Opponent Review of Doctoral Dissertation

Applicant: Eva Klejmová

Title of Dissertation: SELECTED ASPECTS OF STATISTICAL SIGNIFICANCE TESTING IN TIME-FREQUENCY ANALYSIS

Opponent: Prof. Dr. Jarko Fidrmuc

Opponent’s Department: Department of Economics, Zeppelin University Friedrichshafen, Germany

In accordance with the Study and Examination Rules of BUT, in his/her review the opponent will mainly comment on:

a) the topicality of the dissertation,
b) whether the dissertation achieved its given objective,
c) the problem-solving procedure and the results of the dissertation along with the concrete contribution of the doctoral student,
d) the significance for practical application or the progress in the field,
e) formal and language qualities of the dissertation,
f) whether the dissertation fulfils the conditions of Section 47 (4) of the Act,
g) whether the student proved his/her creative abilities in the given research field and whether the work does or does not comply with the standard requirements placed on the dissertations in the given field. The review is not valid without this conclusion.

It is necessary to add a concise commentary to each of the points below.

Ad a) Topicality of the dissertation

The topic of the dissertation is topical.

Comment:

The thesis compares simulation data, technical data and economic data. The comparison of economic data with technical data (including simulations) represents an interesting contribution of the thesis. It is argued and shown that economic data are inherently different from other sources of data. Most importantly, economic variables are characterized by heteroscedasticity, structural breaks, and significant and frequent shocks resulting in non-normal distribution of economic data (characterized e.g. by the so called fat tails). The inherent changing structure of economic process is described nicely by the influential paper by the Nobel Prize laureate, the so-called Lucas’ Critique.
At the same time, the number of observations for economic processes tend to remain low. In other words, higher number of observations opens the question whether the data set is homogenous enough, and whether it is not better to split the data set (e.g. omission of data before some events). These considerations result in the fact that the observation number in general does not change with time.

Moreover, the economic analysis is characterized by the inclusion of a large variety of possible factors. While it is generally accepted that everything can influence everything, it is important to find a small group of factors with a dominant influence. Therefore, economic analysis puts a strong emphasis on significance tests. The reason is to distinguish between spurious correlations and possible causalities.

These aspects are partly addressed in the thesis, which discusses how to present significance tests in the time-frequency dimension. Moreover, it considers specific questions of heteroscedasticity and structural breaks.

Ad b) Objective of the dissertation

The objective of the dissertation was achieved.

Comment:

The thesis sets tree main objectives. First, to combine different characteristics of TFA methods to obtain relevant spectrogram. Second, to modify the standard tests for volatile data. Finally, to apply the tests for subsequent data filtering. These objectives have been largely achieved. This required an intense work of the author.

The thesis consists of, in addition to two introductory chapters, nine main analytical chapters. The first part (chapters 3 to 8) presents a description of the applied methods. Chapters 9 to 11 present application of methods to selected economic problems which were published in recognized journals. This documents a significant student effort as well as a publication success of the student and her supervisor.

Ad c) Problem-solving procedure and the results of the dissertation and the concrete contribution of the doctoral student

The problem-solving procedure and the results of the dissertation are above average.

Comment:

The student has succeeded to participate in three publications in good recognized journals. This is a good outcome for a PhD thesis, which is slightly above the average also in international comparisons. At the same time, a large part of the thesis represents general methodological discussion which was not published in any form.
Ad d) Significance for practical application or progress in the field

The significance for practical application or progress in the field is weak.
Comment:
The thesis represents largely interdisciplinary research project, which is applying the recent approaches in signal processing to economic analysis. This is inherently risky area because it may fail to connect the different scientific disciplines. Despite the results have been published in two economic journals, the impact of the research seems to remain rather moderate, maybe partially due to the language and style, which is anchored too strongly in the engineering analysis and less understandable for economists.

Ad e) Formal and language qualities of the dissertation

Formal and language qualities of the dissertation are average.
Comment:
The thesis is nicely structured. However, there are style differences between methodological chapters (2-8) and publications (chapters 9-11).

Ad f) The dissertation fulfils the conditions of Section 47 (4) of the Act

The dissertation fulfils the conditions of Section 47 (4)*) Act No. 111/1998 Sb. Higher Education Act: YES

(*4) Studies are duly finished with a doctoral state exam and dissertation defence, which prove the ability and readiness to work independently in the field of research or development, or in theoretical and creative arts. The dissertation must comprise original and published results or results accepted for publication.

Ad g) Creative abilities of the student in the given research field. Compliance with the standard requirements placed on the dissertations in the given field.

The doctoral student did prove his/her creative abilities in the given research field and the work does comply with the standard requirements placed on the dissertations in the given field.
Comment:

The students proved her abilities to work with acknowledged scholars in the field, which are not affiliated with her home university. The research results were successfully published in three research papers.

Overall evaluation:

Opponent’s questions:

Given the inherited instability of economic data, economic analysis usually use only 100 to 200 observations (corresponding to 25 or 50 years with quarterly data). Moreover, the main focus of the analysis is usually on the last 20 observations. Given your comparison of long technical and simulation data, how reliable is the analysis of relatively short data sets in the time-frequency domain?

In addition to heteroscedasticity problems, economic data are subject to non-standard distributions. Among other, we can observe frequent extreme events (e.g. recent financial crisis, pandemic crisis, Ukraine war). How sensitive are time-frequency methods to frequent outliers?

I ☒ recommend ☐ do not recommend the dissertation for the defence.

Date: 20.05.2022

Signature: …………………………………………………………………..