Global food supply meets global food demand: Should we bother about the household distribution in global CGE models?

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Abstract

During the last years, an increasing number of studies was appearing which analyze food security issues through the prism of global CGE models. Nevertheless, that within the modern literature the close link between poverty, food insecurity and vulnerability is well defined, global CGE models still tend to use the concept of the single representative agent or household within their analysis. This approach is capable to depict between countries differences in the state of food security, however, it is limited to provide valuable insights about the food security situation of particularly vulnerable socio-economic groups within countries. Within the present study, we aim to compare the features of integrating, disintegrating and merging CGE and alternative type models for the assessment of the medium-long term changes of food security. The particular focus is made on the role of aggregation of households in the assessment of issues of food security.

Keywords: CGE modeling, food security, household survey

Introduction and motivation

Over the last 50 years, the world community was able to achieve a remarkable progress in the performance of global food system. It was so prominent that even in the far 1996 it was possible to state that each person in the world could have in theory a sufficient amount of food available for his daily consumption (FAO, 1999)[1]. However, this appearance seems to be rather deceptive. The latest FAO data on global food insecurity indicates that at the same time when the world food supply has reached 2874 kcal/capita/day (FAO, 2016), 793 million people still suffer from chronic hunger in 2015 (FAO, 2015). Nevertheless that the number of undernourished people was decreasing over the last 20 years, the final date of the capitulation of Global Hunger still seems to be unknown.

Recent studies of the AgMIP research group have shown that the average food demand is projected to increase in the range from 62% to 98% by 2050 (Valin et al., 2014). These high numbers raise additional concerns for the international community, policymakers and researchers, who are generally asking the question if the world production systems are actually able to meet such high targets. The underlying and emerging trends and driving forces of global food security such as the population and economic growth, changing of the food market policies, degradation of natural resources and increasing water scarcity might diversely influence the food security situation in various regions. Moreover, the current situation clearly indicates that not everyone has an access to the required food consumption minimum, even if the sufficient amount is available at the global level. Hence, the challenge which our society will face in 2050 is not only how we can increase global food supply in order to meet the future global food demand, but in particular how changes on a global level affect the regional food distribution and thus the household's access to food.

During the last years, an increasing number of studies was appearing which analyze food security issues through the prism of global CGE models (Anderson & Strutt, 2014, 2016; Shutes &

[1] In 1996, the world food supply was equal to 2674 kcal/capita/day (FAO, 2016)

Kuiper, 2014; M Van Dijk & Meijerink, 2014; Michiel Van Dijk et al., 2013). Nevertheless, that within the available literature the close link between poverty, food insecurity and vulnerability is well defined, global CGE models still tend to use the concept of the single representative agent or household within their analysis. This approach is capable to depict between countries differences in the state of food security, however, it is limited to provide valuable insights about the food security situation of particularly vulnerable socio-economic groups within countries. In recent years, several attempts were made to extend standard CGE modeling approaches in this regard. There are three major directions to consider disaggregated households in CGE analyses. First, e.g., Bouet, Estrades, and Laborde (2013) and Shutes and Kuiper (2014) disaggregate a single representative agent into multiple households within the same modelling framework in order to depict the effects of heterogeneous households[2]. Second, e.g., Wiebelt et al. (2013) utilize the combination of global, regional CGE models and microsimulations to assess the food security situation in Yemen. Third, to analyze the poverty effects at the household level, which in nature are close to the assessment of food security, Boysen and Jensen (2016) link the GTAP model with a country-specific CGE model for Uganda.

In light of the differences of approaches a comprehensive overview of features of integrating, disintegrating and merging global CGE with alternative models' types for the assessment of the medium-long term changes of food security is clearly required. The assessment will be conducted on the basis of reviewing of recent studies where key elements of food security, such as food availability and food accessibility were evaluated by methods of CGE modelling and additionally on studies where issues of household disaggregation and income distributions were implemented. The particular focus is made on the role of aggregation and heterogeneity of households in the assessment of issues of food security and methods of its implementations. The next section provides the broad overview of current methodological approaches for modelling food security within CGE framework and facilitate the discussion of the model choice.

Overview of available approaches

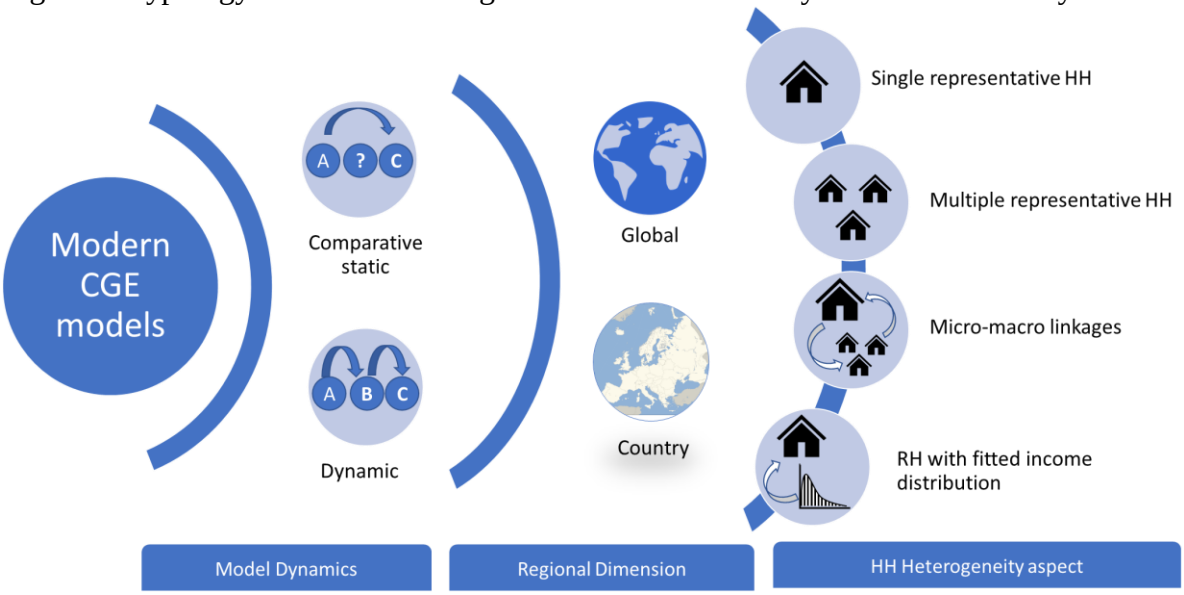
The definition of the Food Security was going through the substantial refinement along the history. Thus we are able to observe the smooth transformation of definition from representing the purely supply side point of view in 1974 to the much more inclusive approach of individual demand and consumption at the end of the 20th century (FAO, 2003). The most actual definition of the Food Security states that the Food Security exists "…when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 2002). This definition clearly indicates the fundamentally local status of the problem. At the same time, it does not deny that the individual's food security is undoubtfully influenced and evolves under the set of the macro-level factors, such as changing of the aggregated food supply, demand and related prices. That is why modern analytical and modelling frameworks for analysis of food security should clearly include linkages between the individual, household, national and international levels (Laborde et al., 2016; Pieters et al., 2013).

Historically CGE models became a workhorse for analysis of the macroeconomic drivers and macro-level policies due to its strength in depiction of interactions between different agents,

[2] Bouet, Estrades, and Laborde (2013) are utilizing the Mirage-HH principle and Shutes and Kuiper (2014) are utilizing MyGTAP principle.

economic sectors and markets (Nelson et al., 2010; Van Ruijven, O'Neill, & Chateau, 2015). Considering the close link between the topic of food security, food production, consumption and trade, there is no surprise that substantial number of studies are already directly or indirectly discussing various aspects of the food security[3] utilizing either global or regional/country CGE models with and without integrated dynamics. The global CGE models however tend to implement the concept of the single regional/country representative household which is quite often considered to be rather restrictive with respect to the depiction of distributional effects within regions (Bacchetta et al., 2012; Davies, 2009; Nelson et al., 2010). Shutes & Kuiper (2014) underline that due to the strong linkage between the source and level of household income, along with volume and pattern of consumption, the analysis of the food and nutrition security should be analyzed if not an individual household member level, but at least at much more disaggregated level than single representative household. This statement conforming to the recent discussion of issues of analysis of poverty within the GE framework (Hertel et al., 2015; Savard, 2005). Interestingly enough, country applications of CGE models opt to integrate some degree of household heterogeneity to their studies. Thus several existing overviews (Ahmed & O' Donoghue, 2007; Bourguignon & Bussolo, 2013; Colombo, 2008; van Ruijven et al., 2015) outline three broad groups of approaches for inclusion of the income distribution aspect and household heterogeneity that are fundamental for the analysis of Food Security (Figure 1).

Figure 1. Typology of CGE modelling structures used for analysis of Food Security



Source: Own elaboration

[3] Typically, food availability and food accessibility dimensions of food security were receiving attention of modelers.

Preliminary, expected or proposed results:

The preliminary analysis of the literature has shown that there is still a limited consensus between researchers regarding the structure and the required level of details in the assessment of effects of macroeconomic shocks on food security. Nevertheless, that implementation of a representative agent within CGE models produce comparable macroeconomic and sectoral results to alternative methods, it has a restricted potential for the assessment of effects on the vulnerable social groups, which are typically the subject of major interest and concern. At the same time integration of households' heterogeneity within various methods is greatly restricted by high data intensity required for its realization, along with the possible limited reconciliation between various databases (e.g., between surveys and model data).

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