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VERIFICATION OF THE FORECASTS FOR FIRST GENERATION BIOFUEL PRODUCTION IN POLAND IN 2006-2008

Abstract: The article runs a verification of biofuels production forecasts in Poland in years 2006-2008, which have been provided with the use of one of the three models presented in the author's previous article. There has also been conducted a short analysis of events influencing biofuels market situation in Poland in years of the forecasts verification, the conclusions of which allow to claim that the most appropriate would be variant forecasts of bioethanol and biodiesel production output in Poland, which are the mixture of quantitative and expert methods.

Key words: biofuels, quantitative and expert forecasting methods, formal models of the 2nd type, *ex post* errors.

1. Introduction

Being a member of the European Union, Poland has started its compulsory engagement in biofuels since 2005. The market has risen hopes for economic, social and ecological benefits among the fuel producers and consumers, farmers and ecologists. In order to determine the future prospects for biofuels in Poland, there has been undertaken an attempt to state long-term forecasts for the production of bioethanol and biodiesel – first generation biofuels (the models and the forecasts were presented in the article [Szabela-Pasierbińska 2007]).

The following article presents the verification of the forecasts for years 2006-2008, which have been provided with the use of one of the three models presented in the article mentioned above. There has also been conducted a short analysis of the events which influenced the situation on the biofuel market in Poland in the years of the forecast verification. The conclusions of this analysis have become the basis for further suggestions relating to the prediction of bio-fuel production in Poland.

2. The *ex post* errors in biofuels production forecasts in Poland in 2006-2008

As mentioned in the introduction, the forecasts which undergo the verification have been provided on the basis of one of the suggested in [Szabela-Pasierbińska 2007] formal models of the 2nd type, which have been assumed as the most credible one. The model was as follows:

$$\hat{y}_t = \frac{1}{0,000149 + 0,00945 \cdot 0,614052^t} \quad (1)$$

It should be remarked that when setting the parameters for the model there were taken into account the opinions of experts: the director of Telstar Oils, the company which estimated biodiesel production in 2008 amounted to the level of 300,000 tons, who assumed faster production growth of that fuel in the further years; and the Ministry of Agriculture, which predicted bioethanol production to reach up to 370,000 tons. The saturation point was accepted on the level of 6,720,000 tons, i.e. 20% biofuels share in the total amount of liquid fuels used in transport in 2005. The model estimated in such a way became the basis for the yearly forecasts of biofuels production from 2006 to 2020. Their values are shown in Table 1.

Table 1. The forecasts of bio-fuel amounts produced in Poland (in thousands of tons) for years 2006-2020 calculated on the basis of the given model (1)

Year	2006	2007	2008	2009	2010	2011	2012	2013
Production	269.36	427.88	670.00	1026.77	1525.61	2174.25	2942.45	3757.70
Year	2014	2015	2016	2017	2018	2019	2020	
Production	4528.07	5180.20	5682.76	6042.73	6287.29	6447.52	6550.03	

Source: [Szabela-Pasierbińska 2007].

On the ground of the real values of bio-fuels produced in Poland in 2006-2008, there have been estimated absolute and relative *ex post* errors in the forecasts. The results are presented in Table 2.

Table 2. The real and the forecasted values of biofuel production in Poland in 2006-2008 as well as absolute and relative *ex post* errors for years 2006-2008

Years	2006	2007	2008
Real values (thousands of tons)*	218.77	289.65	385.48
Forecasts (thousands of tons)	269.36	427.88	670.00
Absolute <i>ex post</i> errors (thousands of tons)	-50.59	-138.23	-284.52
Relative <i>ex post</i> errors (%)	-23.13	-47.72	-73.81

* Data of Energy Regulatory Office.

Source: author's own study.

The forecast was overrated in relation to the real amount for each of the examined years (the forecasts have been burdened) – average per cent *ex post* error in forecasts (MPE) in 2006-2008 amounted to -48.22% , the value which overrated accepted 10% (which is the error acceptable for companies ordering their fuels from PKN Orlen).

3. Factors which influenced bio-fuels production in the period of forecast verification

In years 2006-2008 there occurred several events which affected country's production of first generation biofuels, and resulted in quite a significant discrepancy between the presented forecasts and the real production of biofuels in Poland. The main reason for the mentioned discrepancy seems to be the Minister of Finance Order dated on 22 December 2006 which changed the order concerning excise duty exemption dated on 26 April 2004. It made the hitherto biofuels production unprofitable as the result of lowering the government subsidy by half. That in turn led to a decrease in biofuel producers number – according to the bio-components produced and sold in 2007 specification, prepared by the Energy Regulatory Office, there were 88 companies producing, storing or marketing bio-components in the first quarter of 2007, whereas the number dropped to 63 in the fourth quarter of that year. The mentioned order also slowed down previously planned biofuel investments, for example, the building of bioethanol factory in Skarbimierz in Opolskie district [*Produkcja paliw...* 2008].

Due to the changes in excise tax policy, one of the main bio-fuels producers in Poland – Lotos, stopped the process, started in 2006, of adding methyl esters to diesel oil, as it could not be economically justified [Pańczyszyn 2008]. Although there were introduced two new acts in 2007 (the act of changing the excise duty act and of changing some other acts dated on 11 May 2007, as well as the act of changing the act of business entity income tax dated on 23 August 2007) which were meant to soften the effect of the mentioned above order, they are not applicable in practice as they did not obtain a positive decision by the European Commission (the Commission still requests the Polish government administration to complete the documentation sent to Brussels) [*Wsparcie rynku...* 2008]. Producers have named 2007 the year of a biofuel slump.

Another unfavourable effect of the legal situation is a significant rise in import of biofuels from Western Europe. According to GUS (the Main Statistical Office) data, the import of biofuel in 2006 amounted to over 2.2 thousand tons, and over 22.2 thousand tons in 2007. The price for the product quoted by foreign producers occurred to be more competitive for the two biggest oil concerns – Orlen and Lotos. In case of biodiesel, years 2006-2007 brought the import of only 142 tons whereas in 2008 there were imported to Poland 200.8 thousand tons of that bio-component, mainly from Germany, Switzerland, Czech Republic, France [*Rośnie polski...* 2009].

As it occurs then, only half of the total rough material for biofuels and bio-components production in 2008 came from the country's sources, although, as the Ministry of Agriculture claims, Polish agriculture could have fully satisfied the needs of the Polish biofuel market [*Ministerstwo Rolnictwa...* 2009].

A big demand for cheaper West-European bio-components among the country producers in 2008 was mainly a result of another legal norm – 2008 was a year in which each liquid biofuel producer or importer was obliged to fulfil the National Index Goal (NCW) – the order stating percentage of bio-component which each producer has to include in the general amount of biofuels sold, traded or used for his own purposes. In the year discussed, the index was determined at 3.45% and was obtained by twenty-five (out of twenty-eight) entities. The Energy Regulatory Office chairman started the proceeding aimed at imposing a financial penalty for the three remaining entities which had not complied with the minimal share requirement. It needs to be remarked that applying bio-components by Polish oil companies is unprofitable, and NCW is regarded as an unjustified economical duty.

4. Polish bio-fuel market after 2008

The difficulty in predicting the bioethanol and biodiesel production in Poland results mainly from the instability of legal environment of biofuel market. It is known that NCW for years 2009-2013 should reach the following values: 4.6, 5.75, 6.2, 6.65, and 7.1%, and missing the given values may lead to heavy penalties. Oil concerns had related obtaining the 4.6% biofuels share in 2009 mainly to the fact, whether the European Commission will allow adding bigger amount, i.e.7% share of bio-components to the mineral fuels (which is presently on the level of 5%) and whether it will accept the changes to the excise duty act dated on 11 May 2006, which would improve profitability of B100 fuel (pure biodiesel) sales through the abolition of obligatory fuel charge and through lowering excise to the level of PLN10 per m³. The regulations of that type were finally positively accepted by the European Commission in September 2009. There was also noted a record breaking bumper harvest of rape in 2009 – 2 million 400 thousand tons. It is almost double as much as in 2004. It is predicted that the rape production may reach 3 million tons in a few years' time, which, as the processing companies claim, will allow to produce enough amount of bio-fuels and satisfy the requirements of their consumption [*Biopaliwowe zmiany* 2009]. However, the oil industry representatives still demand either lowering of NCW, or postponing its obtaining in time, or its total cancellation. One needs to remark though, that article no 24 of liquid biofuels and bio-components act states that only in case of unusual events occurrence resulting with the change of conditions for biomass or agricultural resources supply, the government may lower the currently valid NCW for a given year in the form of an order. The situation does not seem to be likely in the closest future.

The performance of year 2008 showed that bio-components producer branch development mainly depends only on the governments' consequent policy applying the compulsory bio-component use, whereas NCW implementation did not result with the full use of country's resource and bio-fuel production potential.

Forecasting country's production of these products depends also on price competitive bioethanol from Brazil and the United States as well as biodiesel from Western Europe. Polish producers are trying to block bio-components import by introducing legal regulation stating the compulsory certification of bio-components origin on the home market. That would oblige home companies to purchase their resources only from the certified suppliers [*Producenci biokomponentów...* 2009]. Moreover, bio-components producers (including foreign ones) can protect their future by signing contracts for bio-components supplies with fuel producers. If compulsory certification was introduced and oil concerns contracted their bio-components supplies from home producers, the forecasts for production and use of bio-fuels in Poland would be basically limited to predicting liquid fuels use in Poland and then calculating the shares reflecting NCW in preceding years.

It must be taken into account though that in order to minimise the costs of introducing bio-fuels on the Polish market, home companies will extensively use cheaper bio-components from third countries such as the United States, Brazil or Malaysia, as the concerns (Orlen and Lotos) will lose about PLN330 million in 2009 due to the legal requirement of bio-fuel sale [*Koncerny muszq...* 2009]. Such being the case, bioethanol and biodiesel production forecasts in Poland calculated as a share in general liquid fuels use should undergo a relative current correction. The situation would be similar if less controversial second generation fuels came into general use.

Following the considerations above, the most appropriate in such a case would be providing variant forecasts. Besides, assuming that due to their accuracy, businesses find the mixture of quantitative and expert methods very effective [Makridakis, Wheelwright, McGee 1998, pp. 503-508; Montgomery, Johnson, Gardiner 1990, pp. 8-10] the forecasts' variants could be calculated on NCW basis and then experts could modify them considering the qualitative changes as well as their own predictions and future assessments. The experts should represent oil industry, agriculture and home and European law environment. When building the variant forecasts one could also apply subjective probability i.e. the probability of the forecasted event occurrence estimated by an expert [Dittmann et al. 2009, p. 206].

5. Conclusion

Conducted in section 2 of the article forecasts' monitoring, i.e. checking their accuracy in order to state whether they are burdened or whether their errors do not go over given tolerance range [Dittmann et al. 2009, p. 223], revealed that model (1) had not supplied satisfactory forecasts for years 2006-2008. In spite of the fact that model parameters had been set on the basis of bio-fuel experts' opinions, it had not taken

into account most of the mentioned in the article factors of definitely qualitative character. However, if it was assumed that the forecasts built concerned used (not only country produced) bioethanol and biodiesel, 2008 forecast error would be about 14%.

The biofuel market in Poland will undoubtedly develop. Experts of Krajowa Izba Biopaliw (National Biofuels Chamber) estimate that if there was introduced 5.75% of bio-components in 2010, which would fulfil NCW target for that year, the demand for imported oil would decrease by 2.47 million tons and expenses related to that by PLN4.56 million [Pańszczyżyn 2008]. It is not known though whether producers, drivers, farmers and ecologists would benefit from that in the same range.

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WERYFIKACJA PROGNOZ PRODUKCJI BIOPALIW PIERWSZEJ GENERACJI W POLSCE W LATACH 2006-2008

Streszczenie: W artykule przeprowadzono weryfikację prognoz produkcji biopaliw w Polsce w latach 2006-2008, które wyznaczone zostały za pomocą jednego z trzech modeli zaprezentowanych we wcześniejszym artykule autorki. Przeprowadzono również krótką analizę wydarzeń kształtujących sytuację na rynku biopaliwowym w Polsce w latach weryfikacji prognoz, a wnioski z niej wynikające pozwoliły stwierdzić, iż najstosowniejsze byłyby prognozy wariantowe wielkości produkcji bioetanolu i biodiesla w Polsce, będące kombinacją metod ilościowych z metodami eksperckimi.