Financial contagion and volatility spillover: An exploration into Indian commodity derivative market☆

Rudra Prosad Roy[a], Saikat Sinha Roy[b,*]

[a] Department of Economics, Jadavpur University, Kolkata 700032, India
[b] Department of Economics, Jadavpur University, 188 Raja S. C. Mallik Road, Jadavpur, Kolkata 700032, India

ARTICLE INFO

ABSTRACT

This study measures the extent of financial contagion in the Indian asset markets. In specific it shows the contagion in Indian commodity derivative market vis-à-vis bond, foreign exchange, gold, and stock markets. Subsequently, directional volatility spillover among these asset markets, have been examined. Applying DCC-MGARCH method on daily return of commodity future price index and other asset markets for the period 2006–16, time varying correlation between commodity and other assets are estimated. The degree of financial contagion in commodity derivative market is found to be the largest with stock market and least with the gold market. A generalized VAR based volatility spillover estimation shows that commodity and stock markets are net transmitters of volatility while bond, foreign exchange and gold markets are the net receivers of volatility. Volatility is transmitted to commodity market only from the stock market. Such volatility spillover is found to have time varying nature, showing higher volatility spillover during the Global Financial Crisis and during the period of large rupee depreciation in 2013–14. These results have significant implication for optimal portfolio choice.

1. Introduction

This paper investigates into contagion and transmission of volatility shocks in Indian commodity derivative market from other Indian asset markets. Asset return co-movements and transmission of volatility shocks have significant implications for asset pricing and portfolio allocation (Aloui et al. 2012; Jin et al., 2012) as existence of a higher degree of co-movement between asset markets reduces the diversification benefits (Lessard, 1973; Solnik, 1974). Among assets, commodities serve as diversifiers in the process of portfolio choice (Abanomey and Mathur, 2001; Ankrim and Hensel, 1993; Anson, 1999; Becker and Finnerty, 2000; Georgiew, 2001 and Kaplan and Lummer, 1998). Commodities are believed to have low return correlation with traditional asset classes and hence are useful tools for strategic asset allocation (Jensen et al., 2000; Erb and Harvey, 2006). Global investors use commodities for hedging (Bodie and Rosansky, 1980;

Bodie, 1983) especially during financial stress, appraising its nature of positive co-movement with inflation and hence a tendency of backwardation. However, commodities may be considered risky in the presence of financial contagion and volatility spillover from other markets. If large numbers of investors hold commodities along with other conventional assets, the set of common state variables driving stochastic factors grows; and adverse shocks in one market may cause liquidation across several markets (Kyle and Xiong, 2001). Integration of commodity market and conventional asset markets may allow systematic shocks to increasingly dominate commodity returns by raising time varying correlation between commodity and other assets (Silvennoinen and Thorp, 2013).

Despite a voluminous literature on financial contagion,[1] there is no universally accepted definition of it. By distinguishing it from "interdependence", Forbes and Rigobon (2002) define contagion as a significant increase in cross market linkages after a shock to one

market (or group of markets). Prior to Forbes and Rigobon (2002), there were some studies that mainly addressed "interdependence" and not "financial contagion".[2] Since the publication of Forbes and Rigobon (2002), the existence of financial contagion has been studied mainly around the notion of "correlation breakdown". Financial contagion can be internal (cross market) as well as global (cross border). In a financially globalised world, any external shock may affect any asset market in an economy and then get transmitted to asset markets in other countries as well. Internal shocks, through inter-linkages spread out to other domestic asset markets. If a crisis hits any market around the globe, the negative shock gets transmitted from the foreign source to any of the domestic asset markets. During the Global Financial Crisis, while asset markets in advanced economies were initially affected, the effect did spread out to other asset markets in developing and emerging market economics (EMEs) through financial contagion.[3] The studies on financial contagion are of two types: (i) the determination of contagion effect, and (ii) the determination of the channels of contagion.[4] This study attempts to investigate the nature of financial contagion effect and volatility spillover, if any, in Indian commodity derivative market vis-à-vis other asset markets since 2006.

Most of the other studies discuss financial contagion in the equity markets only.[5] A very few of existing empirical studies aim at analyzing the contagion effect between commodity and other asset markets during a financial crisis. The studies on commodity markets mainly discuss co-movement of commodities along with other assets, mainly stocks (see for example Büyüksahin et al., 2010; Tang and Xiong, 2010; Silvennoinen and Thorp, 2013; Lautier and Raynaud, 2011 etc.). Although some very recent studies[6] discuss the evolution of correlations between commodities and financial assets in the aftermath of the Global Financial Crisis, their focus was not on the contagion effect between commodity and other asset markets.[7] Silvennoinen and Thorp (2013) and Wen et al. (2012) are of the exceptions.

Even though the literature on financial contagion in commodity market is limited, the literature on volatility spillover taking into account commodities along with other assets is large. With regards to volatility spillover in commodity market, most studies[8] have considered the oil market focusing mainly on three issues: interactions between the crude oil market and other energy markets, equity markets and foreign exchange markets. Among others, the study by Zhang et al., (2008) explores mean spillover, volatility spillover and risk spillover between the U.S dollar exchange rate and crude oil prices. Mensi et al. (2013) show a significant correlation and volatility transmission across commodity and equity markets. For the Indian commodity market, Ghosh (2011) shows that an increased oil return leads to the depreciation of Indian currency vis-à-vis US dollar.

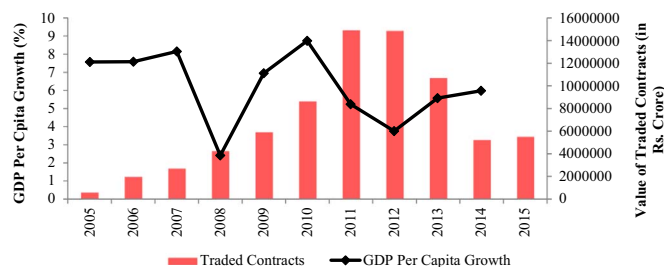Prior to the Global Financial Crisis, a commodity price boom,

Fig. 1. Economic growth and commodity trading in India. Source: World Bank database (for per capita GDP growth); Multi Commodity Exchange (for traded contracts).

unprecedented in its magnitude and duration, was observed. The real prices of energy and metals more than doubled during 2003-08, while the real price of food commodities increased 75% (Erten and Ocampo, 2013).[9] In India, on account of high growth and other factors, commodity prices increased at a rapid pace creating investment opportunities. As shown in Fig. 1, there is an overall increase in commodity trading in India since 2005. Interestingly, the trend continued even during the Global Financial Crisis. This may be on account of investors opting for commodities to hedge against inflation at the time of financial stress. During different crisis periods, Indian commodity market shows huge volatility. Now, it is important to decipher the origin of the volatility in commodity derivative market; whether the shock hurt the Indian commodity derivative market first and then was transmitted to other Indian asset markets or vice versa.

The above review of literature shows some important research gaps. First, studies on financial contagion considering overall commodity market during the period of financial crisis are rare. Further, studies on contagion with regards to Indian commodity derivative market are even more rare. While there are some studies that discuss the nature of the co-movement or correlation or time varying correlation among different commodities or between some specific commodities and equity, there is no study considering contagion in the commodity market. Second, studies discussed above have only considered international financial contagion and not contagion among domestic asset markets. Third, most studies are found to concentrate on intra-market volatility spillovers considering only different commodities and few other studies which have consider the inter-market volatility spillovers taking into consideration oil and equity markets. Fourth, it is also important to understand the nature of dynamic and directional spillovers from and to the commodity market. Under these circumstances, it is important to understand the overall nature of volatility spillover from and to the commodity market. These gaps in the literature motivate us to study the nature and extent of financial contagion and volatility spillover in Indian commodity derivative market vis-à-vis other Indian asset markets. This paper is structured as follows. Section 2.1 presents data used for the purpose of analysis and provides some stylized facts on daily returns of commodity and other assets. Section 2.2 gives a brief on the different econometric methods used in this study. An exhaustive analysis of econometric results is presented in Section 3. The paper summarizes the major findings in Section 4.

2. Data and econometric methodology

2.1. The data and certain stylized facts

The data on five asset markets namely, commodity derivative market, bond market, currency or foreign exchange market, gold market and equity or stock market, used in the study are obtained

[2] See for example King and Wadhwani (1990), Longin and Solnik (1995), Calvo and Reinhart (1995), Solnik et al. (1996), Ramachand and Susmel (1998), and Butler and Joaquin (2002).

[3] A recent strand of literature studies volatility spillover among different asset markets within an economy (see Yilmaz (2010), Diebold and Yilmaz (2012)).

[4] See for example Horta et al. (2016).

[5] See for example King and Wadhwani (1990), Lee and Kim (1993), Calvo and Reinhart (1995), Aloui et al. (2011), Syllignakis and Kouretas (2011), Kenourgios et al. (2011), Aloui et al. (2012), Baur (2012), Bekaert et al. (2011), Hwang et al. (2013), and Dungey and Gajurel (2014) etc.

[6] See, for example, Büyüksahin et al. (2010), Lautier and Raynaud (2011), Silvennoinen and Thorp (2013), Tang and Xiong (2010) etc.

[7] For example, Büyüksahin et al. (2010), Silvennoinen and Thorp (2013) and Tang and Xiong (2010) show how financialization of commodities affects the linear correlations between different commodities or the correlation between commodities and financial assets, while Lautier and Raynaud (2011) focus on integration in energy-derivative markets.

[8] See for example Agren (2006), Aurori et al. (2012), Du et al. (2011), Hassan and Malik (2007), Malik and Hammoudeh (2007), He and Chen (2011), Lien and Yang (2008), Malik and Ewing (2009), Soytas et al. (2009), Sadorsky (2012), Serra (2011), Soytas and Oran (2011) Singh et al. (2010), Syllignakis and Kouretas (2011), Chang et al. (2011), Arouri et al. (2011), Ji and Fan (2012), Awartani and Maghyereh (2013), etc.

[9] Rapid income growth in China and India China was a key factor behind the increase in food commodities after 2007 (see for example Krugman, 2008; Wolf, 2008; Bourne, 2009).