

ESSAYS ON INDIAN COMMODITY DERIVATIVE MARKET: A MACRO-FINANCE PERSPECTIVE

ABSTRACT

This thesis is a collection of four essays exploring different aspects of Indian commodity derivative market from a macro-finance viewpoint. The four essays have dealt with four important commodity derivative market issues by relating commodity futures prices with key macroeconomic indicators, and also with other asset prices in India. The first essay has explored the nature and extent of financial contagion in the Indian commodity derivative market vis-à-vis the Indian equity market. The second essay has investigated the nature of pass-through from commodity futures prices to different macroeconomic indicators relevant to monetary policymaking. The third essay has examined the ability of commodity futures prices in forecasting headline inflation in India. The last essay has probed into the dynamics of transmission of shocks from crude oil prices to the macroeconomy in a theoretical setup.

Since the adoption of flexible inflation targeting as the monetary policy framework by the Reserve Bank of India, exploring the potential linkages between different macroeconomic and financial variables has become imperative. Furthermore, estimating the relationships has become more challenging there were recurrent crises the two decades since 2000. During these crises, the financial markets were highly volatile, and as a consequence, the shocks got transmitted from financial markets to the macroeconomy and vice versa. The existing literature either focuses on understanding the behaviour of different financial variables or examines the nature of their impact with different macroeconomic variables without neglecting their financial properties. Modelling the effects of such shocks from a pure macroeconomic perspective without considering asset market variables are expected to produce biased results.

Commodity is a financial asset, and its behaviour is generally understood in terms of movements in commodity prices and its returns. As commodities are used as raw materials in production, any change in commodity prices has a direct impact on the production decisions of firms and hence the supply of final goods and services. Further, market participants including hedgers, speculators, and arbitragers take part in commodity derivatives trading on the basis of their expectations about the future state of the economy. Their expectations determine their trading positions; and therefore demand for commodity contracts and commodity futures prices. The linkage between commodity futures prices and macroeconomic variables through inflation expectations is commonly known as the 'information effect'. In the existing literature, while the impact of macroeconomic variables on commodity futures prices has been extensively studied, studies on the converse, known as the 'feedback effect', are few and far between. The essays in this thesis have examined the presence and consequences of such a 'feedback effect' in India.

Holding commodities in portfolio give diversification benefits owing to its disassociation with other traditional assets, and also for being an effective hedge against inflation especially during crisis periods. Following liberalization of Indian commodity derivative market, increasing number of market participants started trading in the commodity derivative market. Increasing participation in the commodity derivative market resulted in an increase in i) financialization of commodities, ii) co-movement of commodity prices with other asset prices, and iii) excess volatility in commodity prices and returns.

In the existing macroeconomics literature, the role of commodity derivatives in India while accounting for their financial properties has not been explored. Although the financial properties of commodity futures prices in India have been extensively studied, their linkage with macroeconomic variables has not been examined comprehensively. As the market-determined prices reflect the expectations about the future economic performance,

commodity futures prices are found to contain important information and hence predict the expected economy-wide price level changes accurately. Even though the role of commodity futures prices as an information variable in monetary policy-making has been extensively studied for developed economies, such attempts are found to be rare for developing and emerging market economies. In Specific, no such attempt has been made to examine the role of commodity futures in monetary policymaking in India looking into its ability to predict future trajectory of inflation as well as its linkage with other macroeconomic Indicators.

The stylized facts presented in Chapter 1 show that investment in the commodity derivative market is linked with the changes in macroeconomic conditions in India. Furthermore, there is a significant cross-correlation between international crude oil prices and Indian macroeconomic indicators including real GDP and inflation. Similarly, there is a strong contemporaneous and lead-lag correlation between the domestic commodity futures price index and Indian macroeconomic indicators. The gaps in the literature and the stylized facts show that there is a potential for analyzing the dynamic relationship between commodity prices and macroeconomic variables in India.

This thesis has used the commodity futures price index from the database of Multi Commodity Exchange between 2006 and 2019. In the first essay, the daily data on the commodity futures price index have been used along with the equity price index. The second and third essays use monthly data of commodity futures price indexes and of different macroeconomic indicators. The last essay uses parameter values obtained from the literature to calibrate the theoretical model and simulate the transmission of shocks using impulse response function.

The first essay (Chapter 2) has examined the nature and extent of co-movement and contagion between the Indian commodity derivative and the Indian equity markets using Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity

method. The commodity futures and equity prices returns show excessive volatility during different crises. Volatile returns from commodity contracts during crises show the possibility of financial contagion vis-à-vis the equity market. Time series analyses carried out in this chapter show the co-movement between commodity futures price returns and equity price returns increased at the time high volatility, a phenomenon commonly known as ‘financial contagion’.

To understand the dynamic nature of the co-movement, the time-varying correlation has been estimated using the Dynamic Conditional Correlation Multivariate Generalized Autoregressive Conditional Heteroskedasticity method, while allowing for the possible presence of asymmetries. For the purpose of estimating the nature of financial contagion, the Ordinary Least Square, Quantile regression, and Quantile-on-Quantile regression methods have been applied. While all estimates based on three types of regression analysis show the presence of financial contagion, the Quantile regression and Quantile-on-Quantile regression estimation results show that the contagion is non-linear in nature. The financial contagion in the Indian commodity derivative market is found to exist mainly during periods of high correlation. The non-linear nature of financial contagion is found to exist for commodity futures price indexes at the disaggregated level especially in cases of energy commodities and metals.

Having found the presence of financial contagion in the Indian commodity derivative market vis-à-vis equity markets, and as there is a possibility of transmission of shocks from volatile asset markets to the larger macroeconomy in presence of such contagion, it is necessary to explore the nature of the association between commodity prices and macroeconomic indicators. The second essay (Chapter 3) has examined the relationship between commodity futures prices and macroeconomic variables in short and long runs. Using the Non-Linear Autoregressive Distributed Lag method, it is found that commodity

futures prices provide signals about the future trajectory of inflation and industrial production in India, and thus contain valuable information for monetary policy management. In particular, there is a significant presence of commodity futures prices pass-through to inflation and industrial production, primarily in the long-run.

The observed relationships in Chapter 3 are found to be significantly asymmetric and heterogeneous across different types of commodities. The presence of asymmetries, while estimating the relationships between commodity futures prices and macroeconomic variables, permits examining the effects of positive and negative price changes separately. The differential impacts of price changes give important insights into the relative strength of the ‘cost effect’ and ‘information effect’. This is the first attempt to model the relationship between commodity futures prices and macroeconomic variables considering the possible presence of asymmetries.

Extending the analysis of the second essay (Chapter 3), the third essay (Chapter 4) has examined the ability of commodity futures prices to forecast headline inflation in India. At the outset, a simple theoretical model has been developed to establish the relationship between commodity futures prices and inflation and to form the basis of the empirical analysis. The theoretical model shows a positive impact of changes in commodity futures prices on the general price level. In this chapter, commodity futures price based augmented Phillips curve model has been introduced for estimation purposes as against the crude oil price based augmented Phillips curve model.

For the purpose of empirical analysis, the Feasible Quasi Generalized Least Square estimation method has been employed to get rid of the issues related to persistence, heteroskedasticity and endogeneity that are common when an asset market variable is considered as a predictor in estimation. Following the results obtained in Chapter 3, asymmetric commodity futures price changes have been considered along with structural

breaks in the headline inflation in Chapter 4. The empirical results show that the commodity futures price based augmented Phillips curve model can predict Indian inflation better than all the other variants of Phillips curve model.

The fourth essay (Chapter 5) is set out to understand the possible channels of shock transmissions from the commodity market to the macroeconomy in India. A large body of empirical as well as theoretical literature came along with different crude oil crises of the last five decades analyzing the possible effects of exogenous oil price shocks on different macroeconomic indicators. Although these studies assume that crude oil price shocks can only occur on account of exogenous supply disruptions, a recent strand of theoretical literature shows that there can be impact of precautionary motive of crude oil demand as well. The financial properties of commodities such as the possibility of inventory holding can be introduced in a theoretical setup. The supply shock can be on account of exogenous changes in the supply of crude oil or changes in inventory holding by the speculative inventory holders expecting a future disruption in crude oil supplies.

The fourth essay simulates the effects of exogenous crude oil supply shocks and inventory demand shocks in a New Keynesian Dynamic Stochastic General Equilibrium setup by introducing the possibility of futures trading along with inventory holding. In previous studies, the possibility of futures contract trading has been ignored. The results of the calibration exercise show that the effect of crude oil price shocks on inflation is relatively large and the effect on output is relatively small when the possibility of future trading is introduced along with inventory holding.

The results, econometric or otherwise, in the four essays have implications for monetary policymaking. The results of the first essay have important implications for the investors as well as for the policymakers. Investors in the Indian commodity derivative market need to be well aware of contagion in the Indian commodity derivative market and

also how similar sentiments of investors can cause this contagion to understand the possible diversification benefits from the commodities trading. On the other hand, for the market regulators in India, it is important to understand the nature of contagion in the Indian commodity derivative market vis-à-vis other asset markets in order to react promptly at times of stress in the domestic as well as the international economy.

The results found in the second and third essays are pertinent for the central bankers in predicting inflation for the purpose of flexible inflation targeting. The Monetary Policy Committee of the Reserve Bank of India generally uses international crude oil price movements and movements in international commodity price indices while making predictions about the trajectory of future inflation. Along with validating the argument in favour of using commodity prices in inflation modelling, these results propose that domestic commodity futures price indexes are better predictors of Indian inflation in comparison to international crude oil prices.

The results found in the fourth essay (Chapter 5) have important lessons for the monetary authority practising flexible inflation targeting and also for the financial market regulators. There is always a tradeoff between inflation and economic growth. Regulations in commodity trading should therefore be in accordance with the policy objectives set off by the central bank. The source of the commodity price shocks and their possible consequences are required to be analyzed at the outset, and the policy choices to be accordingly designed for implementation.

Key Words: Commodity Derivatives; Commodity Futures Prices; Financial Contagion; Inflation Forecasting; Crude Oil Shocks;

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