

National Stock Exchange (NSE) - Research Scholar Program

**INTERACTION DYNAMICS OF ARBITRAGE, HEDGING AND
SPECULATION WITH SPOT VOLATILITY : EVIDENCE FROM
CRUDE OIL MARKET**

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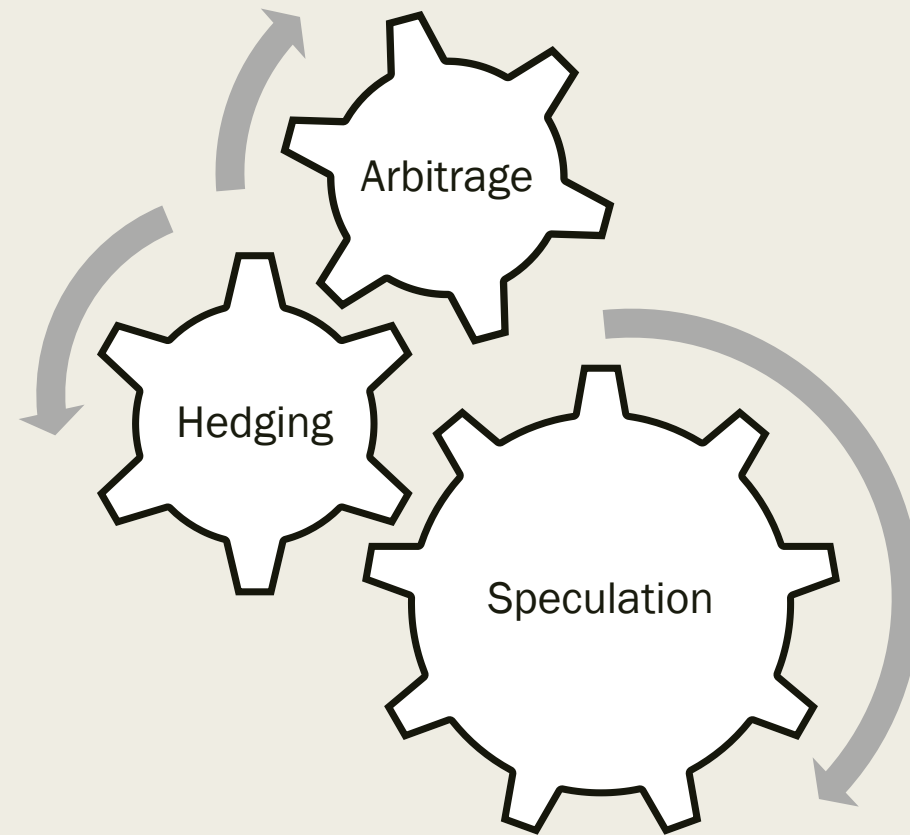
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Trading Activity in Commodity Futures Markets

- Speculators are profit motivated
- Hedgers aim to minimize risk and have exposure in spot markets
- Arbitrage : risk-less profits based on price difference across markets



INTRODUCTION

- Trading in the *Crude Oil Futures Markets* are of three types:
 - *Speculation, Hedging & Arbitrage*
- Intent behind each activity defines it:
 - *Arbitrage: risk-less profits based on imperfection in the market micro-structure*
 - *Hedging: risk mitigation to avoid fluctuation in spot prices*
 - *Speculation: profit-seeking ventures, additionally providing short-term liquidity*
- Overlapping trading intent – Siloed vs Interconnected Activities
 - Working's theory states that different trading activities such as speculation, hedging and arbitrage are not isolated events but interlinked - *Working (1960)*
 - Speculation and hedging work in tandem *Cheng - Kirilenko, and Xiong (2015)*
 - Speculation is used interchangeably with arbitrage as speculators indulge in arbitrage - *Acharya et al., (2013)*

THEORY - VOLATILITY AND TRADING ACTIVITY

Speculation & Volatility

- Master's hypothesis : increased spot price volatility → increased number of profit-seeking speculators - M. Masters (2010); Tokic (2011)

- No impact : speculation on volatility. Speculative trades only promote short-term liquidity - Li *et. al.* (2015)

Arbitrage & Volatility




- Increased market volatility → reduces arbitrage; higher volatility increases the risk of assured pay-offs for debt-constrained investors – Gromb and Vayanos, (2012); Chen *et. al.* (1995) ; Tu *et. al.*(2016)

- Higher volatility → mispricing facilitating arbitrageurs more significant opportunities to trade - Lu *et al.* (2012)

Hedging & Volatility

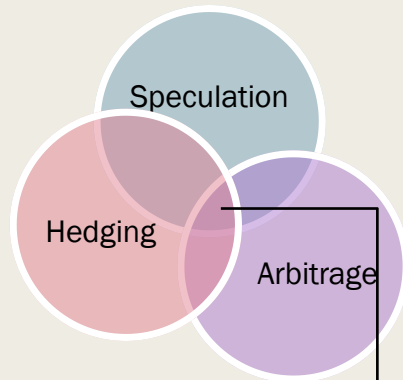
- Period of high market volatility → Demand for crude oil futures for hedging increases -Ranganathan and Ananthakumar, (2014); Junttila *et. al.*(2018)

- Shortfall in speculator's capital during periods of higher volatility → reduces hedging demands as the cost of hedging increases due to lower liquidity – Acharya *et. al.*(2013)

 Positive impact  Negative Impact  No Impact

INFERENCE FROM THE LITERATURE

1. Trading activities (arbitrage, hedging & speculation) are studied as isolated activities
2. Inconclusive evidence of the combined impact of arbitrage, hedging & speculation on spot market volatility



RESEARCH GAP

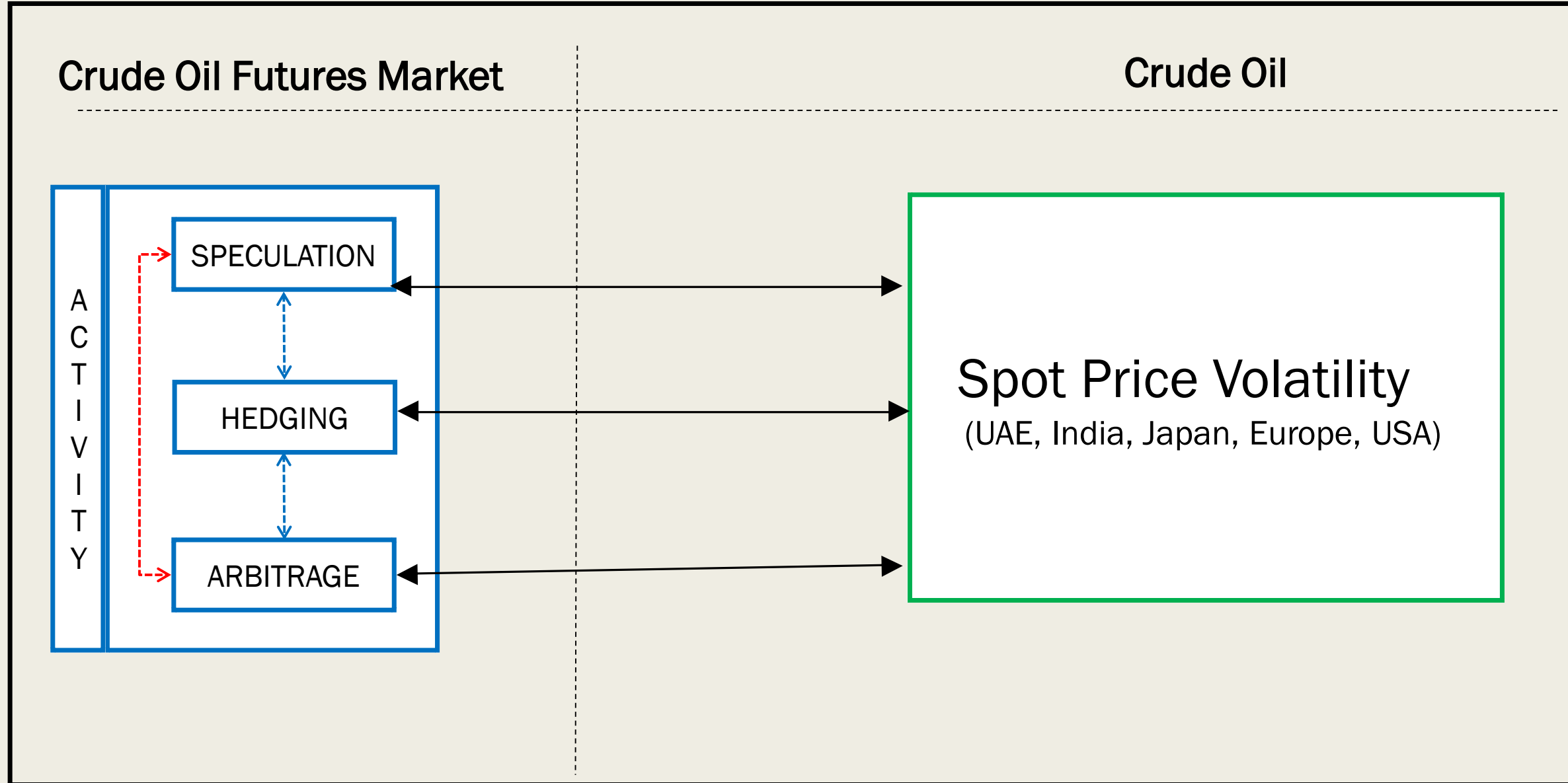
1. Most studies are based only on stock futures
2. No study looking at the impact of speculation, arbitrage and hedging together on the commodity spot market
3. A comparative analysis of various countries in commodity markets has also not been attempted

NEED

- Study connecting all three trading activities i.e. speculation, hedging & arbitrage
- Examine the impact of these activities in explaining the variations in the spot market volatility
- Analyse in the context of crude oil markets across various countries

Examine the interlinkages of speculation, arbitrage, hedging and spot volatility in the context of Crude Oil Market in 5 countries

CONCEPTUAL FRAMEWORK



Data and Methodology

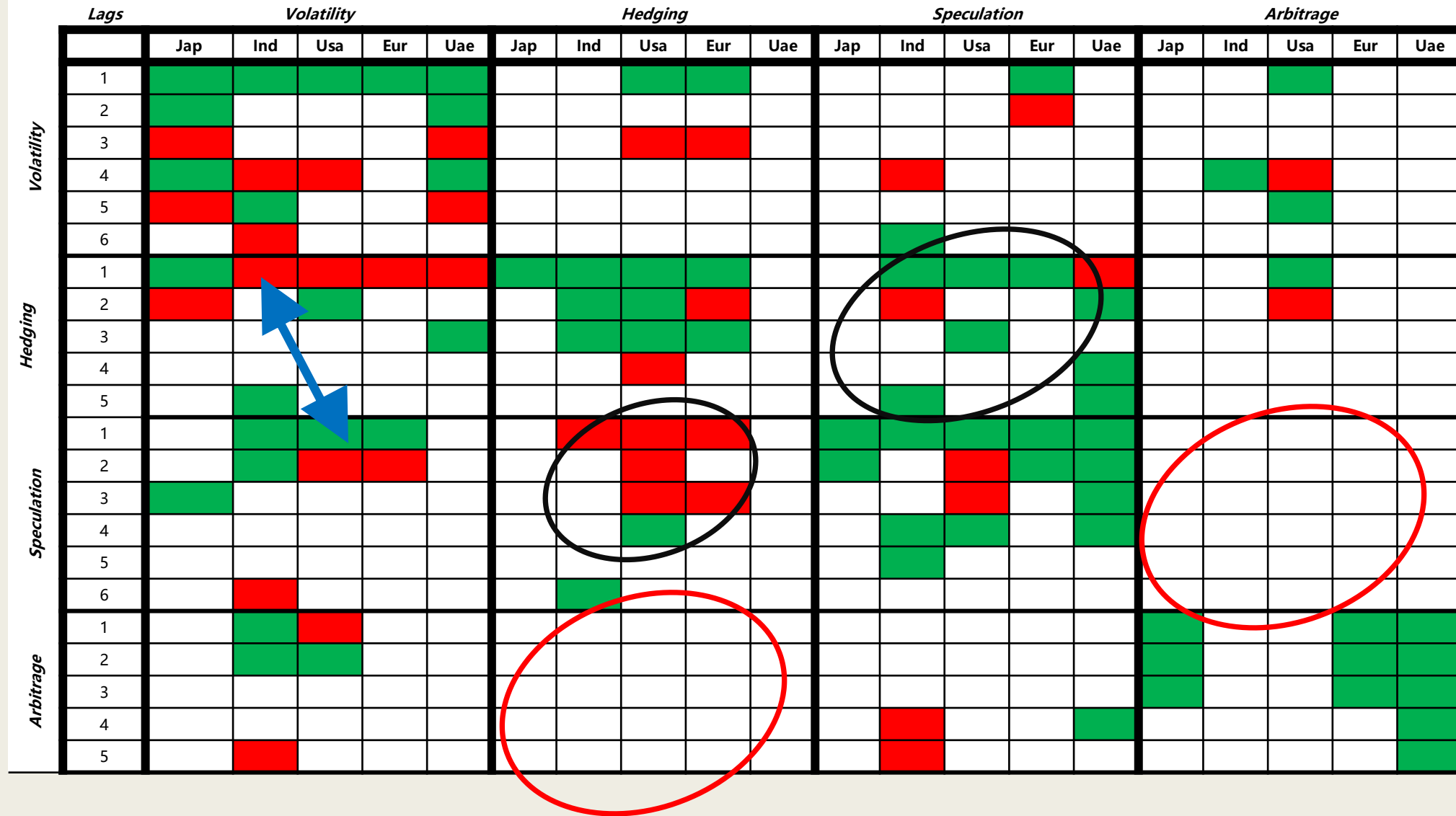
- Data: Crude Oil Futures and Spot - UAE, India, Japan, Europe, USA - (2010-2017)

FUTURES CONTRACT	EXCHANGE	SAMPLE SIZE
Oman Crude Oil	Dubai Mercantile Exchange, UAE	1889
Light Sweet Crude Oil	Multi-Commodity Exchange, India	2072
Crude Oil	Tokyo Commodity Exchange, Japan	1740
Brent Crude Oil	Inter-Continental Exchange, Europe	1921
West-Texas Intermediate	New York Mercantile Exchange, USA	1913

- Methodology: Granger Causality and Vector Auto Regression (VAR), Volatility – GARCH(1,1)

Results

VAR RESULTS



Arbitrage and hedging ; Arbitrage and Speculation show no significant relationships contrary to extant literature

Speculation has a predominantly positive impact on volatility, while hedging has a negative impact

Speculation and hedging show interconnectedness. Hedging lags have a positive impact on speculation, however speculation has a negative impact on hedging

GRANGER CAUSALITY

<i>From → To</i>	<i>Volatility</i>	<i>Speculation</i>	<i>Arbitrage</i>	<i>Hedging</i>
<i>Volatility</i>		USA, Europe, India	India, USA, Europe	Europe & USA
<i>Speculation</i>	USA, Europe, India			UAE, USA, Europe & India
	Japan			
<i>Arbitrage</i>	India, USA, Europe	USA		Europe
	Japan			
<i>Hedging</i>	Europe & USA	UAE, USA, Europe & India	USA	
	UAE, India & Japan			

Unidirectional	Bidirectional
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- **Hedging and speculation consistently show a strong link** which is in accordance to literature which states that hedging and speculation are two sides to the same coin (Working, 1960; Johnson, 1960; Cifarelli and Paladino, 2015)
- **Volatility and speculation** also show interconnected relationships except in UAE.
- **Arbitrage is also seen to contribute to volatility**, however bidirectionality ceases in UAE and Japan as these markets have stringent regulations.

Findings

- Volatility is explained by the lagged variables of the three activities in all countries except in the case of UAE. Consistent with the findings of Tokic (2011), speculation lagged by one period has a positive impact on spot price volatility except in UAE.
- Hedging and speculation are influenced by each other. However, the direction of impact varies across countries. Regulated markets like Japan and UAE show lower influence.
- Arbitrage is the activity that contributes the least to spot price volatility. It is impacted by predominantly by its own lags. However, in select countries such as USA and India, it is interconnected with speculation and hedging.
- There is bidirectional relationship between speculation and volatility(US, India, Europe) and arbitrage and volatility (US, India, Europe) and hedging and volatility in (US and Europe). There is unidirectional relationship impact of Hedging, Speculation and arbitrage on volatility in Japan, and hedging impacts volatility in Indian and UAE.
- The link between (i) arbitrage and speculation and (ii)arbitrage and hedging are almost non-existent in all the markets.

Conclusion

- The study examines the interlinkages between speculation, hedging and arbitrage in the context of crude oil futures, and their combined impact on spot market volatility
- While most studies consider the isolated impact of each activity, our study provides a wholesome view into the impact of all trading activities in futures on spot market volatility
- Hedging and speculation are consistently connected supporting the studies which states that hedging and speculation are two sides to the same coin
- From variance decomposition we observe that changes in spot volatility is contributed by arbitrage and speculation predominantly.
- Arbitrage and hedging ; arbitrage and speculation show no significant relationships contrary to extant literature which state that speculators and arbitrageurs overlap
- The results confirm interlinkage of trading activities with volatility and support Master hypothesis(2010) as speculation increases volatility
- The results imply that the regulators of the futures markets can efficiently monitor spot market volatility by regulating the trading activities in commodity futures market.

Thank you