

Analysis of various investment products in the commodity markets

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Introduction

- In the past commodities are always relatively ignored asset classes for both institutional asset managers and individual investors.
- Commodities based assets under management have grown twice as fast as traditional investments since **2005** by reaching almost **7 percent** in **2013**.
- Commodities based assets under management has fallen to **170 billion USD** in **January 2015** from **270 billion USD** in the first quarter of **2011**.

Introduction

Advantages of commodities as an asset class:

- 1) Low or negative correlation with other traditional asset classes like stocks and bonds.
- 2) Positive correlation with the inflation rate.

Sources of increasing commodity prices:

- 1) Rising demand of commodities in emerging markets like China and India.
- 2) Underinvestment of commodities production and research in the past years.

Problem Statement

Although modern commodities trading can be dated back to 18th century in Japan, where commodity futures were used to trade rice in Osaka, still commodity investments are unknown asset class to the most of the individual investors.

Reasons:

- 1) commodities based investment mechanics works quite different to the traditional asset classes like stocks and bonds.
- 2) commodities exhibit seasonality in price levels along with volatilities and also has paucity of data.

Research Questions

- 1)** What are the different types of commodity based investment products available across the world? Does some regions are lagging behind others?
- 2)** What are the risk and return characteristics of different individual commodity products available across the major international markets?
- 3)** Is there any causal relationship between different commodity products (futures, ETFs, Commodity Stock and Mutual Funds) within the same sector like agriculture ?
- 4)** Is there any causal relationship between different commodity products (futures, ETFs, Commodity Stock and Mutual Funds) across different sector of commodities like metals or energy?

Literature Review

Gorton and Rouwenhorst (2006) found that futures index could potentially offer similar returns to equities. This paper has been re-examined by **Bharadwaj, Gorton and Rouwenhorst (2015)** and concluded that basic results of previous research are still valid.

Creti, Joëts, & Mignon (2013) examined the correlation between 25 individual commodities and S&P 500 index. They found high volatility and correlations during the 2007-2008 financial crises.

Mensi, Beljid, Boubaker, & Managi (2013) showed that there is a significant transmission of volatility and correlations between the equity and commodity markets.

Heidorn and Demodova-Menzel (2007) proved commodities may produce investment benefits when considered as an addition to a diversified portfolio.

Literature Review

Malliaris and Urrutia (1996) used the error correction model (ECM) of **Engle and Granger (1987)** to show the existence of long term relationships between corn, wheat, oats, soybean, soybean meal and soybean oil.

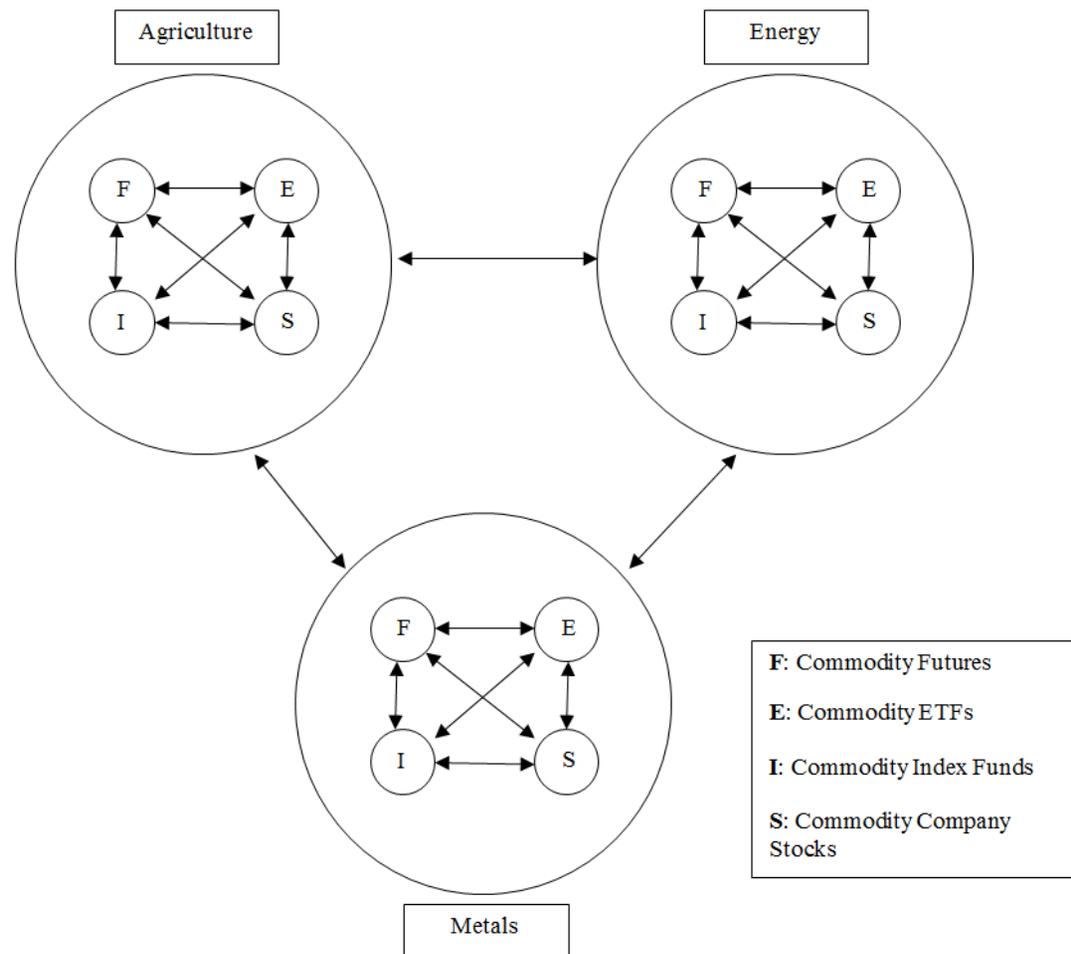
Schnitkey and Kramer (2011) has analyzed the performance of publicly traded agricultural firms and concluded that agricultural index exceeded the S&P 500 index over the time period of 2007 to 2011.

Schneeweis and Spurgin (1997) found that indirect commodity investment in energy companies does not provide direct exposure to commodity price changes.

Greer (2000) studied the available commercial indexes like Chase Physical Commodity Index between 1970 and 1999 and found that returns of commodity index are positively correlated with the rate of inflation and negatively correlated with stocks and bonds.

Methodology

Commodity investment types and their relations



Methodology

Toda and Yamamoto (1995) procedure

Step 1: Identify the maximal order of integration (ρ_{max}) for the variables used in the model using Augmented Dickey Fuller (ADF) test or Phillips-Perron (PP) tests.

Step 2: After the selection of preferred VAR model with optimal lag (k) and the maximal order of integration selected in the step 1 i.e. (ρ_{max}) is further added to the each of the VAR equation. The final bivariate VAR ($k + \rho_{max}$) model is shown as below

$$I_i = \emptyset + \sum_{i=1}^k \alpha_i I_{t-i} + \sum_{i=k+1}^{k+\rho_{max}} \alpha_i I_{t-i} + \sum_{i=1}^k \beta_i S_{t-i} + \sum_{i=k+1}^{k+\rho_{max}} \beta_i S_{t-i} + \mu_{1t} \quad (1)$$

$$S_i = \emptyset + \sum_{i=1}^k \delta_i S_{t-i} + \sum_{i=k+1}^{k+\rho_{max}} \delta_i S_{t-i} + \sum_{i=1}^k \gamma_i I_{t-i} + \sum_{i=k+1}^{k+\rho_{max}} \gamma_i I_{t-i} + \mu_{2t} \quad (2)$$

Where I_i is the log normal daily futures index price and S_i is the log normal daily stock closing price. $\alpha_i, \beta_j, \delta_i, \gamma_j$ are the model parameters and μ_{1t}, μ_{2t} are residuals of the model. ρ_{max} is the maximum order of integration.

Methodology

Step 3: The null hypothesis (H_0) for the VAR model is formulated as follows

For equation (1), we set:

$H_0: \beta_i = 0, \forall i = 1, 2, 3 \dots k$ or commodity related company stocks price does not cause futures index price

$H_1: \beta_i \neq 0, \forall i = 1, 2, 3 \dots k$ or commodity related company stocks price cause futures index price

For equation (2), we set:

$H_0: \gamma_i = 0, \forall i = 1, 2, 3 \dots k$ or futures index price does not cause commodity related company stocks price

$H_1: \gamma_i \neq 0, \forall i = 1, 2, 3 \dots k$ or futures index price cause commodity related company stocks price

Step 4: Modified Wald test (MWALD) is used to test the null hypothesis

Findings

- As a first step towards the empirical findings, Analysis of Causal Relationship between the Grains Futures and Agricultural Equities using Toda and Yamamoto Procedure have done and the results are in line with our initial assumptions.
- From the previous research, **Gorton and Rouwenhorst (2006)** found that commodities companies follow more their stock counterparts rather than underlying commodity prices.
- Most of the research discussed earlier has been done from broader perspective by analyzing the commodities sector as a whole.
- There is no significant research done by analyzing the causality between grains index and agricultural equities. So we have clearly produced more accurate results by narrowing our research to the grains sector and their related agricultural equities.

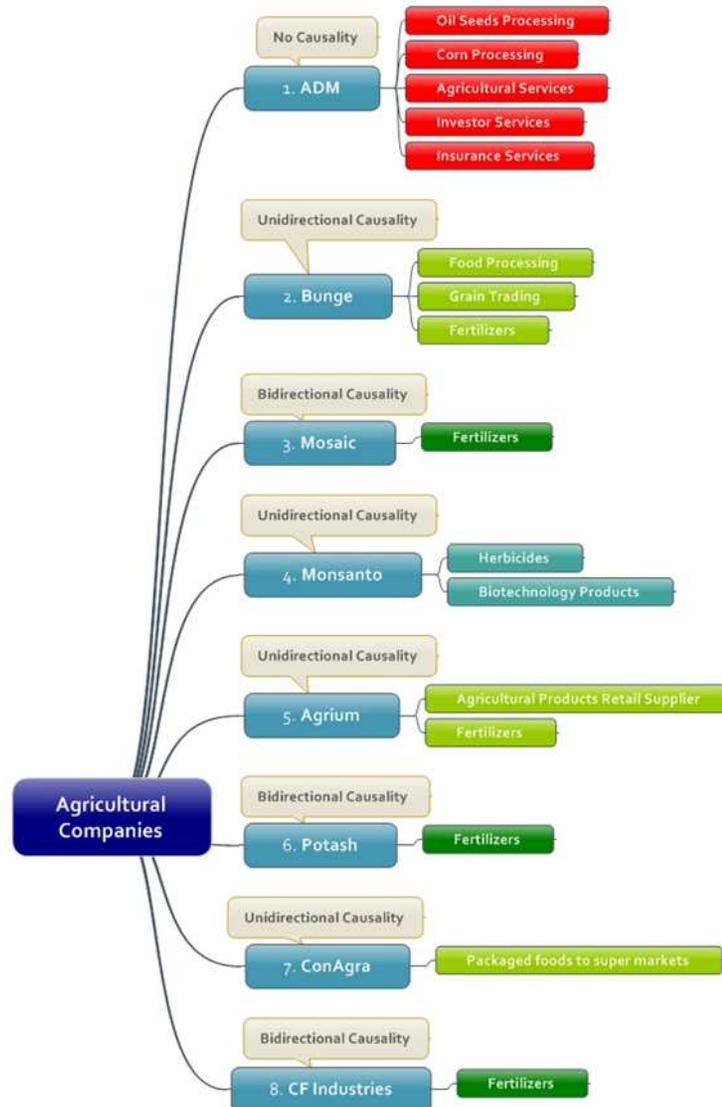
Findings

Wald Statistics (Toda and Yamamoto Granger Causality Test)

Company(Log Daily)	Lags	Stock Prices does not cause Grains Index Price		Grains Index price does not cause Stock Price	
		Wald Statistics	P-Value	Wald Statistics	P-Value
ADM	5	4.154667	0.5274	6.550301	0.2563
Bunge	4	1.524590	0.8223	15.80789	0.0033
Mosaic	7	18.37317	0.0104	35.99670	0.0000
Monsanto	5	10.74100	0.0568	3.211080	0.6675
Agrium	12	17.29758	0.1387	32.47781	0.0012
Potash	6	18.00413	0.0062	33.58310	0.0000
ConAgra	4	7.135604	0.1289	8.517006	0.0744
CF Industries	3	25.56390	0.0000	7.089113	0.0691

- 1) **ADM** Company showed no causality between their equities and grains index.
- 2) **Bunge, Agrium and ConAgra** showed the unilateral causality from grains index price to the stock price of the company.
- 3) **Mosaic, Potash Corporation and CF industries** show the bilateral causality between companies equities and grains index.
- 4) **Monsanto** has the unilateral causality from equities to the grains index.

Findings



Work Plan and Implications

Current work involves analyzing different investment products offered by various exchanges around the world. After this it is planned to conduct the Toda and Yamamoto procedure to find the causality between different commodity investment products.

Goals for publications:

Commodity based investment products in various exchanges across the world (working paper)

*Analysis of Causal Relationship between the Grains Futures and Agricultural Equities using Toda and Yamamoto Procedure (Presented in the **International Conference on Banking and Finance London 2016** and waiting for the peer reviewed publication in a journal)*

Conclusion

The main objective of my research is to analyze individual risk and return characteristics of various investment commodity products like commodity futures, index funds and ETFs along with their interdependence to each other.

The expected results of this research are possibly different from the previous research done by many researchers, as they are taken the aforementioned analysis from the broader perspective or only constrained to commodity futures.

To examine the relationship between various commodity investment products, Toda and Yamamoto (1995) procedure is applied instead of the ordinary Granger causality test.

Questions & Answers

References

Bhardwaj, G.;Gorton, G.; Rouwenhorst, G. Facts and Fantasies about Commodity Futures Ten Years Later. NBER Working Paper No.21243 **2015**.

Creti, A.; Joëts, M.; Mignon, V. On the links between stock and commodity markets' volatility. Energy Economics **2013**, 37, 16-28.

Engle, R.F; Granger, C.W.J. Co-Integration and Error Correction: Representation, Estimation, and Testing. Econometrica **1987**, 55(2), 251-276.

Gorton, Garry B.; Rouwenhorst, G.K. Facts and Fantasies about Commodity Futures. Financial Analysts Journal **2006**, 62 (2), 47-68.

Greer, R. J. The Nature of Commodity Index Returns. Journal of Alternative Investments **2000**, 3(1), 45-52.

References

Heidorn, T.; Demidova-Menzel, N. Commodities in Asset Management. Frankfurt School – Working Paper Series **2007**, 81, 1-58.

Malliaris, A.G.; Urrutia, J.L. Linkages between Agricultural Commodity Futures Contracts. Journal of Futures Markets **1996**, 16(5), 595-609.

Mensi, W.; Beljid, M.; Boubaker, A.; Managi, S. Correlations and Volatility Spillovers across Commodity and Stock Markets: Linking Energies, Food, and Gold. Economic Modelling **2013**, 32, 15-2.

Schneeweis, T; Spurgin, R. Energy Based Investment Products and Investor Asset Allocation, Center for International Securities and Derivatives Markets (CISDM), Isenberg School Of Management, University of Massachusetts, **1997**.

References

Schnitkey, G.; Kramer, C. Performance of Publicly Traded Agricultural Companies Since 2000: Construction of the AgIndex. *Journal of Agricultural and Applied Economics* 44, 2012, 359-369

Toda, H.Y.; Yamamoto. Statistical inference in Vector Autoregressions with possibly integrated processes. *Journal of Econometrics* **1995**, 13, 259-285.