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Statistical analysis of impact of COVID 19 on India commodity markets

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ABSTRACT
How did a fitness crisis translate to a financial crisis? Why did coronavirus bring the worlds financial system to its knees? The solution is to be found in two approaches. Initially, this contagious virus resulted in a lockdown of the business world and economy. A ratio at which the virus has been proliferating, the increased uncertainty is exactly the reason for this bad situation which resulted as unsecured initialization investment between traders. We rely on the present environment in evaluating the constricting procedures, fiscal policies and public health actions that were implemented in that time. This study examines volatility transmission over the financial crisis. Recently established causality in impulse response functions and variance test to everyday data from January 2020 has been implied. To recognize the effect of the food cost crisis, statistics are separated into two intervals i.e. post-COVID period and the pre-COVID period. The variance causality test indicates that the risk transmission among agricultural commodity is zero, but oil market volatility spills on the markets for agricultural products excluding sugar in the post-crisis period. Thus, this paper signifies that the statistical volatility transmission differs post food price crisis. Following, risk transmission materializes as an additional element of the statistical interrelations among agricultural and energy markets.

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1. Introduction

By and large Implications of COVID-19 for creating nation economies Worldwide, the quantity of instances of coronavirus has outperformed the emblematic limit of 100,000. In the wake of watching the encounters of China, Italy, Iran, South Korea, France and other early-influenced nations, an ever increasing number of nations are receiving measures to contain the spread of the infection that include: travel limitations, daily curfews, a prohibition on open occasions, the conclusion of schools, cinemas, exhibition halls, bars and shops. These uncommon measures are pushing down on the world economy, which is debilitating quick. The hit to Gross Domestic Product (GDP) is relied upon to be high, particularly if these limitations most recent a while.

In any case, nobody can dependably anticipate the full monetary effect of the outbreak and theories are evolving quickly. A lot of relies upon what is mysterious—to what extent the outbreak endures, what number of nations it harrows, and the degree to which an organized, coordinated, quick track strategy reaction is prepared and continued. In any case, what we cannot deny is that the flare-up showed up at a powerless point for the world economy, exactly when worldwide development was starting to get from its most reduced rate since the 2009 money related emergency.

That has upsetting ramifications for creating economies: Tighter credit conditions, more fragile development, and the preoccupation of government assets to support human services frameworks and battle the flare-up would decrease finances accessible for key advancement needs. A financial droop would likewise hamper the battle against extraordinary neediness. It is basic, in this way, that policymakers wherever perceive how financial damage can be transmitted starting with one nation then onto the next—and to act rapidly to forestall its spread.

That transmission of monetary damage is probably going to happen through a few channels.

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• The second is through remote money related streams, which could decrease (on account of settlements) or be moved away from coronavirus-influenced nations.
• The third is through the travel industry, a significant income stream for some creating nations that is contracting with declining request and growing travel limitations; and
• The fourth is through local capital—human just as monetary—which is turning out to be underutilized as processing plants are sat and individuals remain at home.

2. Literature review

The connection among oil and farming costs as far as oil as a creation expense in horticulture was inspected by Harri and Hudson [13], Baffes [3,4], Alghalith [4], Chang and Su [8], Alom et al. [2], Du et al. [10]. Baffes [3] broke down how unrefined petroleum costs spill on the costs of 35 globally exchanged essential items and found that the go through of raw petroleum value variations to the general non-vitality product list, the compost list, farming and metals are 0.11, 0.17, 0.33 and 0.16, individually. At a greater number of disaggregating levels, Baffes [4] rethought this relationship and reasoned that the most elevated go through of oil value changes is to the compost file followed by farming. The connection among oil and agrarian costs regarding biofuels was inspected by Zhang et al. [25], Busse et al. [5], Hassouneh et al. [15], Kristoufek et al. [19], and Serra [23]. Serra [23] examined the instability over-flow among unrefined petroleum, sugar and ethanol costs in Brazil. She noticed that there are solid instability connections among the costs and that raw petroleum and sugar advertise stuns trigger an expansion in the unpredictability of the ethanol cost. This demonstrates the presence of a powerful connection among fuel, biofuel, and agrarian markets. In an alternate report, Serra et al. [24] dissected the value relationships and transmission designs in the U. S. ethanol industry and found that there exist since quite a while ago run connections among the costs of ethanol, pulses, oil and gas just as solid connections among vitality and food costs. Like Serra [23], they reveal a since a long time ago run synchronization connection among oil, biofuel, and horticultural marketplaces. Hassouneh et al. [15] inspect the value relationships and value transmission designs among food and vitality costs in Spain. They discovered that there is a since quite a while ago run, synchronization connection among sunflower, biodiesel, and raw petroleum costs; that biodiesel is the main variable that acclimates to deviations from the since quite a while ago run relationship and that sunflower oil costs are affected by vitality costs through short-run value elements. Kristoufek et al. [19] dissect the presence of the connection among ethanol, biodiesel, and related fills and ware costs in the Germany and US. Their outcomes demonstrate that even though biofuel is influenced by fuel and food costs, biofuel costs has a restricted limit in the assurance of food costs. They additionally found that the connection between costs changes relying upon the information recurrence utilized. Busse et al. [5] explored the vertical value transmission in the biodiesel flexibly chain in Germany by concentrating on the associations between costs of vegetable oil, biodiesel, soy oil, and raw petroleum. They discovered proof for a solid effect of unrefined petroleum cost on biodiesel costs, and of biodiesel costs on vegetable oil costs. Zhang et al. [25] break down both short-and since quite a while ago run connection between costs of fuel and horticultural wares. Their outcomes show that there is no immediate since quite a while ago run value connection among fuel and agrarian ware costs and there is possibly constrained, assuming any, immediate short-run connections. Concerning the writing as far as co-development of ware costs with macroeconomic variables and budgetary pointers, Krichene [18] explores oil value developments between January 2000 and October 2007. He contends that the fast increment as of late saw in oil and other item costs can be ascribed to the expansionary financial strategies during the mid-2000s. Because of the effect of expansionary arrangements, world interest for wares rose while gracefully fell behind, squeezing all product costs. He calls attention to the new elements in ware costs because of facilitating of money related position in the late 2007 and mid-2008. Du et al. [10] examined the job of hypothesis in driving unrefined petroleum value variety subsequent to controlling for other impacting factors. They additionally endeavor to measure the degree to which instability in the raw petroleum showcase go through into rural ware markets (wheat and pulses) in the U.S. They discovered proof of unpredictability over-flow among unrefined petroleum, pulses, and wheat showcases after the fall in 2006, suggesting hazard move among these product markets. Cevik and Sedik [7] inspect the outrageous changes in product costs (wine and oil) somewhere in the range of 1990 and 2010. As indicated by their outcomes, macroeconomic variables rise as the primary determinants of product costs. They additionally call attention to that, albeit significant economies represent around half of world utilization, developing markets make up a critical steady option to request. Whatever the purpose for the since quite a while ago run pattern or short run vacillations is, raw petroleum as well as other ware spot costs followed a comparable example. They all accomplished consistently expanding patterns first and afterward an exceptional drop after the worldwide emergency. Evaluating a few elective hypotheses of the raw petroleum value climb in 2008, going from interest and flexibly elements to product hypothesis, Hamilton [12] presumes that as opposed to being elective clarifications, they may together be liable at the cost stuns. As respects to hazard move among vitality and rural markets, in one of the early endeavors to find unpredictability over-flow. Study Data Method Commodity Key discoveries Baffes [3] 1960–2005 (yearly) OLS Crude oil 35 products Pass-through of raw petroleum cost changes to the general non-vitality ware file, the compost list, agribusiness and metals Harri and Hudson [13] 2003–2009 (day by day) Causality Crude oil, pulses, mazies Volatility overflow from oil costs to pulses costs after the food cost emergency Krichene [18] 2000–2007 (every day) LPCHT Crude oil Expansionary fiscal approaches during the mid 2000s influence oil costs Alghalith [1] 1974–2007 (yearly) NOLS Crude oil, food bushel An increment in oil cost and its instability yields a higher food value Baffes [4] 1960–2000 (yearly) OLS Energy record Non-vitality list The manure list shows the biggest go through followed by horticulture and metals. Busse et al. [5] 2002–2009 (week by week) MS-VECM Biodiesel, rapeseed oil, soya oil, raw petroleum Strong effect of raw petroleum cost on biodiesel costs, and of biodiesel costs on rape-seed oil costs Chang and Su [8] 2000–2008 (day by day) EGARCH Crude oil, pulses, soybean Volatility overflow from raw petroleum to pulses and soybean costs Zhang et al. [25] 1989–2008 (month to month) VECM Ethanol, pulses, rice, mazies, sugar, wheat, gas, raw petroleum No direct since a long time ago run value relations among fuel and agrarian product costs Alom et al. [2] 1995–2010 (every day) VAR Crude oil, pulses, mazies, gas Long-run connection among the costs just as solid connections among vitality and food costs. Harri and Hudson [13] noticed
that there is unpredictability overflow from oil prospects costs to pulses fates costs after the food value emergency. In accordance with this discovering, Chang and Su [8] gave proof of unpredictability overflow from raw petroleum to pulses and arraigned that soybeans costs are emphatically critical throughout the sophisticated raw petroleum value period, inferring a monetary replacement impact throughout the higher raw petroleum value period. Notwithstanding unpredictability transmission among world farming and world oil wares, a few examinations focused on the instability transmission from globe oil costs to residential horticultural item costs. For example, Alghalith [1] examined the effect of oil cost vulnerabilities on food costs in Tobago and Trinidad and found that an expansion in oil cost and its instability produces a greater food cost. The finding that a higher hazard in the oil showcase prompts a greater food cost proposes that there exists a hazard move instrument between the two item advertsises. Alom et al. [2] explored instability overflow from world oil costs to food costs for the chose Pacific and Asia nations and noticed that food value unpredictability is decidedly related with world oil value unpredictability however the outcomes shift around nations and sub-periods. Besides, their outcomes infer that unpredictability overflow from globe oil to domestic’s food costs are more grounded for the later sub-time frame, demonstrating expanding interdependency among Asia Pacific horticultural and world oil markets throughout the ongoing years. Evidently there is a quickly developing writing on the elements.

3. Objectives

This article explores the volatility spillover impacts among the agriculture products and crude oil market and estimates statistical conditional correlations. The major contributions of the article are as follows.

1. The various qualities of volatility spillover impacts among each commodity market and crude oil market and after the COVID-19 are evaluated systematically, and the impact of crude oil fluctuations in the prices different commodity markets is being compared.

2. Ultimately, we assess the statistical conditional correlation among each commodity market and the crude oil market and evaluate the time-differing qualities of correlations after and before the COVID-19.

4. Econometric methodology

To evaluate the volatility spillover between world oil and horticultural item costs, this examination receives causality in change test as of late created by Hafner and Herwartz [11]. In analyzing volatility spillover among two arrangement, Cheung and Ng [9] and Hong [16] built up a causality-in-difference test which depends on CCF (cross-relationship capacities) of normalized residuals acquired from univariate GARCH (general autoregressive restrictive heteroscedasticity) assessments. The CCF in accordance with the Portmanteau test is probably going to be experiencing huge oversized in little and moderate examples while the unpredictability forms are leptokurtic [11]. Furthermore, findings from CCF on the basis of testing methodology are delicate to the sets of leads and slacks which thus addresses the heartiness of discoveries. The instability overflow trial of Hafner and Herwartz [11] considering LM (Lagrange multiplier) rule defeats the setbacks of Cheung and Ng’s technique and is handy for exact outlines. Moreover, the Monte Carlo test completed in Hafner and Herwartz [11] demonstrates that the LM methodology is increasingly powerful against leptokurtic developments in little examples and the addition from conveying the LM test increments with test size. The outcomes further demonstrate that an uneasily lead and fellow request decision in the CCF test contours its exhibition and along these lines prompts the danger of choosing an off-base request of the CCF measurement. In what happens next, we quickly clarify the subtleties of Hafner and Herwartz [11] causality in change test. In the Hafner and Herwartz [11] methodology, experimentation for causality in change depends on assessing univariate GARCH models. The invalid theory of non-causality in fluctuation among two return arrangement is depicted as in the following example

\[ H_0: \text{Var}(\epsilon_{it} | F_{t-1}) = \text{Var}(\epsilon_{it}) \quad j = 1, \ldots, N, i \neq j \]  

where \( \epsilon_{it} \) and Ft (j) = Ft(\( \sigma(\epsilon_{it}, \tau < t) \)) are the residuals from GARCH model. The next model is deemed to be test for the null assumption.

\[ \epsilon_{it} = \eta_{it} \sqrt{\sigma_{it}}, \quad G_t = 1 + Z_{it} \eta_{it}, \quad Z_{it} = \left( \epsilon_{it-1}, \sigma_{it-1} \right) \]  

where conditional variance \( \text{var} \sigma_t = \text{var} \epsilon_{it} + \alpha \epsilon_{it-1}^2 + \beta \sigma_{it-1}^2 \) and \( \gamma \) signifies the consistent residuals of GARCH model. In Eq. (2), the adequate condition for Eq. (1) is \( \pi = 0 \) which certifies that the null assumption of non-causality in difference H0: \( \pi = 0 \) is tested against the alternate assumption H1: \( \pi \neq 0 \). The total of the Gaussian log-likelihood function of \( \sigma_t \) is provided by \( \eta_{it} \sigma_{it}^2 \). Hafner and Herwartz [11] recommend the subsequent LM test to test the volatility transmission among the two sequences:

\[ \lambda_{LM} = \frac{1}{4T} \left( \sum_{t=1}^{T} \left( \gamma_{it}^2 - 1 \right) \right) \]  

where

\[ V(\theta_i) = \frac{K}{4T} \left( \sum_{t=1}^{T} Z_{it}^2 - \sum_{t=1}^{T} \eta_{it} X_{it}^2 \right) ^{-1} \]  

\[ K = \frac{1}{T} \sum_{t=1}^{T} \left( \gamma_{it}^2 - 1 \right) ^2 \]  

Asymptotical allocation of the test value in Eq. (3) will rely upon the quantity of specification pointers in \( Z_{it} \). While there are two specification pointers in \( \lambda_{LM} \), the test has an approximate chi-square circulation with two DoF.

Notwithstanding testing for causality in difference between world oil and horticultural ware costs, this examination utilizes impulse response investigation so as to decide how the instability of farming item costs react to a stun in world oil value unpredictability. In such manner, we use the summed up drive reaction strategy supported by Pesaran and Shin [22] and Koop et al. [17] which is better than the conventional methodology since it isn’t dependent upon the symmetry study emerging from Cholesky requesting and the outcomes from the summed up drive reaction capacities are not delicate to the requesting of factors in the vector autoregression (VAR) framework.

5. Data

We utilize day by day information covering the period before COVID-19 at the spot costs of world oil, pulses, maize’s, sugar and wheat. The information on all arrangement is accumulated from DataStream.

The arrival arrangement \( -\ln(p_t / p_{t-1}) \) where \( p_t \) is the cost at day t are utilized in the exact investigation and the characteristic logarithms of the factors are organized in 5-day during the week. With respect to oil cost rural ware costs nexus, it has currently been contended that horticultural item costs are not receptive to
the oil costs till 2006 [6]. Before COVID-19, the food value emergency brings about higher relationship between the financial crisis. To represent the effect of the food value emergency, it is helpful to isolate the full example into subcategories (for instance, [6,13,14,20,21]). We thusly work with two groups: (i) the pre-emergency period crossing before COVID-19, and (ii) the post-emergency period which will cover the time structure after COVID-19.

Table 1 addresses to the elucidating measurements for the sub-time frames. It appears that information qualities of the arrival arrangement are marginally unique in the pre-and post-emergency periods. As a matter of first importance, true to form, the mean and the unpredictability of the profits in the post-emergency period are higher in comparison to the pre-emergency period. Furthermore, the kurtosis, skewness, standard deviation, and mean of the world oil returns are more prominent than those of the horticultural product returns in the pre-emergency period. Then again, the rural product returns have greater skewness and mean in comparison to the oil returns. In the post-emergency period, standard deviation for maize's and pulses are significantly greater in comparison to different factors. This in truth is relied upon because of the way that the oil cost flood during the ongoing years expands the determined interest for the agrarian items, for example, pulses and maize's which are utilized in biofuels creation which thusly prompts a considerable ascent in the costs of those products. The various information attributes in the post-and pre-emergency periods bring up the issue of whether the relationship among the world oil and horticultural ware returns change over the sub-time frames.

6. Analysis approach

6.1. Statistical conditional correlation

To further examine the time-differing qualities of correlation among the crude oil market and each commodity market and to evaluate adjustments before and after the COVID-19, we projected the statistical conditional correlation coefficients. Fig. 2a represents the statistical conditional correlation among the agricultural products and crude oil market. The correlation demonstrates markedly dissimilar qualities after and before the COVID-19. Before the COVID-19, the conditional correlation coefficient initially reduced and then improved, demonstrating a different V-type trend, with the turning point in the vicinity. Though, following the financial crisis, correlation among the agricultural products and crude oil market improved, surpassing the pre-crisis high point and changing to a lesser degree at a greater level. By contemplating trends for the agricultural products and crude oil price index in Fig. 1, the adjustments in correlation could be explained. Though, price differences for crude oil and other goods are not completely synchronized. Global investors were enthusiastic about the outlook for the crude oil reason for this is that it is a key strategic resource, so a huge amount of unpredictable capital was flowing to the crude oil market, which additionally drove up oil prices, so an stock replacement impact of crude oil on other raw materials market is evident. Later, to prevent risks, the market livestock impacted a flow of speculative money from the economic markets to the commodities markets. In this phase, the cost of most basic goods rapidly improved, so the relationship among the agricultural products and crude oil market continuously improved.

7. Impacted nations

A decline in Chinese flexibility of rational information sources can affect the profitable limit and along these lines the fares of some arbitrary nations relying upon how dependent its enterprises are on Chinese providers. For instance, some's European vehicle producers may confront the deficiency of basic segments for their activities, organizations in Japan may discover hard to acquire parts important for the gathering of computerized cameras, etc. For some organizations, the restricted utilization of inventories brought by a lean and without a moment to spare assembling procedure would bring about deficiencies that will affect their creation abilities and by and large fares. Table 1 states by division the potential impact of COVID-19 on trades in the most presented nations to Chinese flexibly interruptions. Generally, the most affected economies will be the European Union (hardware, automobiles, and synthetic compounds), the United States (apparatus, automobiles, and exactness instruments), Japan (hardware and automobiles), the Republic of Korea (transmission equipment and hardware), Taiwan Province of China (office equipment and transmission equipment) and Viet Nam (transmission equipment).

8. Conclusion

This article researches volatility spillover among oil and chose farming item advertises (wheat, maize, pulses and sugar) that are important agrarian items for biofuel production and for food on the planet. The information crossing is separated into two periods as when COVID-19 (the post-emergency period) to represent the item emergency. In the elucidating examination, we saw that item advertise returns follow comparable properties as budgetary returns. It is settled that oil markets have consistently pulled in worldwide financial specialists. The way that noteworthy hazard transmissions are seen from oil to agrarian product showcases after the emergency recommends that speculators looking for places of refuge increment the financialization of the rural item advertises. This proposes nearby measures to smoother value vulnerability in farming markets might not be compelling in the short term. The worldwide factors, for example, the hazard in vitality markets appear to drive the short-run unpredictability in farming markets. The significance of this impact is better for nations that are generally helpless against food value variances. Even more light can be dropped on this problem by contemplating the reactions of

| Table 1 Narrative Statistics. |
|-----------------------------|
| Before COVID-19             |
| Sugar                      | 3.44E-05 | 2.74E-06 | 3.36E-06 | -4.48E-06 | 2.78E-05 |
| Wheat                      | 0.112    | 0.029    | 0.025    | 0.026     | 0.036    |
| Pulses                     | -0.305   | -0.940   | -0.940   | -0.507    | -2.158   |
| Mazie’s                    | 20.373   | 32.017   | 22.870   | 9.300     | 32.497   |
| After COVID-19             |
| Sugar                      | 5.19E-05 | 6.89E-05 | 7.00E-05 | 9.86E-05  | 4.90E-05 |
| Wheat                      | 0.033    | 0.042    | 0.020    | 0.034     | 0.037    |
| Pulses                     | -0.292   | -0.572   | -0.735   | -0.300    | 0.087    |
| Mazie’s                    | 5.623    | 7.600    | 7.554    | 6.299     | 9.096    |
neighborhood horticultural costs to worldwide vitality stunts. Moreover, financial specialists keen on item markets ought to understand that hazard in one ware market may not be autonomous of hazard in other ware markets. Further examination is fundamental so as to discover how chance transmission system functions among various money related and item advertises. The elements of product costs are muddled, and various components might be influencing these business sectors. The ongoing conversation recommends that notwithstanding the vitality farming linkage, the budgetary factors, for example, trade rates, prospects markets, theory, and financing costs may assume job on the ongoing elements of product costs. In this manner, examining agrarian value assurance proposes the requirement for increasingly experimental examination to mutually recognize the effects of different factors on rural costs. In that regard, future investigations can expand the writing in any event in two different ways. In the first place, inquiries about can profit by the adaptability of auxiliary vector autoregression models to force hypothetical limitations to recognize effects of vitality and money showcases on agrarian markets. Besides, multivariate unpredictability overflow examination which gives space to apply causality in fluctuation tests and drive reaction investigation dependent on multivariate models may give new experiences.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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