Crop production costs in Austria: Validation of simulated results using farm observations

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***Abstract* - This paper compares simulated crop production cost data against observations made on farms. The data to be validated are taken from INCAP ('Index-based Costs of Agricultural Production') which is a detailed engineering data set on production costs in the Austrian agriculture. INCAP's purpose is to capture different production characteristics and management variants in Austria. Results are compared with cost accounting data from farm records in Lower Austria. The results show that the levels of various cost items are similar but that deviations in other cost items need further research.**

Introduction

In agricultural risk analyses, relevant developments or events are usually measured in economic terms resulting in a positive or negative impact on farm incomes. The newly developed 'Index-based Costs of Agricultural Production' (INCAP) data set is designed to make such analyses possible by covering all relevant production activities of the Austrian agricultural sector (Heinschink et al., forthcoming and Heinschink et al., 2016). Data derived from INCAP can be used as a tool for examining risk in Austria's agricultural sector, such as fluctuations of activity-specific gross margins, farm-specific incomes or incomes at sector level. The data used for INCAP are not based on cost accounting data of farms but are derived from many sources. INCAP is therefore an engineering data set and the quality and validity of results is therefore an open question.

In this presentation INCAP results are compared with statistics based on observations of farms for the same crops. The question is if the level of different cost items, if yields and prices are similar or systematically biased. Apart from averages, second moments are also compared.

Structure and Data

INCAP covers the most important production activities relevant in Austria's agricultural sector (plants: arable crops, feed, hay, silage, grazing; livestock: suckler cows and calf production, dairy cows and milk production, heifer rearing, bull fattening, piglet production, pig fattening). Currently the activities comprise three dimensions: (a) attributes that aim at differentiating costs, e.g. by management variants, (b) quantities and prices, and (c) time. The attributes considered for plant activities include field size (in ha, continuously adjustable), two farming systems (conventional, organic), two tillage systems (standard, conservation), two labor types (farm family labor, hired labor), two climate types (dry, humid) and three plant protection intensities (high, medium, low). The baseline data set is established for the reference period (annual average 2012-2014). To capture changes over time, yield data is indicated by year (using statistics of Statistik Austria) and indices are applied to each input and output price component in the reference period.

Naturally, technological coefficients differ by activity. For instance, the work steps and the machinery specified for wheat production differ from the work steps and machinery in soy production. In addition, technological coefficients vary based on the assigned attributes with respect to the work steps involved, the machinery used and the number of applications. Apart from that, technology is fixed over time. This implies that the INCAP can be used to analyze adaptations of currently existing systems to varying price conditions but only in a static manner. For longer term studies, technological shifts need to be represented explicitly which is currently not the case.

INCAP is derived from existing data repositories (primarily from AWI, 2015). The data used in the validation exercise presented in this paper is sourced from farmers' working groups. Many farmers in Austria who are interested in improving the economic performance of their farm are collaborating in working groups where they meet in order to discuss problems, to work on solutions and where they exchange experience on production activities and economic outcomes. Experts from the local chamber of agriculture are coaching the participants of working groups, are handling the data, support the discussion process and give advice to solve problems at hand. An annual report on the economic results of farms in the best and least performing brackets gives individual farmers feedback on their position in the group of peers. Statistics based on the data are collected and published for those who contribute to their generation. A small sample of such 'working group cost data' was made available for the purpose of this validation study.

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Methods

The validation of INCAP results is carried out in two separate steps which are repeated if necessary. In the first step, a set of cost items is prepared for validation. For INCAP, a decision on attributes is necessary that fits to the data of the farms in the sample (e.g. the type of climate, the region, the prevailing production system). For working group cost data, statistics on averages of cost items and their volatility over time are calculated and documented. INCAP and working group data are then juxtaposed (Figure 1). In the second step, experts involved in farmer's working groups and developers of INCAP systematically explore deviations and fine-tune the parameters used in INCAP. Such an interactive collaboration not only gives a better fit of simulated and observed results, but also makes it possible to account for the heterogeneity of production on farms.

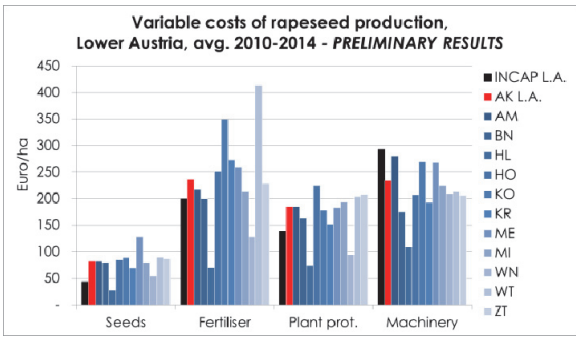

Figure 1. Comparison of a specific INCAP rapeseed production activity in Lower Austria ('L.A.', column 1) with working group cost data (column 2: average for L.A.; remaining columns: averages for eleven districts in L.A.).

Selected Preliminary Results

We compare INCAP results for rapeseed production from 2010-2014 using the following combination of attributes: dry climate in Lower Austria, conventional farming, standard tillage, medium intensity of protection, hired labour for harvest, own labour for all other work. These results are compared with the averages of district-specific data from the working group cost data set.

The comparison shows that INCAP costs for seeds are very similar to observed working group cost data. This is also true for fertilizer costs. Such a correspondence is remarkable given that INCAP costs are based on yield-specific nutrient requirements whereas farmers report actual expenses.

The comparisons of machinery and plant protection costs require further scrutiny because deviations are notably larger. By time of writing this abstract, results are preliminary. More elaborated results on the validation will be presented at the conference.

Scope for Improvements

By design, INCAP offers a large number of combinations of production activities, management systems and production characteristics. Corresponding information in the working group cost data set is available only for some of these combinations. One reason is that the number of farmers in working groups is relatively small.

Currently only data from one production region are used to validate INCAP data. A necessary improvement is to collaborate with more working groups in order to extend the spatial scope. Another extension is to include additional plant and livestock production activities.

Conclusions

This paper presents results that are derived from an active collaboration between farmers, experts in extension services and researchers. The quality of data used in applied research can be significantly improved by combining the expertise of all three groups. In order to provide tangible benefits for farmers, further efforts are necessary. It is intended to publish an improved version of INCAP in an accessible format that experts in extension services can use for their consultation purposes. Promising applications for farmers are farm-specific simulation or optimisation. In particular, such farm-specific analyses could focus on the economic outcomes of various sets of production activities, of alternative production systems or of alternative management variants.

In its current version, INCAP is designed to match existing production systems and management variants. Once an acceptable fit between simulated and observed results is achieved, an even more ambitious goal can be targeted: In order to help farmers to make good choices in situations that are likely to occur as a consequence of climate change, it will be necessary to develop a further improved version of INCAP.

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