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Long-term association between European and Indian markets on carbon credit price

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ABSTRACT

This study tries to explore cointegration and Granger causality of daily CER prices in European Energy Exchange and Multi Commodity Exchange (MCX) in India in a multivariate framework after controlling euro–rupee exchange rate and Inter-Bank Offer Rate, a measure of country specific risk. Both ARDL bounds tests and Johansen–Juselius maximum likelihood procedures fail to establish a cointegrating relationship among the variables indicating that an arbitrage opportunity exists between these two markets. The study, however, establishes a short-term Granger causality running from change in CER price in European Energy Exchange and exchange rate to Indian exchange. Generalised error variance decomposition of variables indicates that the price of CER at the Indian stock exchange is most endogenous in nature.

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1. Introduction

It has been accepted that increasing concentration of green house gases (GHGs) in the environment is associated with activities that are anthropogenic in nature. In order to address this cause, the United Nations Framework Convention on Climate Change (UNFCCC) laid the foundation of the Kyoto Protocol in 1992. The Kyoto Protocol was eventually adopted on December 11, 1997, under which member countries commit themselves to reduction of four GHGs (carbon dioxide, methane, nitrous oxide and sulphur hexafluoride) along with two groups of gases (which are hydrofluorocarbons and perfluorocarbons). The protocol allows for flexible mechanisms so that the Annex I countries are able to meet their GHGs emissions obligations. These flexible mechanisms include emission trading, clean development mechanism and joint implementation. Emission trading refers to the transfer of permit to discharge a specific volume of pollutant. Under joint implementation projects, any Annex I country can invest in emission reduction projects in any other Annex I country where it is cheaper to reduce emission than at the home country. The credit of

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these reductions in emissions can be applied towards their commitment under the Kyoto Protocol. Clean development mechanism, on the other hand, can benefit the parties which are non-Annex I along with Annex I countries. While non-Annex I countries can achieve sustainable growth through Clean Development Mechanism (CDM), Annex I countries can be benefited in achieving compliance with their emission reduction commitment.

The Clean Development Mechanism (CDM) is one of the key instruments developed under the Kyoto Protocol to facilitate carbon trading. It was the first of the flexible mechanisms to come into effect, with the launch of the regulatory body, the CDM Executive Board in late 2002. It received unexpected support from the developing countries. Key to this support was the CDM's explicitly stated twin objectives of not only emissions reductions for industrialised countries, but also accelerated sustainable development in developing nations. By providing investment incentives, CDM acts as an aid to project finance in host countries, encouraging sustainable development through the adoption of cleaner energy sources, or more efficient industrial processes.

The parties to the convention have been meeting annually from 1995 at the Conferences of the Parties (COP) to assess the progress of UNFCCC. The objective of these COPs is to strengthen the provisions of UNFCCC and contain anthropogenic emissions of GHGs. COP 15 (Copenhagen: 2009) failed to provide a successor to the Kyoto Protocol. This increased uncertainty about the future of the carbon markets. However, COP 16 (Cancun: 2010) was relatively more successful and a new fund was designed for climate finance. The aim of this fund was to channel money, from the developed to developing nations, to protect developing nations from the impacts of climate change and to assist them in low-carbon development. A framework was also established to reduce global deforestation and forest degradation in developing countries. COP 17 (Durban: 2011) was also successful as a Green Climate Fund was established and an agreement was reached to negotiate a more inclusive treaty. Decision was also taken regarding the second commitment period for the Kyoto Protocol. Thus, the steps initiated at Cancun for emission reduction were implemented at Durban.

Certified Emission Reductions (CERs) are carbon credits generated by CDM projects which have completed the registration process. Majority of these projects have been in China and India. These projects generate primary Certified Emission Rights (pCERs) which are substitutable for emissions in the European Union Emission Trading System (EU ETS). Since 2007, CDM credits have been traded in the secondary markets as well (sCERs). Each CER represents the abatement of one tonne of carbon dioxide equivalent. CERs are issued by the CDM Executive Board once estimated abatement volumes have been validated independently, and a stringent verification process is in place for ongoing monitoring. As of March 31, 2012 the total number of CERs issued was 909,900,908 against 951,933,749 CERs requested.[2] This number is expected to grow in future with the implementation of more CDM projects all across the world [1].

Despite the growth and importance of carbon market, relevant academic research beyond the scope of environmental economics and policy has been very limited. The empirical research in this domain has been concentrated entirely on the European Union Emissions Trading Scheme (EU ETS) markets [2–5] as they are the most liquid and most developed markets. Limited studies have been conducted in the area of CER price dynamics.

Mizrach [6] analysed the market structure and common factors of emission reduction instruments in Europe and North America. His study reveals that the spot and near-term futures expiries in case of Eurpoean Union Allowances (EUAs) are cointegrated across exchanges in Europe and North America. There have also been researches focused primarily at European carbon markets. Certain studies have studied the price dynamics of EU ETS and have found long-term cointegrating relationships between various EU ETS instruments [2–5]. Koop and Tole [7] explored the relationship between spot and future prices of EUAs and CER price. They found evidence of contemporaneous causality between their variables of study. Kapoor [8] modelled time-varying volatility of CER prices at European Energy Exchange and found changes in volatility between two successive COPs.

Such studies have taken into consideration the prices at the European and American exchanges which are exclusively buyer economies in case of carbon credit trading. The research has been extremely sparse in the study of CER price dynamics taking into account the developing economies like India and China, which are the major suppliers of CER across the globe. The present study tries to bridge the gap by exploring cointegration and Granger causality between Indian and European CER markets.

CER trading started in India in January 2008 with MCX being the first Asian commodity exchange to launch futures trading in carbon credit contract. Since then, similar products are being traded at Indian and European energy exchanges. As described above, empirical research has established stable long term association among buyer economies of carbon credit contracts [2–7]. However, no significant work has explored the relationship of CER prices between carbon credit markets at buyer and seller economies respectively. Therefore, this study aims to explore the association of CER prices at Indian and European energy markets.

This study uses a multivariate approach, which is always preferred over a bivariate approach because it avoids specification bias due to omission of relevant variables. The study also employed autoregressive distributed lag (ARDL) bounds testing approach of cointegration developed by Pesaran and Shin [9] and Pesaran et al. [10] which has been complemented by Johansen–Juselius maximum likelihood procedure [11] to provide a sensitivity check on the empirical results [9–11].

The remainder of this paper is organised as follows. Section 2 describes the data in detail. Section 3 discusses the econometric methodology. Section 4 presents empirical analysis and discussion of results. Section 5 presents the summary and concludes.

2. Data descriptions

This study considers following four variables

1. The daily price of CER contract is taken from the MCX (Multi Commodity Exchange) which is a leading commodity exchange in India. The price of CER is quoted in INR.
2. CER prices on European Energy Exchange (denoted by EEX). It consists of daily price observations of secondary CERs for futures contracts expiring in December 2012 listed on the European Energy Exchange (EEX). The price of CER futures contracts on EEX are quoted in €.
3. Euro–Rupee exchange rate (denoted by EX). Exchange rate can be an important determinant of the prices on the Indian commodity market. In a study of price dynamics between two exchanges with different currencies, exchange rate might prove to be a significant variable. Source of this rate was the website of the Reserve Bank of India.
4. Mumbai Inter-Bank Offer Rate (denoted by MIBOR). MIBOR is a measure of country specific risk in a case where we study the prices of a commodity at exchanges in two different countries. Previous studies have also found country level risks in similar

[2] Retrieved from UNFCCC website http://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html