CHAPTER-01

INTRODUCTION TO THE STUDY

AND RATIONALE FOR RESEARCH

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1.1 **OVERVIEW**

Commodities and commodity markets are important part of any economy. Its impact on welfare of large sections of the society -both producers and consumers-is universal. Commodity is a generic term and includes a wide variety of groups of products, ranging from agricultural products to metals, precious metals, gas and crude oil, power. Commodities are those goods which are (largely) homogeneous products, are produces in large quantity and traded in natural state of production without value addition. They are purchased for direct consumption without processing (electricity) or after processing (agricultural products) or for further processing to manufacture value added products. Production of the commodities requires large specific inputs. Agricultural products are not technologically intensive but require land which is a scarce factor. Since agricultural products are essential goods, technology is sought to replace the land as a factor. Metals and precious metals, as commodities, are mined wherever they naturally occur. Vast lands are necessary and major producers are African countries, North and South America, Russia and Eastern Asia. Smaller landed countries, e.g., countries like Japan, European countries, Taiwan, import these commodities and many producers are dependent on a single metal commodity as a major contributor to national income. Oil and gas are indispensable but are exhaustible. Their production requires not only natural occurrence but also very large capital investment. Hence the production is controlled, world over, by few countries and few companies. Managing oil and gas imports/exports is a major challenge to most economies. Electricity generation and distribution is dependent on availability of inputs and require large investment. Requirement of large investment result into natural monopoly. The demand for the product is continuous but varies with time during a day. Since intraday fluctuation could be high, managing production and distribution poses a challenge. Large capacities could result into idle capacity at some time during the
day and small capacities could result in inadequate supply during other part of the
day. Managing the production-consumption balance require developing
sophisticated market mechanisms.

Each group of these products has a unique contribution to the society and Market
for each of these products has different characteristics. Agricultural products are
essential products, have moderate price elasticity (since inter-product substitution
is high) and high income elasticity, highly dependent on uncontrollable external
factors and consequently large price variability, competitive markets and hence
more risky for producers. Energy products, mainly gas and crude oil, have
oligopolistic markets, very high linkages to the other sectors of the economy and
hence low price elasticity, is geographically limited to few regions on the earth
resulting in large imports/exports and having direct and large effect on trade,
income and welfare.

Some commodities, e.g., mineral oil, play a major role in the development of an
economy. Countries which are dependent on the import of these critical
commodities have to plan to minimize the expenditure on imports or develop
sufficient capabilities for exports to finance the imports.

Commodities play a major role in the economic growth, employment and welfare of
large segments of the society, especially in developing countries. In most countries,
commodities are the principal source of income for most of the rural population,
are major export earners, provide a base for industry and employment and are a
significant source of revenue for the government. Commodities are central to many
local economies and communities. Though the share of commodities in national
income decreases as a nation progresses, the importance of commodities is not
diminished. In the initial stages of development, substantial-majority share of GDP
of a country may be contributed by commodities, predominantly, agricultural
products. As nation grows, its manufacturing base grows and individuals become
richer, demand more services and the contribution from both manufacturing and
services grow. Employment base may also shift in the favor of these two. However,
commodities are the base of the economy and hence also of industry and income. Any reduction in commodities production has multiplying effects on other sectors of the economy. Even in the most advanced countries, share of commodities (including energy, metals) to country's GDP would not be less than 10%. With WTO and integration of world economies, commodities are expected to play a major role in both trade and GDP growth. Different countries will have comparative advantage for different commodities. Enhancing and exploiting this advantage would be major policy issues in coming decades.

1.2 COMMODITIES IN THE INDIAN CONTEXT

India is a major producer of several commodities. Being still a largely agricultural country, agriculture forms a major part of commodities production and consumption. India is also a major producer and/or consumer of several other commodities, e.g., crude oil, iron ore, electricity, etc. India's foreign trade was, till a few years ago, largely commodity based (mainly exports). Commodities contribute about 25 percent of India's GDP. Contribution of agriculture is about 16 percent, of metal ores about 2.3 percent, of energy sources about 5 percent, the balance from precious metals, etc. Even today commodities contribute to about 30 per cent of total exports and about 55 percent of total imports. The contribution of commodities to overall GDP of India has declined over period of time; however its absolute value has increased.

The agriculture alone provides livelihood to about 55 percent of the population. Thus, commodities and commodities markets have a direct impact on the welfare of the majority of the population.
1.3 **MAJOR CONCERNS OF COMMODITY SECTOR**

Since the commodities play such an important role in the economy, the sector needs close examination. The issues that are addressed in this research arise out of risks associated with the commodities sector. As the economy has prospered over the years, the variability of income for producers of commodities has increased. Primary reason for this variability is the supply being stochastic in nature due to uncertain and uncontrollable inputs to the production and demand for several commodities being cyclic in nature. For example, demand for crude is closely associated with the growth of an economy, which in turn is controlled by macroeconomic factors. The income uncertainty could be due to stochastic output or uncertain prices. The variability of prices has several effects on producers: It increases the risk to producers (e.g., farmers), decreases welfare and decreases the incentive for further investment. With increased market integration and instantaneous transmission of shocks, disturbance in any part of the world affects the markets in all the countries.

Commodity prices and their movement are critical as they impact the consumer and producer welfare. This is particularly true of agricultural commodities as they are essential but its production is a function of inputs, one of which the producer has no control on: weather. Prices affect the future area under cultivation, the incomes of producers, expenditures of consumers and amount of export earnings. Countries which are predominantly agriculture earnings based for their exports could have wide fluctuations in GDP and other macroeconomic variables. The price elasticities of supply are high whereas price elasticities of demand are likely to be low. Commodity prices have shown higher variability in the long run as well as in the short run. Higher long term variability has predominantly macroeconomic effects whereas short term variability also has microeconomic effects.

Having realized that the fluctuation in the prices of commodities is large, and that the real prices have not really increased over time, and that the costs of price variability are high, especially for poor farmers, the policy and its direction has to be developing skills for predicting movement of price over time and building
institutions, products and markets where the risk can be traded. The risk of adverse movement of prices needs to be reduced or mitigated in order to protect the producers, induce risk taking to ensure adequate and growing supply. The sector therefore needs policy which is directed at understanding the welfare implications and designing systems, policies, institutions, markets and products whose focus is risk reduction and which helps mitigate adverse impact if any.

### 1.3.1 EFFICIENCY OF COMMODITY DERIVATIVE MARKETS

The price risks that are faced by the producer of commodities are traditionally managed by portfolio of products, irrigation facility, adequate storage of commodities, direct government intervention and support, pricing policies, price floors and ceiling, control on movement, exports and imports, etc. These are found to be inadequate, not welfare optimal, are costly.

Markets for risk and insurance are widely prevalent methods the world over since long time. Recently commodity derivative markets have become prominent. However, it is not clear, whether they are playing their role as desired even when such markets exist. Risk mitigation may not happen if the markets are not efficient. Also for individual products, the price of risk may not be optimally designed as the pricing is complex. The question that needs an answer is whether these markets are efficient and can be profitably used for hedging risks. Inefficiency of the market results in uncertain outcomes. Price risk could be replaced by some other risks, say, basis risk.

### 1.3.2 FORECASTING COMMODITY PRICES

Alternate to the use of derivative markets, and even for profitable position in derivative markets, is the expertise and ability to forecast the prices of commodities, especially in near-terms. Many of the producers, especially small agricultural producers have neither the skills to understand the operations of the futures
markets, nor do they have the funds to take position in the market (especially options markets). They have one easier way: forecast the movement of the price. If a good forecast model is available, it can be profitably used to take economic decisions and manage the risks. Since price do not follow predictable linear trend and since expected prices influence the economic decisions, it is necessary to study the price trends and develop an efficient model to predict future price movements.

Economic activity is a function of the profit –social and/or private- derived from the activity. Profit, in turn is a function of expected future value the variables which impinge profit. These include industry supply of inputs and outputs and prices of inputs and outputs. Commodities are inputs for user industries/consumers and output for producers. Its supply and demand are function of its price. Price plays a crucial role as a signal and for resource allocation. Hence, forecasting the price of commodities is essential for both producers and consumers alike. The forecast value is key in decision making.

Policy planners, traders and producers, all try to understand the movement of commodity prices. Policy planners use the long term trends to design or modify policy. Even short term forecasts may be used by the Government, e.g., restrictions on exports or change in duties. Traders forecast to take position in the market. Consumers need price forecast to design their purchase policy and hedge their risks. However, the most critical use is for producers. Producers take calculated risks, design their production plans and dovetail input purchase and inventory policies based on the expectations of future prices of their produce. In the extreme, if the prices are highly volatile or are un-remunerative the producers will not produce at all. Or, even if they produce, they will not take required risks (e.g., investments). The usefulness of the forecasts is underscored by the fact that many firm –who use or sell commodities in substantial amount- have their in-house or outsourced expertise in understanding of price movement and they use very sophisticated techniques (e.g., Econometric models) for forecasting.
The price forecast for commodities is even more critical for developing countries like India. Many developing countries derive their substantial national income from commodities, almost entire or substantial export earnings are commodity based, large population derives their sustenance from commodities, and economic growth is driven by commodities. For them, a reliable model for price volatility and price forecast can result in substantial improvement in current and future welfare.

Though forecasting may appear as a mechanical exercise, there is no accepted forecasting model for any product –either for short term or long term- which is universally true and is inter-temporally accurate at all times. The difficulty in forecasting is obvious. The initial forecast model were simple economic models-e.g., cobweb models. In 1970s, structural models were developed for f0recasting based on supply and demand. However, in 1980s Box Jenkins methodology based models replaced structural models. In last decade or so, neural network models and Bayesian models are being investigated and accepted for forecast. In very recent time, highly integrated models-based on the presumption that the commodity markets world over are integrated- are being looked into.

1.3.3 MANAGING RISK FROM UNCERTAIN RAINFALL

One major source of risk and consequent welfare loss to agriculturists is uncertain weather. Weather plays a major positive role in the production process but its stochastic nature and inability of humans to control it can result in large unspecified losses. Production loss could be huge and can devastate the farmer. A large number of recent deaths of farmers due to debt problems can be traced to effects of weather. Traditional methods of mitigating risk, e.g., crop insurance, have limitations and are inefficient. New developments in risk management, specifically weather derivatives, offer a promising product. Research is required to develop an efficient and affordable product.
1.4 OBJECTIVES OF THE STUDY AND RESEARCH PROBLEMS

The brief outline above indicates the natural consequence in a decentralized market: Commodity markets are characterized by large price fluctuations. Price variability affects the decision making of both the producers (who are exposed to risk to incomes and welfare) and consumers, whose consumption may fluctuate and the expenditure on commodities directly affect the income available for other products in the consumption basket. Both the producers and consumers face the risk and consequent reduction in welfare. Alternately, a centralized market for commodities is inefficient as the decision makers would not know the preferences of the consumers. A centralized market, in the long run, results in misallocation of resources.

Hence this research is undertaken, primarily concerned with a study of commodity markets, its contribution to national income, movement of commodity prices over time and risks inherent in its production. consequent over time and thus focusing on the efficiency of markets for risk mitigation, suggesting optimal forecasting methods for a few products and developing a model and pricing an insurance product for risks management arising from uncertain nature.

Specifically, in Indian context, it attempts to answer the following:

1. Are the commodities derivative markets efficient?
2. What are the best possible forecasting techniques for commodity price in near term, a period of three months, and long term, a period of 3 years?
3. Can a derivative product be designed for offering to farmers to incentivize them and reduce their production and income risk?

The thesis:

1. Examines contribution of commodities to GDP in India
2. Analyzes the price movement of selected commodity products

3. Determines whether the commodity derivative markets are efficient (for selected products)

4. Assesses different price forecasting models for one product each from metals group and agricultural products group, compares them, and recommends optimal model, and

5. Develops a Rainfall derivative model which can be used not only to compensate for price risk but also the income risk

Following hypothesis on the efficiency of the commodity market are tested:

Null Hypothesis-1 : Futures market prices of rubber are unbiased predictor of future spot prices of rubber.

Null Hypothesis-2 : Futures market prices of rubber are unbiased predictor of future spot prices of gold.

Null Hypothesis-3 : Futures market prices of rubber are unbiased predictor of future spot prices of silver.

Null Hypothesis-4 : Futures market prices of rubber are unbiased predictor of future spot prices of tin.
1.5 RESEARCH DESIGN

The research is primarily secondary data based study. Focus is on modeling phenomena and states of nature. Some primary data is also studied but it is not a primary focus.

The research is technique oriented and several techniques are applied. Focus of the research is analytical in nature and hence is focused on study of observed phenomena and explaining them as well as predicting them. The study is concerned examining limitations of the existing products and markets and with policy prescription for creating new markets and institutions and strengthening the existing ones. The study is primarily concerned with the felt need of the small producers and their welfare and in turn the welfare of the society.

1.6 PRESENTATION OF THE STUDY

The presentation of the study starts with understanding what are commodities and their contribution at macro level to any nation. This is discussed in chapter 2. Chapter 3 analyzes the major manifestation of the risk: commodity price. Prices of selected commodities are analyzed and some conclusions of empirical nature are arrived at. Risk management is necessary and requires urgent attention is sought to be established through analysis of movement of the price. This leads to the society's response to the risk. Policies, products and markets are analyzed in brief along with their role in chapter 4. Chapter 5, chapter 6 and chapter 7 examine different aspects of risk, its manifestation and possible strategies to manage the risk. One cannot escape the risk but can manage it. Markets already exist which help contain the risk or even nullify. However how useful these markets are and to who benefits from these markets is not clear. Their primary role is to provide hedging for the risks but it is doubtful if the objective is achieved. Chapter 5 examines this issue through
analytical approach. Understanding the risk is in some way understanding the movement of prices. Study of the price movements is focus of any firm, any producer, any society and the government. Understanding the prices can help take better economic decisions and help design better policies. However, commodity price movements are observed to be too complex not easily mastered. Chapter 6 examines some analytical techniques to forecast prices by applying these techniques to few commodities. There are certain risks which are only generated by the nature and man has no control over them. However, attempts have been made, products have been developed, markets created and institutions established to take care of these nature driven risks. Chapter 7 explores the analytical methods to manage these risks and develops a model which is at once fair and welfare enhancing. Chapter 8 discusses, albeit in limited manner, the actual perception of those who participate in the market about efficacy of these markets. Chapter 9 concludes the study and recommends for policy and future course of action.

1.7 LIMITATIONS OF THE STUDY

The research issues which are objects of this study are multidimensional, can be looked at from different perspectives, can be analyzed in altogether different manner. The vastness of the study’s gambit can be gauged from the fact that so many facets are not even explored.

This study is primarily based on the secondary data. Obviously the study is limited by the data itself. Even when data is available, its reference point may not be the one which this study would require. For example, the study requires actual consumer price index for farmers which exclude self produced goods.
The conclusions may be function of state of development of the economy, of time and of the type of markets. These change over time and hence the conclusions may change over time.

The study has tried to examine risk management from different perspectives rather than confine to one perspective, say, forecasting of price. This is done in order to appreciate the scope of risk management. This approach has its limitations. However the approach is purposefully taken so that the richness of the field of risk management could be felt.

The models that are discussed are themselves “amorphous”. Thus, e.g., there is no consensus on what should be the optimal horizon for forecasting. Thus the results obtained are at once useful from one perspective and limited from other. In the end it can only be said that though limited in nature, attempt is to integrate the focus on important aspects of economy that touch the welfare of so many. However important this study may or may not be it is obviously limited by the limit of the intellect of its author.