Report on **Bachelor Thesis**

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

Student:	**Michal Bureš**
Advisor:	**PhDr. Jiří Kukačka**
Title of the thesis:	**Agent-Based Model of the Software Market**

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

The thesis "Agent-Based Model of the Software Market" brings an innovative idea of modelling this relatively lately emerged and very rapidly developing and evolving market using the multi-agent-based approach. The main motivation for the work is the currently observed situation where standard economic models do not (fully) reflect a specific situation of software as an electronic product being mostly distributed via internet at negligible variable costs, specific motivation and habits of very heterogeneous population of customers and atypical commercial strategies on the sellers side, e.g. the freemium model (also its "illegal" form when developers tolerate piracy to maximise overall profit), software as a service, periodical upgrading etc.

Michal designed and programmed his own agent-based model as a combination of several basic modelling principles form literature and a set of own assumptions on how the software model works. I have to stress here that Michal developed the model as well as the computational algorithm on C++ completely by himself "on the green field" and finally managed to design and create a functional computational economic model which behaves reasonably realistically. To the best of our knowledge a model of this type of market has not been developed so far and definitely not based on the multi-agent approach.

Michal demonstrated strong programming skills, ability to very critically assess mainstream economic theories and also to apply general microeconomic knowledge to design almost complete modelling cycle (from a "real" problem via simplification of assumptions via theoretical model design via implementation to a simple sensitivity analysis). He definitely presented original research ideas and was able to suggest advanced solution for issues emerging during the design of the model (I especially like to idea of using arctan function for modelling probability a customer will change product preferences and thus will make a new choice based on historical satisfaction).

On the other hand, the quality of the thesis apparently suffers from the lack of time for elaboration. To my mind literature is picked out yet sufficiently for the purpose of the work but the literature review to demark the context could have definitely been elaborated more thoroughly. Unfortunately, Michal devoted considerably more time and effort to developing and coding the model itself than to subsequent validation of model behaviour and its testing, reasoning, and a proper sensitivity analysis. What holds for the literature review holds for a sketchy model analysis as well. The ideas and methods presented in Chapter 5 are relevant and interesting but the analysis is based on subjective "common sense" criteria and rough observation and could have surely been assessed more robustly than based on single runs with model parameters relatively arbitrarily set. A proper sensitivity analysis of some key parameters and statistically more valid evaluation of model behaviour would increase the quality of the work considerably but it was inhibited by approaching submission deadline. I appreciate the idea of a case scenario presented in chapter 6, but it again rather shows one specific fancy application of the model than provides an economically relevant analysis of the system behaviour.

The aim and structure of the work are clear, but conclusions are not very "interesting" from the economic point of view as the main focus of the work lies in the development and implementation of the model itself rather than drawing results from its application. Working hypotheses were partially adapted based on the final design and level of detail of the model and are in general answered within the model analysis. The approach as well the format of the work is legitimate for student at bachelor's program. The text of the thesis is supplemented by a WindowsOS-based program where one can play with the model, vary model setting and use predefined scenarios.

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Suggested questions for the defense are:
- What are the main advantages and weaknesess of the model? What economic principles is the model able to replicate well and in what does it generally fail?
- What other real-world scenario can you imagine to investigate using the model? What is the probable output of the model? What economic behaviour observed in the real world (within this scenario) is the model likely to capture well?

Summary:
Finally, according to my opinion the thesis **meets academic standards for bachelor theses written at IES**. Personally considered, the ability of the author to link together microeconomic principles with empirical observation of the real market to design na implement an original computational model that is able to replicate basic economics principles is the most distinctive quality of the work.

I can recommend the thesis of Michal Bureš to defense at the IES FSV UK as it brings a very interesting idea and formally satisfies requirements for bachelor theses. However, my suggestion based on above mentioned comments is to **grade the work between weak "2" (preferred)** and much good "3" based on Michal's ability to deal with opponent comments and questions from the committee during the defense.

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

CATEGORY		POINTS
Literature	*(max. 20 points)*	7
Methods	*(max. 30 points)*	14
Contribution	*(max. 30 points)*	26
Manuscript Form	*(max. 20 points)*	15
TOTAL POINTS	*(max. 100 points)*	**62**
GRADE	*(1 – 2 – 3 – 4)*	**2**

NAME OF THE REFEREE: Jiří Kukačka
DATE OF EVALUATION: 10. 6. 2015

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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	1	= excellent	= výborně
61 – 80	2	= good	= velmi dobře
41 – 60	3	= satisfactory	= dobře
0 – 40	4	= fail	= nedoporučuji k obhajobě