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Presentation title:
“Navigating the Crossroads”:
Analyzing the Interplay between Touristic Activity and
Agriculture for Arable Land in Greece

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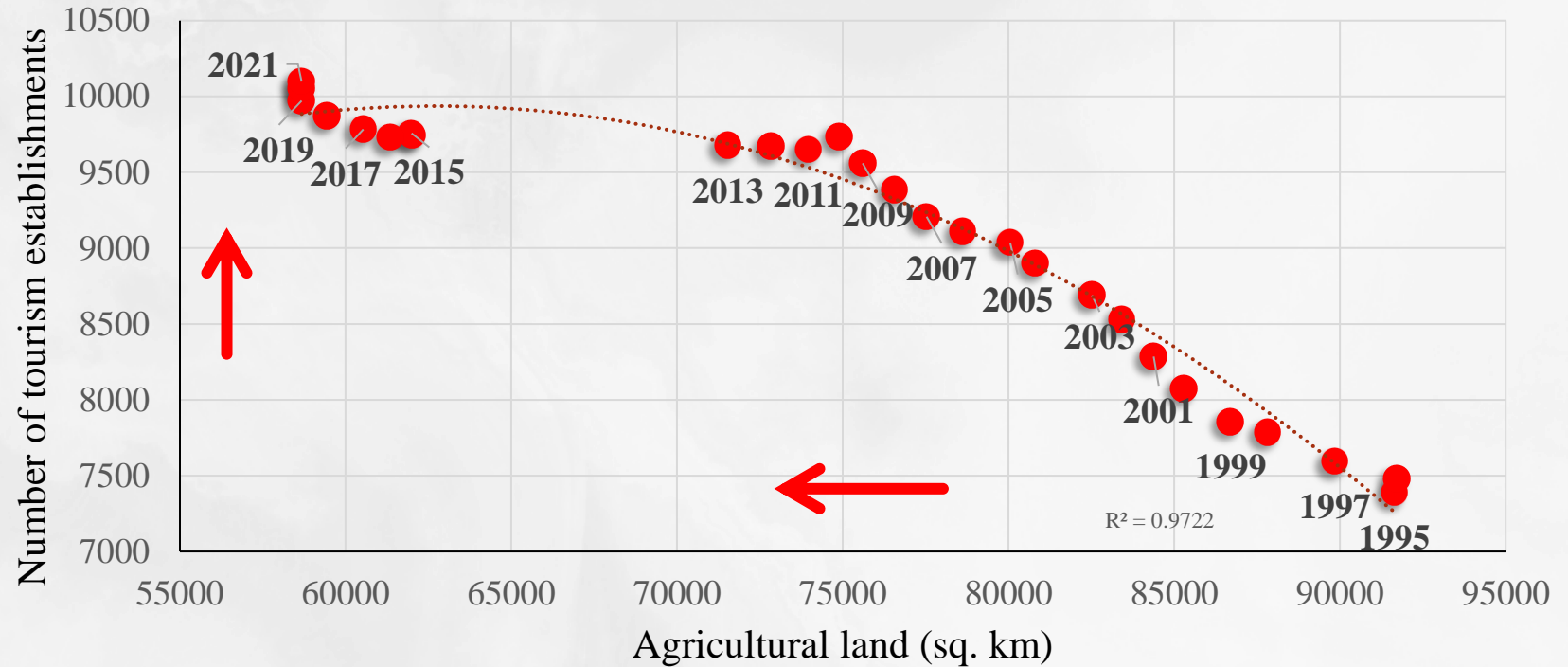
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Some facts...

Tourism establishments vs. agricultural land: Greece (various years)



Land competition patterns between tourism and agricultural activities in Greece, 2001-2021

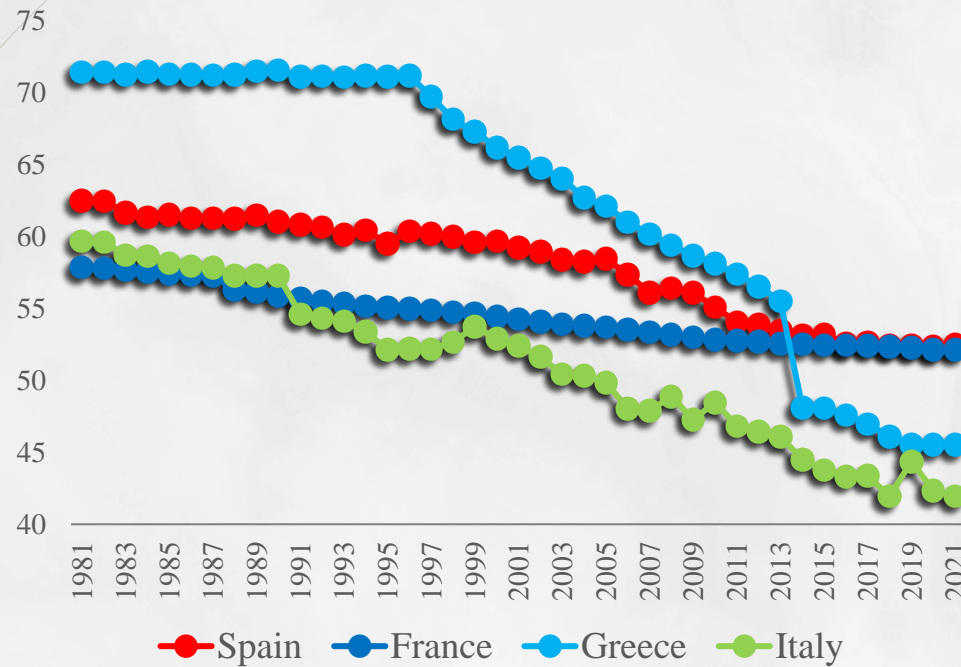
1

Year	2001	2006	2011	2016	2021
Number of rooms (units)	320467	364179	397322	407146	441536
Agricultural land (sq. km)	84380	78630	73960	61360	58671.9
Increase (%) in rooms		13.6	9.1	2.5	8.4
Decrease (%) in land		-6.8	-5.9	-17.0	-4.4
Decrease in land (sq. km) per new room		-0.132	-0.141	-1.283	-0.078

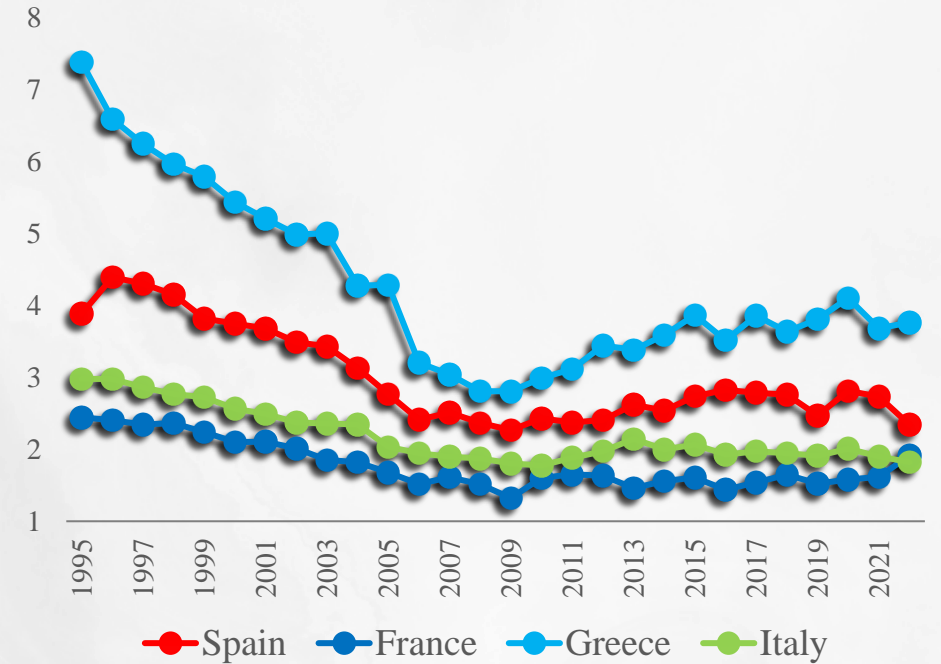
Source: UNWTO & World Bank, 2024.

Some facts and aim of the study

Agricultural land (% of land area)
Source: WDI (AG.LND.AGRI.ZS)



Agriculture, forestry, & fishing, value added (% of GDP)
Source: WDI (NV.AGR.TOTL.ZS)



2

- The study employs the Computable General Equilibrium (CGE) model to dissect the dynamics of the competition between **touristic activity & agriculture at a national level**
- We aspire to further employ the CGE framework to conduct **regional analyses** (NUTS-2 level), investigating variations in the intensity of competition and its localized implications

Lack of recent
relevant studies

Two sectors of
major importance

3

Severe water
scarcity issues

Added value of the study

The contribution of the study:

- **No recent study for Greece:** Economidis & Mena (2017), and Economidis & Economides (2018) for the year 2010...
- No study has ever delved into the **agriculture – tourism nexus...**
- The **major contribution of the tourism sector** to the GDP, but also the devastating effects of the pandemic crisis (2020-2021)
- Many studies have tried to highlight the prospects of **increasing productivity in the Greek agricultural sector**, given the high quality and nutritional value of Greek agri-food products
- Any signs of **strong competition** between these two sectors could imply **significant challenges** for the Greek economy, both in the medium and the long term...
- The need to set out strategies for **sustainable water management** in areas under pressure, due to the intense agriculture and tourism, **water-consuming activities...**
- A first effort to extend this research at the **NUTS2 level** (regions)

Some relevant studies...

- **Skountzos (1988)** sought to establish the quantitative relationships between production activities, factorial incomes and household incomes in Greece
- **Alikaj and Alexopoulos (2014)** estimate the SAM multipliers for the region of Western Macedonia in Greece, highlighting the potential of the services sector for enhancing regional income and employment
- **Economidis and Economides (2018)** employ the input-output tables data for the years 2005, 2008, 2009 and 2010, thus indicating a simultaneous decrease in household and general government income, along with an increase in financial and non-financial institutions
- Several macro-SAMs / CGEs for **Mediterranean** and other countries:
 - Tunisia, 2015 (Ben Salhine et al., 2020)
 - Egypt, 2019 (Serag et al., 2021)
 - Algeria, 2009 (Touitou, 2018)
 - Côte d'Ivoire, 2015 (Ferreira et al., 2021)
 - Ghana, 2007 (Breisinger et al., 2009)
 - China, 1987-2017 (Zhang & Diao, 2020)
- No study has ever delved into the agriculture – tourism nexus...

Step 1. **Identify the sub-sectors of interest**

- **Sub-sectors directly linked to agricultural production**
- **Sub-sectors directly linked to tourism activities**
- **Sub-sectors indirectly linked to both sectors**

Step 2. **Adjust Input-Output (I-O) tables (various years)**

- **Adjust I-O tables for the aggregate of sectors**
- **Adjustments for the selected sub-sectors (+rest of sub-sectors)**
- **Calculate the I-O multipliers**

Step 3. **Adjust SAM tables and run the CGE models**

- **Adjust SAM tables for the aggregate of sectors**
- **Adjustments for the selected sub-sectors (+rest of sub-sectors)**
- **Employ the General Algebraic Modelling System (GAMS) software to run the CGE models**

Step 4. **Collect data for regional SAMs, run the CGE models**

- **Upon request from the Hellenic Statistical Authority (EL.STAT.)**
- **Data calibration and run the regional CGEs**

Which sectors to examine the **tourism** / **agriculture** nexus?

Agriculture	Products of agriculture, hunting and related services	[CPA_A01]
	Products of forestry, logging and related services	[CPA_A02]
	Fish & other fishing products; aquaculture products; support services to fishing	[CPA_A03]
Industry	Rest of the Industry sector	
	Food, beverages and tobacco products	[CPA_C10-12]
Construction	Constructions and construction works	[CPA_F]
Services	Rest of the Services sector	
	Wholesale trade services, except of motor vehicles and motorcycles	[CPA_G46]
	Retail trade services, except of motor vehicles and motorcycles	[CPA_G47]
	Land transport services and transport services via pipelines	[CPA_H49]
	Water transport services	[CPA_H50]
	Air transport services	[CPA_H51]
	Accommodation and food services	[CPA_I]
	Real estate services excluding imputed rents	[CPA_L68B]
	Rental and leasing services	[CPA_N77]
	Travel agency, tour operator and other reservation services and related services	[CPA_N79]
	Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services	[CPA_R90-92]
Sporting services and amusement and recreation services	[CPA_R93]	

- **Databases:** ELSTAT & Eurostat: European System of Accounts (ESA 2010)
 - ↳ **Three (3) Input – Output (I-O) tables for Greece, so far 2010, 2015, 2020**

- **A period of successive crises for the Greek economy and society:**
 - **2010:** Global financial crisis, the Greek economy under the high surveillance of the IMF
 - **2015:** Imposition of capital controls (banking system - June), the impact of the refugee crisis (2014-2016)
 - **2020:** The pandemic crisis, affecting both businesses and households...

- **Which sectors under consideration?**
 - **Aggregate data:** Agriculture / Industry / Construction / Services
 - **Sectoral data:** 16 out of 65 sectors (~25%)

	Intermediate use	Output	2010
1	Water transport services	Travel agency, tour operator and other reservation services and related services	2.07
2	Food, beverages & tobacco products	Products of agriculture, hunting and related services	1.18
3	Accommodation & food services	Fish and other fishing products; aquaculture products; support services to fishing	0.96
4	Accommodation & food services	Food, beverages and tobacco products	0.91
5	Accommodation & food services	Products of agriculture, hunting and related services	0.89
6	Food, beverages & tobacco products	Fish and other fishing products; aquaculture products; support services to fishing	0.46
7	Water transport services	Rental and leasing services	0.46
8	Water transport services	Food, beverages and tobacco products	0.45
9	Water transport services	Products of agriculture, hunting and related services	0.43
10	Water transport services	Fish and other fishing products; aquaculture products; support services to fishing	0.38

The results so far...

Ten highest I-O Multipliers

	Intermediate use	Output	2020
1	Food, beverages and tobacco products	Products of agriculture, hunting & related services	1.51
2	Food, beverages and tobacco products	Fish and other fishing products; aquaculture products; support services to fishing	0.89
3	Accommodation & food services	Fish and other fishing products; aquaculture products; support services to fishing	0.86
4	Accommodation & food services	Food, beverages and tobacco products	0.85
5	Accommodation & food services	Products of agriculture, hunting and related services	0.83
6	Creative, arts, entertainment, library, archive, museum, other cultural services	Sporting services and amusement and recreation services	0.69
7	Food, beverages & tobacco products	Products of forestry, logging and related services	0.63
8	Water transport services	Travel agency, tour operator and other reservation services and related services	0.57
9	Food, beverages and tobacco products	Wholesale trade services, except of motor vehicles and motorcycles	0.50
10	Sporting services and amusement and recreation services	Travel agency, tour operator and other reservation services and related services	0.44

Ten highest I-O Multipliers - Diagonal

SELF - CONSUMPTION	2010	2015	2020
Water transport services [CPA_H50]	7.40	12.33	5.85
Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services [CPA_R90-92]	2.30	2.27	3.04
Fish & other fishing products; aquaculture products; support services to fishing [CPA_A03]	1.36	1.82	2.23
Food, beverages and tobacco products [CPA_C10-12]	1.43	1.55	1.88
Products of agriculture, hunting and related services [CPA_A01]	1.48	1.50	1.79
Sporting services and amusement and recreation services [CPA_R93]	1.28	1.46	1.51
Travel agency, tour operator and other reservation services & related services [CPA_N79]	1.49	2.00	1.31
Wholesale trade services, except of motor vehicles and motorcycles [CPA_G46]	1.13	1.12	1.15
Constructions and construction works [CPA_F]	1.65	1.43	1.13
Products of forestry, logging and related services [CPA_A02]	1.19	1.08	1.10

- If the final demand for intermediate creative/cultural services (CPA_R90-92) rises by 1 monetary unit (euros), then the output of the sector referring to creative/cultural services goes up by **3.04 euros**
- **Strong and increasing multiplier effects in the agri-food sector (2.23 / 1.88 / 1.79 / 1.10 in 2020), very strong but unstable in water transport services (5.85 in 2020)**

TIME	2010	2010	2010	2010	2010	2010	2010	2010
	Products of agriculture	Fish & other fishing products	Food, beverages & tobacco	Construction	Accommodation & food services	Real estate services	Rental & leasing services	Travel agency & related services
PROD_NA (Labels)								
INDUSE (Labels)								
Products of agriculture	1.481	0.050	0.145	0.034	0.008	0.045	0.022	0.023
Fish & other fishing products	0.003	1.358	0.003	0.002	0.001	0.002	0.001	0.003
Food, beverages & tobacco	1.182	0.461	1.434	0.098	0.039	0.126	0.079	0.089
Construction	0.030	0.025	0.026	1.654	0.021	0.105	0.164	0.076
Accommodation & food services	0.888	0.963	0.912	0.112	1.054	0.145	0.098	0.264
Real estate services	0.036	0.033	0.032	0.070	0.029	1.047	0.033	0.047
Rental & leasing services	0.010	0.009	0.009	0.004	0.008	0.005	1.070	0.019
Travel agency & related services	0.154	0.165	0.158	0.043	0.177	0.034	0.073	1.488

TIME	2015	2015	2015	2015	2015	2015	2015	2015
	Products of agriculture	Fish & other fishing products	Food, beverages & tobacco	Construction	Accommodation & food services	Real estate services	Rental & leasing services	Travel agency & related services
PROD_NA (Labels)								
INDUSE (Labels)								
Products of agriculture	1.495	0.075	0.227	0.045	0.015	0.059	0.024	0.029
Fish & other fishing products	0.005	1.824	0.005	0.003	0.002	0.003	0.002	0.006
Food, beverages & tobacco	1.238	0.484	1.550	0.135	0.063	0.164	0.087	0.109
Construction	0.028	0.022	0.024	1.434	0.018	0.076	0.074	0.045
Accommodation & food services	0.977	1.018	1.000	0.175	1.120	0.202	0.133	0.420
Real estate services	0.043	0.039	0.040	0.129	0.036	1.044	0.032	0.050
Rental & leasing services	0.012	0.011	0.012	0.005	0.011	0.007	1.062	0.020
Travel agency & related services	0.380	0.394	0.389	0.126	0.429	0.116	0.160	1.999

- Weakened effect of the final demand in construction sector on output of all sectors involved
- Conjunctural factors → The global financial crisis already affects the Greek economy, namely in the real estate & construction sectors
- Increasing multiplier effects between tourism-related activities and output in agri-food and construction

TIME	2015	2015	2015	2015	2015	2015	2015	2015
	Products of agriculture	Fish & other fishing products	Food, beverages & tobacco	Construction	Accommodation & food services	Real estate services	Rental & leasing services	Travel agency & related services
PROD_NA (Labels)								
INDUSE (Labels)								
Products of agriculture	1.495	0.075	0.227	0.045	0.015	0.059	0.024	0.029
Fish & other fishing products	0.005	1.824	0.005	0.003	0.002	0.003	0.002	0.006
Food, beverages & tobacco	1.238	0.484	1.550	0.135	0.063	0.164	0.087	0.109
Construction	0.028	0.022	0.024	1.434	0.018	0.076	0.074	0.045
Accommodation & food services	0.977	1.018	1.000	0.175	1.120	0.202	0.133	0.420
Real estate services	0.043	0.039	0.040	0.129	0.036	1.044	0.032	0.050
Rental & leasing services	0.012	0.011	0.012	0.005	0.011	0.007	1.062	0.020
Travel agency & related services	0.380	0.394	0.389	0.126	0.429	0.116	0.160	1.999

TIME	2020	2020	2020	2020	2020	2020	2020	2020
	Products of agriculture	Fish & other fishing products	Food, beverages & tobacco	Construction	Accommodation & food services	Real estate services	Rental & leasing services	Travel agency & related services
PROD_NA (Labels)								
INDUSE (Labels)								
Products of agriculture	1.788	0.211	0.438	0.072	0.012	0.093	0.035	0.034
Fish & other fishing products	0.007	2.234	0.007	0.003	0.000	0.004	0.002	0.002
Food, beverages & tobacco	1.514	0.893	1.881	0.144	0.035	0.205	0.099	0.094
Construction	0.014	0.010	0.011	1.134	0.006	0.081	0.035	0.018
Accommodation & food services	0.834	0.858	0.850	0.094	1.022	0.131	0.065	0.154
Real estate services	0.046	0.042	0.041	0.303	0.037	1.061	0.033	0.042
Rental & leasing services	0.008	0.006	0.007	0.003	0.004	0.004	1.069	0.018
Travel agency & related services	0.039	0.040	0.040	0.017	0.044	0.032	0.025	1.306

- A restart in construction activities between 2015 and 2020
- The multipliers in the agri-food industry become even more important
- Final demand in agricultural sector (+1) → Output in construction (+0.045)
- Decreasing multiplier effects between tourism-related activities and output in agri-food and construction..

Social accounting matrix: Greece, 2010

2010		Activities				Commodities				Factors		Agents			ROW	TOT
		AGRI	INDU	CONS	SERV	AGRI	INDU	CONS	SERV	LAB	CAP	HOU	GOV	S-I		
Activities	AGRI					13407									1635	15042
	INDU						60790								14465	75255
	CONS							23785							537	24322
	SERV								257055						22607	279661
Commodities	AGRI	1662	3756	3	862							4779	0	3888		14951
	INDU	1620	27042	6551	18810							36346	6269	14502		111139
	CONS	13	36	1350	2233							699	0	19701		24031
	SERV	1376	14672	5449	64235							98916	43839	40163		268650
Factors	LAB	563	10903	2922	66086											80474
	CAP	7894	13352	6530	90615											118391
Agents	HOU									80474	118391					198865
	GOV	388	2143	595	5234											8359
	S-I	1527	3352	922	31586							58124	-41748	24491		78254
	ROW					1543	50349	247	11596							63735
TOT	15042	75255	24322	279661	14951	111139	24031	268650	80474	118391	198865	8359	78254	63735	1361130	

Values: In million euros

Household consumption

Government consumption

Investment

Exports

Compensation of employees

Operating surplus

total

total

Government income

Imports

Household savings

Government savings

Social accounting matrix: Greece, 2020

2020		Activities				Commodities				Factors		Agents			ROW	TOT			
		AGRI	INDU	CONS	SERV	AGRI	INDU	CONS	SERV	LAB	CAP	HOU	GOV	S-I					
Activities	AGRI					12971									2144	15115			
	INDU						43093								22702	65795			
	CONS							8104							579	8683			
	SERV								179095						23167	202262			
Commodities	AGRI	1894	3434	8	812							5106	0	3405		14658			
	INDU	2037	24633	2625	15500							33719	4581	11039		94135			
	CONS	13	34	138	1295							303	0	6549		8331			
	SERV	1358	12451	2424	44917							65570	33496	30767		190983			
Factors	LAB					755	8459	1617	53996							64826			
	CAP					7330	12636	1261	59811							81038			
Agents	HOU											64826	81038			145865			
	GOV					467	1224	182	4112							5985			
	S-I					1262	2924	428	21819					41166	-32092	16252	51760		
	ROW									1688	51042	227	11888			64844			
TOT					15115	65795	8683	202262	14658	94135	8331	190983	64826	81038	145865	5985	51760	64844	1014280

Values: In million euros

Household consumption

Government consumption

Investment

Exports

Compensation of employees

Operating surplus

total

total

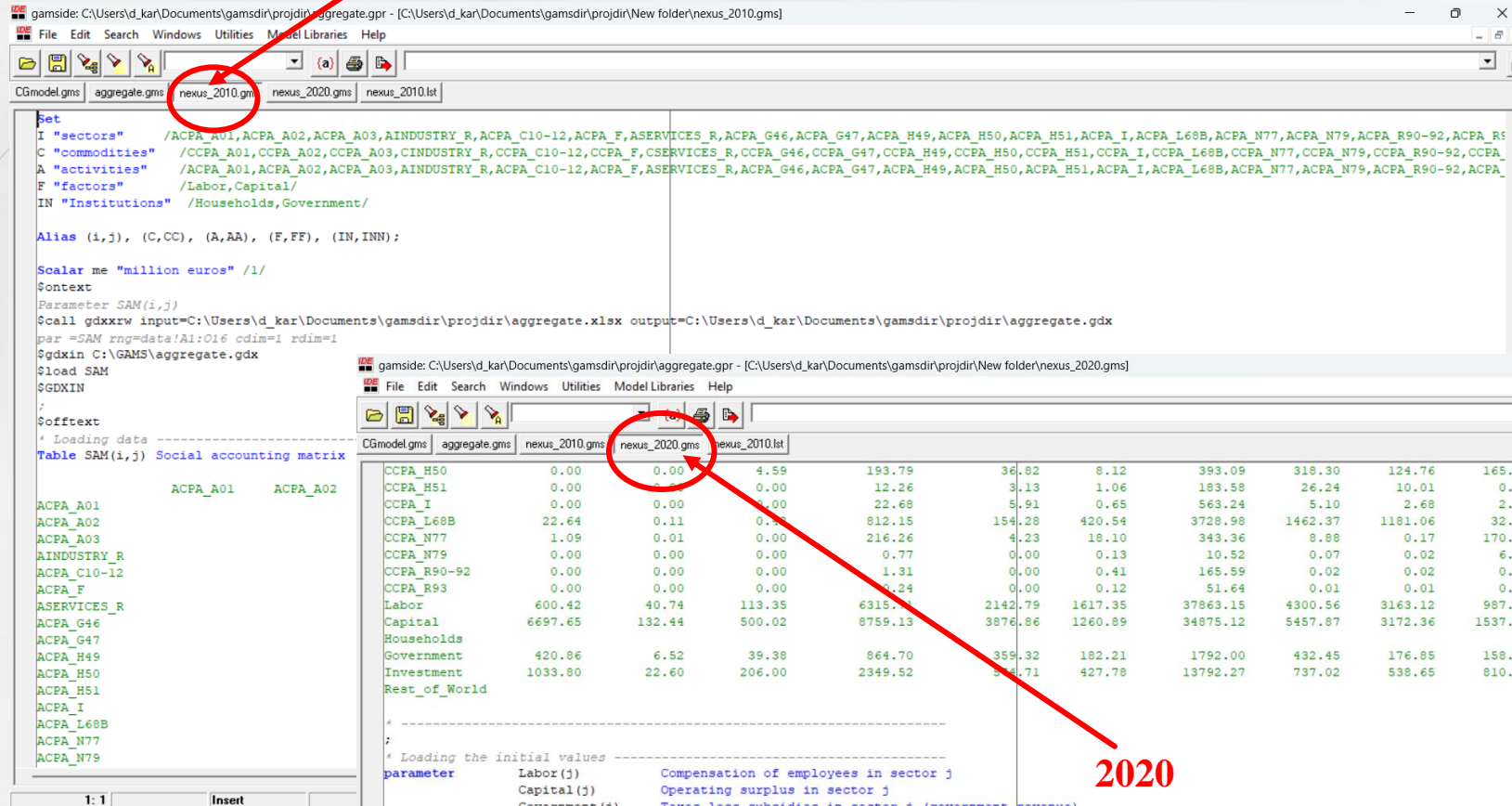
Government income

Imports

Household savings

Government savings

2010



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Set
I "sectors" /ACPA_A01,ACPA_A02,ACPA_A03,AINDUSTRY_R,ACPA_C10-12,ACPA_F,ASERVICES_R,ACPA_G46,ACPA_G47,ACPA_H49,ACPA_H50,ACPA_H51,ACPA_I,ACPA_L68B,ACPA_N77,ACPA_N79,ACPA_R90-92,ACPA_R93/
C "commodities" /CCPA_A01,CCPA_A02,CCPA_A03,CINDUSTRY_R,CCPA_C10-12,CCPA_F,CSERVICES_R,CCPA_G46,CCPA_G47,CCPA_H49,CCPA_H50,CCPA_H51,CCPA_I,CCPA_L68B,CCPA_N77,CCPA_N79,CCPA_R90-92,CCPA_R93/
A "activities" /ACPA_A01,ACPA_A02,ACPA_A03,AINDUSTRY_R,ACPA_C10-12,ACPA_F,ASERVICES_R,ACPA_G46,ACPA_G47,ACPA_H49,ACPA_H50,ACPA_H51,ACPA_I,ACPA_L68B,ACPA_N77,ACPA_N79,ACPA_R90-92,ACPA_R93/
F "factors" /Labor,Capital/
IN "Institutions" /Households,Government/

Alias (i,j), (C,CC), (A,AA), (F,FF), (IN,INN);

Scalar me "million euros" /1/
$ontext
Parameter SAM(i,j)
$call gdxrw input=C:\Users\d_kar\Documents\gamsdir\projdir\aggregate.xlsx output=C:\Users\d_kar\Documents\gamsdir\projdir\aggregate.gdx
par =SAM rng=data!A1:O16 cdim=1 rdim=1
$gdxin C:\GAMS\aggregate.gdx
$load SAM
$GDXIN
;
$offtext
* Loading data -----
Table SAM(i,j) Social accounting matrix
ACPA_A01 ACPA_A01 ACPA_A02
ACPA_A01
ACPA_A02
ACPA_A03
AINDUSTRY_R
ACPA_C10-12
ACPA_F
ASERVICES_R
ACPA_G46
ACPA_G47
ACPA_H49
ACPA_H50
ACPA_H51
ACPA_I
ACPA_L68B
ACPA_N77
ACPA_N79
ACPA_R90-92
ACPA_R93
Labor
Capital
Households
Government
Investment
Rest_of_World
-----
* Loading the initial values -----
parameter
Labor(j) Compensation of employees in sector j
Capital(j) Operating surplus in sector j
Government(j) Taxes less subsidies in sector j (government revenue)
Government(i) Government consumption of commodity i
Households(i) Household consumption of commodity i
Investment(i) Final demand of commodity i for investment purposes
Rest_of_World(i) Exports of commodity i
Rest_of_World(j) Imports from sector j
Investment(j) Consumption of fixed capital in sector j
Totallabor Total compensation of employees to households
Totocapital Total operating surplus to households
Housesav Household savings
Governsav Government savings
Rowsav Savings from the rest of the world
;
Labor(j) = SAM("Labor",j);
Capital(j) = SAM("Capital",j);
Government(j) = SAM("Government",j);
Government(i) = SAM(i,"Government");
Households(i) = SAM(i,"Households");

```

2020

13

Preparing GAMS models
(2010, 2015, 2020)

What's next?

Apply the **CGE model** at the **regional level** as well (NUTS2):
13 regions for Greece

- **Data availability at NUTS2 level (Eurostat)**
 - Value added (*nama_10r_3gva* d/s)
 - Gross Fixed Capital Formation (*nama_10r_2gfcf* d/s)
 - Compensation of employees (*nama_10r_2coe* d/s)
 - Allocation of primary income account of households: Property income paid and received (*nama_10r_2hhinc* d/s)
 - Consumption of fixed capital, operating surplus, taxes (same)
- **Time period under study**
 - Data available for the **2010-2022 period**
 - Any time period extensions → data upon request (EL.STAT.)

Muito obrigado!
Thank you very much!
Ευχαριστούμε πολύ!

