Assessing the economic impact of COVID-19 on the agrifood system and on global food security: exploring different macro-economic and international trade scenarios

Keywords: COVID-19, Infectious Disease, International Trade, Food security, CGE Modeling

Introduction and main findings

In this study, we perform an ex-ante analysis of the economic consequences of COVID-19 virus in the short term with a focus on effects for agri-food markets as well as global food security impacts. In the short term (2020-2021), we assess immediate economic consequences of the pandemic, including repurposed domestic agri-food production and trade measures concerning medical necessities. We quantify different macro-economic (GDP, labour supply, oilprices) and trade (consumption preference) scenarios using an economy-wide modelling framework. The modelling results shed light on the impact of the pandemic on food security across multiple dimensions. We found that the impact of COVID-19 on agri-food production is less than on the production of manufacturing and services. Food prices drop due to the crises and low oil prices. The impact on the three dimensions of food security is strikingly different. While food availability issues are relatively limited, food access becomes under pressure in all COVID-19 scenarios and especially with a second crises in 2021. The food access impact, measured by a food purchasing power index, is opposite to the impact on agricultural prices indicating that income developments are key to be taken into account. Effective policies are needed to address especially the food access dimension for unskilled workers.

Scenarios

In this study we construct five scenarios to assess the impacts of the COVID-19 under different hypothetical contexts. In particular, we consider three macro-economic scenarios, including a Reference scenario without COVID-19 and two scenarios with COVID-19. The two COVID-19 scenarios are based on the IMF (2020) study, consisting of a single-wave COVID-19 scenario (called "Base"), and a scenario with a hypothetical second outbreak of the pandemic (called "IMF2"). In addition, we created two trade preference scenarios which simulate the policy response to COVID-19 of increasing self-sufficiency. Both trade scenarios build from our baseline scenario, Base, with the assumption of a single wave of COVID-19, while these scenarios differ in the implementation of shifts in consumer trade preferences (preferences for domestic products in each country of the world called Dom (10% shift), preferences for EU products within EU called EU (10% shift)).

Methodology

In this study, we assess the short-term macro-economic impacts of COVID-19 with a novel focus on agri-food developments and three dimensions of global food security: (i) food availability, (ii) food access, and (iii) food utilization (Van Meijl et al., 2020a, 2020b)). We use the MAGNET model (Woltjer et al. 2014, Hasegawa 2018, Van Meijl et al. 2020a), a multi-sectoral, multi-regional applied CGE model, with unique theoretical extensions in agriculture, bio-economy, climate change and food security, to quantify macro-economic and trade scenarios. The agriculture- and food-security- specific features embedded in the MAGNET model include: explicit land markets with defined land supply curves, segmented labour markets between agriculture and other markets, detailed agricultural sector aggregations, explicit treatment of nutrients, and the multiple dimensions of food security as aforementioned.

In light of the impact of the COVID-19 pandemic being largely sector-specific and short-term in nature, we made changes to several parameters in the model enabling it more suitable to conduct a pandemic-oriented analysis. The model has been configured for a short-term closure with the following assumptions : First, elasticities of substitution in certain parts of the model are lowered to reflect the expected short-term nature of the pandemic. Second, we prevent productivity changes within agri-food due to lower GDP. Third, labour

is assumed exogenous, and unemployment is taken into account. We target the unemployment rates reported in IMF (2020) where the global average is around 1.1% and the unemployment rates vary across regions.

To account for the various aspects of food security, we follow the FAO's definition of availability, access, utilization and stability (FAO, 2008, 2016). We derive model-based indicators for the first three dimensions: food availability, food access, and food utilization. These indicators have been developed and elaborated for the FOODSECURE and IPCC scenarios (van Meijl et al. 2020b, 2020a, respectively).

Results

The IMF COVID base scenario includes a global GDP loss of 6.8% and a drop in oil prices of about 40% which has next to the GDP impacts a severe impact on the world economy. We found that in the IMF COVID base scenario the impact on agri-food production is less than on the production of manufacturing and services. Agricultural production declines for crops, livestock and processed food with only 0.6%, 0.8% and 1.0% respectively. Agricultural prices decrease due to COVID-19 with 3.5%, 2% and 1.5% for crops, livestock and processed food relative to the reference scenario. However, in 2021 due a second COVID-19 crises in the IMF2 scenario prices for all commodities hardly increase and decline even further with almost 3% for manufacturing.

Figure 1: Food availability measured in kcal per capita per day available for consumption (% change relative to Reference scenario, 2021) globally and by region (EU=European Union countries, Rest OECD: Non EU OECD countries; REAP=Rest of East Asia and Pacific; MENA_FSU=Middle East, North Africa and Former Soviet Union; LAM=Latin America; China=China, Mongolia, Taiwan, Hong Kong; SAS=South Asia; SSA=Sub-Saharan Africa); Source: IMF (2020)

The dimensions of food security are affected in different ways. While the COVID-19 pandemic has a slightly negative impact on food availability on the global level (-0.3%), the impacts on regions vary in both magnitude and direction (see Figure 1). Our results do not show that regions at particular income levels are more vulnerable than the other regions in terms of food availability. With the additional policy experiments, our model suggests that a consumption shift towards domestically produced goods relative to imported goods may moderate the negative impact of the pandemic on food availability due to a production increase to compensate for the efficiency loss. By contrast, the preference shift towards EU products by EU countries

leads to an opposite effect especially in the EU region where food availability is expected to be more negatively affected. This negative effect at the global level is however negligible.

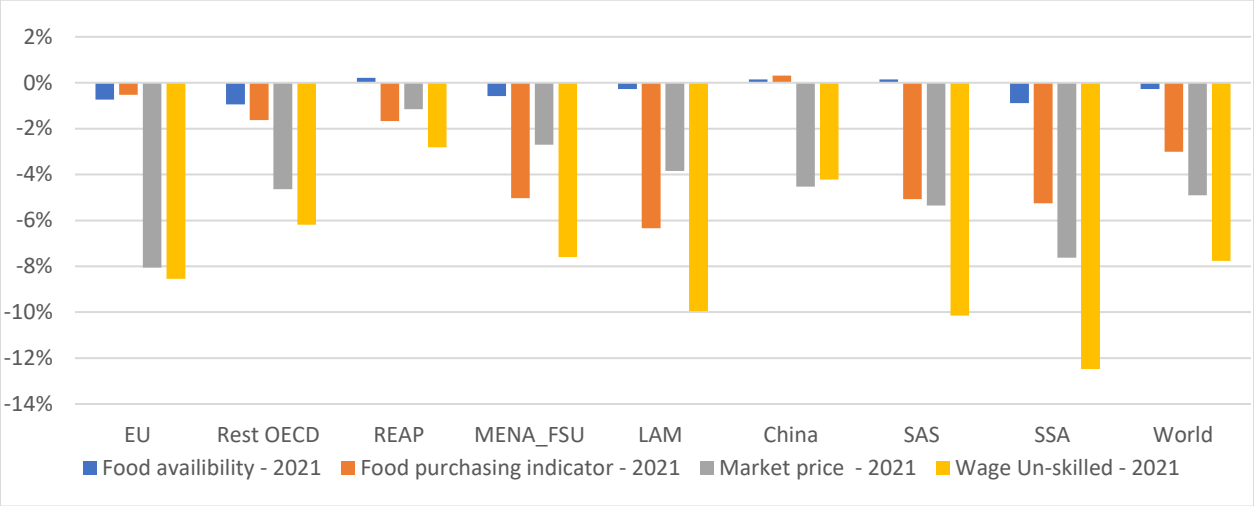

Figure 2: Food availability and food access indicators, including the two key components of food access (market prices and income of unskilled labour) (% change relative to Reference scenario, 2021).

While food availability issues are relatively limited during the pandemic, food access becomes under pressure in the Base and especially the IMF2 scenario. Despite the decline in food prices, food purchasing power index delines, as wages for unskilled people working in agriculture decrease even more. In general the decrease in food purchasing power of unskilled workers in agriculture relative to the Reference scenario is limited in East Asian countries including China and it is quite negatively affected in other developing countries including LAM, MENA_FSU, SAS and SSA, where the index decreases by around a 3 percentage point in the Base situation and a 5 percentage point in the IMF2 situation. These results show also that food prices alone are not a good indicator of food access and that income developments have to be taken into account in the times of crises especially when wages of unskilled workers come under pressure. Transition possibilities between economic sectors and lock-in effects are crucial to determine wage effects in segmented factor markets.

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