Economic and nutritional effects of wheat self-sufficiency in Ethiopia

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1. INTRODUCTION

Ethiopia has been among the four most important wheat producing countries in Africa for the last two decades (FAOSTAT 2024). Nevertheless, it still needed to import a substantial amount of wheat from international markets to cover its domestic wheat demand. Since 2019, the Ethiopian government has made reaching self-sufficiency in wheat a key priority in its economic development strategy in order to improve the countries food security, reduce vulnerability to global price fluctuations and reduce the need for foreign exchange for food imports (import substitution). Apart from yield increases through intensification and technology improvements in established wheat growing areas, the strategy also explicitly involves the expansion of wheat production areas and specifically irrigated areas of wheat production (Effa et al. 2023; Senbeta & Worku 2023).

While significant increases in wheat production have already been observed and brought the country closer to self-sufficiency (Effa et al. 2023), the expected effect on food security and the Ethiopian economy remains unclear. Among other things, it will depend on whether the production increase is achieved by yield increases and expansion onto hitherto unused land or by the replacement of other food crops on existing crop land. Reduction of foreign exchange use will also depend on the extent to which the wheat production expansion is driven by fertilizer use and imports.

In light of the aforementioned context, the study aims to address the following research question: What would be the impact of a substantial expansion in wheat production (area) on the agricultural sector and on food and nutrition security in Ethiopia? The study analyses the impacts of an expansion of wheat production on the agri-food sector including production decisions and factor and input use, farm income and agri-food prices. In addition, we analyse effects on availability and affordability of food and the composition of diets and associated energy and macronutrient intake in Ethiopia by employing a CGE model to compare the potential effects of different scenarios through which this expansion could be reached

2. WHEAT PRODUCTION IN ETHIOPIA, POLICIES AND FOOD SECURITY

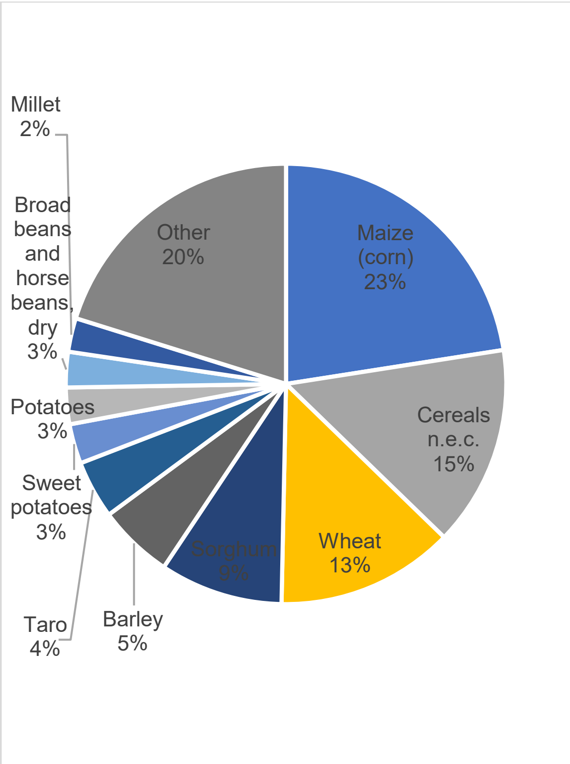
Wheat is Ethiopia's second most important food crop after maize, contributing around 14% of the total national calorie intake (Senbeta & Worku, 2023). It plays a vital role in the country's food system, widely consumed in urban areas as bread, injera, and other traditional dishes, while serving as a key source of income for millions of smallholder farmers in rural regions. In 2023, wheat accounted for approximately 13% of total agricultural production and covered 12% of the harvested area, equivalent to 1.9 million hectares (FAOSTAT, 2025; Figure 1). However, recent government figures claim that smallholder farmers cultivated 3.6 million hectares during both the dry (bega) and meher seasons and produced 123 million quintals, while irrigated farming contributed 107.7 million quintals from 2.9 million hectares, bringing total production to 230 million quintals in the 2023/24 fiscal year (PMO, 2025).

Despite these ambitious claims, Ethiopia continues to rely on imports to meet its growing wheat demand. For instance, the country imported around 1 million tonnes of wheat in 2023 from countries like the USA, Ukraine, and Romania (Figure 1b). This reliance on imports raises questions about the accuracy of government-reported production figures and the sustainability of its self-sufficiency claims. The government has hailed these figures as evidence of transformative policies under the National Wheat Flagship Program (NWFP), which aims to achieve self-sufficiency by expanding irrigated wheat farming, promoting cluster farming practices, and providing improved inputs such as fertilizers and seeds. However, independent estimates from organizations like the African Development Bank (AfDB) and USDA place Ethiopia’s actual wheat production much lower—at 7.5 million tonnes and 5.8

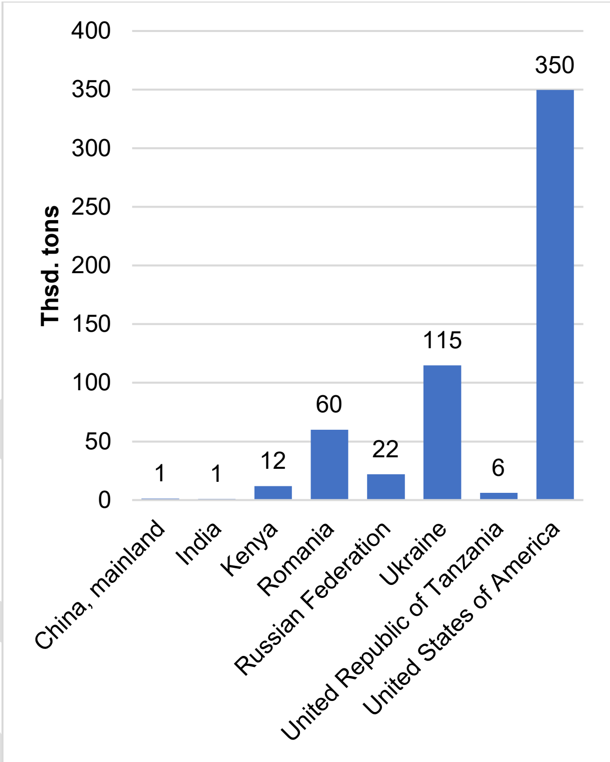
million tonnes respectively—highlighting significant discrepancies in reporting. (Elfenesh Muleta, 2025; The Economist, 2025).

Figure 1 Wheat production and imports in Ethiopia (Source: FAOSTAT, 2025)

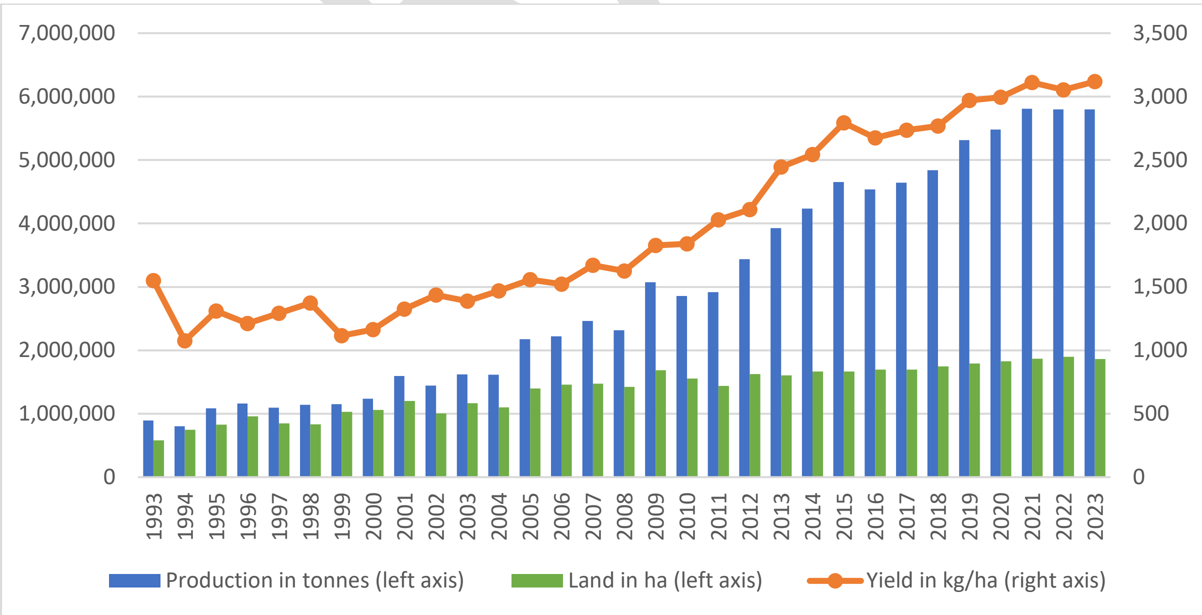
a) Agricultural production (2023)



b) Wheat imports by source country (tons, 2023)



c) Wheat production in Ethiopia



Furthermore, critics warn that the heavy focus on wheat may come at the expense of other staple crops like teff and maize, potentially destabilizing Ethiopia's agricultural diversity. Inefficiencies in input use and management practices persist despite irrigation expansion, limiting productivity gains.

Without addressing systemic issues—including improving data accuracy and tackling productivity constraints—Ethiopia risks falling short of its ambitious targets while exacerbating its dependency on imports amidst rising food insecurity. (Elfenesh Muleta, 2025; The Economist, 2025).

3. METHOD AND DATA

The study uses the single country CGE model DEMETRA (JRC, 2020). The model is using a 2015/2016 Social Accounting Matrix (SAM) for Ethiopia (Mengistu et al., 2019) (section 3.1). The model database is extended in this study to differentiate arable land by quality with respect to suitability for wheat production as detailed in section 3.2. A second extension includes detailed data on micro and macronutrients to determine the nutritional content of agricultural production and processed food commodities (3.3). Key features of the model and model behaviour are described in section 3.4.

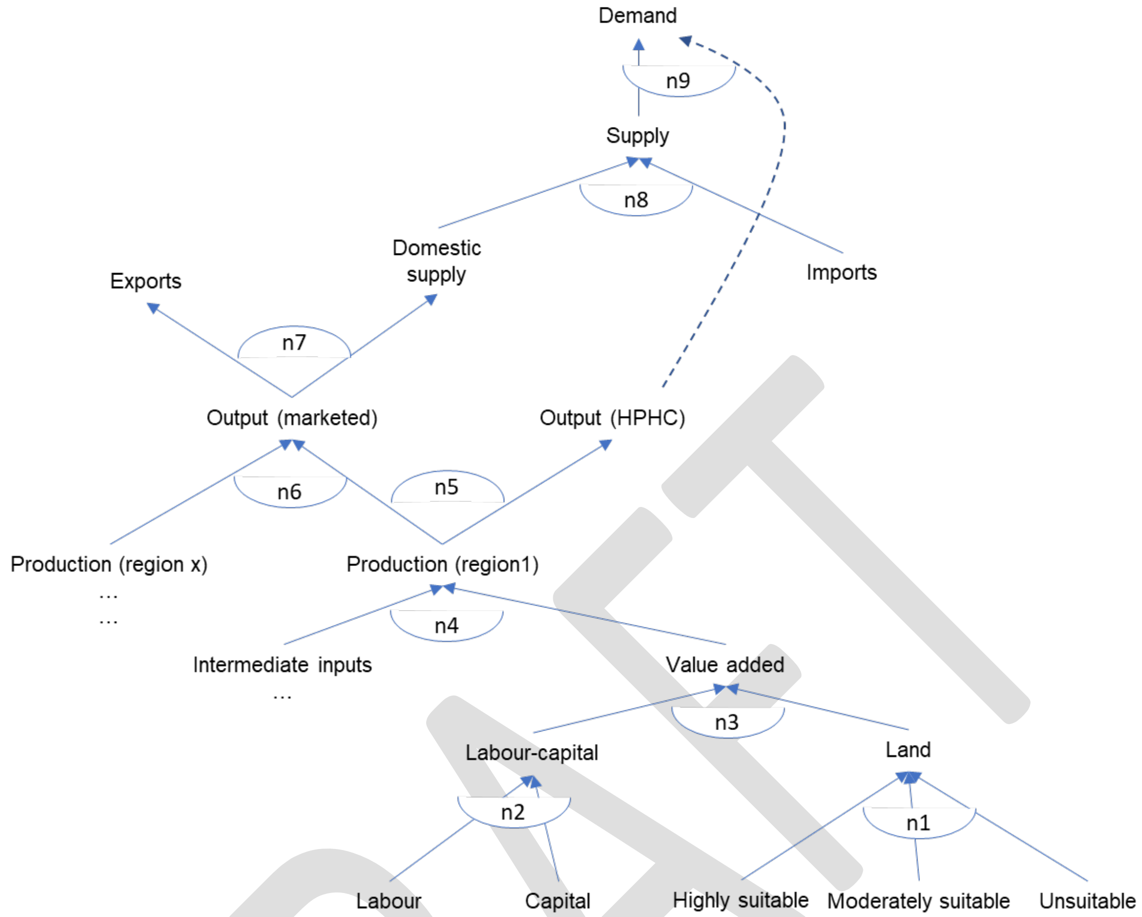
3.1. DATA AND CGE MODEL FOR ETHIOPIA

This study employs a SAM for Ethiopia (Mengistu et al., 2019) for the year 2015/2016. The SAM has been extended for this study with detailed land data, sectors have been segmented to reflect wheat production activities separately. The SAM distinguishes agricultural small-holders that produce mixed output production for eleven administrative regions in Ethiopia. In addition we distinguish a small-holder wheat production sector for each administrative region and a national wheat sector representing large-scale farming. In total there are 73 production sectors of which 36 are related to agriculture, 6 to food, 18 manufacturing and 13 services sectors. Agricultural sectors are employing land, segmented by administrative region and suitability for wheat production. Capital is segmented into livestock capital and non-agricultural capital. Labour groups are distinguishing skilled, semi-skilled and unskilled labour categories by administrative region.

Households are reflected in 28 representative household groups distinguished by administrative region and location into rural, urban and small towns. The SAM accounts for home production for home consumption (HPHC), or non-marketed agricultural production. Small-holder agricultural production sector is producing commodities that are marketed (and subject to transport and trade margins and taxes) and commodities consumed directly by the representative household in the respective region. In total, the SAM distinguishes 71 commodities and 23 non-marketed (HPHC) commodities.

Figure 2 shows a schematic structure of the production and commodity market. Production is depicted in form of a nested production system employing CES and Leontief technology. Value added is formed by a labour-capital aggregate, formed as CES aggregate from labour and capital production factors, and a land aggregate, which is a CES composite of different land qualities. Value added and intermediate inputs are forming a sector's production output, aggregated in fixed shares. A number of sectors produce multiple commodities, the substitutability between commodity output is governed by a CES function. Agricultural sectors, including the wheat sectors, produce output for home consumption (HPHC) which is consumed in the origin region. A part of the output is destined to enter formal markets. Marketed output is aggregated over regions/production activities employing CES technology and can be exported or domestically supplied. The reaction to price changes is governed by a CET function. Finally, imports and domestic supply form marketed supply assuming imperfect substitutability between domestic and imported produce. Final demand is specified in the form of a nested LES system, assuming low substitutability between commodity groups and higher substitutability inside each commodity group.

Figure 2 Schematic model structure of production and the commodity market



Note: The nodes (n1-n9) reflect model behaviour as follows:

Node	Functional form	Parametrisation wheat	Parametrisation other production activities
N1	CES	Highly elastic	Highly elastic
N2	CES	elastic	Elastic
N3	CES	elastic	Elastic
N4	Leontief	0	0
N5	CET	Highly elastic	Inelastic
N6	CES	Highly elastic	Elastic
N7	CET	elastic	elastic
N8	CES	elastic	elastic
N9	Nested LES demand system	Highly elastic btw HPHC wheat and marketed wheat	Inelastic btw commodity groups, elastic inside commodity groups

3.2.LAND SUITABILITY FOR WHEAT

Data

Expansion options for wheat production are derived by comparing wheat suitability and attainable yield maps for Ethiopia (own work and Global Agro-Ecological Zones, GAEZ, Fischer et al. 2021; gaez.fao.org) with spatially allocated production statistics (IFPRI 2024).

The GAEZ data provide attainable yields for a large number of crops at a spatial grid resolution of about 10 ~ 10 km (5’). For each grid cell, attainable yields are specified relative to the most suitable area for the crop, the full cropland area and the full area of the grid cell. The IFPRI SPAM dataset estimates irrigated and non-irrigated cultivation areas, total production and actual yields for the same spatial resolution. For each cell, we calculated an estimated maximum production by assuming that additional to the current wheat area, a specific share (alpha) of the cropland suitable for wheat that is currently not used for wheat can be used for wheat. We then classified cells into 3 classes based on their attainable yield (for that cropland). For each class and administrative subdivision used in the DEMETRA model, we summed up the total crop area and the potential wheat area according to the above calculation. We additionally calculated which crops would be crowded out by the corresponding increase in wheat area, respectively how much of the increase might be possible on unused land.

We cross-checked resulting production areas with an independently calculated wheat suitability map and compared actual production amounts for consistency with the data used in the DEMETRA model.

Land in the CGE model

The three wheat area classes are embedded into the model database. The SAM is further extended to depict a wheat production sector for each region and one national (large-scale farming) wheat sector, thus, replacing the current crop mix by wheat production with different yields for each land class. Land can be employed up to the respective limits. Unused land can enter production employing a land supply curve.

3.3.NUTRITION

We combine the DEMETRA model and underlying SAM with nutritional information based on FAO’s Food Balance sheets data and nutritional indicators for Ethiopia. These data will be used to determine the nutritional content of agricultural production and processed food commodities in Ethiopia. By linking these data to the DEMETRA model, we track energy intake and macronutrients (i.e. kcal, protein and fat) from agricultural production to the final consumer, taking into account seed, feed, losses and other uses and determine changes in food security and dietary composition of different household groups in Ethiopia. Microsimulation techniques will be used to establish a top-down link from DEMETRA to household-level nutritional data. For the nutrient intake of Ethiopian households, the “Household Consumption and Expenditure Survey” (HCES) by FAO is used. It provides information about the consumption quantities of different food groups and their nutritional value, measuring the content of the macronutrients and a selection of vitamins and minerals (FAO, 2024). For Ethiopia, the data is available for different income groups, urban and rural areas, and the administrative regions of the country. Urban households, for instance, have a generally higher energy, protein, and fat intake compared to rural households. The same applies to all micronutrients measured by the survey data. This mainly stems from differences in the diets, since rural households consume more carbohydrates from cereals, roots, and tubers, and urban households generally consume more vegetables, pulses, fruits, and animal products.

To assess the food security outcome of the different model scenarios, the food security indicators of the FAO are used. they are assigned to different food security dimensions to provide a comprehensive picture of a country's food security situation. Using the nutritional data from the FAO’s Food Balance Sheets together with other model output variables, a holistic picture of the food security in Ethiopia can be depicted by measuring the following food security indicators:

Food Availability:

- Average energy supply (kcal/cap./day)
- Average fat supply (g/cap./day)
- Average protein supply (g/cap./day)

- Average protein supply of animal origin (g/cap./day)
- Share of dietary energy supply derived from cereals, roots and tubers (3-year average)
- Dietary diversity, Shannon index

Food Stability:

- Cereal import dependency ratio
- Value of food imports in total merchandise exports

Food Access:

- Gross domestic product per capita
- Household income
- Agricultural income
- Food price index

4. SIMULATION AND RESULTS

4.1. SIMULATION SETUP

Several simulations are conducted to analyse implications of the wheat strategy on food security and nutrition and government budget:

We construct a reference scenario where Ethiopia moves towards self-sufficiency. The reference scenario is based on the SAM for Ethiopia and three points in time are selected as reference years (A, B, C) that represent different situations with respect to wheat trade and production:

A. The first reference year (RY-A) is based on the 2015/16 SAM for Ethiopia. This scenario represents an import share of 40% as depicted in the SAM. This reference scenario is intended to allow analyses of the counterfactual: What would have happened to the Ethiopian economy without the recent wheat expansion until 2023.
B. A second reference year (RY-B) depicts the development of the Ethiopian economy with a focus on the recent developments in wheat production, calibrated to depict the situation in 2023. Up until 2023 the reference scenario accounts for observed growth in population and GDP and reflects updated import and export flows to 2023 levels (FAOSTAT).
C. A third reference (RY-C) year depicts a situation of wheat self-sufficiency, assumed for the year 2030. We explore five pathways on how self-sufficiency could be reached: expansion on new land; limited availability of cultivation area, resulting mainly in substitution of other crops; yield increase with constant fertilizer use; yield increase with more input use; increasing subsidies

Two scenarios are run to analyse the effect of world market price changes (fertilizer and wheat prices) that had been recently affecting Ethiopia. Both scenarios are conducted for each of the two reference years, A and B, to identify the impact of the recent wheat extension:

i) increasing world market prices for wheat
ii) high fertilizer prices in the world market causing a fertilizer shortage in Ethiopia.

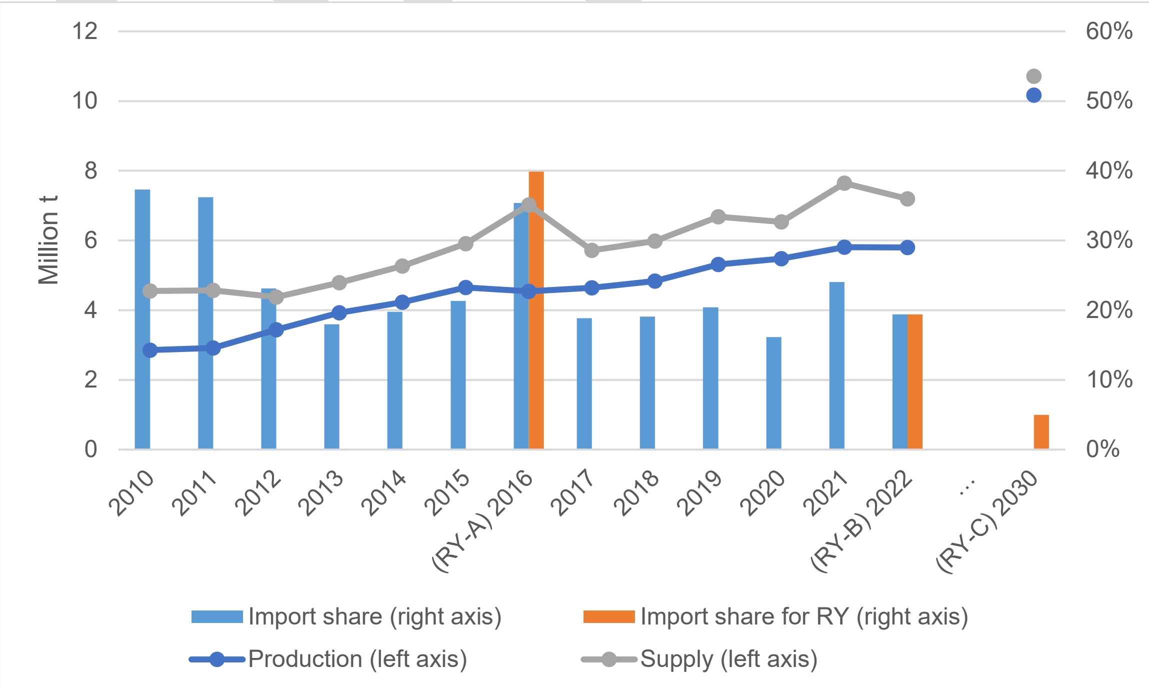
Table 1 Scenario setup

Research question	Wheat self-sufficiency (reference years)	World market price scenarios
Vulnerability to external shocks	A) Past: 40% wheat self-sufficiency (based on 2015/16) B) Current: 20% wheat self-sufficiency (based on 2023)	1. increasing world market price for wheat 2. increasing world market price for fertilizer
How can wheat self-sufficiency be reached and what are the effects on food security and nutrition	C) Future: 95% wheat self-sufficiency (in 2030) i) expansion on new land; ii) limited availability of cultivation area, resulting mainly in substitution of other crops; iii) yield increase with constant fertilizer use; iv) yield increase with more input use; v) increasing subsidies	

The import share of wheat, the share of imports in supply, is decreasing over the last decade. Wheat imports accounted for about 40% of Ethiopian wheat supply in 2010, the share of import decreased in subsequent years (Figure 3). FAOSTAT data shows an in-between high in 2016, the reported import share is close to the import share calculated from the SAM data of 40%. Reference year A, thus, represents a year of relatively high wheat imports, similar also to the years around 2010/2011. In 2022, representing reference year B, the wheat import share is halved, accounting for 19 % of Ethiopian wheat supply. Domestic wheat production has been increasing over this time period from 3 million t to 6 million t.

We assume that Ethiopian reaches self-sufficiency in wheat in 2030 (RY-C), where self-sufficiency is reflected by an import share of 5%. Figure 3 depicts the required wheat supply and production, taking into account population growth between 2022 and 2030.

Figure 3 Ethiopian wheat production, supply and import shares, 2010-2022 (Source: FAOSTAT, 2025). Import share of RY-A based on Ethiopian SAM; data in RY-C derive from SSP2 data and self-sufficiency assumptions.



4.2. EXPECTED/PRELIMINARY RESULTS

[To be completed]

5. CONCLUSIONS

[To be completed]

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