

# Report on Bachelor / Master Thesis

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

Student:	Jonáš Kratochvíl
Advisor:	RNDr. Michal Červinka, Ph.D.
Title of the thesis:	Efficiency of Prague Stock Exchange Market using Markov Chains

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

Please provide your assessment of each of the following four categories, summary and suggested questions for the discussion. The minimum length of the report is 300 words.

### **Contribution**

The main contribution of the thesis comes from a nice and unique match between existing methods and data (on Prague stock exchange indices). Moreover the text on methods is very accessible and may be also very well used for teaching.

### **Methods**

To my knowledge, the level of methods (namely Markov chains) goes beyond standard bachelor level skill set. The methods are in general both well described and applied.

Perhaps the discretization step should be described better. The author states that the model recognizes two states „Increase“ and „Decrease“ based on the comparison of the daily/weekly/monthly return with „expected return of the time series for the whole period“. It is not clear to me, however, what is the definition of expected return and more importantly what does the “period” in the definition stands for. Does it cover only past observations or the whole period of data? If, by any chance, it is the latter case, I would rather call the states “High” and “Low” instead of “Increase” and “Decrease”. Also this approach would rely on the assumption of stationarity of the PX time series but there is no such test.

### **Literature**

The literature review is a bit short. I would suggest some more references on foreign stock market literature (we can find Nigeria, Stockholm, Istanbul in the thesis). The author uses references and sources correctly.

### **Manuscript form**

The thesis is very well written and structured. The text is clear and concise.

### **Summary and suggested questions for the discussion during the defense**

The thesis is really nice. It was a pleasure to read it. **I recommend the thesis for defense.** I have few more comments and suggestions for the discussion:

1. A short part of the thesis is dedicated to testing the data for normality. Even though the author claims that the model does not depend on the assumption of normality, isn't it correct only for the two-state model? I would expect the second four-state model which is used for estimating the future expected returns to rely on it. If so, what might be the effects of fat tails property (common to stock prices) on the results?
2. The suggested trading strategies resulting from the four-state model does not take risk aversion (and volatility) into account. Is there any way to extend the model regarding this issue?

# Report on Bachelor / Master Thesis

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

<b>Student:</b>	<b>Jonáš Kratochvíl</b>
<b>Advisor:</b>	<b>RNDr. Michal Červinka, Ph.D.</b>
<b>Title of the thesis:</b>	<b>Efficiency of Prague Stock Exchange Market using Markov Chains</b>

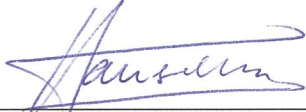
3. Deriving a trading strategy based on the historical data is tricky. Maybe some back-testing strategy that would fit in the presented framework should be discussed.
4. The results of the thesis relies on model selection method based on BIC. It seems to me that this "measure" is very well suited for example for testing inclusion of a new variable in a regression. In case of the thesis it is used to compare models that uses different "amount" of historical information. Specifically it penalizes using t-1 information by the same cost as t-2 or t-3 etc... Wouldn't it be more naural to expect some decay of information value added to the model in time?

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

<b>CATEGORY</b>	<b>POINTS</b>
<i>Contribution</i> (max. 30 points)	26
<i>Methods</i> (max. 30 points)	29
<i>Literature</i> (max. 20 points)	18
<i>Manuscript Form</i> (max. 20 points)	20
<b>TOTAL POINTS</b> (max. 100 points)	<b>93</b>
<b>GRADE</b> (A – B – C – D – E – F)	<b>A</b>

**NAME OF THE REFEREE:** *Václav Hausenblas*

**DATE OF EVALUATION:** 4.6.2018

  
\_\_\_\_\_  
**Referee Signature**