Report on **Bachelor Thesis**

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

Student:	**Tatiana Bielaková**
Advisor:	**PhDr. Jiří Kukačka, Ph.D.**
Title of the thesis:	**Application of a Financial Agent-Based Model to the Cryptocurrency Market**

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

Short summary
Following a common perception that participants in cryptocurrency markets are less rational than their "colleagues" in the standard financial markets and thus more prone to various behavioral biases, Tatiana, in her bachelor thesis, insightfully analyzes the appropriateness of one of the famous financial agent-based approaches by Franek and Westerhoff (2012) for modeling cryptocurrency returns. The model allows for interactions between informed fundamental traders and naïve "speculators" for dynamic adaptation of participants based on the actual profitability of these two trading strategies, as well as for various combinations of components of the attractiveness index (predisposition effect, herding effect, price misalignment effect, wealth effect). While Tatiana can also qualitatively reproduce the original empirical results for the S&P500 index for a considerably updated dataset, the model is much more promising for modeling crypto market returns, especially for Bitcoin.

Contribution
Tatiana's thesis is at the very edge of the researched area of empirical validation of financial agent-based models and significantly exceeds the IES bachelor-level curriculum:

1. There is only very, very limited literature interconnecting crypto with agent-based modeling.
2. The depth of analysis is at the level of a simple research article (analysis of all possible setup combinations for the model, comparison of results for not only S&P500 and Bitcoin, but also for manually constructed hypothetical market-weighted Top20 cryptocurrency index reevaluated at daily frequency), yet still condensed to less than 40 standard thesis template pages.
3. The empirical results are strong and convincing.
4. In the resulting discussion, Tatiana not even transparently uncovers the limitations of the adopted approach and technical setup but also highlights imperfections in several recent papers analyzing the same model.

Finally, suggestions how these issues can be addressed in future research are provided.

Methods
Tatiana skilfully combines theoretical financial agent-based modeling with the empirical econometric approach to model estimation using the simulated method of moments and related econometric testing. Based on our consultations, Tatiana understands all concepts in detail. The methodology is well theoretically described, explained, and thoroughly elaborated. Also, the management of empirical data is at a high level, especially in constructing the index of the top 20 cryptocurrencies weighted by market cap with daily reevaluated weights.

As the thesis supervisor, I am well satisfied with our cooperation. We discussed the progress regularly throughout the year, and Tatiana always considered my suggestions during the works and recommendations for the final design of the thesis. We managed to elaborate and analyze everything originally planned in the proposal. Therefore, I am pleased with the work's methodological state and have little to add. In fact, I was positively surprised by an extra analysis of the imperfections of the current literature that Tatiana added in the last week of the works.

Literature
The literature review is standardly elaborated and considers both main areas of interest: financial agent-based modeling and cryptocurrency markets. Each of these subsections is further split into a discussion of the related concepts crucial for the topic of the thesis. A good selection of the associated research papers, both seminal and most recent working papers, is provided to summarize brief history and state-of-the-art of the related topics. The whole chapter is written in a "positive manner," meaning

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that while it demonstrates that the author is familiar with the related literature, it unfortunatelly does not go much deeper. It does not provide much of a detailed analysis, compare and contrast approach, or critical assessment. Formally, citations are done properly using a standard style for economic papers.

Manuscript form
The thesis is written in decent English, standardly structured, and typeset in LaTeX. The writing style is rather concise but completely sufficient and strongly to the point. The bibliography section is complete and well-formatted. Referencing tables and figures is done correctly in the text, the tables are very well designed, and both figures and tables are self-contained. The simple monochromatic graphics are easy to look through and understand.

Overall evaluation and suggested questions for the discussion during the defense
The assessed thesis undoubtedly surpasses the IES, Faculty of Social Sciences, Charles University bachelor-level standards. Thus I can confidently recommend it for the defense and suggest a grade A (excellent).

The results of the Urkund analysis do not indicate significant text similarity with other available sources.

Additional topics for the discussion:

- While not very much highlighted in the text, results for the Top20 data (Table 6.3) are interesting because only some of the model specifications pass the empirical test of overidentifying restrictions. Please explain the main idea of the test and discuss (and potentially speculate why) what specific model designs produce data close enough to the empirical time series.
- The computational costs of the estimation approach bring considerable limitations to the setup. A brief subsection 7.3 is devoted to a discussion of potential alternatives. Can you be more specific and explain the expected benefits of their application?

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

CATEGORY		**POINTS**
Contribution	*(max. 30 points)*	29
Methods	*(max. 30 points)*	30
Literature	*(max. 20 points)*	16
Manuscript Form	*(max. 20 points)*	19
TOTAL POINTS	*(max. 100 points)*	**94**
GRADE	**(A – B – C – D – E – F)**	**A**

NAME OF THE REFEREE: Jiří Kukačka

DATE OF EVALUATION: 30. 5. 2023

Jiri Kukacka
Digitally signed by Jiri Kukacka
Date: 2023.05.30 13:30:06 +02'00'

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.*

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.*

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

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.*

Overall grading:

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