

# Report on Bachelor Thesis

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

**Student:** Michael Dibon  
**Advisor:** Mgr. Aleš Čornanič  
**Title of the thesis:** Accounting-based credit scoring models - The Altman Z-score

**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.*

The bachelor thesis of Michael Dibon "Accounting-based credit scoring models - The Altman Z-score" is a fairly elaborated work with a clear and uncomplicated but, on the other hand, an interesting and reasonable research idea. It reads well and the individual steps of the analysis are rather intuitive and logically interconnected, so I enjoyed reading it quite a lot.

The overall research question deals with the hypothesis whether the original Z-score model (1968) by Edward I. Altman (NYU Stern) is still relevant after the global financial crisis (because many authors suggest instead of re-estimation of old models to develop a new model to reflect potentially important structural breaks in the economy) and even for European companies (although the original model was developed for U.S. companies). Surprisingly, after a thorough analysis and comparison with several updated "Z-score" approaches as well as alternative models of companies' default, the results suggest that the original Altman Z-score model is still satisfactory today and its updated versions as well as alternative models are not significantly better.

## Contribution

The intended contribution of the thesis needs to be accentuated at the beginning. The thesis follows a straightforward line from an overall clear research hypothesis to well-founded results on which a valuable economic interpretation is based. I was happy about the general result that even and relatively 'old' models still perform well and it is difficult to beat them with more recent, but also much complicated approaches. Thus some version of the Z-score can be (according to thesis results) well used as an approximate benchmark that is easy-to-calculate from readily available databases. Moreover, for practical applications, the author provides a table of new cut-off points for as the original cut-off point appeared to be inefficient.

## Methods

First, author compares a reasonable family of models of similar kind, namely the original Z-score model and its updated version for United Kingdom from 2012, then the revised and more general Z"-score (1983) and its updated version from 2017 also considered mainly for European companies, further the 9-factor linear model of O-score (1980) and its updated version from 2004, and the T-score model from 1983 designed again for United Kingdom. Some other simple benchmark models for elementary comparison are further used.

It was unclear to me from the title and abstract whether these all are models for credit scoring or for prediction of default. The author might want to explain the difference between those and make this clear during the defense.

The author also talks about a "bias" several times (pg. 9, 11). But I was not sure from the text what kind of bias he means. Can the origin of these biases be explained into reasonable detail?

Section 3.1 with formal working hypotheses is a bit problematic. H1 is related to overall already acknowledged motivation but H2 is problematic as it is not clear what "calibrated coefficients" really mean. Are these just re-estimated based on new data or really calibrated based on some specific "need-to-fit" basis? I guess the former is the case but the author should recall what is the difference

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between model calibration and model estimation in general. The H3 is then clearly absurd as it states the “*The better performing models are going to, ..., perform better*”. This one will be simple to check, I guess.

The author talks about univariate and multivariate models but I think he means simple and multiple regression models. Actually, one of the simple regression models using only WC/TA is nested by original Z-score. Is it really needed then?

Wrt to the dataset, it seems well-considered and carefully designed. Within the literature review, two very distinct approaches of dataset collection are mentioned, mainly the “paired” method (used for the original Z-score) and “impaired” method used finally for this thesis. Could author compare advantages and drawbacks of these two approaches from the econometric point of view? Additionally, following important econometric principles, how would author assess the issue of multicollinearity e.g. in the original Z-score model (containing for instance two “earnings-related” variables RE/TA and EBIT/TA)?

Further, I did not understand the reason for non-bankrupted company to have “*on average 4.4 observations in the final sample*” compared to bankrupted. Can this be made clear during the defense. Also the winsorization of data should be more described (e.g. to what extent it was really needed etc). Final dataset is very well described, various descriptive statistics are calculated and an overall analysis with general interpretation of those figures is provided. I liked this part very much.

Wrt to 6. Methodology part directly, I like the utilisation of ROC curve, but the author should be aware of the fact that it is not correct to minimise the type I and type II errors separately as these are interconnected via a reciprocal proportion. In Eq. 2 the trapezoidal rule might have been explained a bit or cited and also it is not formally clear what is being optimised and how (min, max?).

Finally, I like the final “test of economic value” in 6.2 but it seems to me as a rather complicated simulation-based analysis in which several aspects such as a random seed control, robustness checks, or multiple hypotheses testing problem deserve a proper attention which is in a contrast with a rather simple and short (one page) description provided.

## Literature

The literature review is rather standardly elaborated and covers a rather large set of important works of the field related to the specific research objective starting from 30s’ going to the most recent work of Edward Altman and his colleagues from 2017. Thus, it offers a well balanced survey of historical and the most recent approaches.

It would be nice to see an attempt for some advanced analysis of the literature instead of a “paper-by-paper” descriptive approach. Some patterns or tendencies in the related research might have been discovered, papers might have been clustered according various dimensions of interest, important similarities and differences among papers might have been detected and highlighted. However, this is a rather frequent imperfection of many bachelor and even master theses.

In 2.2.3. the author suggests that “*factors have to follow multivariate normal distribution-which is in terms of financial ratios not very common*”. This and several following statements are rather strong, thus deserving citation, which is, unfortunately, missing. Moreover, can you think about any estimation method where you do not get “*only an approximation of true values*”?

The final Bibliography section seems consistent and in accordance with citation standards.

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## Manuscript form

The thesis is generally standardly structured and written in a decent English. The reader will enjoy a nice time reading this work. The flow of ideas and topics has a clear logical structure and the flow of results is well connected with their interpretations.

Some minor imperfections:

- Improper wording: *“models became in academic research mainstream”*.
- Footnote 8 should definitely not be a footnote, the information clearly belongs to the main text.
- Section 3. Hypotheses and motivation should not provide *“the big picture motivation for the thesis”*, the Introduction should.
- In Table 9 it was not clear to me not clear to what variables these desc stats relate.
- Pg. 39, *“Our results are leaning towards Agarwal and Taffler’s remarks”*... towards or against?

I detected only a minimal number of typos:

- no comma pg. 13: *“recent studies, found a solid degree”*.
- I did not find Tables 7 and 8 in the text.

## Suggested questions for the discussion during the defense

Except several questions already suggested in the previous report, I would be interested in how these models perform shortly before or at the beginning of a turbulent period such as global financial crisis was. Does the author have some expert opinion/guess about this issues? Do you think the results based on 2012-2017 data would be robust with this respect? Actually, can the evolution of the Z-score be used as one of the red flags for a looming crisis? How could this warning signal work in general.

## Summary

I do find this thesis well meeting academic standards for bachelor theses written at IES. Personally considered, a clear research idea and its fair elaboration are the most distinctive qualities of the work. I am thus pleased I can recommend the thesis of Michael Dibon to defense at the IES FSV UK and in case of a successful defense during which Michael manages to answer some of my questions, I suggest grade “B”.

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

CATEGORY	POINTS
<i>Contribution</i> (max. 30 points)	28
<i>Methods</i> (max. 30 points)	24
<i>Literature</i> (max. 20 points)	16
<i>Manuscript Form</i> (max. 20 points)	14
<b>TOTAL POINTS</b> (max. 100 points)	<b>82</b>
<b>GRADE</b> (A – B – C – D – E – F)	<b>B</b>

**NAME OF THE REFEREE:** Jiří Kukačka

**DATE OF EVALUATION:** 4. 6. 2018

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Referee Signature

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## 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.

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

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

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

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

## Overall grading:

TOTAL	GRADE
91 – 100	<b>A</b>
81 - 90	<b>B</b>
71 - 80	<b>C</b>
61 – 70	<b>D</b>
51 – 60	<b>E</b>
0 – 50	<b>F</b>