

Report on Bachelor / Master 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

Tatiana's thesis aims at explaining the behavior of agents on the cryptocurrency market. She models the S&P500, BTC and an index consisting of top 20 cryptocurrencies using an established financial agent-based model of Franke and Westerhoff (2012) in 8 different specifications and estimates its parameters using the simulated method of moments.

The research is well-motivated and clearly linked to previous advances in related fields. The author provides a broad literature review aimed at financial agent-based models and cryptocurrencies. Tatiana also extensively describes financial agent-based models and the related estimation methods.

The results are well documented and the author pinpoints the most important figures. First, the thesis provides the results of applying the model of Franke and Westerhoff (2012) under several specifications to the S&P 500 index and compares them to previous findings. Then, the main results for the Bitcoin and Top20 index are provided. The results show evidence in favor of applying financial agent-based models to cryptocurrencies. Tatiana then follows with a discussion of the limitations of her approach.

Overall, I believe that the thesis is of very good quality and I have enjoyed reading it. Below, I comment on several aspects of the thesis in detail, including several suggestions for improvement.

Contribution

The author provides very clear motivation for applying financial agent-based models to study cryptocurrencies which, despite the recent cooldown in prices, remain a hot topic of research. In traditional financial markets, financial agent-based models help explain many stylized facts that conventional theories can not. Because similar stylized facts (heavy tails, etc.) have been related to cryptocurrencies as well, it is natural to apply financial agent-based models to this class of assets, too. This is exactly what Tatiana did and what makes her work contributive and original. As the results show, the thesis is one of the firsts examples of a successful application of a financial agent-based model to the cryptocurrency market.

I only have one critical comment regarding the contribution of the thesis. The author claims that financial agent-based models have not been applied to cryptocurrency markets yet. While financial agent-based models and cryptocurrencies are not within my core fields of expertise, and while I have not found financial agent-based models to be used in the particular setup of this thesis, a simple Google Scholar search reveals that many applications of such approach have been made in the context of cryptocurrencies. I suggest that perhaps some of the works relating financial agent-based models and cryptocurrencies, although in different setups, deserve to be mentioned.

Methods

Tatiana utilizes the simulated method of moments, an in-depth description of the method is provided in Chapter 3. The next chapter introduces one of the most prominent financial agent-based models, the Franke and Westerhoff (2012) model. Basics of the model are well formulated, including switching mechanisms and the relative attractiveness measure. In Chapter 7, Tatiana correctly points out that the approach which she uses is computationally demanding and comments on the consequent limitations. Overall, the methodology section is well organized, the methods are well described and I also believe that their complexity is above the level of standard bachelor theses.

Report on Bachelor / Master 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

I have the following suggestions which would, in my eyes, improve the thesis. First, if I understand the construction of the Top20 index correctly, the index might suffer from survivorship bias. However, the impact of the bias on the results should be small because the most dominant cryptocurrency Bitcoin would drive the price of the index anyway. Second, because Bitcoin's and Ethereum's market share on the cryptocurrency market is so overwhelming, it would be very interesting to see the results replicated on an index excluding these two cryptocurrencies.

Third, while Tatiana's results are promising, I'm missing some greater discussion about the individual parameters of the model and the constraints set for them, or e.g. why the 4 fixed parameters are set to the respective values. The estimated parameters vary greatly across model specifications and some of them have very wide confidence intervals which undermines the validity of some of the parameters in some of the specifications. The author devotes a part of Chapter 7 to discuss the parameters and, correctly, points to some possible ways of improvement. It is unfortunate, that the suggested improvements have not been carried out before finishing the thesis. I believe that greater effort in this direction would add much value.

Fourth, I would argue that due to the nature of the model, the optimization must be performed again in order to perform a meaningful reevaluation of different values of the fixed parameters in Chapter 7.2.1. I do not see well how conclusions can be made based on changing the fixed parameters after the optimization, considering that the optimization itself would have arguably produced different results if the parameters were changed in advance.

Lastly, I would appreciate more explanation given in Section 7.3 on why using the median of J values would produce better results than using the mean and also the main results obtained when using the median.

I must add that I understand that the research has been computational demanding enough and that applying all, or at least some of the above suggestions would require a lot of additional effort.

Literature

The first part of the literature review chapter is dedicated the financial agent-based models. In the second part, the author reviews the research related to cryptocurrency markets. Overall, the thesis contains a well organized and extensive review of the relevant literature and summarizes its most important findings. However, as mentioned above, a small section devoted to applications of financial agent-based models in the cryptocurrency market might be included in the thesis.

Manuscript form

The thesis is well structured and organized. In general, it was very clear what, why, or how the author is trying to achieve. The flow of the text is good and the thesis is easy to read and understand. I have only two minor comments on the form of the thesis. First, I would appreciate more comments on the results in the introduction section and second, most tables and figures are either missing descriptions completely, or could be described in more detail.

Overall evaluation and suggested questions for the discussion during the defense

Overall, the quality of the thesis is very good.

Report on Bachelor / Master 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

The results of the Turnitin analysis do not indicate significant text similarity with other available sources. The thesis fulfills the requirements for a bachelor thesis at IES, Faculty of Social Sciences, Charles University, Hence I recommend the thesis for the defense and suggest a grade A.

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

CATEGORY	POINTS
<i>Contribution</i> (max. 30 points)	28
<i>Methods</i> (max. 30 points)	26
<i>Literature</i> (max. 20 points)	19
<i>Manuscript Form</i> (max. 20 points)	18
TOTAL POINTS (max. 100 points)	91
GRADE (A – B – C – D – E – F)	A

NAME OF THE REFEREE: *Lukas Petrasek*

DATE OF EVALUATION: 27.5.2023

*Digitally signed by
Lukas Petrasek
(27. 5. 2023)*

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