# Report on Master Thesis

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

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| **Student:** | **Petr Nový** |
| **Advisor:** | **Mgr. Michal Paulus** |
| **Title of the thesis:** | **Measuring the DRG classification system performance in the Czech Republic** |

***OVERALL ASSESSMENT:***

The thesis analyzes the explanatory power of the Czech hospital inpatient classification system (DRG) in relation to the length of stay (LOS) of hospital cases. It uses regression analysis to estimate how much variance in LOS is explained by DRG classification, as well as other explanatory variables. The author finds that Czech DRG performs reasonably well in this regard.

The thesis starts with an exhaustive literature review that nicely summarizes current DRG literature and methods for analyzing LOS. It then follows with an overview of the DRG system itself and its adaptation in the Czech Republic. Here the author manages to avoid any major misinterpretation and factual errors, even though some small misunderstandings and mistakes are present. This section could also use some further clarifications as some parts seem rather confusing and some terms are explained only briefly or not at all.

The core of the thesis is an empirical analysis that uses OLS and two negative binomial models to explain LOS. The models themselves are employed appropriately and the majority of the results are sound. I do have, however, the following concerns/questions for the author:

- Why do you assume linearity of LOS with respect to age? It could be argued that LOS is on average the same for people between 15-40, but then it rises sharply. Can you think of any model adjustment that would solve this nonlinearity issue?
- You suggest that multicollinearity does not represent a serious problem. But consider the case of highly specialized hospitals stays (transplants, pacemakers etc.) that are performed uniquely by specialized university hospitals – here you will have almost perfect collinearity between DRG dummies for specialized stays and dummy for university hospitals. Also consider the correlation between region and hospital type.
- OLS assumes independence of observations – is it satisfied in your model? Can it be that DRG cases within one hospital (often the intersection of region and hospital type dummies) are in fact not independent and the error terms are as a result correlated?
- It is unclear how you approach the trimming of outliers. It seems that you identify outliers on the sample as a whole rather than within each DRG separately (which would be the more appropriate way) – can this relate to your finding that trimming does not improve explanatory power? Furthermore, it would be useful if you also considered identifying outliers that is used in CR for reimbursement purposes (LOS<1/3* mean LOS or LOS>3* mean LOS within each DRG).

Some of these concerns can also relate to some of the unintuitive findings that result from the estimation – notably that university hospitals have lower LOS. Is it possible that much of the effect of hospital type is in fact included in the regional dummy (consider for example the district Hradec Králové where you have one big university hospital)?

I also have a comment regarding the analysis of the impact of severity of illness on LOS. The author suggests that cases with complications and comorbidities should have higher LOS than cases without them. On average this is true, but consider some acute conditions such

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as heart failure or stroke, where complications in fact increase mortality and thus reduce LOS – not necessarily a flaw in the DRG classification. Overall the author should be more cautious with his conclusions.

As for the contribution, the thesis offers valuable insights into the current predictive power of DRG classification in terms of LOS and thus represents a helpful contribution for the DRG literature. The author should however more emphasize how the contribution and results of the thesis relate to the current DRG debate in the CR and he should also mention what are some of the major shortcoming of the DRG classification (the performance of DRG is not measured solely by LOS predictive power).

To summarize, the author did a solid job in analyzing the complex inpatient DRG classification system (albeit with some shortcomings) and therefore I suggest the thesis for defense and propose the grade "2".

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

| **CATEGORY** | | **POINTS** |
|---|---|---|
| *Literature* | *(max. 20 points)* | 18 |
| *Methods* | *(max. 30 points)* | 18 |
| *Contribution* | *(max. 30 points)* | 20 |
| *Manuscript Form* | *(max. 20 points)* | 16 |
| **TOTAL POINTS** | *(max. 100 points)* | **72** |
| **GRADE** | **(1 – 2 – 3 – 4)** | **2** |

***NAME OF THE REFEREE: Mgr. Tomáš Troch***

***DATE OF EVALUATION: 2. 9. 2016***

***Referee Signature***