Doctoral project title:

Wavelet methods in forecasting economic activity and assessment of stabilization policies

The project aims at applying and also further developing a new econometric approach to macroeconomic studies, namely the discrete wavelet analysis of multivariate spectra, introduced by Whitcher and Craigmile (2004) (Whitcher B. J., Craigmile P. F., 2004, Multivariate Spectral Analysis Using Hilbert Wavelet Pairs, *International Journal of Wavelets, Multiresolution and Information Processing*, 27) and advocated by the author of this research proposal in her monograph and papers (Bruzda J., 2013, *Wavelet Analysis in Economic Applications*, Toruń University Press, Toruń; and, for example, Bruzda J., 2019, Complex Analytic Wavelets in the Measurement of Macroeconomic Risks, *North American Journal of Economics and Finance*, 50). The aims of this project are twofold: methodological developments and empirical inquiries into the monetary and financial stability of chosen economies and future growth trajectories of a panel of European countries.

The first aim in the part of the project devoted to methodological considerations is to develop tests of constancy of the cyclical variance based on the complex-valued discrete analytic wavelet transform and the concept of instantaneous amplitude. Our initial simulation studies point out that complex-valued counterparts of the existing wavelet-based tests for variance changes, which are exclusively based on real-valued wavelets, have better power properties. We will discuss CUSUM of squares test statistics computed with coefficients of the decimated discrete complex-valued wavelet transform, jointly with the corresponding procedures for timing of changes of the cyclical variance with the help of the nondecimated variation of the wavelet transform, as well as tests of equality of the cyclical variance in subsamples, providing both asymptotic justification for the suggested procedures and simulation-based evidence concerning their small-sample properties.

Further in the methodological part, we will design wavelet strategies of constructing econometric models for forecasting business activity. The novelty of this approach will consist in utilizing information obtained through the analysis of multivariate wavelet spectra, such as, among other things, partial time delays and partial phase-locking values. We will consider both wavelet-based forecasting of economic growth and wavelet strategies of predicting business cycle phases.

In the empirical part of this project, we plan to undertake several studies. In our first study, we will apply the tests for variance changes which will be developed in this project to examine changes in the cyclical variance of inflation in a panel of inflation targeting economies to answer questions about reliability of their monetary stability policies. Next, in the second empirical study, we would like to use the concepts of partial phase-locking values and partial amplitude correlations to shed more light on the influence of the conventional and nonconventional monetary policy on financial cycles, taking into account globalization factors and potential policy coordination. In this study, we would like to underline and further discuss the utility of the new tool – the discrete wavelet analysis of multivariate spectra – in macroeconomic analysis. Finally, the third empirical study is a large forecasting exercise, encompassing wavelet forecasting of growth rates of the GDP and wavelet prediction of business cycle phases in a panel of European economies. This study is aimed at further discussing the usefulness of the discrete wavelet analysis of multivariate spectra in macroeconomics, this time in the context of forecasting, and also at illustrating the application of the forecasting strategies design earlier in the methodological part. In addition, we would also like to check if certain carefully chosen asymmetric wavelets produce better forecasting results than their nearly symmetric counterparts.

The methodological approach encompasses literature review, simulation analyses, formal statistical derivations and extensive empirical studies based on macroeconomic data from publically available databases.

The project's main results will be new econometric tools for studying and forecasting macroeconomic phenomena, jointly with some in-depth macroeconomic analyses on the effectiveness of stabilization policies in chosen economies, and a large forecasting exercise concerning future growth trajectories and business cycle phases in a large panel of European countries.