the study period. The analysis of the coefficient of multiple determination (R square) in selected companies which varies between 0.266 (GAIL) and 0.793 (BHEL) reveals that the variation in ROCE explained by the combination of FATR and WCTR of the companies ranged from 26.6 per cent to

79.3 per cent during the period under study period.

VI. Conclusion observations

- a) A significant upward trend in overall profitability was noticed in 12.5% cases, and a notable declining trend in it was observed in 37.5% cases while in remaining 50% cases no describe trend in the overall profitability was established during the study period.
- b) A notable significant declining trend in the profitability from owner's viewpoint was observed in 50% cases, whereas, in only 12.5% cases a significant upward trend in the same parameter was observed and in remaining 37.5% cases no significant trend in it was observed during the period under study.
- c) The analysis of composite profitability scores based on average and consistency coefficient of the selected profitability indicators of the companies under study revealed that GAIL and ONGC jointly proved themselves as highest profit earner during the period under study while SAIL finds place in last bench in terms of earning profitability.
- d) A significant positive relationship between efficiency in fixed asset management and overall profitability was observed in 50% cases whereas in remaining 50% cases insignificant negative relationship was noticed.

It implies, fixed assets management of BHEL, CIL, ONGC and SAIL made a notable contribution towards enhancing the overall profitability during the study period.

- e) A notable negative association between efficiency in managing working capital and overall profitability was observed in 25% cases while significant positive relationship between them was noticed only in 12.5% cases. It reflects that the strong evidence of adverse impact of working capital management on overall profitability in substantial portion of selected companies.
- f) The analysis of the partial regression coefficient of ROCE on FATR indicates that in 50% cases the favourable impact of fixed asset management on overall profitability which was found to be statistically significant was noticed while in 12.5% cases it put an adverse impact on overall profitability which was also found to be statistically significant. In the same way the analysis of partial regression coefficient of ROCE on WCTR reflects that in 12.5% companies' working capital management made a significant positive impact on overall profitability while in 25% companies it made significant negative impact on overall profitability.
- g) The net result derived from the analysis of the coefficient of multiple

determination of ROCE on FATR and WCTR indicates that the percentage of the total variation in overall profitability explained by the efficiency of managing both the fixed assets and working capital was maximum in BHEL which was followed by NTPC, CIL, SAIL and ONGC respectively in that order.

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Table: 1 Analysis of “overall Profitability of Maharatna CPSEs in India based on ROCE 2000-2019

<i>Company</i>	BHEL	BPCL	CIL	GAIL	IOCL	NTPC	ONGC	SAIL
<i>Year</i>								
<i>1999-2000</i>	16.43	18.7	5.41	17.31	13.8	13.72	16.21	1.29
<i>2000-2001</i>	-6.11	16.17	4.18	21.77	11.95	14.17	15.89	4.21
<i>2001-2002</i>	13.14	21.82	12.63	26.03	18.69	12.05	23.34	-4.78
<i>2002-2003</i>	20.14	28.22	7.95	25.44	17.46	12.18	29.84	33.00
<i>2003-2004</i>	19.89	33.07	4.79	33.50	27.32	11.17	46.77	29.26
<i>2004-2005</i>	23.55	15.91	12.84	32.87	29.68	17.25	31.10	25.36
<i>2005-2006</i>	26.86	4.71	12.33	29.75	16.73	14.14	36.61	68.77
<i>2006-2007</i>	36.37	17.09	17.09	30.15	15.69	15.16	35.68	38.03
<i>2007-2008</i>	45.16	13.68	24.33	24.10	17.42	15.75	33.17	51.28
<i>2008-2009</i>	45.23	12.29	22.43	29.14	16.88	15.93	31.82	49.44
<i>2009-2010</i>	40.73	9.84	27.79	28.37	11.15	13.22	27.30	31.28
<i>2010-2011</i>	45.47	10.17	25.13	27.14	17.04	13.10	25.38	24.63
<i>2011-2012</i>	35.94	10.21	22.72	26.52	11.58	12.45	24.93	13.87
<i>2012-2013</i>	28.56	14.65	36.52	22.07	13.55	11.61	28.41	10.08
<i>2013-2014</i>	23.37	17.69	45.62	20.20	8.16	13.72	21.30	6.18
<i>2014-2015</i>	11.01	20.58	72.47	18.58	8.40	10.90	20.83	4.43
<i>2015-2016</i>	4.64	26.98	71.30	11.64	6.35	8.09	15.85	5.03
<i>2016-2017</i>	3.15	23.36	85.89	9.33	13.13	7.40	13.34	6.61
<i>2017-2018</i>	5.63	21.26	71.34	17.44	24.86	7.52	13.88	2.62
<i>2018-2019</i>	6.90	18.38	75.58	21.23	18.14	7.16	18.89	8.64
<i>Maximum</i>	<i>45.470</i>	<i>33.070</i>	<i>85.890</i>	<i>33.500</i>	<i>29.680</i>	<i>17.250</i>	<i>46.770</i>	<i>68.770</i>
<i>Minimum</i>	<i>-6.110</i>	<i>4.710</i>	<i>4.180</i>	<i>9.330</i>	<i>6.350</i>	<i>7.160</i>	<i>13.340</i>	<i>-4.780</i>
<i>Average</i>	<i>22.303</i>	<i>17.739</i>	<i>32.917</i>	<i>23.629</i>	<i>15.899</i>	<i>12.335</i>	<i>25.527</i>	<i>20.462</i>
<i>SD</i>	<i>15.608</i>	<i>6.915</i>	<i>27.314</i>	<i>6.573</i>	<i>6.082</i>	<i>2.946</i>	<i>8.835</i>	<i>19.992</i>
<i>CC</i>	<i>1.429</i>	<i>2.565</i>	<i>1.205</i>	<i>3.595</i>	<i>2.614</i>	<i>4.186</i>	<i>2.889</i>	<i>1.023</i>
<i>Slope of Trend Line</i>	<i>-0.320</i>	<i>-0.009</i>	<i>4.242</i>	<i>-0.580</i>	<i>-0.284</i>	<i>-0.329</i>	<i>-0.622</i>	<i>-0.869</i>
<i>t value</i>	<i>0.519</i>	<i>0.032</i>	<i>9.878**</i>	<i>2.594*</i>	<i>1.218</i>	<i>3.729**</i>	<i>1.945*</i>	<i>1.129</i>

Figures in the parentheses indicate $|t|$ values **Significant at 1 per cent level. * Significant at 10 per cent level.

Source: Compiled and computed from Capitaline Corporate Database, Capital Market Publishers (India) Ltd. Mumbai.

Table: 2 Analysis of “Profitability from owners’ view point” of Maharatna CPSEs in India based on RONW, 2000-2019

<i>Company</i>	BHEL	BPCL	CIL	GAIL	IOCL	NTPC	ONGC	SAIL
<i>Year</i>								
1999-2000	25.71	20.14	6.76	18.22	17.37	14.95	22.13	-36.65
2000-2001	8.16	19.43	3.17	20.55	17.21	14.46	18.01	-17.49
2001-2002	11.08	21.25	13.74	22.22	19.02	12.35	13.22	-75.32
2002-2003	14.28	28.59	5.05	21.93	18.44	13.00	22.34	66.73
2003-2004	11.45	31.98	1.83	28.08	35.72	11.99	32.17	88.85
2004-2005	15.58	15.78	13.75	27.12	33.38	13.03	22.72	35.04
2005-2006	16.84	3.77	13.00	24.32	19.95	14.85	29.71	41.47
2006-2007	25.20	18.66	15.75	24.84	17.78	14.93	28.63	37.33
2007-2008	30.02	14.40	24.72	22.34	19.35	14.68	27.00	41.47
2008-2009	29.23	8.41	20.12	21.33	18.34	14.65	25.20	37.33
2009-2010	26.47	12.20	24.93	20.19	8.36	14.91	21.59	24.10
2010-2011	29.88	11.40	25.54	19.89	21.62	14.57	20.20	21.98
2011-2012	33.33	9.05	28.12	19.76	14.06	13.97	20.48	13.94
2012-2013	30.93	16.75	43.15	17.88	18.61	13.07	23.87	9.22
2013-2014	23.70	22.50	48.87	17.54	8.41	16.42	17.63	5.37
2014-2015	10.90	24.25	81.21	17.06	9.25	13.21	16.92	4.51
2015-2016	4.23	28.34	80.67	10.82	6.23	12.29	12.61	4.86
2016-2017	2.72	28.21	101.30	7.70	14.65	12.02	10.80	10.00
2017-2018	2.47	23.36	73.20	11.45	19.37	10.16	10.31	-1.34
2018-2019	3.87	19.41	74.79	13.36	15.54	10.93	13.16	5.71
Maximum	33.330	31.980	101.300	28.080	35.720	16.420	32.170	88.850
Minimum	2.470	3.770	1.830	7.700	6.230	10.160	10.310	-75.320
Average	17.803	18.894	34.984	19.330	17.633	13.522	20.435	15.856

<i>SD</i>	<i>10.642</i>	<i>7.545</i>	<i>30.822</i>	<i>5.334</i>	<i>7.269</i>	<i>1.577</i>	<i>6.363</i>	<i>35.278</i>
<i>CC</i>	<i>1.673</i>	<i>2.504</i>	<i>1.135</i>	<i>3.624</i>	<i>2.426</i>	<i>8.576</i>	<i>3.212</i>	<i>0.449</i>
<i>Slope of Trend Line</i>	<i>-0.425</i>	<i>0.126</i>	<i>4.698</i>	<i>-0.673</i>	<i>-0.578</i>	<i>-0.103</i>	<i>-0.589</i>	<i>-0.041</i>
<i>t value</i>	<i>1.030</i>	<i>0.420</i>	<i>8.856**</i>	<i>4.767**</i>	<i>2.264*</i>	<i>1.779*</i>	<i>2.777**</i>	<i>-0.029</i>

Figures in the parentheses indicate | t | values ** Significant at 1 per cent level. * Significant at 10 per cent level.

Source: Compiled and computed from Capitaline Corporate Database, Capital Market Publishers (India) Ltd. Mumbai.

Table: 3 Computation of Final Profitability Rank Considering both the Average and Consistency Parameters of the Selected Profitability Measures of the Maharatna CPSEs in India, 2000-2019

Profitability Measure	ROCE				RONW				Sum of Ranks	Ultimate Profitability Rank
	Average		Consistency Score		Average		Consistency Score			
	Value	Rank(1)	Value	Rank(2)	Value	Rank(3)	Value	Rank(4)		
BHEL	22.303	4	1.429	6	17.803	5	1.673	6	21	6
BPCL	17.739	6	2.565	5	18.894	4	2.504	4	19	5
CIL	32.917	1	1.205	7	34.984	1	1.135	7	16	3
GAIL	23.629	3	3.595	2	19.330	3	3.624	2	10	1.5
IOCL	15.899	7	2.614	4	17.633	6	2.426	5	22	7
NTPC	12.335	8	4.186	1	13.522	8	8.576	1	18	4
ONGC	25.527	2	2.889	3	20.435	2	3.212	3	10	1.5
SAIL	20.462	5	1.023	8	15.856	7	0.449	8	28	8

Source: Compiled and computed from Capitaline Corporate Database, Capital Market Publishers (India) Ltd. Mumbai.

Table: 4 Analysis of correlation between efficiency of Fixed Asset Management (FATR) and overall Profitability (ROCE) of Maharatna CPSEs in India

Company	Pearson's	Spearman's	Kendall's
BHEL	0.579*	0.432*	0.571*
BPCL	-0.194	-0.206	-0.307
CIL	0.541*	0.596*	0.724*
GAIL	-0.404	-0.26	-0.375
IOCL	-0.22	-0.201	-0.286
NTPC	0.14	0.081	0.103
ONGC	0.548*	0.436*	0.612*
SAIL	0.537*	0.491*	0.642*

Source: Compiled and computed from Capitaline Corporate Database, Capital Market Publishers (India) Ltd. Mumbai.

Table: 5 Analysis of correlation between efficiency of Working Capital Management (WCTR) and overall Profitability (ROCE) of Maharatna CPSEs in India

Company	Pearson's	Spearman's	Kendall's
BHEL	0.820*	0.670*	.855*
BPCL	-0.544*	-0.274	-0.403
CIL	0.403	0.251	0.313
GAIL	-0.139	-0.211	-0.305
IOCL	-0.088	0.074	0.042
NTPC	-0.653*	-0.228	-0.365
ONGC	-0.157	-0.232	-0.34
SAIL	-0.111	-0.147	-0.202

Source: Compiled and computed from Capitaline Corporate Database, Capital Market Publishers (India) Ltd. Mumbai.

Table: 6 Analysis of Multiple Regression of Overall Profitability on Efficiency of Fixed Asset Management and Working Capital Management of Maharatna CPSEs in India

Company	ROCE= $\alpha + \beta_1 \cdot \text{FATR} + \beta_2 \cdot \text{WCTR} + e$								
	α	t value	β_1	t value	β_2	t value	R	F	R Square
BHEL	-25.273**	4.109	3.649**	3.151	15.584**	6.148	0.891**	32.646	0.793
BPCL	17.290*	2.305	-0.156	0.121	-0.018*	2.501	0.544	3.580	0.296
CIL	12.315	1.356	22.690*	2.346	7.968	1.420	0.601*	4.933	0.367
GAIL	38.344**	6.224	-10.384*	2.391	-0.064	1.545	0.516	3.082	0.266
IOCL	25.687*	2.372	-2.336	0.921	-0.001	0.346	0.234	0.494	0.055
NTPC	15.432**	3.832	-1.910	0.316	-0.459**	3.500	0.656**	6.419	0.430
ONGC	-7.857	0.580	56.974*	2.586	-0.009	0.020	0.548*	3.643	0.300
SAIL	-11.066	0.934	32.078*	2.791	-0.020	0.923	0.568*	4.048	0.323

Figures in the parentheses indicate |t| values ** Significant at 1 per cent level. * Significant at 5 per cent level.

Source: Compiled and computed from Capitaline Corporate Database, Capital Market Publishers (India) Ltd. Mumbai.

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Anova test value	30
ARIMA Analysis	19,25,29,30
Balance of Payment	84,114
Bitcoin	19,-36, 51-62, 64-66
Blockchain	21,24,25,51,53,59,63
Cash Turnover Ratio (CTR)	70,71,73,115
Central Public Sector Enterprises (CPSEs)	113,114-118, 120, 124-128
Climate Protection	1,2,9,18
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