# To what extent are the Italian regional food systems vulnerable to (climate) shocks? The case of wheat

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*Le disuguaglianze territoriali: Prospettive per regioni e città*
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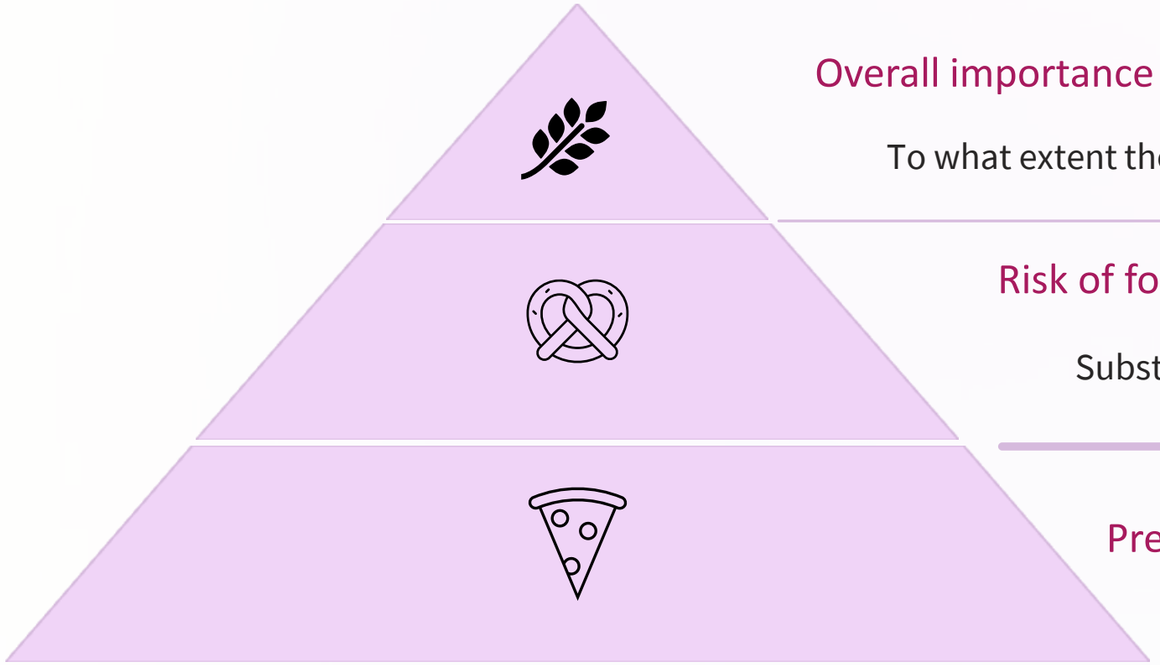
# Aims and objectives

Food value chains are particularly vulnerable to climate shocks, which are expected to dramatically grow in number and intensity in the very next years (e.g., FAO, 2021). They are generally not predictable and geographically dispersed. Moreover, in the last few years, many other types of shocks occurred (e.g. geo-political) with relevant impacts on the provision of food and prices. Since countries are more and more dependent on imports for their food security, their vulnerability is likely to increase.

This study presents an innovative multi-level analysis framework that reconstructs the value chains activated by food consumption in Italian regions and assesses their exposure to different types of risk. The approach integrates an interregional Supply and Use table (SUT) with a food satellite account, spatial information on crops and firm-level data.

Our analysis focuses on the case study of durum wheat and common wheat, staples of the Mediterranean diet, characterized by a low degree of substitution due to their intrinsic properties for industrial processing. Despite their resistance to drought, the effects of climate change and geopolitical crises could have significant consequences on global production and availability. Once estimated the wheat-based value chains, we assessed the impact of recent shocks *via* a Leontief price model.

# *Methodology*:
# “criticality” of a food product



## Overall importance of a food product

To what extent the food product is economically and nutritionally relevant and substitutable

## Risk of food supply chain disruption

Substitutability on the supply side

## Preferences of consumers

Substitutability on the demand side

The evaluation framework is adapted by the European Commission approach, which defines as critical those materials which are crucial to some industries, based on the share of net demand and the gross added value generated by them. Moreover, they are critical when their supply is at risk (CE, 2023; Blengini et al., 2017)

# Is wheat a critical product?

Base product of many Mediterranean diets

*Low level of substitutability on the demand side*

*because it is nutritionally and culturally relevant*

Is it a relevant intermediate input for Italian food industries?

*Contribution to GDP growth and exports of final Made in Italy products*

Global production is highly concentrated in few countries?
To what extent is Italy dependent on imports?

*The concentration of production in few countries suggests that local shocks (e.g. geopolitical crises, protectionism) can highly impact the global production of food and increase prices (Devadoss, Ridley, 2024; Mottaleb et al., 2022). The effects of climate change on the production of wheat are mixed and blurred (Zhang et al., 2022; Xiong et al., 2020; Liu et al., 2016), but the recent shocks provide an opportunity to observe some evidence on the behaviors of value chains and possible impacts*

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# *Methodology*:

# Steps

In order to estimate the impact of the recent shocks on wheat-based value chains we need the following "ingredients":

1. Reconstructing the value chains: identifying the main value chains which are based on wheat and the main actors operating along them, from the raw materials up to the final products; quantifying in monetary terms the supply and demand of intermediates and final goods at each step of the identified value chains

2. Investigating the nature of the shocks and how they were observed along the value chains (e.g., shocks on quantities vs. shocks on prices)

3. Choosing the appropriate model to estimate the impact of the shocks via the cascading effects over the value chains

# *Methodology*:

# The multi-level framework analysis

Macro: interregional-international international SUTs

Interregional SUTs supplemented with BACI-CEPII international trade data, allowing disaggregation of traded products down to 6 digits in HS nomenclature.

Meso: Agri-food satellite account account

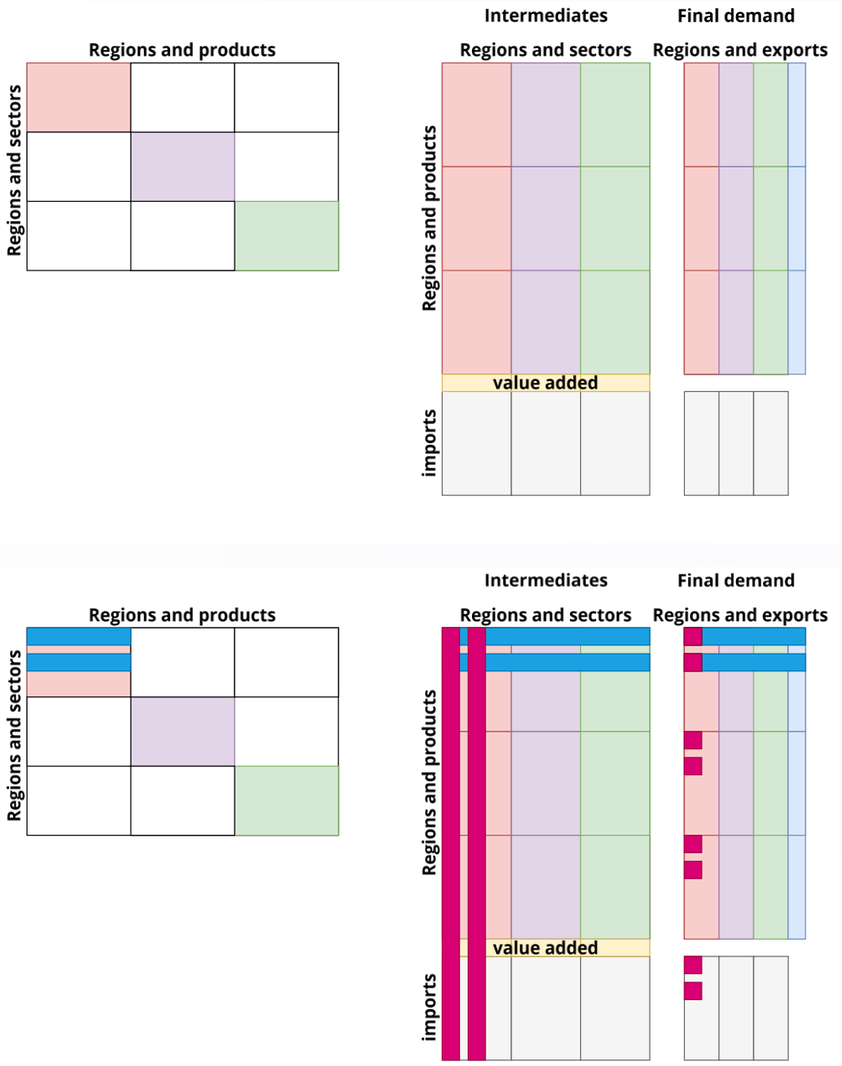
Disaggregation of agricultural and food production of the different regions in both sectoral and product terms, using Agriculture Accounts (ISTAT), FADN, Asia Agriculture, PRODCOM and other databases.

Micro: Spatial and firm disaggregation

Analysis of the spatial distribution of agricultural production and microeconomic characteristics of farms, integrating tax data, AIDA and other information sources.

This multi-level approach allows to consider the complexity of the value chains, due to the variety of diets among different regions, the geographical dispersion of production, the length of the supply chains and the heterogeneity of the actors involved.

# *Methodology*: The food satellite account




Inter-regional-international SUT: Italian regions (Paniccià, 2024) have been included within the international information set FIGARO SUT (Remond-Tiedrez and Rueda-Cantuche, 2019) and then 'augmented' with BACI-CEPII international trade data(which allow for the disaggregation of products traded down to 6 digits in the HS nomenclature)

Agri-food satellite account: disaggregation of the agricultural and food production of the different regions in both in sectors and products; as is the final consumption of households in an inter-regional SUT framework

# The wheat value chain in Italy

*Production*

**Growing of wheat (NACE 01.11).**
**The availability of grains is the sum of production (national wheat) and imports (foreign grains), minus exports**

*Manufacture of grain mill products*

**Both national and foreign wheat are use by mills (NACE 10.61) to produce *semola* and flours**

*Manufacture of bakery and farinaceous products*

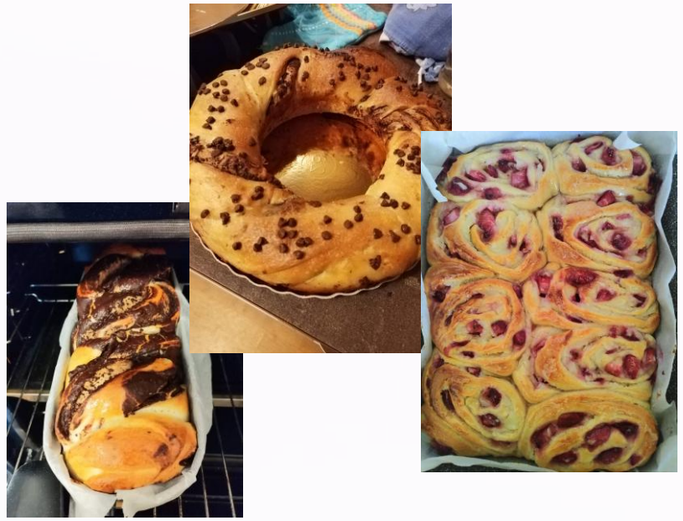
**Flours are used as intermediate inputs by the food industry, particularly by the bakery industry (10.71 and 10.72) and pasta manufacturers (10.73)**

*Distribution and consumption*

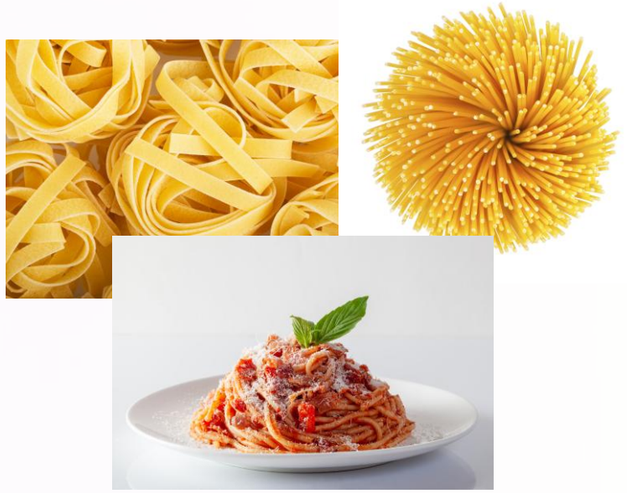
**Production is partly exported and partly made available to other sectors of the economy or to end users via the retail industry**

# Flour as intermediate input

Manufacture of bread and
fresh pastry goods and cakes (10.71)



Other bakery products (10.72)

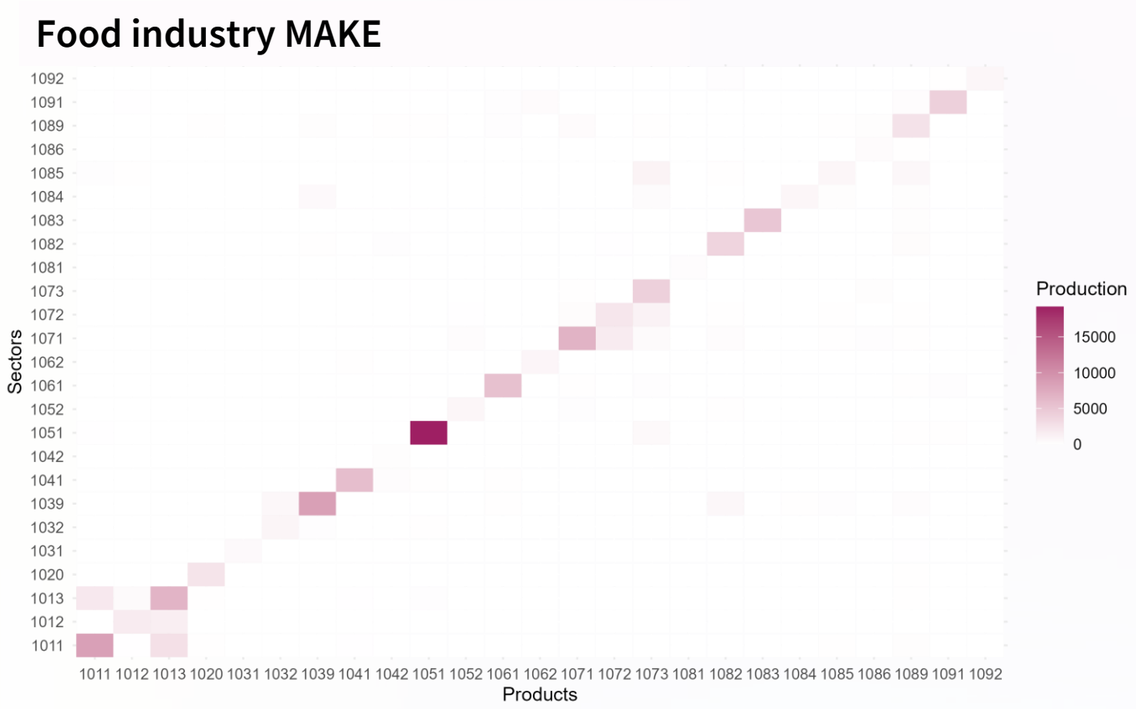


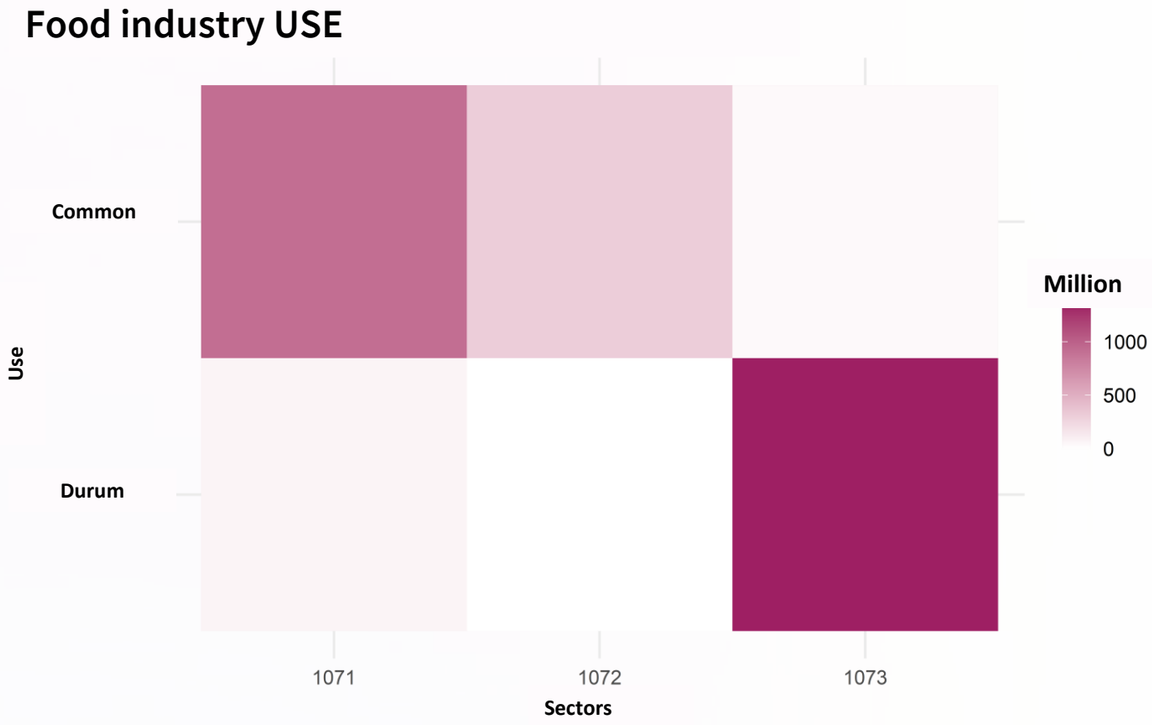
Manufacture of pasta (10.73)

This sector almost exclusively uses durum wheat flour (so-called *semola*), due to its high protein and gluten content. Italian pasta production is strongly export-oriented, representing a leading *Made in Italy* product.

These sectors of bakery products mainly use common wheat flour, exploiting the elasticity of dough that this variety guarantees.

# The wheat value chain according to the food satellite account

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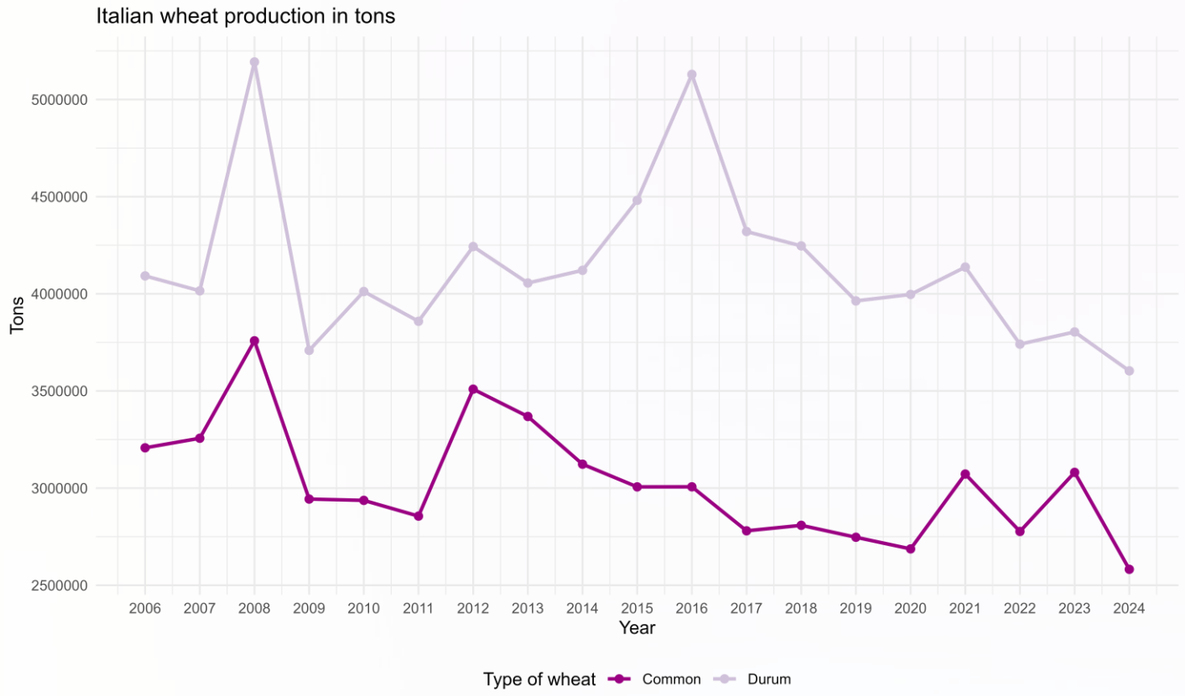
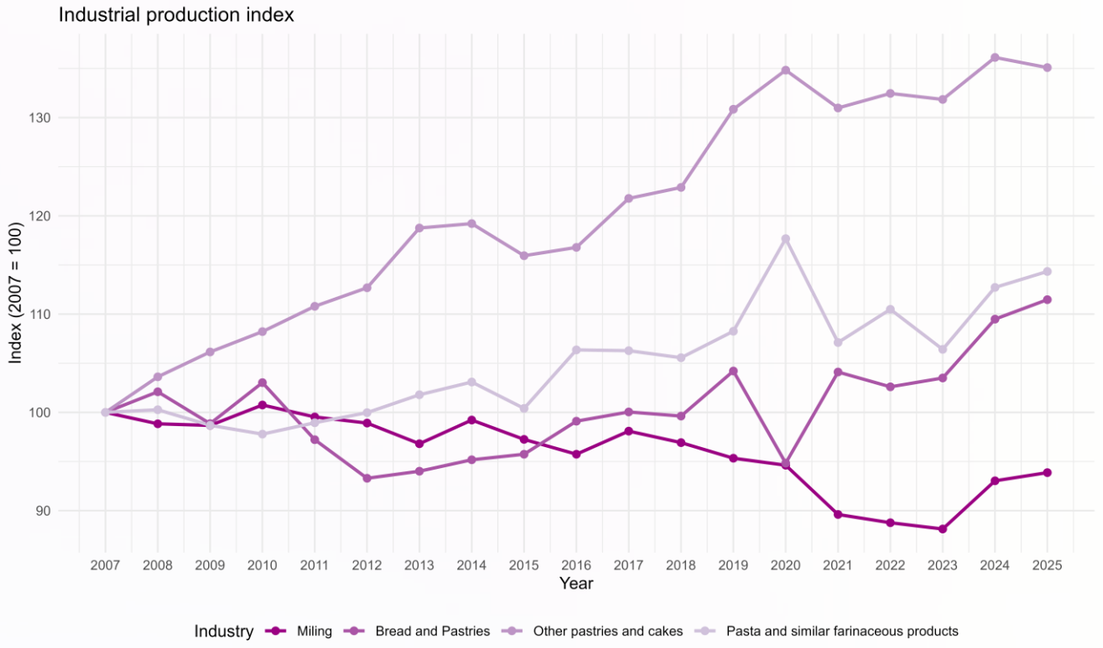
# Trends in wheat and industrial production

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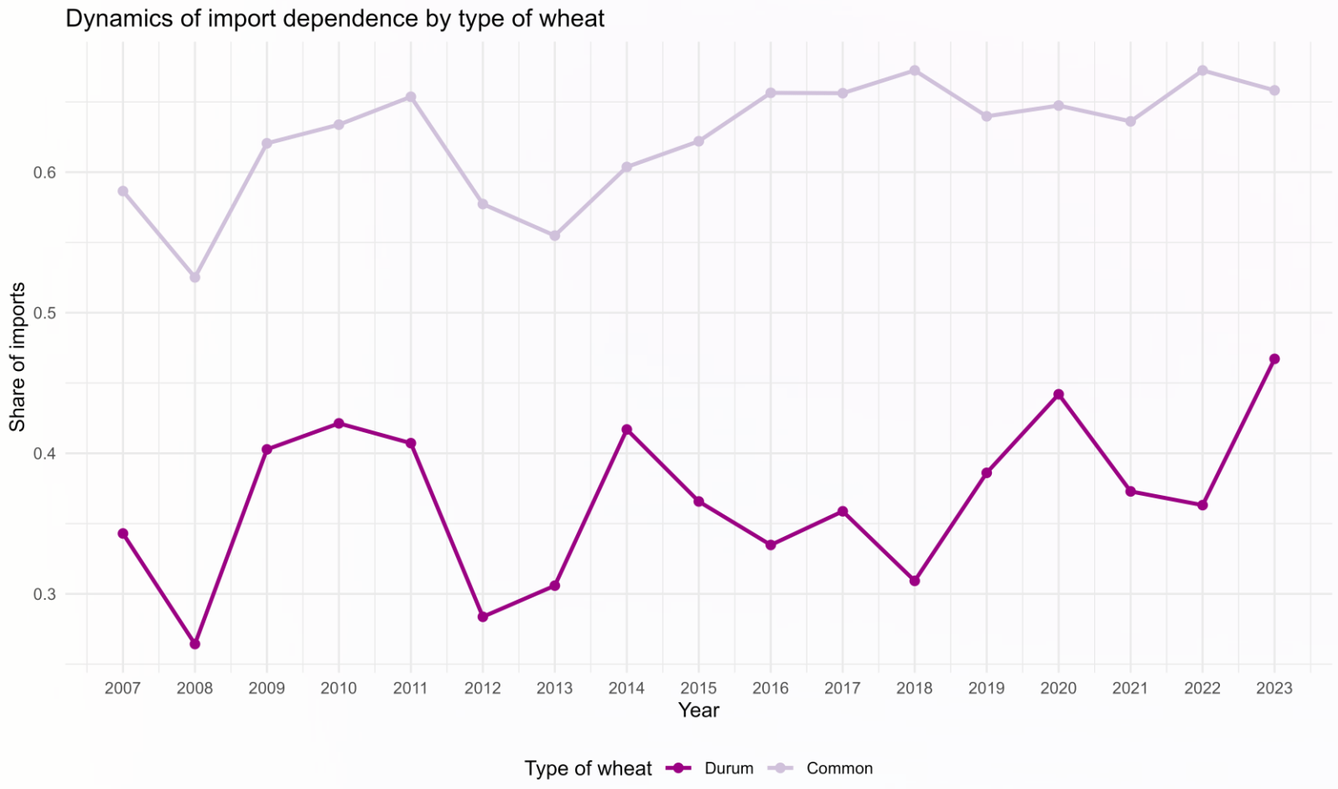
# The import dependency

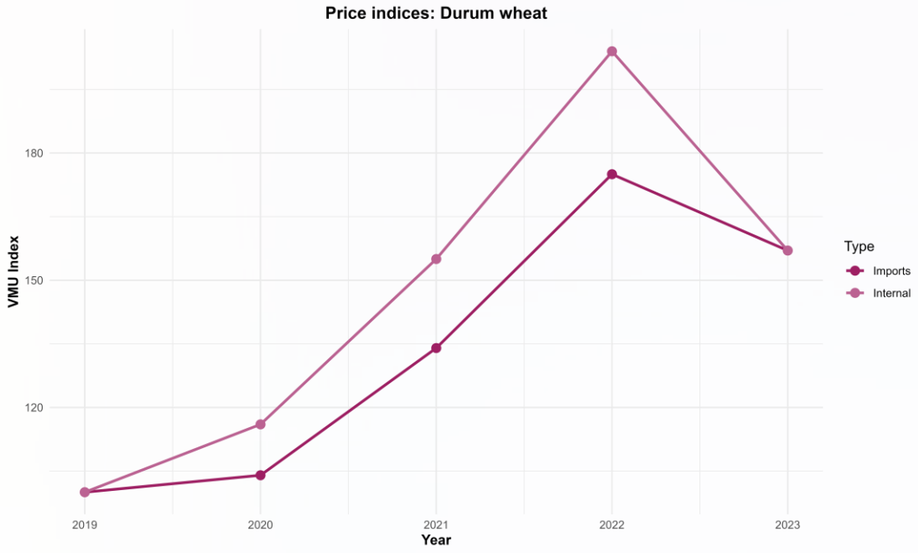



Despite its limited physical size and a declining agricultural sector, Italy is a relatively large producer of wheat, accounting for 1% of global production. Being also a large user, it remains a net importer.

Over time import dependency increased. We are mainly dependent on the import of common (70%) but today the dependence on foreign durum ranges between 35% and 45%.

# Recent shocks: available *quantities* and *prices*







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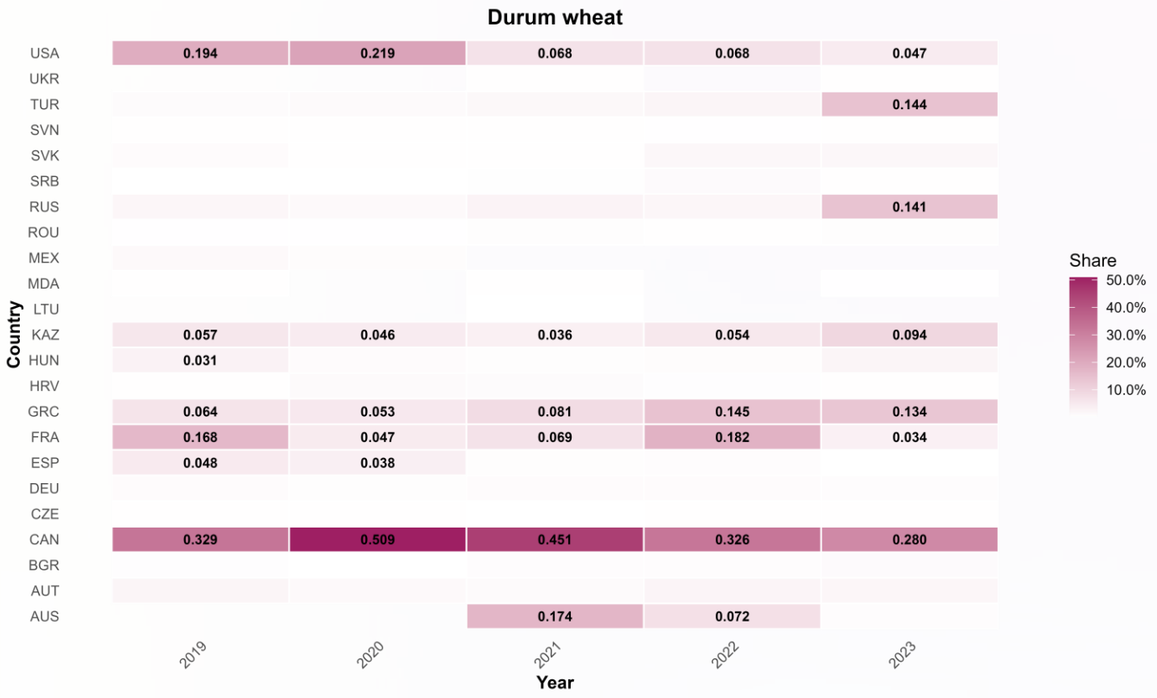
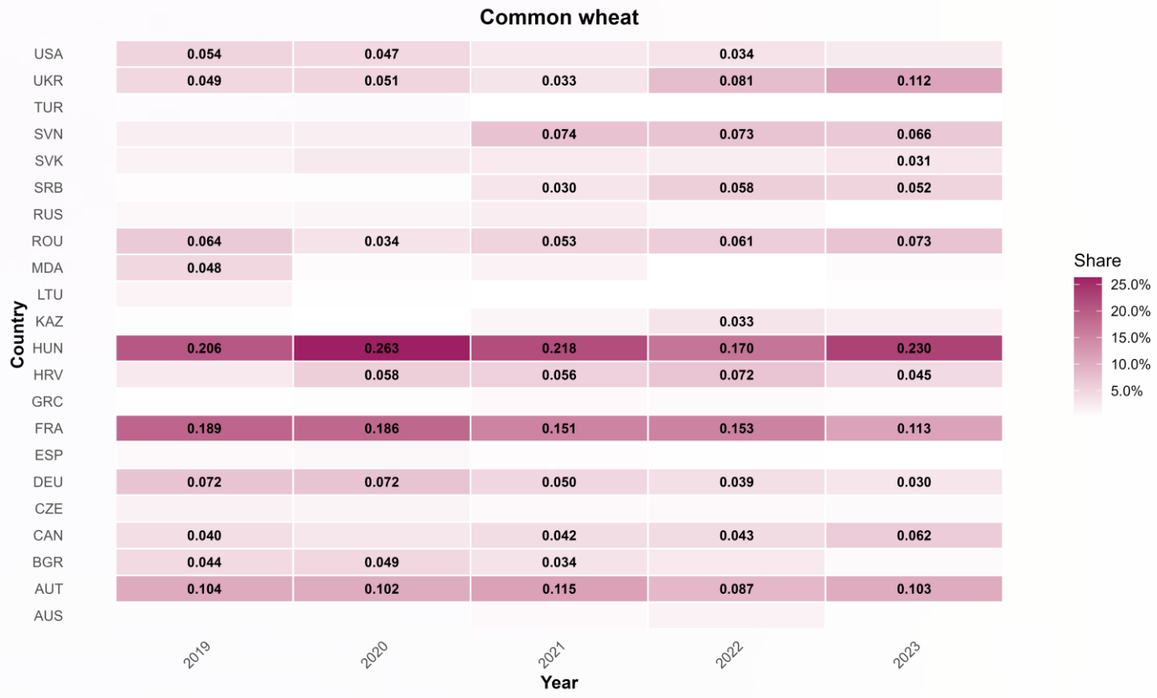
# Recent shocks: *the geography of wheat suppliers (to Italy)*

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# Recent shocks: *effects*

**1. Increase in the cost of wheat**

First shock in the raw material

**2. Increase in the price of flour**

Transmission of the initial shock to the production of intermediate inputs

**3. Increase in the producer price index of final products**

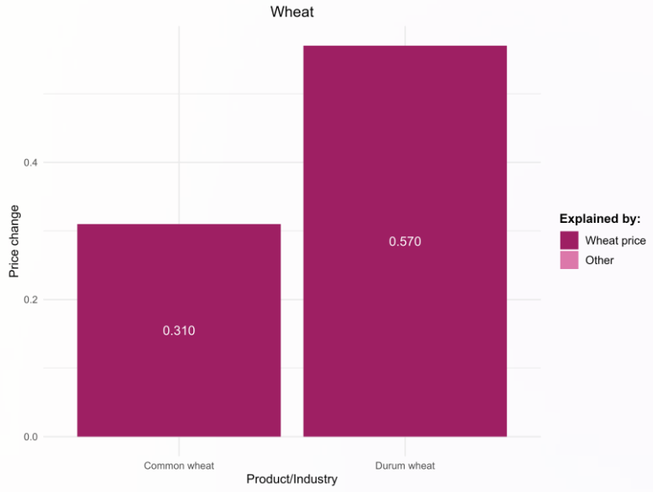
Pressure on the prices of bread, bakery products and pasta

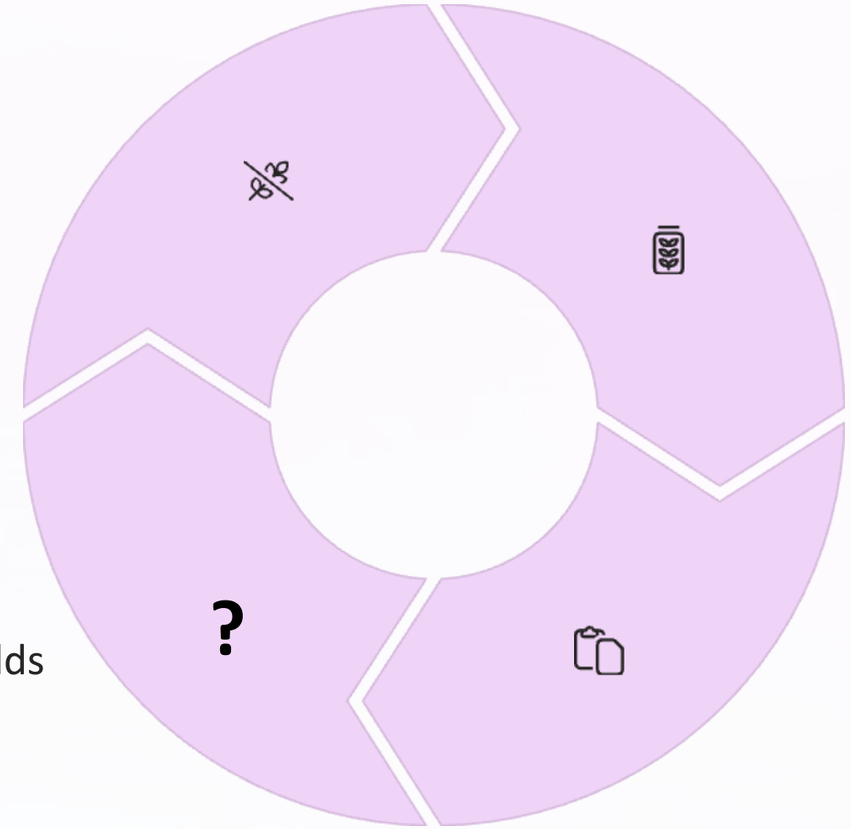
**4. Impact on households**

Increase in the price of final products and potential rationing

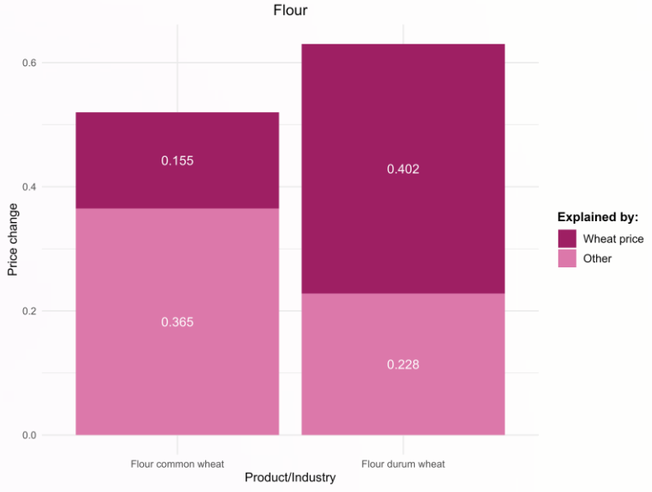
We employ a **Leontief cost-push model** to simulate the impact of the prices of the final products generated by the observed increase in the cost of wheat. The model generates cascading effects over the value chains under the assumption of i) **stable demand**; ii) **stable value added coefficients**

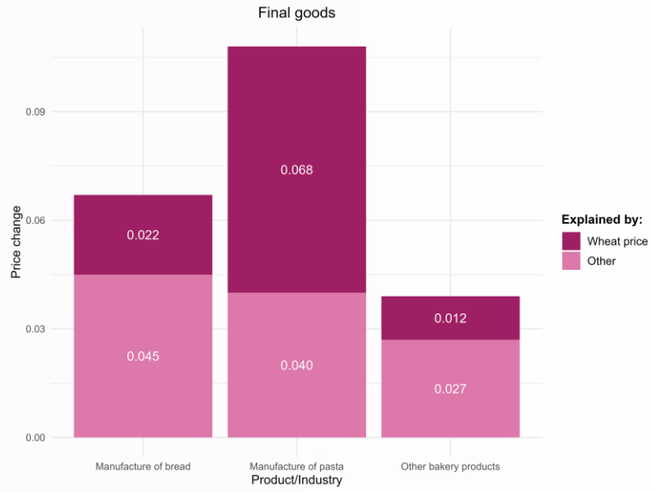
# Recent shocks: *effects*




Impact on households

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# Recent shocks: *results*

The increase in wheat prices has been passed on to the downstream sectors, particularly affecting the durum wheat value chain (+7% for pasta; ¼ of the total price increase of the sector), compared to a smaller increase for the other two sectors (2.2% for bakeries and 1.2% for other bakery products).

Other sources of increases of prices which have not been investigated - such as energy – have also contribuited to the rising prices of the final products.

The impact on consumers remains to be assessed, depending on the behavior of wholesale and retail sectors.

# Concluding remarks

Over time the dependency of Italy on wheat imports has increased, especially for durum which is largely cultivated in the Southern regions. Imports compensated for stagnating domestic production over time.

The increased dependency raises the exposure of Italy to external shocks, both geopolitical and climatic, so as to challenge both food security and a relevant part of our Made-in-Italy labelled economy.

Once reconstructed the Italian wheat value chains for both durum and common, we implement a Leontief-price model to simulate the impacts of recent shocks on the wheat prices and the cascading effects on the downstream sectors. The results showed that the contribution to price growth was higher for durum wheat products, confirming that increased exposure to the global market can affect the provision of very critical products.

# Next steps

For the multi-layer assessment framework:
- Completing the estimation of the food satellite account connecting the regional household food consumption basket, the disaggregated intermediate input table, and the disaggregated make matrix
- Adding more regions to the spatial and to the microeconomic layers of the assessment framework

For the wheat case study:
- Investigate the role played by the wholesale and retail sectors in determining the final impact on households
- Investigate whether different sectors of the supply chain were able to transmit cost increases differently through price increases
- Investigate the role played by international prices of durum vis-à-vis common wheat in shaping the dynamics of internal prices

Thank you!

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