

# Report on Bachelor Thesis

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

<b>Student:</b>	<b>Jiří Nosek</b>
<b>Advisor:</b>	<b>Mgr. Martin Hronec</b>
<b>Title of the thesis:</b>	<b>At the right time, in the right factor. Can factors be timed?</b>

## **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.*

The thesis addresses a question of timing factors for construction of investment strategies. The thesis concerns various factors (HML high-minus-low, SMB small-minus-big and WML winners-minus-losers) as well as various timing signals defined for the considered factors (value spread, time-series momentum spread, average momentum spread and size spread). The so-called Kelly criterion is employed to determine the optimal monthly investments in the factors.

### **Contribution**

The thesis enriches the literature on implementing the Kelly criterion and providing a comparison of performance of timing strategies based on various timing signals with respect to buy-and-hold strategy. The author performs analysis on the US data first. He then provides analogous results for the European and Japanese data along with a brief comment on the inherent differences which provides partial explanation for the differences in performance of timing strategies. The results are not exactly optimistic about the relevance and usefulness of the implemented approach. Such conclusion is, at least, in line of the previously reported results.

### **Methods**

The main workhorse of the thesis is a regression analysis on models with conditional heteroskedasticity (ARCH and GARCH models). Unit root tests are applied for detection of auto-regressive behavior.

The construction of factors follows a rather straightforward procedure. A major task for the author seemed to be preparation of the data set from the raw data from Thomson Reuters. However, that part feels rather fuzzy to me as the data cleansing rules (described on pages 23 and 24) are not supported by some logical arguments nor literature references.

The presentation of methods shows significant errors and corrupted formulations and formulas may easily lead to confusion on the side of a reader. This very well starts on page 3 in footnote 3 which contains incorrect relations between various types of return. Definition 2.1 (which is the only formal definition in the manuscript and thus its form in the text appear rather awkward) introduces a huge (and completely unnecessary) abuse of notation between random variable and a set of random variables (the author of the thesis seems to introduce this abuse himself as exact text of the particular definition in the source book does not contain that part of the sentence). Some formulated models contain an error term, some not (this is particularly notable on page 6). Model on page 6, the second line from below, contains an intercept with index  $i$ , but the subsequent explanation of the notation states intercept dependent on  $t$  as well. In subsection 2.3.1, the author takes iid sequence of random variables and further works with them as with a weakly dependent process only.

Text which should illuminate ARCH and GARCH shows low understanding of these models by the author. The computation of the unconditional variance shows auto-correlated behaviour and does not illuminate conditional heteroskedasticity at all (computing conditional variance is suitable for that purpose). Moreover, one can compute a closed form of unconditional variance as a function of parameters.

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## Literature

The list of used literature in the Bibliography shows significant corruption in numerous items. Namely Arnott et al 2016, Asness et al 2017a, Asness et al 2017b, Asness 2016, Baba Yara et al 2018, Khana 2016, Newey and West 1986, and Thomas and Shapiro 2015, show corrupted list of authors, incomplete reference, missing journal specification, missing paging or issue numbering, etc. The latter reference is not even a paper in a refereed scientific journal. Similar errors can be found in the text of the manuscript itself.

The chapter on literature review seems brief and by the style of writing and composition already posed by the author of the thesis as unimportant for the subsequent text.

## Manuscript form

I have a difficulty to understand the logic in the order of presented material. There are no soft breaks between the sections which would help the reader to smoothly follow the text, understanding what comes next. I am puzzled by the split theoretical part of the thesis between Chapter 2 and 4 which in my opinion may very well be unified, literature review would better serve its role right after the introduction and Subsection 5.2 has no connection to data set itself and should have been placed right after introduction of factors and timing as it presents the key theoretical concept used in the thesis. On the other hand, Subsection 2.5.2 seem rather superfluous, I have not found any further reference to error adjustment in case of serial correlation in later sections.

Ambiguous terminology frequently (and fluently) occurring throughout the manuscript is a nightmare. E.g. valuation signal spread is also value spread, average momentum signal is also avg momentum spread, sorting signal spread is also size spread. Many abbreviations used are left unexplained upon the first use (e.g. ETF on page 1; FF explained on page 30 although its first use is in footnote 5 on page 24).

The manuscript contains numerous misprints and grammar flaws in the text. Some of the misprints seem systematic, e.g. the trouble of the author to spell heteroskedasticity correctly on page 12. On top of that, there is an unbearable amount of misprints in mathematical expressions. The not-at-all unified notation of models throughout the text, namely in Section 2, makes the theoretical part rather hard to digest. To name a few examples, notation  $\rho_1$  and  $\rho$  in Subsection 2.5.1 is confusing, moreover, for  $\rho=1$  is the correlation computed on top of page 16 not only non-zero, but equal to 1. Also, the author uses a whole zoo of letters for dependent variables, factors and errors in various models (it seems the author picks up the notation from various sources as is and conflicting notation between sections does not bother the author at all).

## Summary and suggested questions for the discussion during the defense

The manuscript delivers on the goals formulated in the thesis proposal, however, the submitted form of the manuscript has certain shortcomings which contribute negatively to the quality of the thesis. As such, I suggest **grade D**.

Suggested question for the defense:

Please explain properly the application of Newey and West standard-errors adjustments in your analysis of data sets. Could you illuminate the proposed evaluation of value of  $g$  based on the sample size  $n$ ? When is that more suitable instead of determining the proper order using e.g. tests for higher-order of serial correlation?

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

CATEGORY	POINTS
Contribution (max. 30 points)	24
Methods (max. 30 points)	18
Literature (max. 20 points)	12
Manuscript Form (max. 20 points)	8
<b>TOTAL POINTS</b> (max. 100 points)	<b>62</b>
<b>GRADE</b> (A – B – C – D – E – F)	<b>D</b>

**NAME OF THE REFEREE:** Michal Červinka

**DATE OF EVALUATION:** August 16, 2019

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**Referee Signature**

**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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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