Brane-World Economic Theory
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Motivation

- According to the Brane-World scenario, the universe we perceive corresponds to an infinitely, positive tendency super-thin membrane.
- This membrane is immersed in a (4+n)-dimensional space-time (Bulk), with gravity being able to propagate to additional dimensions and spread gravitational interactions throughout the space.
- Explaining how the geometric properties affect the orbits of other things in their gravitational fields, we can accurately locate all gravity interactions at any point in the Brane-World membrane.
- Based on this Brane-World theory it is studied the interactions between the major stock markets, as well as the equilibrium relationship between them.
- It is considered that the financial markets are bound to a super-thin membrane and their interdependencies can be determined precisely, by interpreting the geometric properties of distorted space-time, estimating Shapley Values and calculating probability amplitude for an event.

Financial Market Scenarios

- The global stock market crash was studied that began on 20 February 2020 and ended on 7 April and specifically the interaction between the stock markets of the USA, China, and Germany.

Results and Future Work

- It is a multi-dimensional multivariate method that has multiple time-dependencies as each variable depends on its past values and also has strong relations to other attributes from others dimensions (time series)¹.

Mathematical Reasoning

- Brane theory by the use of a delta density:
  \[ S_{brane}(\bar{\phi}) = \int d^4x d^3y \sqrt{|g(4)}|L(\bar{\phi}(x))\delta(\bar{\phi} - \bar{\phi}_0) \]
- Estimating Shapley Values with Monte-Carlo sampling:
  \[ \hat{\phi}_j = \frac{1}{M} \sum_{m=1}^{M} \left( \hat{f}(x^m_{+j}) - \hat{f}(x^m_{-j}) \right) \]
- Calculating probability amplitude for an event:
  \[ \phi = \sum_i \phi_i; P = |\phi|^2 = \left| \sum_i \phi_i \right|^2 \]

Future Work will include:

- Effort to link this theory to the post-pandemic² situation and global divergence of economic prospects.
- Modeling the equilibrium relationships between the economic recovery of the developing countries.
- Analysis of the interactions between the emerging financial cryptocurrencies markets and traditional stock markets.

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