

To what extent are the Italian regional food systems vulnerable to climate shocks?

The case of wheat

S. Turchetti T. Ferraresi



13th IAERE Annual Conference
Roma, February 20-21, 2025

Motivations - 1

- Climate shocks are expected to dramatically affect agriculture and food production in the very next years (e.g., FAO, 2021). They are generally not predictable and geographically dispersed
- Since the 1980s onwards, global trade of food commodities increased as well as intensive methods of production, thus increasing the imports of inputs

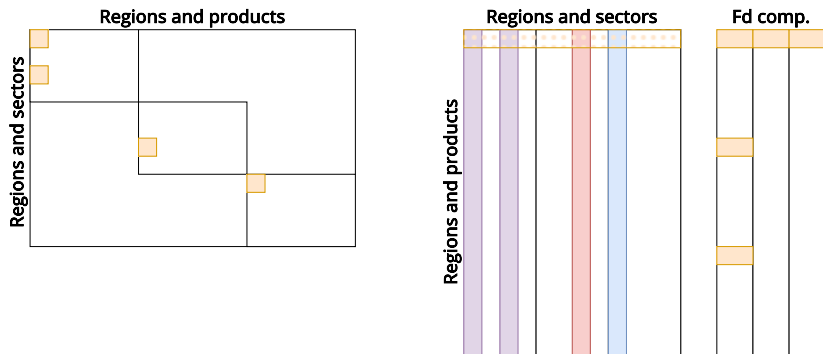
MAIN QUESTION OF THIS RESEARCH PROJECT

To what extent the Italian regional food systems (RFSs) are vulnerable to climate shocks?

Motivations - 2

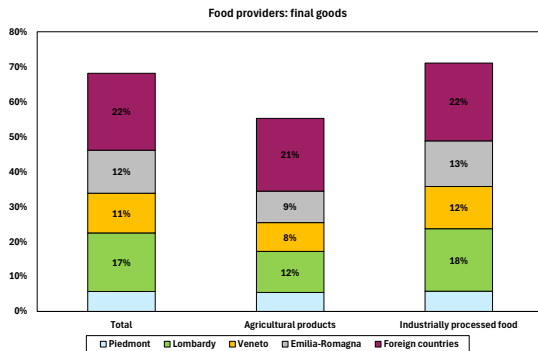
- When tackling vulnerability of RFSs to climate shocks the input-output framework appears appealing: trade indeed is not purposeless but it satisfies specific (consumers', firms') needs (vertically integrated sectors; value chains)
- However, classic approaches suffer from different (sometimes overlapped) issues → level of aggregation of inter-sector/inter-territories relations, hypotheses about input substitutability, geographical lenses used to examine phenomena, lack of attention to firm heterogeneity and market structures, etc..

Our starting point: the interregional SUT



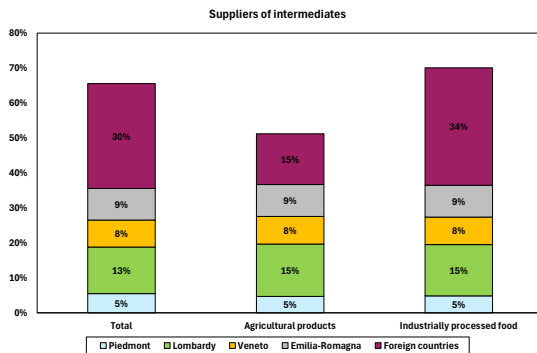
Our starting point is an interregional-international SUT with 43 sectors, 54 products, 66 geographical areas (21 Italian regions, 44 countries, Rest of the World)

RFSs in the international-interregional SUT framework - 1



Almost 70% of final food products is provided to Italian regions by 4 Italian regions (Piedmont, Lombardy, Veneto, Emilia-Romagna) and foreign countries

RFSs in the international-interregional SUT framework - 2



Foreign countries are also relevant providers of intermediate inputs to Italian regions serving final demand for food. Backward foreign dependence (final + intermediates) of RFSs accounts for 45%.

Further steps to evaluate impact of climate shocks on RFSs



1. An inter-country interregional framework based on trade data and SUTs
2. An interregional framework based on disaggregated SUTs
3. A spatial disaggregation of production
4. Firm level data on productions and balance sheets

The (disaggregated) interregional framework (2) is integrated in the inter-country interregional framework (1)

Further steps to evaluate impact of climate shocks on RFSs

- The final aim of the project is to construct a **food satellite account** with a satisfactory level of disaggregation of products and sectors to track regional heterogeneity in the participation to food value chains
- ... and an adequate spatial representation of production so as to match the spatial granularity of climate shocks → **Geolocalization of cultivations**
- ... and firm heterogeneity to account for criticalities stemming from the impact of climate shocks on firm balance sheets → **A data-driven ABM for food production**

Food satellite account - Data & Methods

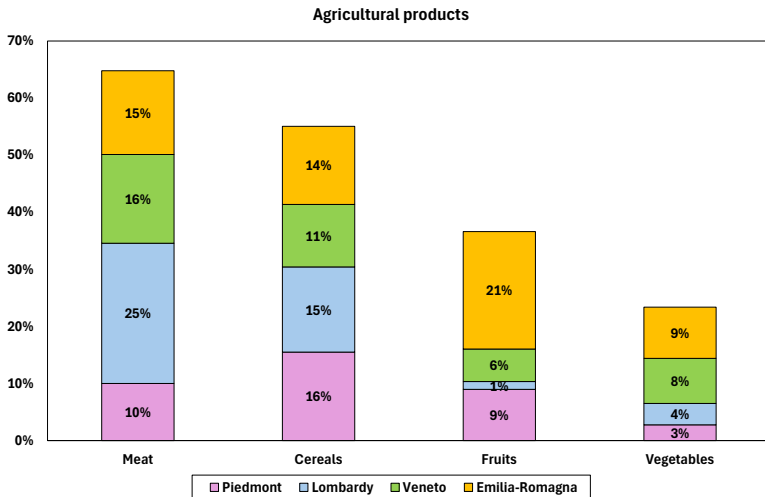
Production side:

- For agriculture the starting point is represented by Istat agricultural accounts (disaggregated products, aggregated sector with production, value added, intermediate inputs) combined with FADN accounts (much more aggregated products, disaggregated sectors) and COEWEB and BACI-CEPII data on international trade
- For the food & beverages industry we use PRODCOM (5 digits sectors, 8 digits products) combined with SCI, SCI pmi (5 digits sectors), ASIA microdata and COEWEB and BACI-CEPII data to disaggregate sectoral regional accounts

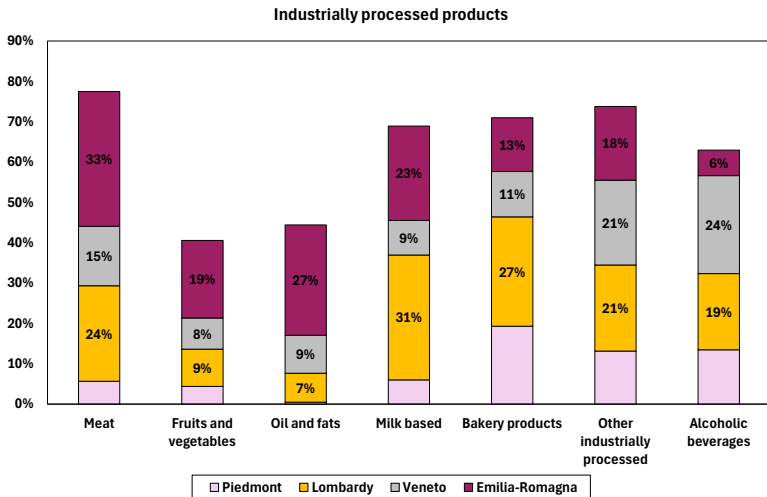
Consumption side:

- Consumption survey (up to 100 items in the food basket)

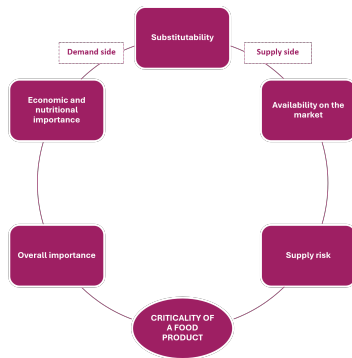
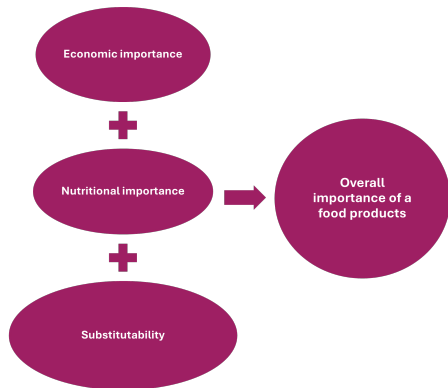
Food satellite account: Evidence - 1



Food satellite account: Evidence - 2



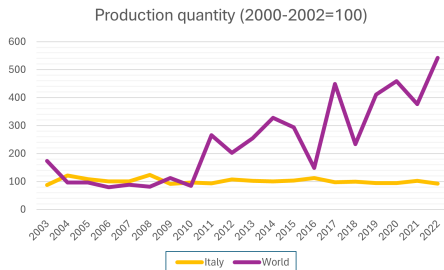
Evaluating the criticality of a food product



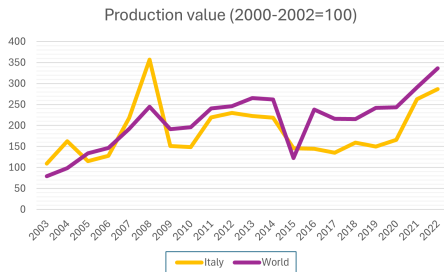
The wheat-based supply chains in Italy - 1

- Wheat is the basis of many food staples in Italy and therefore is critical for its nutritional importance. From an economic perspective, it can be considered critical for many food industries and Made in Italy products.
- Its degree of substitution is very limited. On the supply side, it is largely available on the global market but some studies claim that climate change is likely to reduce yields (e.g., Sattar et al. 2021)
- On the demand side, even if there are many valuable and healthier alternatives and consumers greatly appreciate variety, as intermediate wheat has some specific characteristics in terms of gluten content which can be hardly replaced

The wheat-based supply chains in Italy - 2

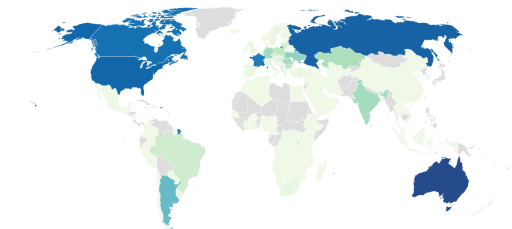


- Rising global production
- Stagnating internal production



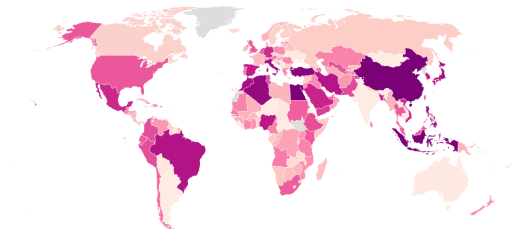
- Price dynamics quite aligned

The wheat-based supply chains in Italy - 3



→ Main wheat exporters

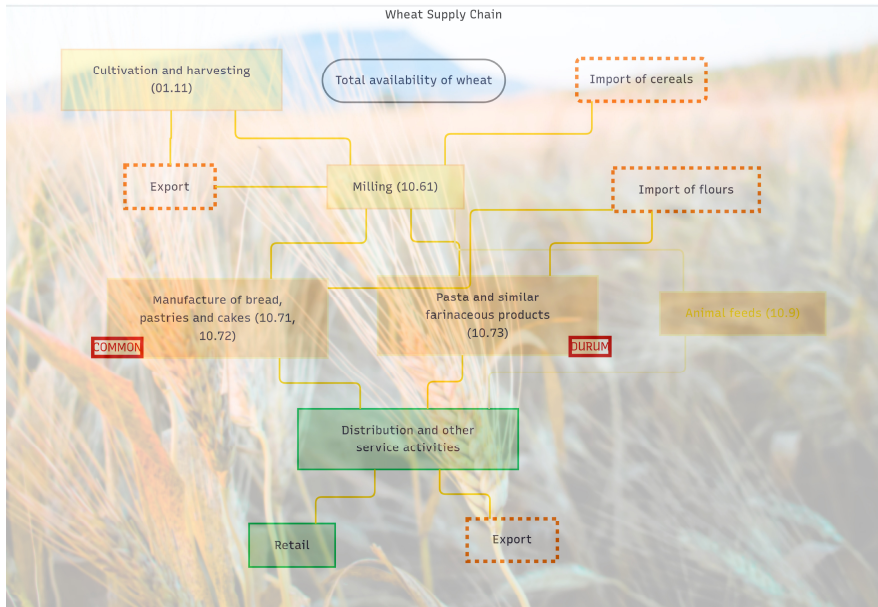
Creato con Datawrapper



→ Main wheat importers

Created with Datawrapper

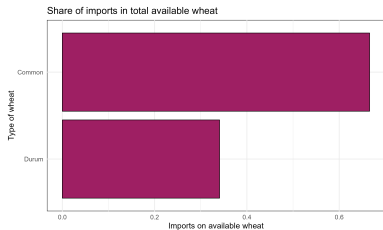
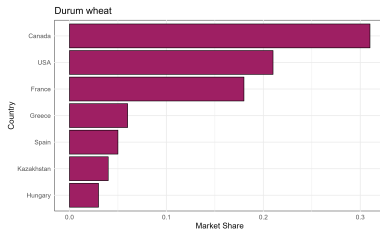
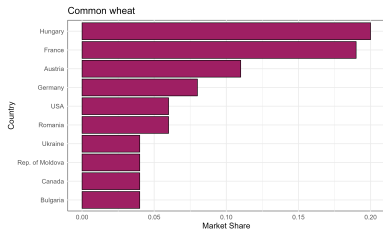
The wheat-based supply chains in Italy - 4



The wheat-based supply chains in Italy - 5

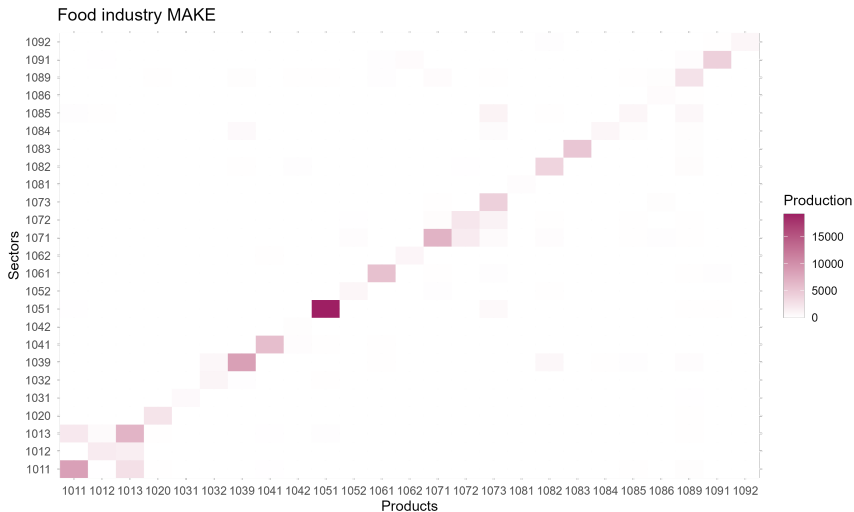
- In order to reconstruct an account of wheat-based supply chains further data is needed: from wheat to flour to the production of flour-based food items
- Data about production and destination of flour from Italmopa (in tons); Flour prices from ISMEA (wholesale prices): notice that, whereas international dependence is high for wheat, this is not the case for flour
- Data was adjusted using estimates from Food Satellite Account (from the MAKE matrix: Flour production + production of the main input users; from the USE matrix: input use in flour production + from the main input users)

The wheat-based supply chains in Italy - 6

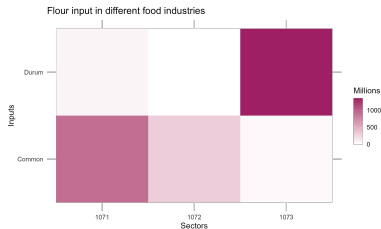


- Dependence upon international imports is far higher for common wheat
- The geography of dependence of the two varieties is also different

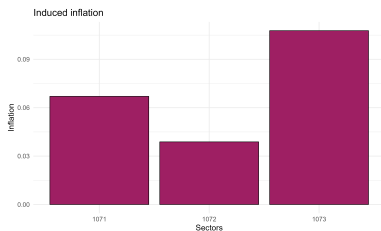
The wheat-based supply chains in Italy - 7



The wheat-based supply chains in Italy - 8



- Durum wheat is intensively used in NACE 1073 whereas common wheat is far more important as an input for sectors 1071 and 1072



- The observed increases in flour prices during the period 2019-2023, in a cost-push modelling framework, could have contributed to a rise in producer prices between 4% (1072) and 10% (1073)

Discussion

- The approach of criticality is very useful for assessing the impact of climate shocks on production, but still limited for essential goods like food
- From this perspective, we need to assess to what extent the damages have a direct impact on our food security
- Evaluating the impact of climate shocks on RFSs through the integration a plurality of layers provides a promising toolkit for addressing this crucial challenge

Discussion - 2

- As to wheat-based supply chains, we saw how wheat is a critical raw material, whose production can be threaten by climate (and geopolitical) shocks
- Italy is highly dependent from international markets, especially when it comes to common wheat
- This may lead to steep rises in prices in the manufacturing of some essential final food items

→ The importance of supporting internal production in the face of stagnating margins and of the appeal of competing uses of land