Storm warning: Financial tsunami heading this way

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In today's global village, national coffers are more interconnected than ever before. And as the current economic crisis has proven, a downturn in one country can travel in a wave across the globe, like a financial tsunami. Now, researchers from Tel Aviv University, in collaboration with the Kiel Institute of World Economy in Germany, have developed a market "seismograph" — a new methodology that measures the interconnections between stock markets across the globe. It has the potential to serve as an early warning system and provide measures to manage and mitigate the spread of financial crisis.

The method sheds new light on the structure of the global financial village, says Ph.D. student Dror Kenett, working with Prof. Eshel Ben-Jacob of TAU's School of Physics and Astronomy and Matthias Raddent and Prof. Thomas Lux from the Kiel Institute. Recently published in the journal *PLoS ONE*, the research investigates connections among individual major world markets by analyzing the concurrent behavior of the stock market as a global whole.

Their approach studies individual economies in the context of the global financial village, exploring the flow of information between financial markets, says Kenett. "It has become both vital and critical to understand the relationships and dependencies among the world's markets," he explains, suggesting that each country could use this method as a tool for analyzing the extent of its connection to particular foreign markets and identifying where they are at risk — prompting protective financial measures.

Financial ties that bind

There's nothing new in analyzing the correlations between stocks in an individual market, using parameters such as market index and volatility to determine whether prices of stocks will rise or fall in tandem. But with this project, the researchers have introduced the concept of the "meta-correlation," in which they measure the average correlation of countries' stock markets against one another. The result is a precise understanding of how changes in one market impact another. At worst, these connections can lead to a fast spread of financial crisis.

To develop their method, the researchers looked at data from six major world markets — the U.S., the U.K., Germany, Japan, China, and India — from the beginning of 2000 to the end of 2010. Choosing the leading stocks in each market, the team then mapped the correlations between the groups of stocks from each country over the 11-year period. With the exception of China, which tended to operate independently, the researchers discovered an interesting pattern of interdependencies between these markets. Some markets, such as the U.K. and U.S., were closely connected, as predicted. But there were also surprising findings, such the fact that Japan fluctuates in its financial alignment between western and eastern countries.

Predicting economic disaster

According to the researchers, this method of understanding market connections could help each country predict when a financial crisis is imminent, allowing it to set up policies that will protect their own markets from becoming dangerously intertwined with struggling markets. "In the current era, when the global financial village is highly prone to systematic collapses, our approach can provide a sensitive 'financial seismograph' to detect early signs of global crisis," Prof. Ben-

Jacob says.

There are different safety mechanisms that each country can implement, continues Kenett, citing Greece's financial problems and their impact on the European market as a whole. "Germany is so invested in Greece that they don't have an option other than to bail Greece out," he says, noting that if it had been able to see the extent of their dangerous connection with Greece, Germany could have opted to reduce its investments earlier.

Having attracted the interest of governmental financial ministries, the project will now be extended to include even more markets. "With such high frequency data, you can have almost real-time or short-time predictions on how economic information flows throughout the world," Kenett notes.

Provided by Tel Aviv University

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