INFORMATION DIFFUSION, CLUSTER FORMATION AND ENTROPY-BASED NETWORK DYNAMICS IN EQUITY AND COMMODITY MARKETS

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Introduction

Opportunities for portfolio diversification.

New phenomenon: the financialization of commodity markets.

Evidence of a structure of two interacting networks.
Data

**Equity indices**
- S&P 500
- Consumer Discretionary
- Health
- Energy
- Financials
- Industrials
- Materials
- Technology
- Utilities
- Automobiles
- Consumer Staples

**Commodities**
- Brent Crude Oil
- Heating Oil
- Natural Gas
- Copper
- Platinum
- Silver
- Gold
- Corn
- Wheat
- Cocoa
- Coffee
- Cotton

Log-returns

$$R_t = \ln(P_t) - \ln(P_{t-1})$$
Data

We use lagged data together with data.
Methodology

We analyze the data using:

• Correlation and
• Transfer Entropy
Results for correlation
Results for correlation

<table>
<thead>
<tr>
<th>From Commodities to Commodities</th>
<th>From Commodities to Equity indices</th>
</tr>
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<tbody>
<tr>
<td>From Equity indices to Commodities</td>
<td>From Equity indices to Equity indices</td>
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<tr>
<td>From Lagged Commodities to Commodities</td>
<td>From Lagged Commodities to Equity indices</td>
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<td>From Lagged Equity indices to Commodities</td>
<td>From Lagged Equity indices to Equity indices</td>
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</tbody>
</table>
Results for correlation

T=0.6

T=0.4

T=0.2
Results for Transfer Entropy

[Heatmap image with numerical values]
Results for Transfer Entropy

Transfer Entropy

Transfer Entropy for Randomized Data

Effective Transfer Entropy
Results for Transfer Entropy
Results for Transfer Entropy
Dynamics

CORRELATION MATRICES IN TIME (SEMESTER BY SEMESTER).


Corr 01/2013  Corr 02/2013  Corr 01/2014  Corr 02/2140  Corr 01/2015
Dynamics

Effective Transfer Entropy Matrices in Time (Semester by Semester).


ETE 01/2009  ETE 02/2009  ETE 01/2010  ETE 02/2010  ETE 01/2011  ETE 02/2011  ETE 01/2012  ETE 02/2012

ETE 01/2013  ETE 02/2013  ETE 01/2014  ETE 02/2014  ETE 01/2015  ETE 02/2015
Dynamics

Centrality Measures

Node Strength

\[ NS_i = \sum_{j=1}^{N} C_{ij} \]

In Node Strength

\[ NS_{in}^i = \sum_{j=1}^{N} (L)TE_{ij} \]

Out Node Strength

\[ NS_{out}^j = \sum_{i=1}^{N} (L)TE_{ij} \]
Dynamics

Node Strengths of Correlations Between Variables in Time
Dynamics

Node Strengths of ETES between variables in time
Conclusions

• Commodities and Equity markets form two separate, but interacting clusters.

• Commodities form three subclusters: energy, metals, and agricultural.

• There is evidence of exchange of information between energy commodities and the equity market of energy.

• There is exchange of information from platinum and silver to the equity market.
Conclusions

• Commodities and Equity markets form two separate, but interacting clusters.
• Commodities form three subclusters: energy, metals, and agricultural.
• There is evidence of exchange of information between energy commodities and the equity market of energy.
• There is exchange of information from platinum and silver to the equity market.

• There has been an increase in correlation between the commodities and equities markets (financialization), with a peak in the crisis of 2008.

• There has not been an increase in Transfer Entropy between both markets, except for peaks in the crisis of 2008 and in 2011.

Obrigado!