# Report on Master Thesis

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

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| **Student:** | **Tony Sako** |
| **Advisor:** | **doc. PhDr. Jozef Barunik, Ph.D.** |
| **Title of the thesis:** | **Good volatility, bad volatility, and the cross-section of stock returns at different investment horizons** |

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

*Please provide your assessment of each of the following four categories, summary and suggested questions for the discussion. The minimum length of the report is 300 words.*

**Contribution**

The master thesis of Tony Sako "Good volatility, bad volatility, and the cross-section of stock returns at different investment horizons" is a work of several contradictions. On the one hand, it is clear that the author had to master several advanced and specialized econometrics methods going far beyond the master level curriculum and he for sure spent load of time with all parts of the analysis, coding, and with producing all presented results. On the other hand, unfortunately he was not able to take the advantage of all these efforts enough and translate them properly and sufficiently into high-quality text of the thesis. The same contradiction holds for the technical side vs. economic contribution nexus of the work. The author analyzes several important questions that definitely relate to the most recent research interest in the field of financial econometrics, each via a different advanced method (volatility decomposition and assessment of its structure, volatility estimation, rolling regression, volatility forecasting, volatility pricing), he combines various specifications of the datasets (complete portfolio, sector portfolios, full sample, training vs. testing sample), he provides detailed comparisons of performance of several estimators, etc., but he was finally not able to "capitalize" this huge amount of results well into a reasonably aggregated economic discussion and persuade me as a reader of his final "report" completely on their contributive value added both in terms of their real economic importance for financial market participants, as well as in terms of their real scientific importance and novelty.

It was also not completely clear to me what research hypotheses are being assessed as there are three good research hypotheses in the thesis proposal, but in the thesis itself the overview of hypotheses (that might have changed slightly over the period of writing) is missing, individual research areas are only a bit confusingly spread over the text.

The author also frequently comments on an additional potential step of the analysis in a non-strategic manner with a "magic term" *"it is out of the scope of this work"*, however with no clear explanation why, raising a question whether such an extension would not be in fact beneficial in the end. The thesis is 55 pages long including many tables, so since the minimum range for master theses in English is 50 pages, there definitely is a leeway for some improvement.

Some important and strong statements are only vaguely presented with insufficient explanation, raising a question, whether the author is fully aware of related scientific knowledge or methodological consequences, e.g. *"Fourier analysis requires that the data series is stationary. In terms of financial data series this is a big challenge."* or "*Significance does not however necessarily imply that aggregate volatility is priced since there could be a correlation between aggregate volatility and idiosyncratic volatility…"* or *"… however this could just be an issue with a small sample set."* (there are 2341 observations in fact…). Sometimes an attempt for a contributive economic interpretation of numerical results is completely missing.

**Methods**

I find the methodological part the best of the thesis and it suggests that author understand the rich set of advanced methods well. This is especially valuable because not only one method (as is the case of the majority of theses) but several to some extent different approaches are being utilized in the work.

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Starting with a general theoretical notion of volatility, through the theory of realized volatility, the author further presents methods of wavelet analysis, and advanced "CAPM" modelling (Famma-French 3 and 5 factor models). Finally, the HAR model for realized volatility is used as the main modelling framework in the thesis. Is is obvious that the author had to devote a huge amount of time to understand and apply all these methodologies properly which shifts the methodological side and "apparatus" of the thesis much above a standard master level. On the other hand, a bit more attention to detail and to the text of the thesis itself would be definitely beneficial in this part, e.g. already in the description of Eq. 3.1, where the time dimension is crucial, there is a mismatch of the "t" subscript (drift with t, sigma and W without, J with as well as without). Eq. 3.11 a 3. 12 are given without sufficient introduction (to my mind) and with a bit confusing specification of the indicator function (1 instead of I, not explained) and wrongly formatted >< signs in the subscript, this repeats also in some other equations later. In Eq. 3.20 I did not understand the difference between **W** and **X** if they are equal and what X stands for in fact. In Eq. 4.1 and 4.2 different notation of errors would be correct.

Wrt to the dataset, the span is not precisely defined (first in Sec. 4.2 as: *"starting July 2005 until December 2015"…* ), I did not find a note where the Fama-French factors were obtained (although this is obvious), the number of S&P500 stocks in the dataset is not reported (I just saw once in the text that it is actually 433, not 500), I did not find specification of calculation of returns used (although log-returns very likely, relates to Tab. 4.2).

**Literature**

The literature review covers perhaps the most important papers related to the topic of the thesis, but describes those rather simply and generally in the historical order. No attempt for an advanced analysis of some tendencies, similarities and differences across literature, open issues, etc. was made. Also, it is not completely clear why especially selected papers have been selected and why these are of the highest importance for the work. In the "Volatility" part, all the seminal works of Robert Engle on ARCH/ GARCH modelling is simply skipped via two first sentences without any citation or even mentioning his name. The literature on volatility as well as CAPM modelling is extensive and this fact is not very much reflected in the work. Moreover, there is another additional/duplicated "Literature review"-like section in the "3. Theoretical overview" chapter (pg. 18 - 19) which makes the second chapter of the thesis incomplete and premature.

Some important and strong statements remain completely unsupported by any citation, an example: *"We consider that the case for aggregate volatility as a factor has strong theoretical foundations."* or *"And many others have also found other factors that help explain the cross-section of returns."*.

**Manuscript form**

Formally the weakest part of the thesis. The authors refers to his work sometimes as to a "paper", sometimes as to a "thesis". I would like to make this clear here - this is a thesis. It is often difficult to understand a sort of "as it were unfinished" ideas/sentences, this can be already seen in the Abstract (*"aggregate volatility is generally more important"* [for what?, for whom?], *"we were able to reduce by at least half the volatility forecasting errors"* [compared to what?] and it further appears relative frequently in the text. The author uses inconsistent tenses (eg. mixing up past and present simple in the literature review, I also find future "will" suboptimal in academic English as the final work is presented as a complete thing and it is not important to stress out the flow of works). The author standardly uses for academic English inappropriate *"it's, we're, they're, didn't, etc"* or *"quite good"*, *"quite useful", quite ideal",* etc. Some abbreviations are first used without the long version to explain it meaning (search e.g. for "ICAPM"). Layout of some citation is wrong (in brackets in case they should not be: e.g. pg. 12, 13,1 4, or vice versa e.g. pg. 7). Some terms are used without proper context (e.g. *"d parameter"* pg. 5,

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*"alphas, and betas"* pg. 7). On pages 51 and 52 three sizes of text are used in three tables. Some additional typos and grammatically incorrect or puzzling constructions are then only a minor detail.

Table generally are often not self-contained making orientation difficult to the reader. I was sometimes even not able to find additional explanation in the related text (see eg. *"Risk Avg..AggVolIMed0.Risk"* in Tab. 6.4 (which is even not referred in the main text), I am really not sure what that stands for).

Importantly, the Bibliography section is a bit inconsistent and incomplete for some references, e.g. publisher is missing for Addison (2002), journal is missing for Andersen et al. (2007), Barndorff-Nielsen and Shephard (2004a), capital letters are disturbing, some working paper specification is missing for Chen (2002), Clements and Liao (2013), Tamoni (2011).

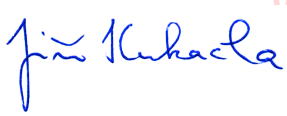
**Suggested questions for the discussion during the defense**

- Why Fama-French (2016) 5-factor model was not used when commented on in the literature section.
- I was surprised by a consistently very low R^2 of regressions for the industrial portfolio compared to all other portfolios. Can you discuss some economic explanation(s) for this results?
- In Sec. 5.2. the author suggests that volatility is generally unimportant but in some specific periods it is extremely important. But it is not clear for what purpose… the author might want to clarify this during the defense.
- When commenting on numerical results, the author almost automatically suggest they are *"statistically and economically significant"* with no explanation of the notion of economic significance. Could author concretely assess economic significance of main results in some of the tables e.g. in Sec. 5.4.
- Author suggests based on his results some *"key periods"* (2009, 2011, 2015, pg. 34) with extreme market volatility, and comments on the *"elevated turmoil"* in 2009, 2011, 2013, 2015 (pg. 36). This "one year precision" is insufficient when working with daily data I think. Since absolutely no economic discussion is provided about important real-world events or a reasonably detailed overall economic development during analyzed years, related interpretation is thus also very weak and almost tautologic. Could author match some important economic events causing *"elevated turmoil"* in 2015 to his results? Why 2013 *"elevated turmoil"* cannot be seen in the data?

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

| **CATEGORY** | | **POINTS** |
|---|---|---|
| *Contribution* | *(max. 30 points)* | 24 |
| *Methods* | *(max. 30 points)* | 29 |
| *Literature* | *(max. 20 points)* | 12 |
| *Manuscript Form* | *(max. 20 points)* | 7 |
| **TOTAL POINTS** | *(max. 100 points)* | **72** |
| **GRADE** | **(A – B – C – D – E – F)** | **C** |

***NAME OF THE REFEREE: Jiří Kukačka***
***DATE OF EVALUATION: 14. 6. 2018***



Digitally signed by Jiri Kukacka
DN: cn=Jiri Kukacka, o=Charles University in Prague, Faculty of Social Sciences, ou=Institute of Economic Studies, email=jiri.kukacka@fsv.cuni.cz, c=CZ
Date: 2018.06.15 10:50:37 +02'00'

***Referee Signature***

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***EXPLANATION OF CATEGORIES AND SCALE:***

***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* |

***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* |

***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* |

***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 | **GRADE** |
|---|---|
| 91 – 100 | **A** |
| 81 - 90 | **B** |
| 71 - 80 | **C** |
| 61 – 70 | **D** |
| 51 – 60 | **E** |
| 0 – 50 | **F** |