Report on **Master Thesis**

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

Student:	**Bc. Barbora Chochláčová**
Advisor:	**MUDr. Ing. Daniel Hodyc, PhD.**
Title of the thesis:	**Improvement of Risk Adjustment Model to Strengthen the Competition among Health Insurance Companies in Slovakia**

***OVERALL ASSESSMENT**:*

The thesis deals with a current topic in health economics - the risk adjustment used for funds redistribution among health insurers in a health system with multiple health insurance companies. Though inspired by recent changes in the Czech Republic, the statistics and analytical work is carried out on data from Slovakia.
The thesis has 62 pages, including several longer tables.

Contribution
The thesis analyses possibilities to improve currently used risk adjustment formula, given the provided data constraints. Author demonstrates critical thinking and clearly states the value added of the statistical exercise performed in the thesis (in conclusion).
In some cases, author's argumentation would benefit from deeper research in relevant literature, including both the theory and the empirics. Just to name an example, page 39 – explanation of decreasing age-specific health care spending profile in older ages (literature offers better explanation of lower health care costs of older seniors than assigning it to their immobility or mental disorders).

Methods
In her analyses, the author doesn't use official 2016 Slovak risk indices, but calculates her own based on data sample that she received (all policyholders of one health insurer). For the calculation, OLS on 2014 data is used to estimate the coefficients which are then used to calculate risk indices. These are further used in the analyses of risk adjustment formula refinement.
In the thesis, I miss the argumentation why OLS was chosen for regression. Only opponents to OLS are named (page 29), no reference is given to its proponents or other's work using OLS in a similar case.
Regarding adequacy of analytical methods, I miss some comparison of the sample data with the whole Slovak population (descriptive statistics of the demographics, etc). Also, some descriptive statistics could help to argue why 3 different groups of people with Hypercholesterolemia are used and that these 3 groups of patients really do differ.
Last, I do not agree with the statement (page 48) that though some variables are insignificant in the regression, it is necessary to continue the further analyses with these calculated coefficients. Though for the whole Slovak population these variables might be significant, in the analytical exercise the author performs it would be better to recalculate the regression without the insignificant variables or with regrouping them. In the second step of the analysis the author uses the same demographic set, so such an adjustment would not cause a problem.

Literature
The literature is quoted in a proper way. In my opinion, some more literature search could be done on partial argumentation to support author's opinion or deductions. Rather than author's speculations for an explanation, further literature search could sometime provide better arguments. Also, when stating "it is suggested to use", any source citation would be useful. This applies throughout the thesis.

Manuscript form
The tables and figures are generally well referred to, in an appropriate format. Structure of some chapters is a bit misleading. In the introduction or thesis beginning, the main aims are missing. These are stated only later, in chapter 4. "Literature Review" (page 24), and then more precisely in chapter 5.1.2 "Modified Model Determination" (page 32). Also, another part of the "Literature Review" would better fit in the "Methodology" chapter.

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The English used is often using structure of the Czech language for sentence formation. The thesis could benefit from being written in Czech, also given its content.
The thesis contains many very long tables that could be moved to appendix (13, 15, and 16). It is not necessary to copy whole tables from other papers, such as table 9. Instead, summary of their conclusions in the text would be enough.

Summary and suggested questions for the discussion during the defense
The thesis does offer an innovative look at the currently used PCG models in risk adjustment in the Czech and Slovak health care systems and its calculations may be used in further systems' refining. The common conclusion on more patient categories capturing more variability of individuals' health care costs holds. The attention needs to be paid to the significance of the coefficients and risk indices. I recommend the thesis for the defense and suggest the grade B.

Questions for discussion:

1) Can you offer any comparison, at least descriptive statistics, demographics, of the sample data with the whole Slovak population? Can you present why you chose the 3 groups of patients with hypercholesterolemia and can you show that these 3 groups of patients do differ in any statistics so that it makes sense to distinguish them (for example rate of hospitalization, frequency of doctor visits, or their age or socio-economic background)?
2) How different are the calculated risk indices compared to the official 2016 risk indices?
3) On page 55, R-squared as a proportion of explained variance to the total variance of dependant variables is calculated for prognosed year t (2016), using coefficients calculated in original regression on data from year t-2 (2014, results on pages 46-48). Surprisingly, these are 2.7 to 2.9 percentage points higher than R-squared of the original regression. This could suggest the model prognoses better individual health care costs in a 2-year lag. Do you agree with this? Or could you provide any other explanation? Could we get a potentially better results with a different time lag?
4) During the defence, you can explain your methods of comparison of different models (R-squared, MAPE and MARE, Profit/Loss, Boxplot).

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

CATEGORY		**POINTS**
Contribution	*(max. 30 points)*	27
Methods	*(max. 30 points)*	24
Literature	*(max. 20 points)*	17
Manuscript Form	*(max. 20 points)*	14
TOTAL POINTS	*(max. 100 points)*	**82**
GRADE	**(A – B – C – D – E – F)**	**B**

NAME OF THE REFEREE: Lucie Bryndová

DATE OF EVALUATION: September 11, 2018

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Referee Signature

EXPLANATION OF CATEGORIES AND SCALE:

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*

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*

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*

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	**GRADE**
91 – 100	**A**
81 - 90	**B**
71 - 80	**C**
61 – 70	**D**
51 – 60	**E**
0 – 50	**F**