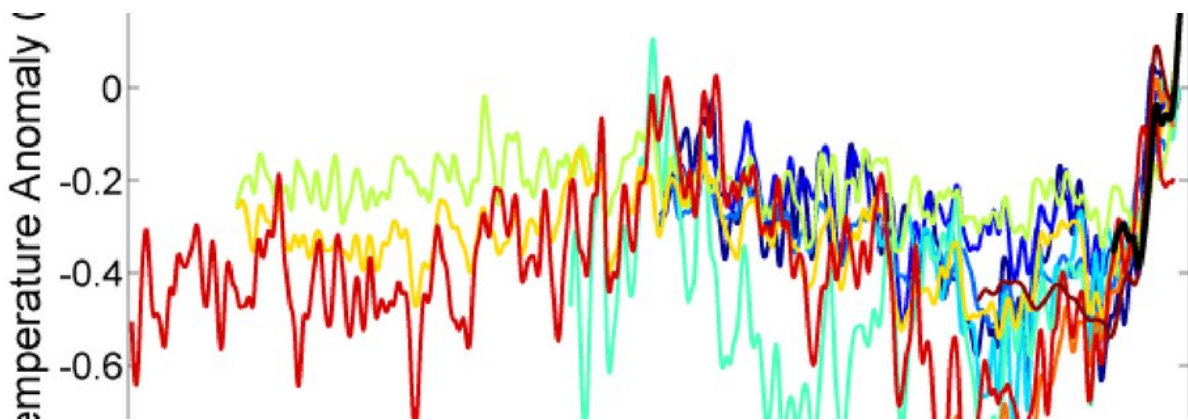# Paradoxical persistence of all negative growths from reformulation of Markowitz theorem

November 7 2017, by Wiida Fourie-Basson

Credit: Wikimedia Commons/Global Warming Art/ GNU Free Documentation License 1.2

An improvement on the famous Markowitz theorem may have the potential to not only more accurately predict the next financial crises, but also the outbreak of pests and diseases, or whether a patient will have a heart attack in two hours or not.

Described as a newer version of Markowitz's portfolio theory, the unified 'landscape portfolio platform' is able to predict inflated growth and reduced volatility in an ensemble of stochastically co-varying populations across the landscape.

It was developed by Prof Cang Hui, a bio-mathematician from Stellenbosch University, in collaboration with two researchers from the United States of America, Prof Gordon A Fox, a statistician from the University of South Florida, and Prof Jessica Gurevitch, a well-known ecologist from Stony Brook University.

The theorem was published in the *Proceedings of the National Academy of Science* (*PNAS*) today with the title 'Scale-dependent portfolio effects explain growth inflation and volatility reduction in landscape demography'.

Prof Hui says the collaboration started after Profs Fox and Gurevitch visited South Africa in 2014 as Fellows of the Stellenbosch Institute for Advanced Studies (STIAS).

"Initially we were looking for ways to quantify population demographics of invasive species on a larger scale in order to make it more relevant to management," he explains.

At that stage, most demographic work had been carried out on a few populations and at local scales.

But the idea to use the Markowitz theorem was completely serendipitous: "I often go to the library and browse a section of books. That day I was in the economics and statistics section when my eye caught a book on the portfolio theory of financial investment. That is where the idea then came to use Markowitz's theorem as the corner stone."

By combining concepts from landscape ecology and Markowitz portfolio theory, they developed the landscape portfolio platform to quantify and predict the behaviour of multiple stochastic populations across spatial scales. As a case study, they used a 35 year time series on gypsy moth

populations, covering about 350 000 square kilometres.

The landscape portfolio platform, however, is applicable to any situation where subsystems fluctuate with a certain level of synchrony, from trade analysis in stock market to sudden outbreaks of pathogens and invasive species.

Prof Hui says while the current article took an invasive moth species as case study, the new theorem is applicable to the financial world, ecologists working on regional scale invasions or threatened species, as well as any biologist working with time-series data.

Prof Hui and co-researchers are now working on expanding the platform to allow the differentiation of system stochasticity and external noise in driving portfolio inflation.

More about Markowitz' portfolio theory

Harry Markowitz's portfolio theory is described as one of the most important and influential economic theories dealing with finance and investment. Published for the first time in 1952, it is a mathematical framework for assembling a portfolio of assets in such a way that the expected return is maximised for a given level of risk, defined as variance. Its key insight is that an asset's risk and return should not be assessed by itself, but by how it contributes to a portfolio's overall risk and return. In 1990, Markowitz received the Nobel Memorial Prize in Economic Sciences for this work.

  More information: Cang Hui et al, Scale-dependent portfolio effects explain growth inflation and volatility reduction in landscape demography, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1704213114