

# Report on Master Thesis

Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague

<b>Student:</b>	<b>Bc. Jana Sedlaříková</b>
<b>Advisor:</b>	<b>Doc. PhDr. Krištofek Ladislav, PhD.</b>
<b>Title of the thesis:</b>	<b>Are financial returns and volatility multifractal at all?</b>

## **OVERALL ASSESSMENT** (provided in English, Czech, or Slovak):

In her thesis, Jana Sedlaříková studies the presence and sources of multifractality in returns on four stock market indices (S&P 500, Bovespa, Nikkei 225, STOXX 50) and their volatilities. Three multifractality detection methods are used and compared: generalized Hurst exponent analysis, multifractal detrended fluctuation analysis and multifractal detrending moving average analysis. In all cases, multifractality strength is measured via the span of estimated Hurst exponents and singularity strength exponents. Moreover, the hypothesis of spurious multifractality is tested by comparing the results with those for simulated monofractal ARFIMA time series with the differencing parameter corresponding to the Hurst exponents found in the original data. Then, three sources of multifractality are analyzed (temporal correlations, “broad” probability density function and “hidden” non-linear structure) using comparison of multifractality strength estimated in the original data and their transformed versions.

In general, I would like to highlight the non-triviality of the research topic, the proper execution of several advanced econometric methods, a very good use of literature and overall the extent and quality of the empirical part of the thesis. It definitely shows the motivation and ability of the student to do some serious research. On the other hand, the manuscript form would need, in my opinion, a significant revision. To discuss each evaluation category separately:

**Methods:** The methods seem to be appropriate and correctly applied, the comments I have would be mostly topics for a discussion rather than a critique. Overall, the empirical analysis is a real strength of the work.

**Contribution:** Next to the advancement of the authors' knowledge, skills and experience, the thesis definitely provides original results, which can be of interest for other researchers focusing on the multifractality in financial time series.

**Literature :** In my opinion the use of literature is at a very good level; the literature review is extensive and also the references supporting the methodology are relevant and more than satisfactory.

**Manuscript Form:** The manuscript form is, in my opinion, the only weak aspect of the work. I am missing a clear structure, as the methodology is somehow presented throughout the whole thesis instead of the chapter focusing on it, which results in duplicities and makes the methodology more difficult to understand; the individual concepts are not always logically ordered and a lot of information seems to be redundant. I believe that the author should consider the relevance of the information no matter how interesting it is. This applies especially to the introduction and the methodology, which could and should be significantly shorter, simpler and better focused on the research topic. Next, I would suggest placing the literature review right after the introduction as it disrupts the flow of the text – I would expect the methodology to be followed directly by the data description and the empirical results. Moreover, a shorter (summarized) version of the literature review could be more reader-friendly, but this is just a suggestion, not a critique affecting my final manuscript form evaluation. Concerning the abstract, I would suggest not to use shortcuts for methods without their full names and to provide the same information in both the Czech and English version. Next, some terminology used throughout the thesis is unnecessarily confusing, e.g. multiscaling vs. multifractal, self-similar vs. self-affine (“we should be aware of the distinction between self-similarity and self-affinity” (...)) “However, for our purposes we do not distinguish between these two terms and the following definition can be used for both self-similar and self-affine processes.”, p.8) and often I was wondering why some concepts are introduced and how are they linked to the multifractality. Finally, there are many sentences without any informational content which only make the thesis longer, not better.

From the positive aspects, the results presentation is clear and supported with relevant graphs and tables.

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## Suggested technical questions:

- Can the author explain the relationship between multifractality and the following concepts: long memory, self-similarity, fractional Brownian motion (concepts introduced in the methodology chapter)?
- Why is the detailed introduction of quadratic variation and its decomposition (Theoretical framework p.30-33) important for the thesis?
- What stands the "Q" for in formulas 2.6 and 2.9 on p.12 and 13?
- The approach to testing for spurious multifractality is based on comparison with simulated, appropriately parametrized ARFIMA. Are there cases of spurious multifractality which this method does not uncover?

## Suggested question for a general discussion:

- The author reviews a rich literature on the multifractality detection and analysis. Is the presence of multifractality really not adequately statistically tested in any of the works as it is stated in the thesis motivation (e.g. in the 1<sup>st</sup> paragraph on p.4)? If not, does the thesis fill the gap, at least to some extent?

In the case of successful defense, I recommend the grade " **excellent** " ("výborně" , 1)

## **SUMMARY OF POINTS AWARDED** (for details, see below):

<b>CATEGORY</b>	<b>POINTS</b>
<i>Literature</i> (max. 20 points)	20
<i>Methods</i> (max. 30 points)	30
<i>Contribution</i> (max. 30 points)	30
<i>Manuscript Form</i> (max. 20 points)	6
<b>TOTAL POINTS</b> (max. 100 points)	<b>86</b>
<b>GRADE</b> (1 – 2 – 3 – 4)	<b>1</b>

**NAME OF THE REFEREE:** Lucie Kraicová

**DATE OF EVALUATION:** 17.06.2016



**Referee Signature**

**EXPLANATION OF CATEGORIES AND SCALE:**

**LITERATURE REVIEW:** *The thesis demonstrates author's full understanding and command of recent literature. The author quotes relevant literature in a proper way.*

Strong                  Average                  Weak  
20                          10                          0

**METHODS:** *The tools used are relevant to the research question being investigated, and adequate to the author's level of studies. The thesis topic is comprehensively analyzed.*

Strong                  Average                  Weak  
30                          15                          0

**CONTRIBUTION:** *The author presents original ideas on the topic demonstrating critical thinking and ability to draw conclusions based on the knowledge of relevant theory and empirics. There is a distinct value added of the thesis.*

Strong                  Average                  Weak  
30                          15                          0

**MANUSCRIPT FORM:** *The thesis is well structured. The student uses appropriate language and style, including academic format for graphs and tables. The text effectively refers to graphs and tables and disposes with a complete bibliography.*

Strong                  Average                  Weak  
20                          10                          0

**Overall grading:**

TOTAL POINTS	GRADE		
81 – 100	<b>1</b>	= excellent	= výborně
61 – 80	<b>2</b>	= good	= velmi dobře
41 – 60	<b>3</b>	= satisfactory	= dobře
0 – 40	<b>4</b>	= fail	= nedoporučuji k obhajobě