Report on Bachelor Thesis

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

Student:	**Pavel Dvořák**
Advisor:	**PhDr. Ladislav Krištoufek**
Title of the thesis:	**Ising model in finance: From microscopic rules to macroscopic phenomena**

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

If the submitted bachelor's thesis "Ising model in finance: From microscopic rules to macroscopic phenomena" should be described very shortly, I would just say that it is an extraordinary thesis, which would be easily defended as master's thesis as well. On its 35 pages of text (plus additional pages of tables, figures, references, etc.), Pavel analyzes whether a relatively simple model of ferromagnetism (Ising model) can replicate the stylized facts of the financial markets and, in short, he succeeds.

The basic idea connecting Ising model and the real financial markets is that in Ising model, we have particles that are either positively or negatively magnetized. The magnetization of each separate particle is affected by two influences – the closest (neighboring) particles and the magnetization of the whole magnet. Translated into the economics/financial markets, the particles are actually agents which are influenced by other agents with similar beliefs but are also affected by the mood of the whole market. In a similar way, agents are also polarized – they are either buying or selling (or not doing anything, which is also controlled for in the thesis).

Pavel starts with a basic model proposed by Bornholdt (2001) but adds new features into the model – fixed number of trading agents in each period and Poisson-like behaving number of trading agents. Moreover, Pavel proposes a magnetization dependent number of traders for each period which enters the Poisson distribution for trading agents. By simulations, he shows that the most important stylized facts are replicated by the models – mainly non-normality, no auto-correlation of returns, volatility clustering, and strong auto-correlation in absolute returns. Note that there is no noise added to the simulations and all these stylized facts come up from practically entirely deterministic processes (apart from the initial distribution of magnetization of individual particles/agents).

Pavel Dvorak discussed the thesis on regular basis and was able to incorporate all important suggestions. The simulations have been conducted in Wolfram Mathetica software, i.e. Pavel also showed very advanced computational skills.

In summary, the thesis is extraordinary in both formal and content matters. Note that the results of the thesis have been accepted for presentation at WEHIA 2012 conference in Paris, France, and it is planned to submit at least one paper based on this thesis in a refereed journal. **I gladly recommend grade A with distinction for an excellent bachelor's thesis.**

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

CATEGORY		**POINTS**
Literature	*(max. 20 points)*	20
Methods	*(max. 30 points)*	30
Contribution	*(max. 30 points)*	29
Manuscript Form	*(max. 20 points)*	19
TOTAL POINTS	*(max. 100 points)*	**97**
GRADE	**(1 – 2 – 3 – 4)**	**1**

NAME OF THE REFEREE:

DATE OF EVALUATION:

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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