

Thematic Analysis of Volatility Spillover in Commodity Market with Special Reference to China- A Growing Economy

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Abstract. *Volatility in any asset class in an important topic to study since it is directly related to risk and return of a security. Risk and return of an asset are the things, investors have always been interested in. Market returns are studied with some important key factors and volatility in the market is one of the most important among them. In the last two decades, China has emerged as one of the largest growing economies in the commodity futures market. In this paper, there is an attempt to present a review of papers related to commodity futures market volatility with special reference to Chinese commodity futures market. We understand the term with its importance and growth of the Chinese futures market. We try to gain an insight into the type of linkage that Chinese commodity futures market has developed across the world. This study will help in understanding conceptually that how china has successfully implemented the economic reforms in the commodity futures market by the evidence of literature available on the volatility spillover in the commodity futures market in the growing economy and its linkages across the world.*

1. Introduction

The commodity futures market is indeed a lesser-explored area concerning its potential as an alternate asset class. It serves the purpose of price discovery and hedging risk in spot price volatility [1], [2]. The importance of the futures market is identified in its ability to forecast the future spot price of a commodity and thus making agents able to manage the risk in trading of a particular commodity [3]. However, many others follow an assumption that derivatives in commodities are detrimental to the healthy functioning of the spot market and cause inflation. That is why the wheat market in china has been found to be inefficient [4], [2]. Authors commented the possible reason that wheat, being a commodity of mass consumption, comes under the protection policy of the Chinese government. Investors in a market are interested in return, and return can never be studied in isolation with the risk associated with a security. The trade-off between risk and return is the main theory in the valuation of a security. The risk associated is measured in terms of price volatility in the market. While talking about commodity market, one of the largest consumer, producer and even exporter and importer economy named china, which is the highest populated country, draws our attention to be referenced in studying volatility in commodity markets.

Another reason for giving special reference to China is that it could be taken as a proxy for emerging economies. This paper studies meaning of volatility, its various effects, and spillover across the world. This paper aims to contribute to the existing literature in term of giving a brief overview of the development of the futures market in China and its volatility linkages across the world in due course of time after the economic reform in china.

2. Development of Chinese commodity market

According to Wang & Ke [4], initially, china was a centrally - planned economy and started significant economic reforms in 1978 to make it a market-oriented economy. The establishment of first wholesale agricultural market in 1990 named, Zhengzhou grain wholesale market (ZGWM), and then the exchange named, China Zhengzhou commodity exchange (CZCE) with many other institutions were a part of the

economic reform [4]. Xin, Chen and Firth [5] have briefed the emergence of Chinese commodity futures market in the decade of 1990s. “After the decade of 1980s, china started relaxing its control over prices and set the market free to decide its equilibrium, it needed a futures market to discover prices. China took various steps in the commodities market after 1988, like deregulation of prices, set up of first commodity exchange in Zhengzhou 1991. The market started to expand. But this expansion was uncontrolled or unregulated and as a consequence, stakeholders of the market met many misfortunes. A large number of brokers and exchanges contained unnecessary, duplicated and non-standard contracts causing confusion and fraud. The very purpose of the development of the market was defeated in the absence of effective monitoring. To overcome these anomalies, in 1993-94 various regulations were introduced, even the number of futures exchanges were reduced to 14. All these measures helped to restore the credibility of the market. To make the market more efficient in price discovery, again in 1998-99 more reforms were incorporated under which the number of exchange was further reduced to only 3 namely SHFE, ZCE and DCE. The number of futures contracts were also reduced to 7 [5]”. Since then the market has grown rapidly and turnover now has increased manifold. Now it makes available more than 50 commodity futures through different exchanges.

The commodity derivatives market came into existence with one of the primary functions of risk hedging. With due course of time, this market is developing itself as an alternate investment class among investors due to its various fascinating characteristics. A greater section of authors also believes that it serves the purpose of a hedge against the stock market. The last two decades have seen a good amount of growth of this market in economies including emerging economies. But the amount of literature available on the empirical analysis of commodity derivatives is unmatched with the size of the market across the world. From the investor's point of view, returns of the market is the most attractive term associated with it and for the analysis of return, volatility has gained unmatched popularity among the authors. The studies regarding price discovery and volatility spillover can be categorized into two types- one is studying the spillover effects between the futures market and spot market and the other one is between the futures market of two different economies [6]. This study collects papers involved in the empirical analysis of both types.

3. Volatility and its characteristics

Volatility can be understood as the measure of uncertainty associated with a security. The value of volatility in price is seen as how large the price deviates from its mean value. A security being higher volatile means that price change is more frequent and large in the short term and this change may be in either direction. So, the risk associated with such security also increases. While lower volatility represents a smooth movement of price over time, fluctuations are less, therefore the risk is less.

Zhang and Ding [7] describes volatility as the central issue in the discussion of the global economy for various reasons. “Volatility has the potential to add to inflation. It is the measure of risk associated. Since an important function of commodity futures is of price risk transfer, volatility becomes an important issue in hedging possibilities and allocation of assets. So volatility affects risk management, portfolio selection and even derivative pricing. So, quantifying the volatility relationship in two markets can help study issues like transmission of shock. The author accepts the importance of trading volume in futures in affecting price volatility” [7]. A direct relationship has also been suggested between volatility and trading volume [8]. The cause of exceptional volatility could be described in two bullet points and those are growing demand for commodities and excess speculation and arbitrage [9]. Many believe that speculative trading in derivatives causes inflationary pressure on commodity prices.

4. Volatility spillover and information flow among commodity futures markets

The Study of the flow of information and volatility spillover between US and China commodity futures market using three commodities (Copper, Soybean and Wheat) differentiates wheat from other commodities. The inference drawn was that the price in the Chinese market follows US market, however, in case of Wheat, the result was not true and the reason has been attributed to Protection policy of Chinese government for wheat being an essential commodity for mass consumption [9]. On the other hand, three major wheat-

producing markets namely US, Canada and the European Union have significant volatility transmission on one another. Canada has a greater price influence on US than Vice-versa. Similarly, the EU is also self-dependent and volatility transmission is from EU to the US and not vice versa [11]. Contracts traded on CBOT trade and Japan have an identical specification in corn futures however trading systems used by the exchange differ with non-overlapping trading time. A clear reflection of influence from CBOT exchange in the opening price of Tokyo Grain exchange has been found in corn futures [12]. The above two results have later been supported by concluding that there is always a spillover dependence not within the agricultural market but across the different exchanges of the world [13]. The results showed, especially for corn and wheat, that spillover has increased in recent years. But in case of China, same reason account for the result of [4] and [2] studies where the wheat market is found to be inefficient in china in the price discovery in spot market whereas for soybean futures a long term equilibrium relationship is found between the cash price and futures price in china. Again no co-integration in wheat futures across DCE of China and CBOT in the later study. However, all three commodities have volatility spillover effect from the US market showing there is a flow of information from the US market to the Chinese market. The same result was validated for copper also [14]. Perception of integration in volatility and transmission of price from US market to China could not be rejected up to that period. Later, when Liu et al. studied the market for soybean futures again to know whether it is still a price taker, the result was different from the previous result [10]. It reported that the spillover effect has weakened over time. Especially Chinese soybean has developed its pricing mechanism. Further, volatility in long positions is greater as compared to volatility in short positions in china's domestic market [15]. In the same year, the study of four important agricultural commodity derivatives (Soybean, Wheat, Corn and Sugar) of US and China to examine the daily, overnight, intraday and rolling return spillover is remarkable where the result does not support the previous findings for soybean futures as the spillover is bi-directional but at the same time, it is much stronger from the US to China side [16].

The above discussion concludes that in 2015, China commodity derivative market has come at a stage where it has started making an impact on US commodity derivative market but it has much more to go and this is true for at least agricultural commodities. Chinese and the US commodity futures market studied to investigate the mean and volatility spillover across the market using VAR-BEKK-Skew-t Model give the same results of the dominance of the US market [17]. Kang and Yoon [18] studied to examine the dynamic return and volatility spillover between London Metals exchange and Shanghai futures exchange for the period of ten years from 2007 to 2016. The model used for analysis was the spillover index of Diebold and Yilmaz. The results obtained supports the theory that spillover increases after the crisis. The result has also been empirically established by another author [9]. "The US has been net transmitter of volatility for the UK also where the sample was taken for a period from February 2008 to March 2013. Result of the study states that not only the futures market but the spot market of the UK also is the net receiver of volatility and obviously the US is the net transmitter of volatility. It has also been added that spot and futures market volatility in the US and UK are bidirectional in nature" [8].

Natanelov et al. [19] and Luo and Ji [20] studied volatility connectedness of agricultural commodity futures in the US market and Chinese market respectively but used a different angle. These authors studied the market with US crude oil futures. The study reports that the magnitude of spillover is weak and the volatility effect has leverage across markets. For the US agricultural commodity futures market, it was found that in the long run there is a co-movement in the price of agricultural commodities and crude oil futures market of the US. However, the author has suggested that various political, economic and seasonal factors have an effect on the intensity of volatility in the price of both agricultural commodities and crude oil [19], [20]. Different studies throw light on the effect of crude oil futures on metal futures and its efficiency in the price discovery process of crude oil spot market [21], [22]. ARJI and GARCH model helps to conclude that the global oil price shocks have a great effect on the Chinese metals futures market, however, aluminium futures in comparison to copper futures is less affected by the global oil price shocks [21]. The latter reveals that the crude oil futures market is very efficient in the price discovery process and risk transfer [22]. The

dynamic spillover and linkages between the energy market and cereals prices are found to be affected by the news announcements from the organisation of petroleum exporting countries [23].

Apart from agricultural commodities futures, the results have not changed much when a review of metal futures studies is carried out in different markets. [24], [9] and [25] studied metal futures. There is an increase in the transmission of information among the exchanges of US, UK and China commodity futures market in the post-global economic crisis period [9]. Both US and China market has gained efficiency in incorporating the information in price, however, the Chinese market is better than the US market in incorporating information efficiently [24]. Khalifa, Miao and Ramchander [25] took intraday futures of bullions and a base metal (copper) futures from 1998 to 2009 and estimated using different predictive models available. Out of all the volatility measures, IVFT measure is greatest. Return distributions are not normal for the three metals. Higher is the flow of information transmission from one market to another, higher will be the volatility in the price of not only spot but also commodity futures [25]. In other words, in an arbitrage-free economy, an increase in volatility in one market is directly related to the flow of information between the markets. If the flow of information rise in the futures market, it would increase the volatility of the spot market also provided that the volume of trade in a commodity is not considerably low. The same theory has been proved in the Indian market also. The authors examined the volatility spillover in spot and commodity market using six commodities to conclude that price transmission from futures market plays a crucial role in the price discovery process of the spot market and gives a tool to get an idea about the future movement of the spot price [6].

Authors have added to the literature by studying the volatility and information transfer in commodity futures with the stock market and other financial futures also. Information flow and transmission of volatility have been traced among stock market, commodity futures and other financial futures. Kang, McIver and Yoon [26] studied long memory volatile properties between BRICS stock and commodity (gold and oil) futures using trivariate DCC- FIAPARCH model and found significant asymmetric long memory volatile properties between the markets. However, the correlation between BRICS stock and commodity market is time-variant and has an impact on other major financial and economic events [26]. In the Mexican and Chinese exchanges, studies show the importance and role of commodity futures by reporting that the inception of commodity futures have helped the price discovery function for spot market and it causes volatility in the underlying commodity spot market [27],[28]. In China, the researchers concluded that there is no risk spillover between the said two markets suggesting that both the markets are subject to different risks and portfolio could be designed to hedge the risk in one market against another [28]. The study was made for the year 2004 to 2015 for eight commodities. Other financial instruments like forex, gold price and bond were included in the study [29] and the inference was drawn that stock market and commodity market acts as the net transmitter of volatility and the other three which are bond, gold price and forex are the net receivers of volatility. The effect of liquidity risk on the volatility of different commodity was studied to come to a conclusion that that liquidity shocks strongly relates to both the risks, originating from market volatility and market return [7]. The study of the relationship between speculative activity in agricultural commodity futures and volatility in returns using VAR model with Granger Causality test states that speculative activity in case of most of the commodity is directly proportional to increase in returns volatility so speculation has a positive influence [30]. The Granger Causality test also supports the result. In the above studies, various models of GARCH has been used to study the volatility spillover between the markets. Most of the authors have used various models of ARCH and GARCH to study the volatility spillover of price or return across different markets [10], [14], [25]. On the other hand, some of them [18] used spillover index to study the volatility spillover effect.

5. Findings and conclusion

This paper aims to present a review of papers related to volatility in the commodity futures market in China. Prior to the decade of 1980s, china was a centrally planned economy, the price was controlled and traded in a regulated market. China saw its real development of commodity market after the regulatory

measures taken in 1998-99 when most the exchanges were merged into three major exchanges named as SHFE, DCE and ZCE. In the last two decades, the trade volume of the market has seen considerable hikes. We understood volatility as a measure of the deviation of price from its mean value. It influences the risk and return of the market. Volatility is influenced by trading volume and open interests. A security being higher volatile means that prices change more frequently in a short span of time. This frequent change indicates higher risk. The cause of exceptional volatility could be excess demand of a commodity or excess speculation and arbitrage. It could also add to inflationary pressure in the market. Post-sub-prime crisis period, authors report contradictory result. It is found that the soybean has started developing its own pricing mechanism and spillover from US market has weakened over time. Spillover is found bidirectional in nature with London markets. Highly marketed commodities like corn and soybean are found to have increased spillover to the US market. Further, in china's domestic market, volatility in long positions is greater as compared to volatility in short positions. Spillover from one market to another has increased post crisis with time varying direction. In the first half of the decade of 2010, various authors reported that Chinese markets of commodities like copper, soybean, follow US market. The commodities of mass consumption, like wheat, was not exposed to the market and had their own price mechanism for being protected by the government. The wheat market is found inefficient in price discovery in the spot market also. On the other hand, the case of the US, Canada and the European Union, the three major wheat-producing countries show significant volatility spillover among them. China market is found to be more efficient in incorporating information in price after the global crisis period. Literature review reveals that price discovery function has improved over the years. The direction of the flow of information is reverting and the market has started affecting the price dynamics of the world market. From the above discussions, it can be said that China has successfully implemented the economic reform measure in its commodity market.

6. Scope and limitations

The study has taken China commodity market in the centre to study the development of the market and spillover effects. Other emerging commodity markets could be taken to explore the various aspects of the linkages and spillover.

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