Structural Differences of the Brazilian Stock Market

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Purpose

• Understanding the structure and dynamics of financial markets
• We look at the effect of the market index on the correlations of its components and how they change over time
• There are different types of markets with different types of connections and relationships so the results of one market do not necessarily hold for all
• We use the Brazilian stock market as it has a better behavior before, during and after the most recent financial crisis
• Can we find a way to distinguish stock market healthy growth from the formation of a bubble?
Theoretical Perspective

Brazilian Index Price and S&P 500 Price

Transform using:

\[ r_i(t) = \log P_i \left[ (t) \right] - \log P_i \left[ (t - 1) \right] \]
Stock Correlations

- \( C(i, j) = \langle (r(i) - <r(i)>) \cdot (r(j) - <r(j)>) \rangle \)

\( \sigma_i \cdot \sigma_j \)
Partial Correlations

- The partial correlation (residual correlation) between i and j given a mediating variable m, is the correlation between i and j after removing their dependency on m; thus, it is a measure of the correlation between i and j after removing the affect of m on their correlation.

\[
PC(i, j \mid m) = \frac{C(i, j) - C(i, m) \cdot C(j, m)}{\sqrt{1 - C^2( (i, m)) \cdot (1 - C^2( (j, m)))}}
\]

**Similar Analyses**

Correlations over time of S&P 500 stocks in U.S.

- Correlations Among stocks
- Partial Correlations Excluding The index
• Similar results have been found for other markets such as U.K., Germany, Japan, and India
• U.K. Germany, and U.S. all track each other closely
• Japan and India are not as uniform, but still follow time dependence

Data for Brazilian Stock Market

- **29 Brazilian Stocks from 1/03 - 12/13**

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<td>TELEF BRASIL</td>
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Methods For Analyses of Brazilian Stock Market

- Adjusted stock daily closing prices $\rightarrow$ logarithmic returns

- A short time window, of 22-trading days used

- Correlations of all stocks and partial correlations between the stocks excluding the index

- At each window we calculate stock correlation (partial) matrices, and average them to obtain a vector of correlations (partial)

- Also we take another average of the correlations (partial) to obtain the overall market correlation for that window
Brazil at a Glance

- Sao Paulo Stock Exchange Index (IBOVESPA)
- 8th-13th largest stock exchange in the world
Results

Correlations Among stocks

Partial Correlations Excluding Index

Identical
How similar are the two measures?

This market then cannot be said to be index driven, and the jump in correlations are not being pushed by feedback from the index.
Before, During, and After Crisis
What does the structure of a non-index driven market look like?

A hierarchical tree where the linkage to discern differences is the magnitude of the average correlations.

Finance
Utilities
Telecommunication
Construction/Basic Materials
Consumer
Capital Goods
Oil

Pre Crisis
Post Crisis
Interpretation

- Not driven by the index, but due to an actual intra-stock correlations.
Conclusions

• We have found differences in the structures and dynamics of the Brazilian Stock market compared to developed stock markets
• The Brazilian stock market has shown to not be driven by its index
• Could be reason for better behavior during and after crisis, we could be in presence of a possible measure as an early warning signal for the health of stock markets and distinguishing growth from bubbles
Further Research

• There are many types of markets in the world
• Much more work needs to be done to look at the structure of other emerging markets
End

• Thank You!
• Questions?