Advisor's Report on Dissertation Thesis

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Title of the Thesis:	Essays on Data-driven, Non-parametric Modelling of Time-Series
Type of Defense:	**DEFENSE**
Date of Pre-Defense	January 10, 2024

Address the following questions in your report, please:

a) Can you recognize an original contribution of the author?
b) Is the thesis based on relevant references?
c) Is the thesis defendable at your home institution or another respected institution where you gave lectures?
d) Do the results of the thesis allow their publication in a respected economic journal?
e) Are there any additional major comments on what should be improved?
f) What is your overall assessment of the thesis? (a) I recommend the thesis for defense without substantial changes, (b) the thesis can be defended after revision indicated in my comments, (c) not-defendable in this form.

(Note: The report should be at least 2 pages long.)

This thesis is a collection of four papers that make an original contribution to the time series literature. These papers are based on non-parametric methods that allow for a better understanding and modelling of time series data. The thesis can be divided into two parts. The first two papers use nonparametric methods in the frequency domain. The last two papers focus on learning and predicting probabilistic distributions using data-driven techniques. These non-parametric modelling tools often provide better results than parametric methods, which require strong and unrealistic assumptions. As such, the work is timely and makes an original contribution to the literature.

The first paper contributes to the macroeconomic literature by investigating the cyclical and persistence properties of macroeconomic time series. More specifically, it provides a detailed analysis of the synchronisation of business cycles between the Visegrad Four countries and the European Union. The adoption of the wavelet methodology allows to overcome the problems of parametric measures, as it operates in the time-frequency domain and thus does not require the stationarity of the time series. The results show that increasing co-movement and convergence with the EU may reflect the benefits of economic integration.

The second paper proposes a frequency-based method as an alternative way of looking at the dynamics of monetary policy transmission. The paper examines a traditional monetary system with three variables, GDP growth, inflation and the interest rate. Frequency response functions are used to study the persistence of macroeconomic variables. The results suggest that the price puzzle phenomenon may be frequency dependent and propagate at different cycles. This cannot be observed using only standard impulse response functions.

The third paper focuses on probabilistic forecasting of macroeconomic and financial time series using deep learning. This approach has several advantages over traditional methods. The recurrent neural networks learn the distributions from the data, providing a valuable method for predicting distributions without the need for model specification. The proposed approach is particularly innovative for economic time series that cannot be modelled by parametric methods, which require the estimation of mean and variance based on a Gaussian distribution. This work makes a significant contribution to the literature by proposing how deep learning techniques can be used as a useful tool for approximating and predicting conditional distributions in data-rich environments.

The fourth paper applies the machine learning approach to probabilistic hourly electricity price forecasting. This paper builds on the previous paper on probabilistic forecasting and contributes to the emerging literature on machine learning methods in the framework of hourly electricity price forecasting. The novelty lies in the fact that the literature suggests learning only some properties of the distribution, such as moments, while the approach used in this paper selects the best distribution from all possible empirical distributions learned from the data.

In conclusion, the thesis focuses on the structure of economic time series. All the methods used are non-parametric methodologies aimed at better understanding and modelling time series data. The thesis proposes new important concepts that advance the state of current knowledge. The work is original, it makes a contribution, it is carried out rigorously and it is complete. Therefore, my overall assessment of the thesis is that (a) I recommend the thesis for defense.

Date:	26.2.2024
Advisor's Signature	
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