Chapter 7. General conclusions

Estimating functions such as planted area functions or demand functions is time-consuming work for a model with one commodity in a specific country. To produce a supply and demand model of an agricultural commodity in a specific country, 2–3 years were needed.

Results of crop yield estimation in our project have indicated a grid level in the world. Therefore, the target regions must be split into units that are as small as possible.

Obtaining price elasticities of supply, input demand and food demand are crucially important issues that must be resolved to develop a world food model. The Cobb–Douglas production function is quite popular in economic research. Nevertheless, the elasticity of substitution is well-known to be limited to one. Although this is a tight restriction, this function presents useful benefits.

The first-order condition of profit maximization reveals that the parameters of the production functions of each input are equal to the cost share to the output. Therefore, the parameters of the production functions can be ascertained if the cost shares are obtained.

Input demand functions will be derived by solving the profit maximization problem if one-time parameters of the Cobb–Douglas production function are obtained. Furthermore, by substituting these input demand functions into the production function, a supply function will be obtained.

Results of this study show how to ascertain the price elasticity of supply and input demand based on a Cobb–Douglas production function. This framework is extended to the food demand side: the price elasticity of food demand is derived from the input demand system of agricultural goods. An important shortcoming of this demand approach is that income elasticities are independent of the system. If commodities are aggregated to groups such as cereals or meats, then elasticities of demand will be easily estimated using the system-wide approach proposed by Theil (1980). This commodity block-wise system must be used to support the consumer demand analysis in the world.

For this study, the crop yields are estimated using logistic and log linear functions with variable climate factors. The results are reasonable. Especially, the results revealed that not only Sub-Saharan African and south Asian countries but also some economically developed countries are expected to be adversely affected by climate change.

For further precise analyses, estimated yields of the CYGMA crop model (Iizumi et al., 2017) are used in a revised version of the world model applied for the study described herein. In addition, updating forecasts of macro-economic variables is necessary because recent economic conditions are stagnating because of inward-looking policies in many countries.

This model will be useful for trend analyses of supply of nutrition elements and economic evaluations of new agricultural technologies such as dissemination of high-temperature tolerant varieties of crops in economically developing countries under climate change. Corresponding to these purposes, tubers and vegetables will be added to the target commodities of this model.

It can be easily extended to the target commodities and countries if production cost shares and launch-pad data available even for a short period. Therefore, the framework of this model is suitable for evaluating the effects of climate change on food supply in economically developing countries.

The purpose of this study will be attained if this model is used as a platform for analyses of climate change effects.

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