

Report on Bachelor / Master Thesis

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

Student:	Zankoo Abbaspour
Advisor:	prof. Ing. Evžen Kočenda MA, Ph.D., DSc.
Title of the thesis:	Natural gas in the EU: An empirical study of price determinants in the age of blooming shale gas and LNG exports

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 This is a well executed applied econometric article. While the author does not present any really new original ideas or approaches, he still displays quite a good level of understanding of both subject of his thesis (gas pricing) and the econometric technique used. The thesis provides a good value added to the applied econometric analysis of the natural gas pricing.

Methods The student is using state of the art methodology well above the standard required econometrics curriculum required from IES students. The technique used is appropriate for the analysis of this diploma thesis. The thesis topic is nicely comprehensively analysed well above a plain applied econometrics regression exercise – student is showing a good understanding of the gas pricing topic analysed in this thesis. The thesis is very much focused on a use of one particular technique without extensive comparisons with other standard techniques.

Literature The author quotes relevant literature in a proper way. The thesis provides a good literature review of many relevant papers. Nice feature of this literature review is a clear connection of the reviewed papers with this diploma thesis. While the list of literature is quite extensive, covering many relevant articles, some important recent works are missing, for example:

M Su, Z Zhang, Y Zhu, D Zha Data-Driven Natural Gas Spot Price Forecasting with Least Squares Regression Boosting Algorithm *Energies*, 2019

M Su, Z Zhang, Y Zhu, D Zha, W Wen Data Driven Natural Gas Spot Price Prediction Models Using Machine Learning Methods *Energies*, 2019

H Ghodusi, GG Creamer, N Rafizadeh Machine Learning in Energy Economics and Finance: A Review *Energy Economics*, 2019

D Zhang, T Wang, X Shi, J Liu Is hub-based pricing a better choice than oil indexation for natural gas? Evidence from a multiple bubble test *Energy Economics*, 2018

Manuscript form The thesis is well structured. However having two sections (section 7 and section 8) with exactly the same title (Methodology) is not a good notation. Also the student should realize that during the discussion of the results (like on page 40) it would be helpful for a reader not to see just coded variable name, but to have a clear identification of the variable in plain English. To read that the most important factor in forecasting of prices at the Dutch gas hub is how much the Scandinavian gas storages are filled up is much easier that to read that more than 50% of the total percentage gain comes from the NP_full_ugs (yes, the meaning of NP_full_ugs is clearly explained on pages 31 and 32, but especially for the most important results, it does not hurt to be easy on the reader). To be fair, this addition of plain English explanation of coded variable names is done in some places (see page 44).

Summary and suggested questions for the discussion during the defense

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As properly indicated in the acknowledgement of this thesis, this thesis belongs to a wide stream of IES energy economics research supported in the sequence of broad EU projects (ECOCEP, GEMCLIME, GEOCEP) on energy and climate change economics.

The thesis shows that the most important features explaining the day-ahead prices at the most important European natural gas hub (Dutch Tittle Transfer Facility) are the filling rates of natural gas storage facilities in Scandinavia, Baltic States and Central Eastern Europe and the previous day value of this dependent variable (natural gas price at Dutch Title Transfer Facility).

The importance of 1 day lagged dependent variable is intuitively very clear. The importance of storage facilities in such marginal places, far away from Dutch hub, like Baltic States (similarly Scandinavia and Central Eastern Europe) is much less obvious – consequently it is discussed in detail on pages 47-49 (mainly with respect to really marginal Baltic States storages, with just a paragraph dealing with less marginal Scandinavian and Central Eastern European storages).

In the literature review and in the introduction a lot of attention is given to explaining the evolution of natural gas pricing from oil linked contracts to hub pricing. However the empirical part of the thesis is focused on non-oil price factors. During the defence the author could elaborate more on the question of possible relevance of oil prices for prediction of natural gas prices at Dutch gas hub.

The title of thesis is very explicit about shale gas and LNG exports (probably meaning LNG imports to Europe). The empirical results do not support significant importance of shale gas and LNG imports for European natural gas pricing, therefore author should talk more about shale gas and LNG during defence. In particular, the inclusion of LNG imports into estimation (the data, variables, used) should be thoroughly explained during the defence.

Another key feature of this thesis (beside already mentioned role of oil prices versus other determinants of natural gas price and shale gas/LNG imports) are the renewables. In the light of low connection of Iberian market with the rest of Europe, as emphasized in the thesis, how does the author explain that out of included renewables, the prominent ones are Iberian (Spanish) solar (and to a lesser degree Iberian wind) rather than German or Danish renewables?

Since the XGBoost algorithm used in this thesis is good in dealing with missing data, why author focused just on 2018-2019 period (actually the data go from December 2017 to October 2019 – why this particular starting date (December 2017) is used?). Author writes that data are resampled to daily granularity – could the author be a little more specific? Does he have available data for all used variables for totally every day of the year?

When the author introduces the term non-associated gas, he should make it clear that this refers to the natural gas coming from reservoirs that contain only natural gas and no oil.

On page 18, I do not see from Fig 5-1 how „ households accounted for nearly half of the natural gas consumption.“

On page 18, is water heating in residential sector really significantly impacted by the outside temperature?

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On page 19, NWE and CEE should be clearly defined. While CEE is defined in Appendix A, NWE is not defined there. Why just Italy is added? Why not to add Iberian peninsula or for that matter any other country or region or going for the whole Europe? The author should clearly warn reader that his definition of EU-27 and EU-28 is not just European Union with and without UK. In the definition of EU_28, EU_27 on page 55, why Slovenia is in EU_28 and not in EU_27. What about Ireland, which is not included? Is Ireland connected to the rest of European gas system through UK connection?

On page 22, it would be good to explain CHP in Fig 5-5 sooner than on page 24.
On page 27, DA- October, DA-March (probably meaning day ahead) should be clearly explained.

I consider this thesis to be a very good C thesis, definitely deserving to be evaluated as passing thesis for obtaining IES Mgr. Degree.

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

CATEGORY	POINTS
<i>Contribution</i> (max. 30 points)	25
<i>Methods</i> (max. 30 points)	25
<i>Literature</i> (max. 20 points)	15
<i>Manuscript Form</i> (max. 20 points)	15
TOTAL POINTS (max. 100 points)	80
GRADE (A – B – C – D – E – F)	C

NAME OF THE REFEREE: **Karel Janda**

DATE OF EVALUATION: **January 15, 2020**

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.*

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.*

LITERATURE REVIEW: *The thesis demonstrates author's full understanding and command of recent literature. The author quotes relevant literature in a proper way.*

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.*

Overall grading:

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