

A vibrant Andalusian street scene. On the left, a yellow building with a red-tiled roof is partially visible. In the center, a light blue building with white trim and black metal balconies stands. To the right, a reddish-brown building with white trim and black metal balconies is visible. A large tree with green leaves is on the left, casting shadows on the buildings. A red bicycle is parked in the center. In the foreground, there is an outdoor seating area with two small wooden tables and four wicker chairs with red cushions. A small potted plant sits on one of the tables. The ground is paved with cobblestones. The overall atmosphere is warm and sunny, with strong shadows cast across the buildings and ground.

The COVID crumbling of tourism in Andalusia

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The background image shows a sunny street scene. On the right, there is a two-story building with a red lower half and a light-colored upper half. The upper part has windows with ornate black metal grilles. A blue sign with a white 'H' and the word 'CIUDAD' is mounted on the red wall. In the foreground, there are two small wooden tables with metal frames and wicker chairs with red cushions. A red bicycle is parked against a tree on the left. The scene is dappled with sunlight and shadows from the trees.

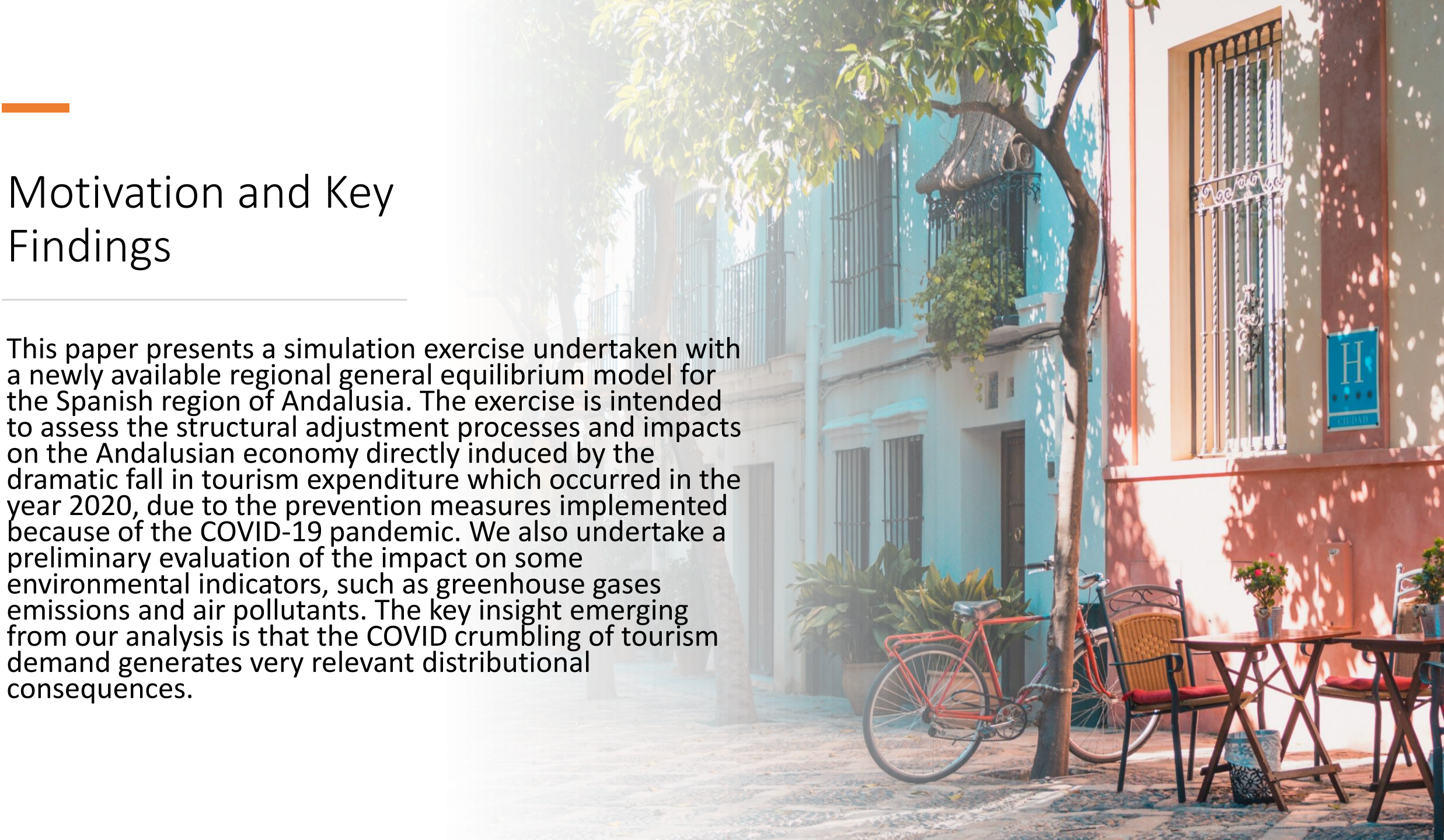
Overview

- Introduction and Motivation
- Data and Modelling Strategy
- Economic Impacts
- Environmental Impacts



Motivation and Key Findings

This paper presents a simulation exercise undertaken with a newly available regional general equilibrium model for the Spanish region of Andalusia. The exercise is intended to assess the structural adjustment processes and impacts on the Andalusian economy directly induced by the dramatic fall in tourism expenditure which occurred in the year 2020, due to the prevention measures implemented because of the COVID-19 pandemic. We also undertake a preliminary evaluation of the impact on some environmental indicators, such as greenhouse gases emissions and air pollutants. The key insight emerging from our analysis is that the COVID crumbling of tourism demand generates very relevant distributional consequences.





The Social Accounting Matrix

87 commodities / 84 activities

3 regions

2 households

1 public sector

8 primary factors

Investment/savings



	Commodities / A	Commodities / E	Commodities / W	Activities	Prim. Factors	Households	Public Sector	Savings/Inv.	E Rest of Spain	W Rest of World
Commodities / A				Intermediate Dem. A		Internal HH Consumption	PS Int. Cons.	FCF (Inv.) Internal	Export to E	Export to W
Commodities / E				Interm. Dem. Imp. E		Import E HH Cons.	PS Imp. E Cons.	FCF (Inv.) Imp. E		
Commodities / W				Interm. Dem. Imp. W		Import W HH Cons.	PS Imp. W Cons.	FCF (Inv.) Imp. W		
Activities	Production by activities				Loss compensating transfers					
Prim. Factors				Factor Income					Inc. Fact. Inc. (E)	Inc. Fact. Inc. (W)
Households					Factor Income to HH		PS net Transfers to HH		E net Transf. to HH	W net Transf. to HH(1)
Public Sector				Production Taxes	Factor Taxes	Consumption taxes			E net Transf. to PS	W net Transf. to PS
Savings/Inv.						Households' Savings	PS net Savings		Trade deficit E	Trade deficit W
E Rest of Spain		Import from Rest of Spain			Spanish (E) Factor Income	And. HH consuming in RoS				
W Rest of World			Import from RoW		Foreign (W) Factor Income	And. HH consuming in RoW				

(1) = in case of non-resident households, this expresses the consumption expenditure



The model: MEGA

The general equilibrium model, based on the SAM, takes the form of a large non-linear system of equations, including market balances, budget constraints and accounting identities.

As it is customary in CGE models, functional forms adopted in the model to express the behavioral response of economic agents (to changing relative prices) are based on combinations of Constant Elasticity of Substitution (CES) functions and their variants, like Constant Elasticity of Transformation (CET) and Linear Expenditure System (LES).





The model: MEGA

All primary factors are not perfectly mobile. A CET function is used to allocate the factors among the various productive activities, in such a way that more (but not all) factors get employed where their returns are relatively higher.

Average salaries for labor factors are endogenously determined through a wage curve, meaning that the model computes variations in employment (or unemployment) by worker category.





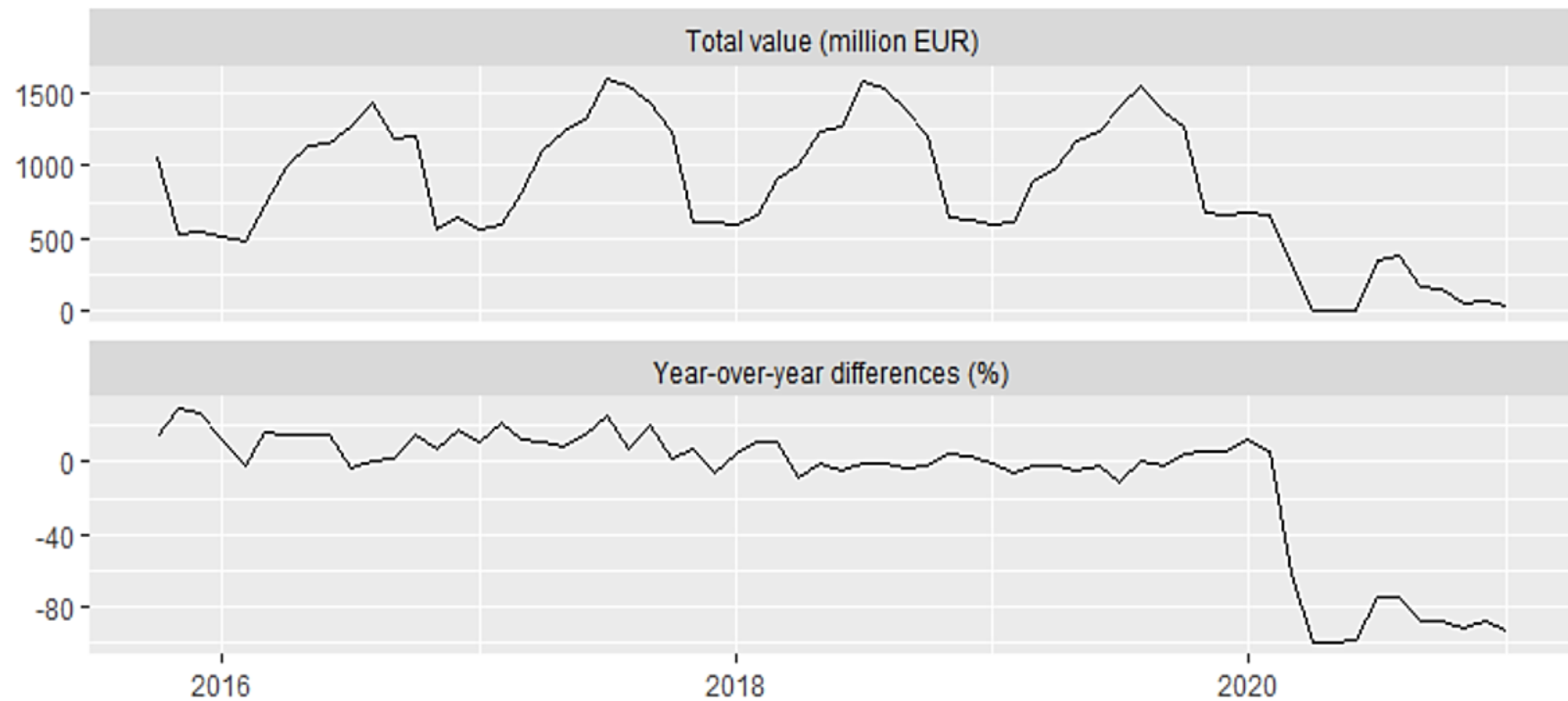
Model closure

As exogenous:

- Prices of imports
- Quantity of exports
- Transfers to/from households and public sector
- Public sector expenditure
- Supply of non-labour factors



Expenditure in Andalusia by international tourists





Running the simulation

Shock to expenditure by Spanish and ROW
tourists

Foreign transfers to non-resident households:

RoS -70%

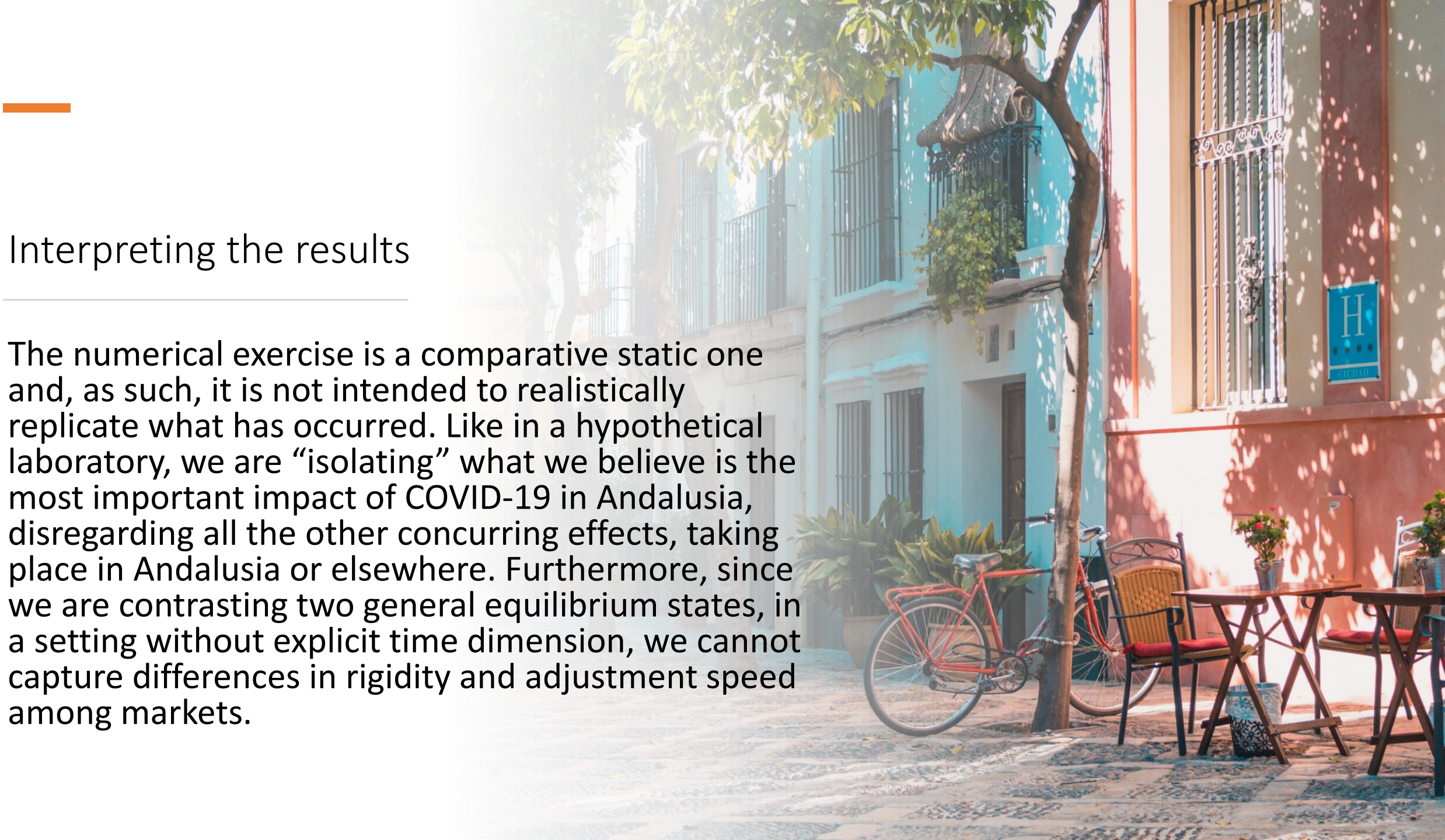
RoW -75%





Interpreting the results

The numerical exercise is a comparative static one and, as such, it is not intended to realistically replicate what has occurred. Like in a hypothetical laboratory, we are “isolating” what we believe is the most important impact of COVID-19 in Andalusia, disregarding all the other concurring effects, taking place in Andalusia or elsewhere. Furthermore, since we are contrasting two general equilibrium states, in a setting without explicit time dimension, we cannot capture differences in rigidity and adjustment speed among markets.





Economic Impact: Key Findings

Regional GDP -3.74%

Price index -1.28%

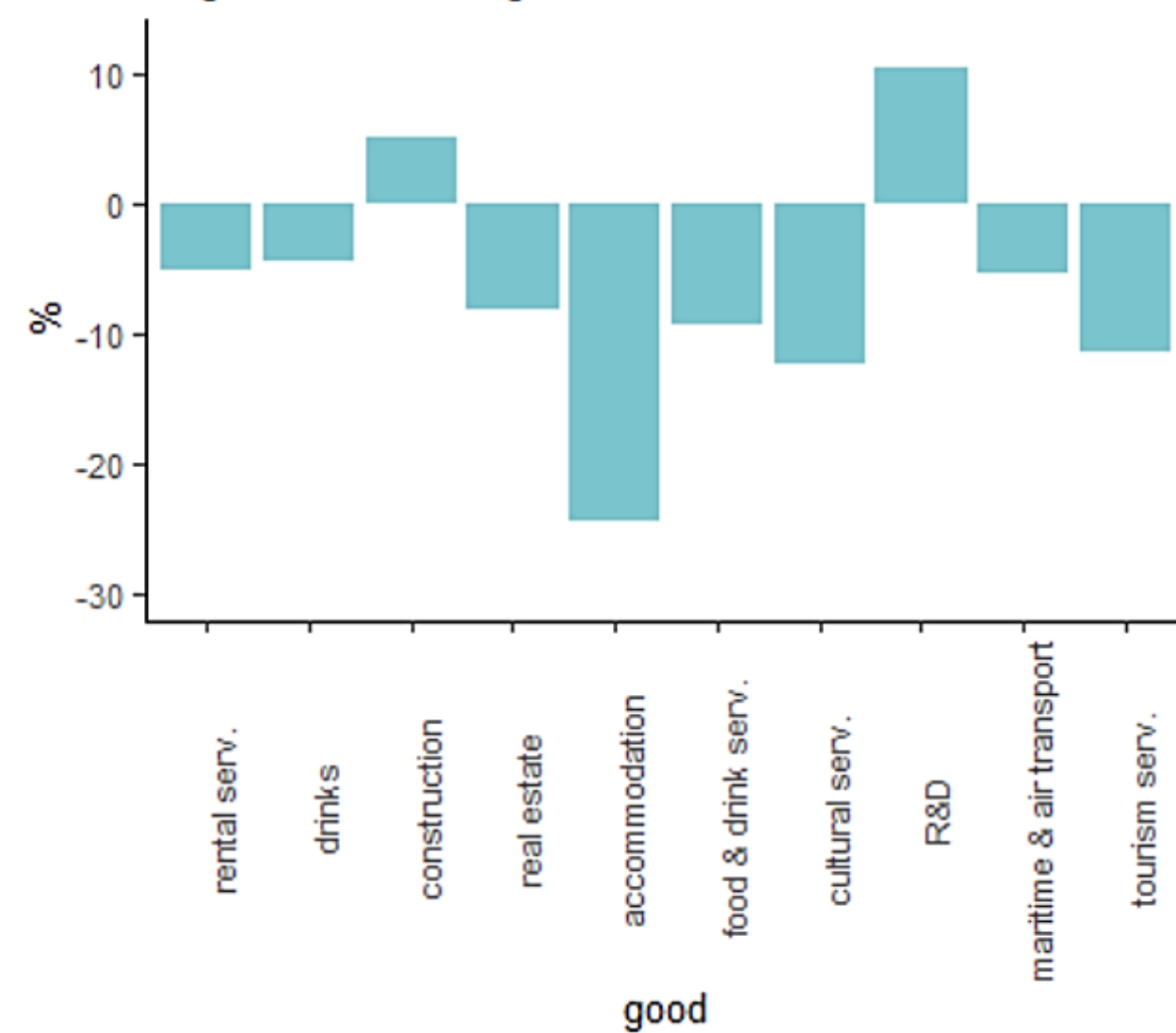
Household income for residents -1.7%

EV for resident households +1968M€



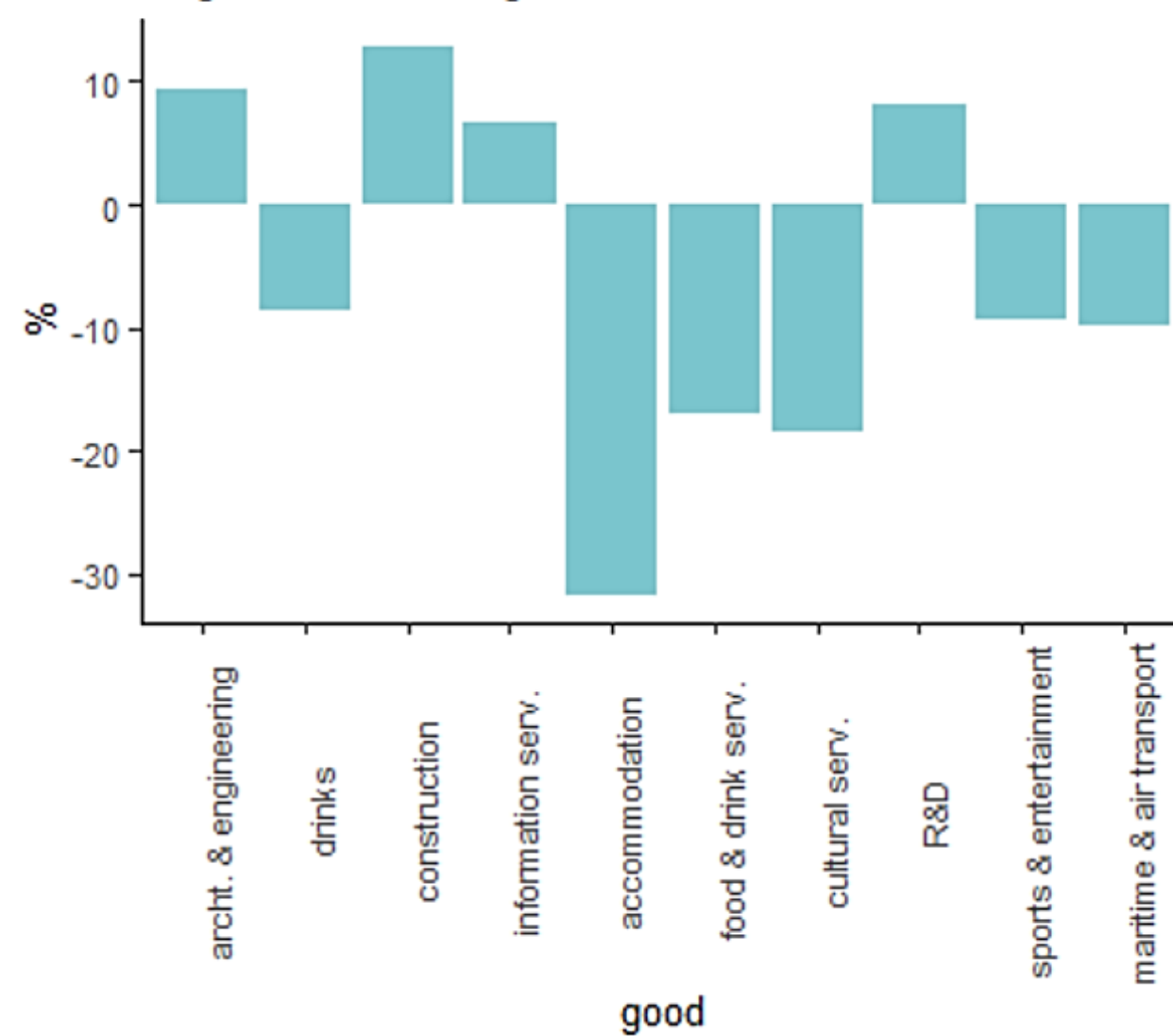
A Change in prices of Andalusian products

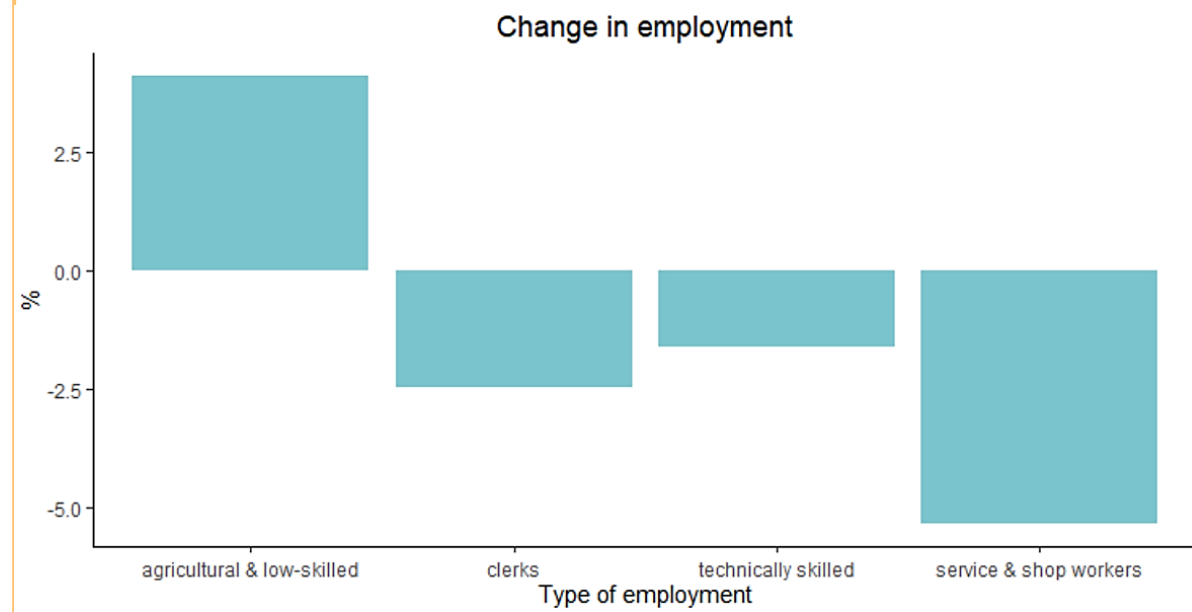
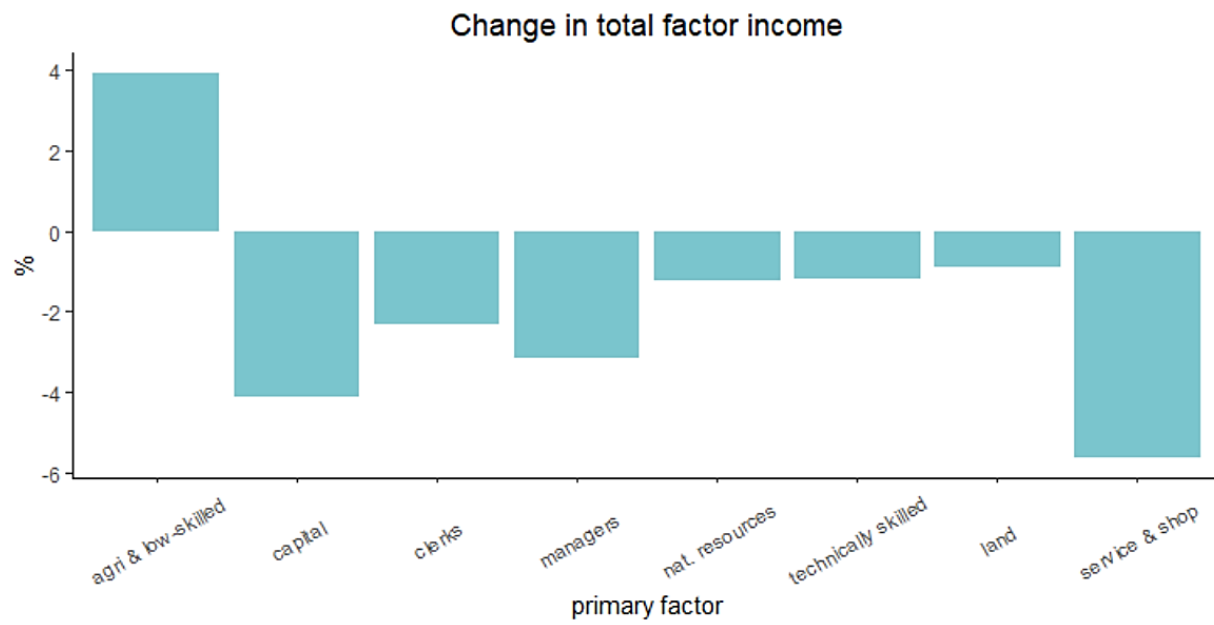
Largest relative changes



B Change in supply of Andalusian products

Largest relative changes







Positive EV?

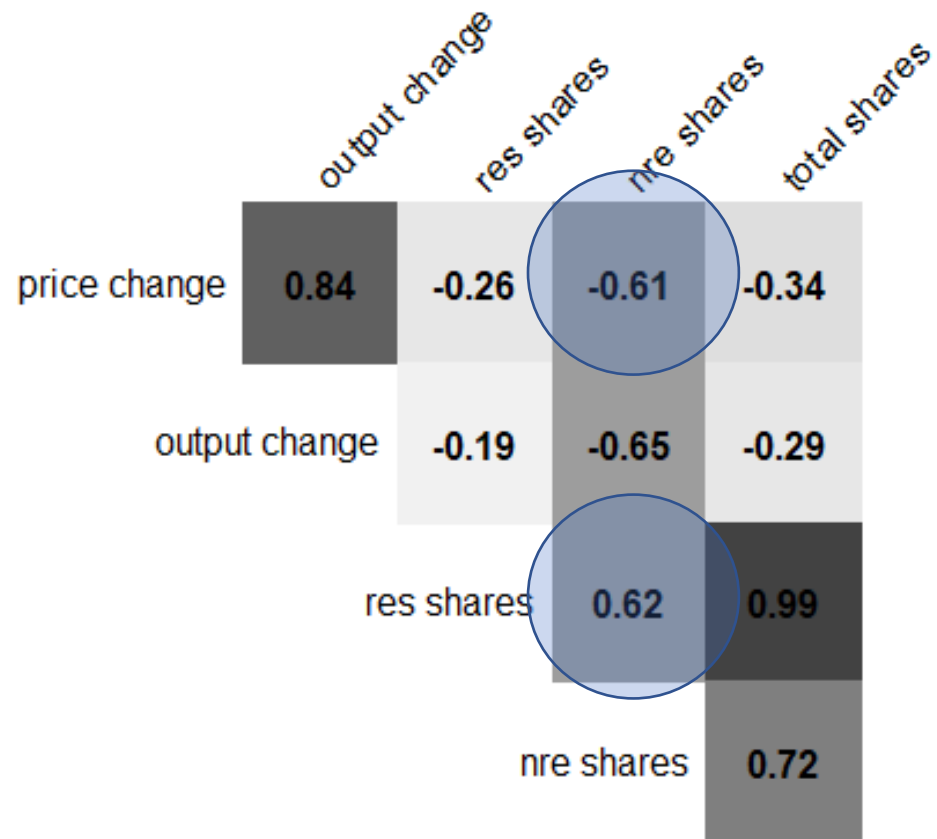
May happen if real income increases + constant saving rate.

CPI falling more than GDP?

Yes, if prices of consumption items with large shares diminish considerably.

May happen if consumption structures of residents and non-residents are sufficiently similar.

Correlation





Environmental Impact

Emissions and air pollution (GTAP)

Two steps for conversion:

- I-O coefficients for Spain

- Incidence matrix for SAMA

Choose corresponding variables in MEGA



Aggregate Findings

Domestic production:

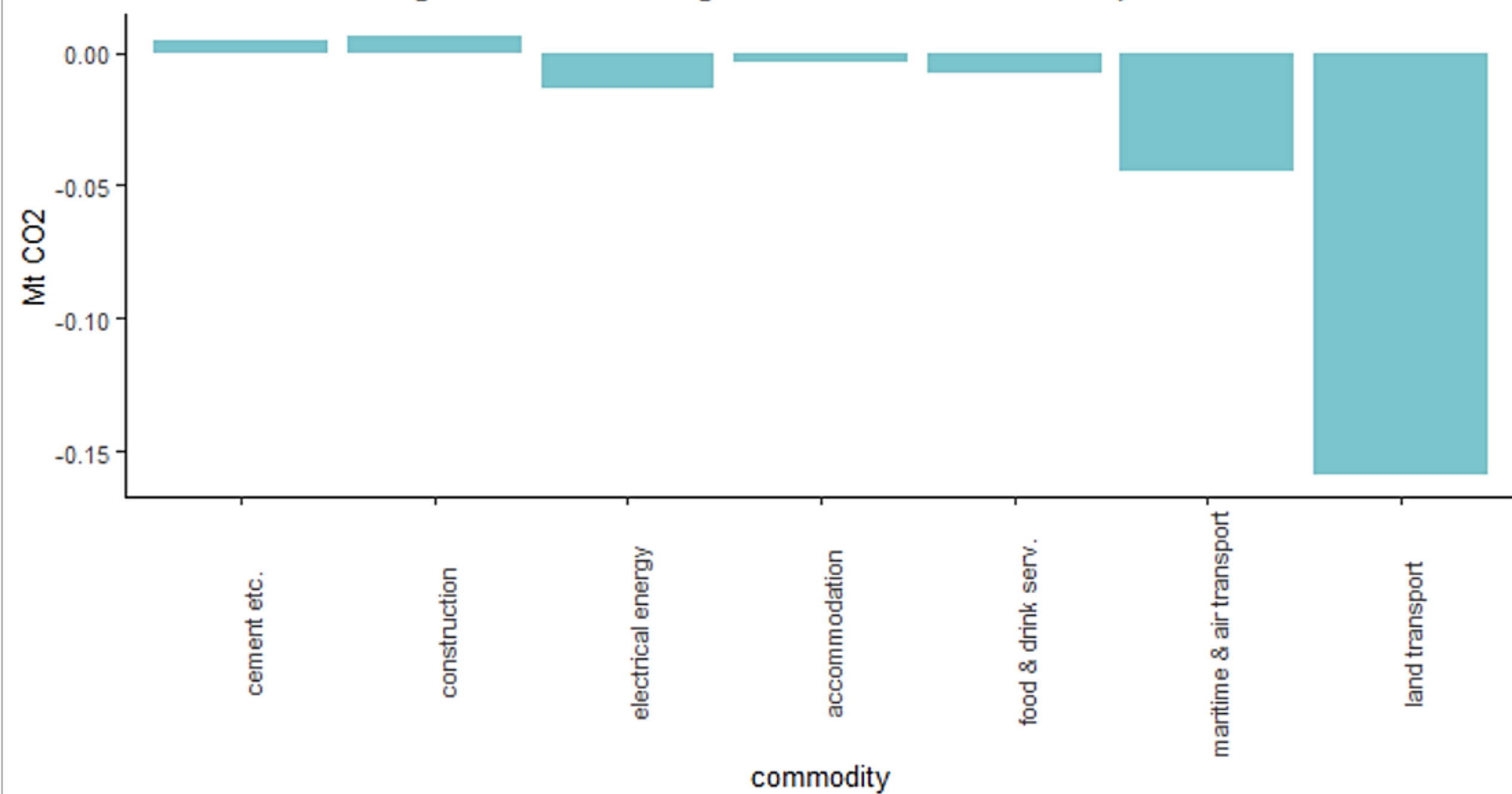
- Decline in CO₂ (-3%), non-CO₂ emissions (-0.4%)
- Increase in air pollution (+0.23Gg)

Private consumption:

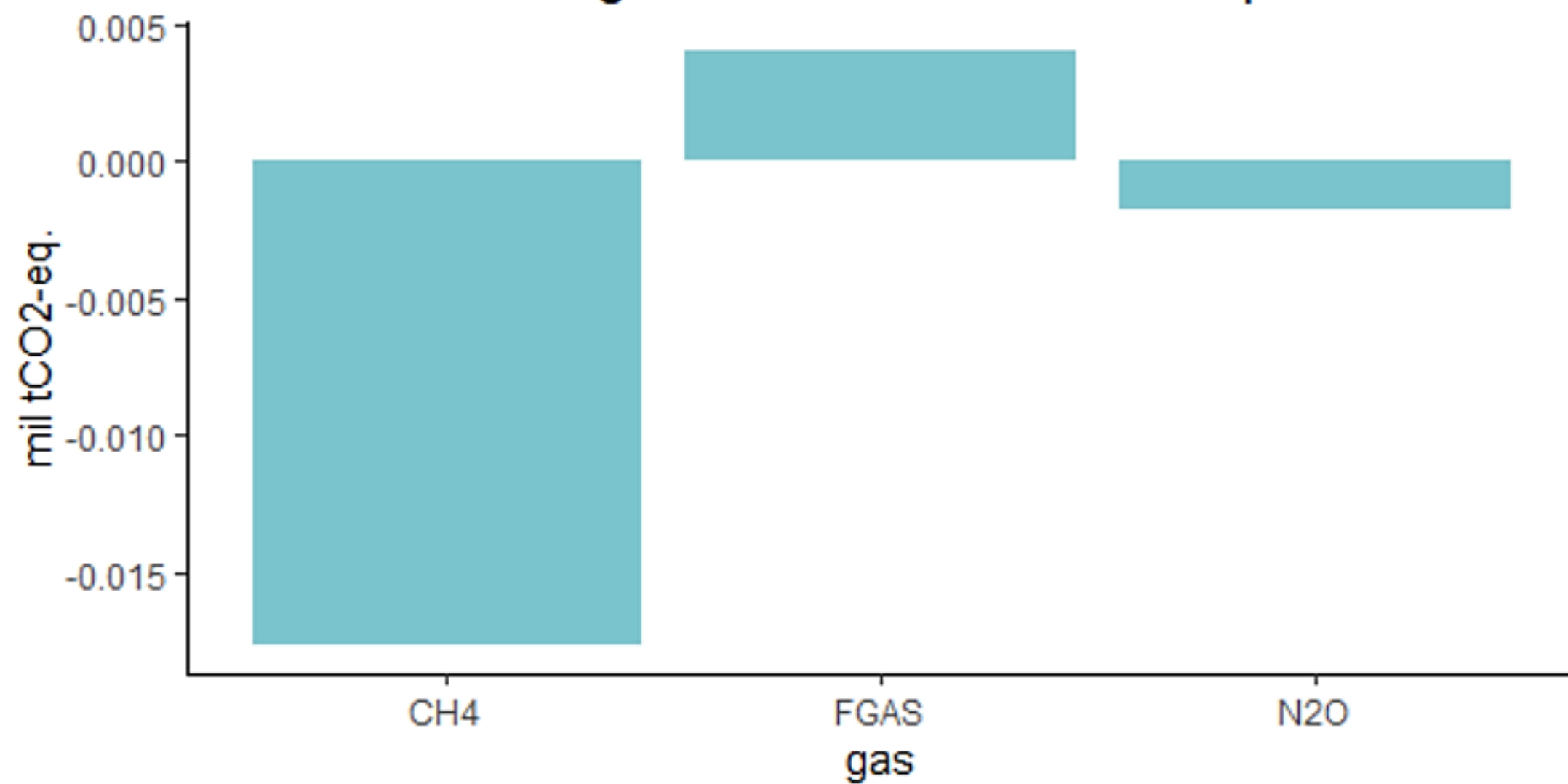
- Decline in CO₂ and non-CO₂ emissions (-6.7%),
- Decline in air pollution (-8.8Gg)

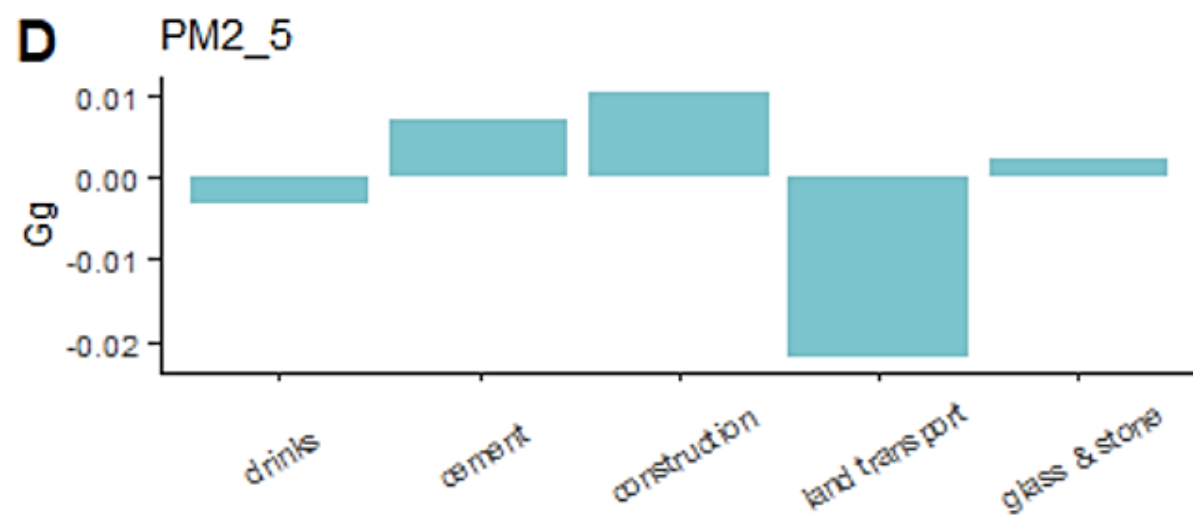
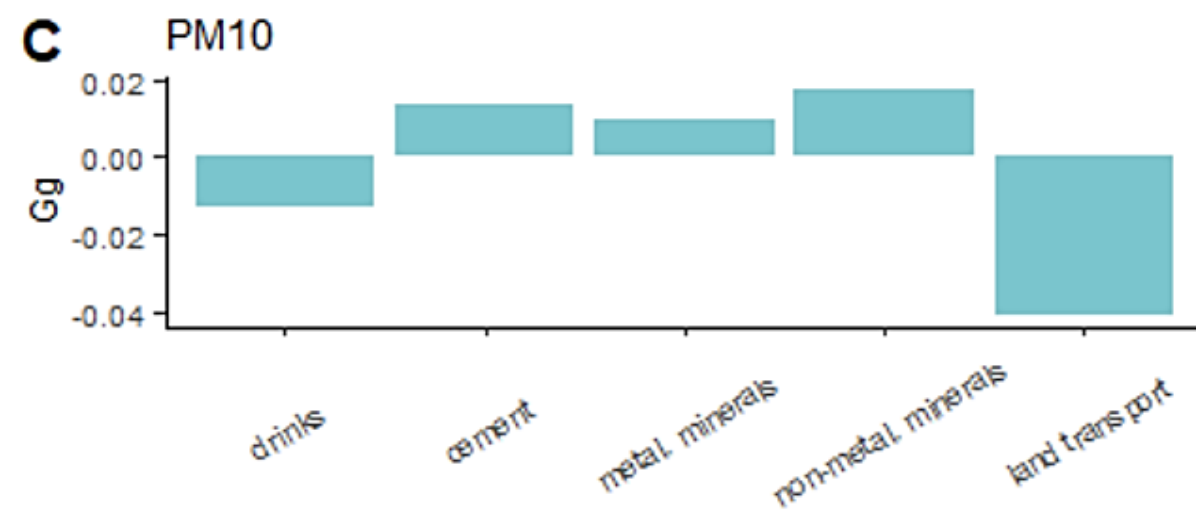
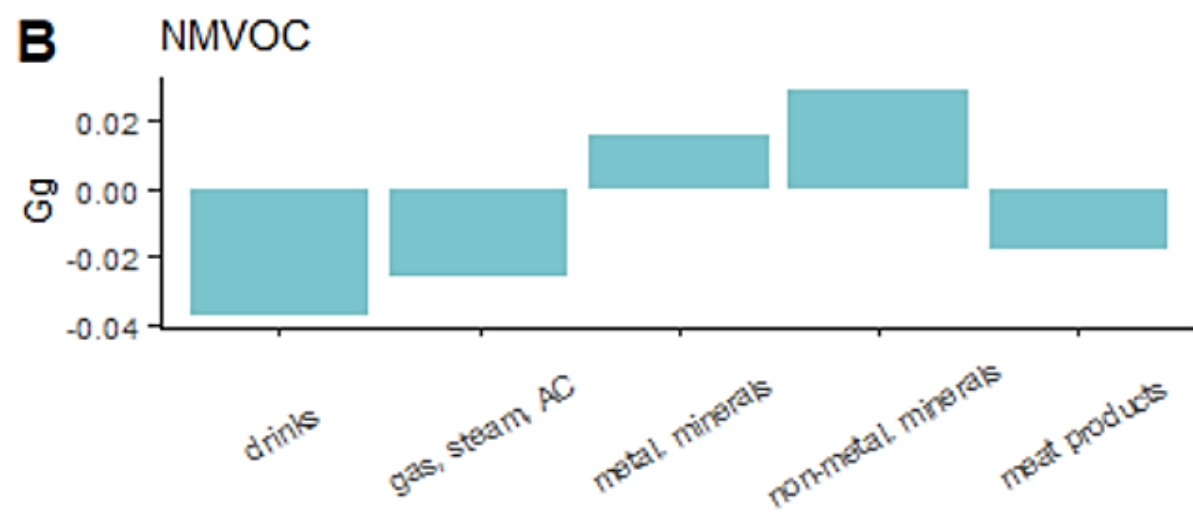
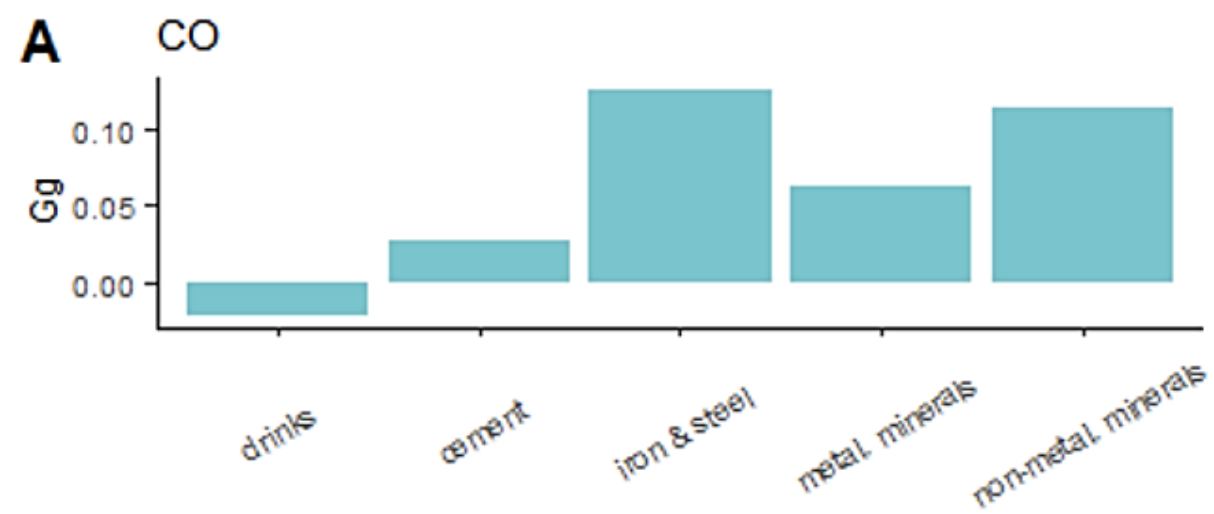


Largest absolute changes in CO2 emissions from production



Absolute change: non-CO2 from domestic production







Decomposition

The pollution impact can be usefully decomposed in two parts. Total emissions vary because of the general activity slowdown, as well as because of the different sectoral mix in the economy.



Table 2. Decomposition of changes in production related emissions

		PHYSICAL			PERCENTAGE	
GHGs	Structure	Scale	Total	Structure	Scale	Total
CO2	-0.129	-0.097	-0.226	-1.66%	-1.26%	-2.92%
N2O	0.006	-0.008	-0.002	1.06%	-1.37%	-0.31%
CH4	0.020	-0.038	-0.018	0.73%	-1.35%	-0.62%
F-gas	0.010	-0.006	0.004	2.21%	-1.34%	0.87%
Total non-CO2	0.037	-0.052	-0.015	0.96%	-1.35%	-0.40%
Air Pollutants						
BC	0.007	-0.008	-0.001	1.10%	-1.26%	-0.16%
CO	1.151	-0.820	0.331	1.80%	-1.28%	0.52%
NH3	0.031	-0.023	0.008	1.67%	-1.26%	0.41%
NMVOC	0.222	-0.269	-0.047	1.03%	-1.24%	-0.22%
NOX	0.019	-0.025	-0.006	0.95%	-1.25%	-0.30%
OC	0.011	-0.013	-0.002	1.04%	-1.25%	-0.21%
PM10	0.100	-0.114	-0.014	1.11%	-1.27%	-0.16%
PM2.5	0.038	-0.041	-0.002	1.18%	-1.25%	-0.07%
SO2	0.027	-0.065	-0.038	0.52%	-1.23%	-0.72%

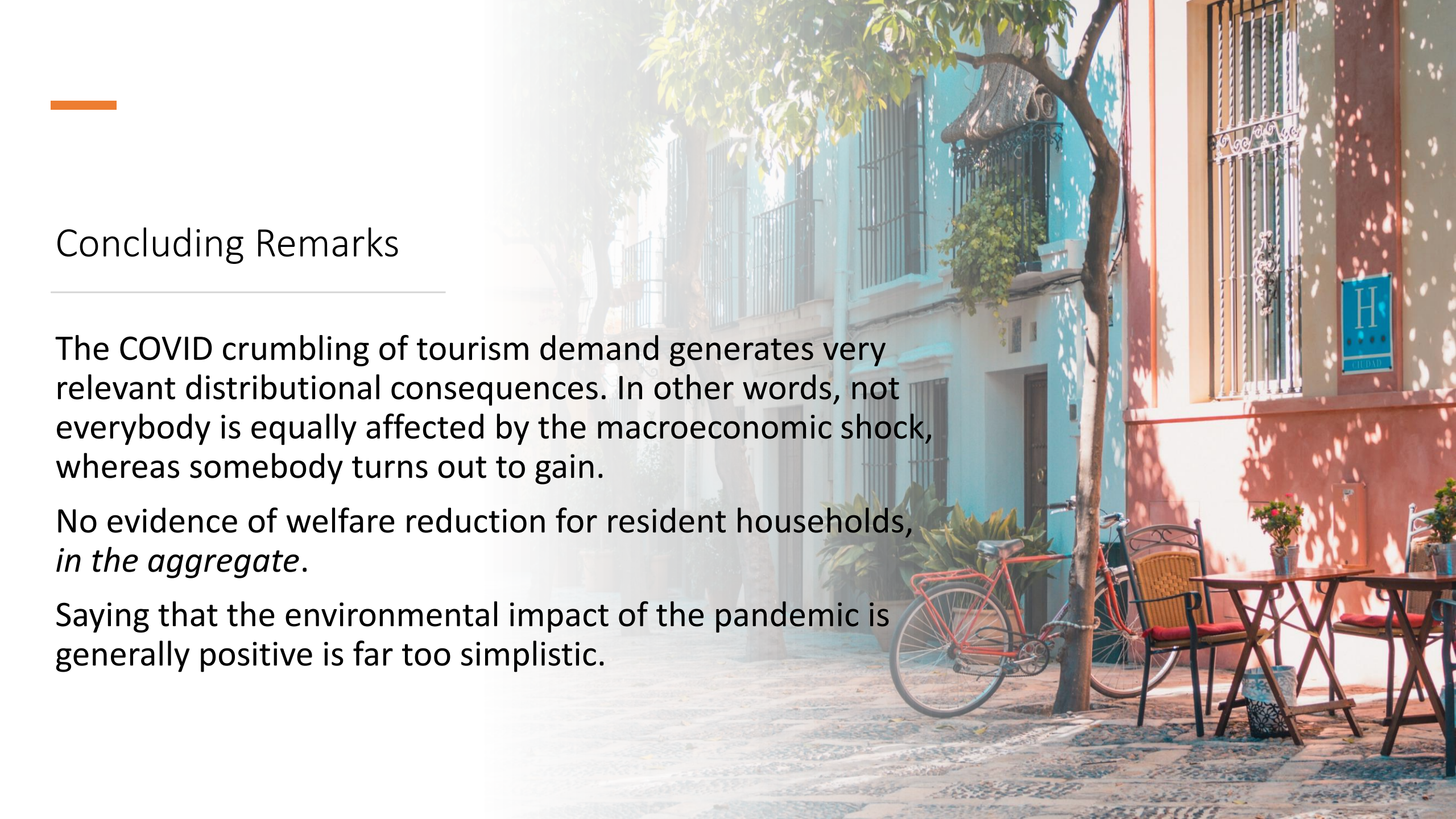


Decomposition

The scale effect is always negative, which simply means that the decrease in economic activity reduces emissions.

The structural change component is generally negative, the only exception being CO₂. This means that the different sectoral mix generated by the tourism demand shock would push the regional economy towards more polluting industries.





Concluding Remarks

The COVID crumbling of tourism demand generates very relevant distributional consequences. In other words, not everybody is equally affected by the macroeconomic shock, whereas somebody turns out to gain.

No evidence of welfare reduction for resident households, *in the aggregate*.

Saying that the environmental impact of the pandemic is generally positive is far too simplistic.



Any question?