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# CISS -- A Portfolio-Theoretic Framework for the Construction of Composite Financial Stress Indexes

Topic 3 – More rapid statistics and indicators on new phenomena

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## Introduction

The recent financial and economic crisis revealed considerable gaps in the theoretical underpinning and the empirical toolkits available to analyse and monitor financial stability in general and systemic risk in particular. Academics and financial authorities all around the globe have been stepping up efforts to improve the suit of tools and models in this field accordingly.

This paper contributes to this branch of literature by proposing a new composite indicator of systemic financial stress, named Composite Indicator of Systemic Stress (CISS), which aims to measure the contemporaneous state of instability in the financial system as a whole; it can therefore be interpreted as a measure of systemic risk which has materialised. Its specific statistical design is shaped in accordance with standard definitions of systemic risk. The main innovative feature of the CISS is the application of portfolio theory to the aggregation of individual stress indicators into the composite index.

Along the lines of how portfolio risk is computed from the risks of individual assets, we propose to compute the level of stress in the system as a whole by aggregating five market-specific subindices of stress - comprising a total of 15 homogenised individual stress indicators - on the basis of time-varying cross-correlations between them. The CISS thus puts relatively more weight on situations in which stress prevails in several market segments at the same time.

## Methods / Problem statement

The 15 input series are homogenised by applying the probability integral transfom (PIT) which delivers a set of (approximately) standard uniform distributed variables. The PIT possesses the distinct advantage that whatever is the original distribution of the raw indicators, the transformed indicators are homogenous in terms of scale and distribution. Since it involves the use of order statistics, the PIT also robustifies the composite indicator against the addition of outliers in sub-sample computations.

This property is important in the present case since the CISS is regularly updated and published "in real time" over an expanding data window. Moreover, the distributional homogeneity helps avoid that the dynamics of the composite indicator may be dominated by those components which tend to produce more observations far away from the sample mean by the nature of their original distribution function. The time-varying rank correlations are computed as exponentially weighted moving averages.

## Results / Proposed solution

The CISS is found to peak at all well-known financial stress events in the euro area since 1987. In addition, its information content proves very robust to sample variations, a property which is not shared in general by alternative transformation and aggregation schemes for financial stress indexes. In my view, robustness in particular to the addition of a string of outliers is an important property of a financial stress index that is supposed to be updated on a regular basis. I will also present recently developed CISS variants for the USA and China.

## Conclusions

By now the euro area CISS has become a widely known and used index since its first publication in 2010. It is published externally via the ECB's Statistical Data Warehouse from which it feeds into data providers like Datastream and Haver Analytics which helped further spread the usage of the CISS by financial analysts, forecasting institutions, central banks, other financial stability authorities and academics.