

# Report on Master Thesis

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

Student: **Bc. Jana Hortová**  
Advisor: **PhDr. Ladislava Křištofuk, Ph.D.**  
Title of the thesis: **Forecasting Jump Occurrence in Czech Day-Ahead Power Market**

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

The thesis submitted by Jana Hortová thoroughly analyses Czech day-ahead power market (i.e. electricity spot prices) via combination of several econometric tools: Quadratic variation theory to disentangle the jump component from the continuous component of the total spot price volatility, OLS model to forecast electricity demand, and Logit-type models to forecast probability of jump occurrence. The main motivation of the work lies in the latter, i.e. the frequent occurrence of large price jumps which generally is a crucial attribute of electricity markets compared to other financial/commodity markets caused by specific technical features of the electricity itself and its production. A possibility to predict these jumps is likely to increase power market efficiency as it decreases both the spot price risk for retailers as well as it might help to the industry part of the electricity supply side to reduce costs of the electricity production. The author especially highlights the originality of the presented research for the Czech day-ahead power market. This brings not only scientific contribution but also potential practical value when considered within the industry in the future.

I am pleased to summarise at the very beginning of this report that **Jana has written a high quality piece of work and therefore I can honestly suggest the highest grade (1)**.

Within the course of the thesis, Jana managed to master the practical utilisation of standard econometric models as well as a new advanced econometrics topics (quadratic variation theory), which is not a part of the standard IES curriculum. Jana also demonstrated important capability to deal with practical research issues when reality does not match the theory perfectly and data do not come exactly as we need them according to optimal model design. She was able to suggest several practical solutions and simplification based on which the research could have been carried out from the practical point of view. However, to my mind the most outstanding quality of the thesis lies in a rigorous sensitivity analysis of several important researched phenomena: three alternative models for the single jump identification, an attempt to choose a proper significance level for jump detection (three options again), and various cutoff values for the out-of-sample performance. This adds considerable robustness to the results of and contributes substantially to the quality of the research.

On the other hand, below I mention several minor comments, questions, and areas to clarify that might be further explained/discussed during the defence or just contemplated by the author. She may also use this list to her advantage and consider them for possible further research:

1. Pg. 16: resolution of the Figure 3.2 is insufficient especially when displaying hourly data. You should provide vector-graphics depiction to allow readers zooming into details.
2. Pg. 19: you use R. R Studio is only a user interface for R.
3. Pg. 20: why do you use first differences instead of simple returns of the financial econometrics "industry standard" log-returns? Does it bring any advantage? E.g. Andersen & Bollerslev (1998) that you cite in this respect use log prices and derived log-returns.
4. Pg. 21: the Augmented Dickey–Fuller test is often used as a test for (non)stationarity. Therefore you report results of two different tests that might seem somewhat conflicting. This section thus requires an extended discussion of tests' conclusions.
5. Pg. 22: I do not understand why the Czech day-ahead market seems to be very attractive, please clarify.
6. Pg. 22: "people are generally known to increase the consumption of goods in time"... a source for this statement would be useful.
7. Pg. 22: why do you compute deviation in degrees Celsius (°C)? Is there not any other way of the temperature difference formulation (e.g. some percentual form)?
8. Pg. 23: Figure 4.2 insufficient resolution again.
9. Pg. 24: "the spot prices in all POWER markets exhibit specific features".
10. Pg. 25: you use astronomical "definitions" to divide year into four quarters, why do not you rather use a division based e.g. on average temperatures?

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11. Pg. 26: a discussion about the possible shortcomings and trade-offs related to utilisation of high frequency data to calculate realised volatility is missing. A more in-depth discussion would be desirable.
12. Pg. 29: why do you consider +2 SD in Equation 4.13 when in the previous text you report +3 SD (point 1. Pg. 28).
13. Pg. 31: jumps clustering is reported and commented as a specific characteristic of the power market. What about a possible distinct effect of positive and negative jumps? Can you identify some similarity to the "leverage effect" in Finance (i.e. bad news are more important than good news, falls more likely followed by subsequent falls, volatility increases when the stock price falls)?
14. Pg. 40: I do not understand how the "rolling" average temperature might be kept constant. I also got lost in the explanation why the "higher Temperature means lower daily temperature". Please clarify.
15. Pg 47: Can you find some explanation why April, October, and December appear statistically insignificant at 5% level for the demand?
16. Pg. 55: Why do you indicate the optimum of the accuracy and confidence as the intersection of both lines? In what sense is this point more reasonable/optimal than any other point. What is the criterion for optimality in this case?

The aim of the work, working hypotheses, and the design of the econometrics part are clearly stated and carefully elaborated. The work is well structured and meets high academic standards also in terms of English and text-editing quality. The theoretical part provides the reader with a useful summary of utilised methods. Jana also demonstrates good understanding of the portfolio of econometrics tools and capability to work well with the most recent literature, many relevant sources are mentioned very properly thorough the whole text (the only exception is the Introduction where asked myself many times in a sense "From where does she know this...?". I would recommend adding sources to several nontrivial statements there as well. Although these are further clarified in the text, one usually reads from the beginning...).

## **Suggested question for the defense:**

1. The thesis deals with the occurrence of jumps. What is, however, not predicted is the direction (sign) of these jumps. Ability to predict also direction of jumps would definitely be a great practical advantage. What if I wanted to predict also the direction? What aspects need to be considered/analysed/assumed/modified?

## **Summary:**

As large, I do find this thesis **well satisfying academic standards for master theses written at IES**. Personally considered, the careful empirical elaboration, sound sensitivity analysis of results, and original contribution are the most distinctive qualities of the work.

Moreover, in case of considering eventual application to the Ph.D. program, it would be my pleasure to encourage and support Jana in this decision. I honestly believe that Jana demonstrated qualities to manage doctoral studies well and that the presented work constitutes sound foundations for further research in the field of energy economics.

I am very pleased I can strongly recommend the thesis of Jana Hortová to defense at the IES FSV UK. With no doubts I suggest the grade "1", i.e. "excellent".

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

<b>CATEGORY</b>		<b>POINTS</b>
<i>Literature</i>	<i>(max. 20 points)</i>	19
<i>Methods</i>	<i>(max. 30 points)</i>	27
<i>Contribution</i>	<i>(max. 30 points)</i>	29
<i>Manuscript Form</i>	<i>(max. 20 points)</i>	17
<b>TOTAL POINTS</b>	<i>(max. 100 points)</i>	<b>92</b>
<b>GRADE</b>	<b>(1 – 2 – 3 – 4)</b>	<b>1</b>

**NAME OF THE REFEREE: Jiří Kukačka**

**DATE OF EVALUATION: 4. 2. 2016**

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**Referee Signature**

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## **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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
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.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
20	10	0

## **Overall grading:**

TOTAL POINTS	GRADE		
81 – 100	<b>1</b>	= excellent	= výborně
61 – 80	<b>2</b>	= good	= velmi dobře
41 – 60	<b>3</b>	= satisfactory	= dobře
0 – 40	<b>4</b>	= fail	= nedoporučuji k obhajobě