Report on Master Thesis

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

Student:	**Tomáš Křehlík**
Advisor:	**Jozef Baruník**
Title of the thesis:	**Does wavelet decomposition and neural networks help to improve predictability of realized volatility?**

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

The thesis brings an original work in the field of modelling volatility of stock market returns. Main contribution of the work is in thorough comparison of various recently proposed volatility estimators and usage of neural networks as a modelling and forecasting vehicle. An interesting empirical contribution is in application of the proposed methodology to different classes of assets and commodities representing important drivers of an economy; namely crude oil, gold and U.S. stock market index S&P 500. Author finds an estimator based on the time-frequency decomposition to carry the largest portion of information in case when an asset includes significant jumps and also finds neural networks to outperform the standard econometric tools. To my knowledge, there is no similar study in the literature proposing a combination of these methodologies and while author brings potentially economically interesting results (although testing its economic significance is not aim of the work as it would deserve a separate thesis), I am sure that the results are publishable in a respected international journal such as International Journal of Forecasting.

The text is well motivated, logically structured, and easy to read, Tomáš shows a very good command of understanding the literature. The text takes the reader through all the important aspects of methodology, data and estimation thoroughly, explaining the realized volatility estimators, through the neural networks and the methodology for statistical testing up to the empirical results. English of the thesis is on the very good level as well (although I have to admit that sometimes the text would benefit from better 'academic' treatment, e.g. using less personal language).

In the work, Tomáš showed excellent quantitative skills and knowledge reaching far beyond the Master level studies. He has written his own package in R for realized volatility estimators including new JWTSRV estimator of Barunik and Vacha (2012) not included in any other available package. I would like to stress that the work with the tick data is very demanding and Tomáš managed it with ease as well. During the last year, we have discussed all the issues quite extensively and I plan to work with Tomáš even more closely on publishing the interesting results brought by the thesis. Thus I have no additional questions to the defence.

In conclusion, I believe that the thesis is an excellent piece of work in all aspects. The very demanding work with all the estimators, high frequency data and advanced econometric techniques brought interesting empirical results as well and Tomáš takes it well beyond being just another technical exercise. The results are potentially interesting for the literature, thus I fully recommend the thesis of Tomáš Křehlík to be defended with grade excellent – 1. Due to the originality and contribution of the results I also believe the thesis deserves a consideration for the "distinction for an extraordinarily good master's diploma thesis" award.

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

CATEGORY		POINTS
Literature	*(max. 20 points)*	20
Methods	*(max. 30 points)*	30
Contribution	*(max. 30 points)*	30
Manuscript Form	*(max. 20 points)*	16
TOTAL POINTS	*(max. 100 points)*	**96**
GRADE	**(1 – 2 – 3 – 4)**	**1**

NAME OF THE REFEREE: Jozef Baruník

DATE OF EVALUATION: 11.6.2013

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