CENTER FOR REGIONAL ECONOMICS AND POLICY
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ESCUELA DE NEGOCIOS

Chile: Socio Economic Impacts from Climate Policies

By
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Latin America and Caribbean (LAC) awareness creation workshop to maximize the positive and minimize the negative impacts of implementation of Climate Change response measures.

May 22th to 24th, 2019, Santiago, Chile.

United Nations Climate Change Secretariat

Ministerio de Relaciones Exteriores
Gobierno de Chile

Naciones Unidas
CEPAL

International Labour Office
Bureau international du Travail
Oficina Internacional del Trabajo

Acknowledge

Project CONICYT - FAPESP 2018/08337-8

Agricola and Agroindustry Sustainability in Chile: Modeling the Climate Change and Natural Disasters Impacts in an Integrated System.

Supported by:

CONICYT
Ministerio de Educación
Gobierno de Chile
FONDECYT
Fondo Nacional de Desarrollo Científico y Tecnológico

FAPESP
FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO

Developed by:

NEREUS
Núcleo de Economia Regional e Urbana da Universidade de São Paulo
The University of São Paulo Regional and Urban Economics Lab

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Team

Project CONICYT - FAPESP 2018/08337-8

NEREUS
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Patricio Aroca (coordinator)
Pilar Jano
Juan Pedro Eberhard
Esteban López

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Project CONICYT – BMBF 150061

Development of Sustainable Mining Strategies in Chile with a Regionalized National Model

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GLIS
SPECIALISTS IN EMPIRICAL ECONOMIC RESEARCH

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Development of Sustainable Mining Strategies in Chile with a Regionalized National Model

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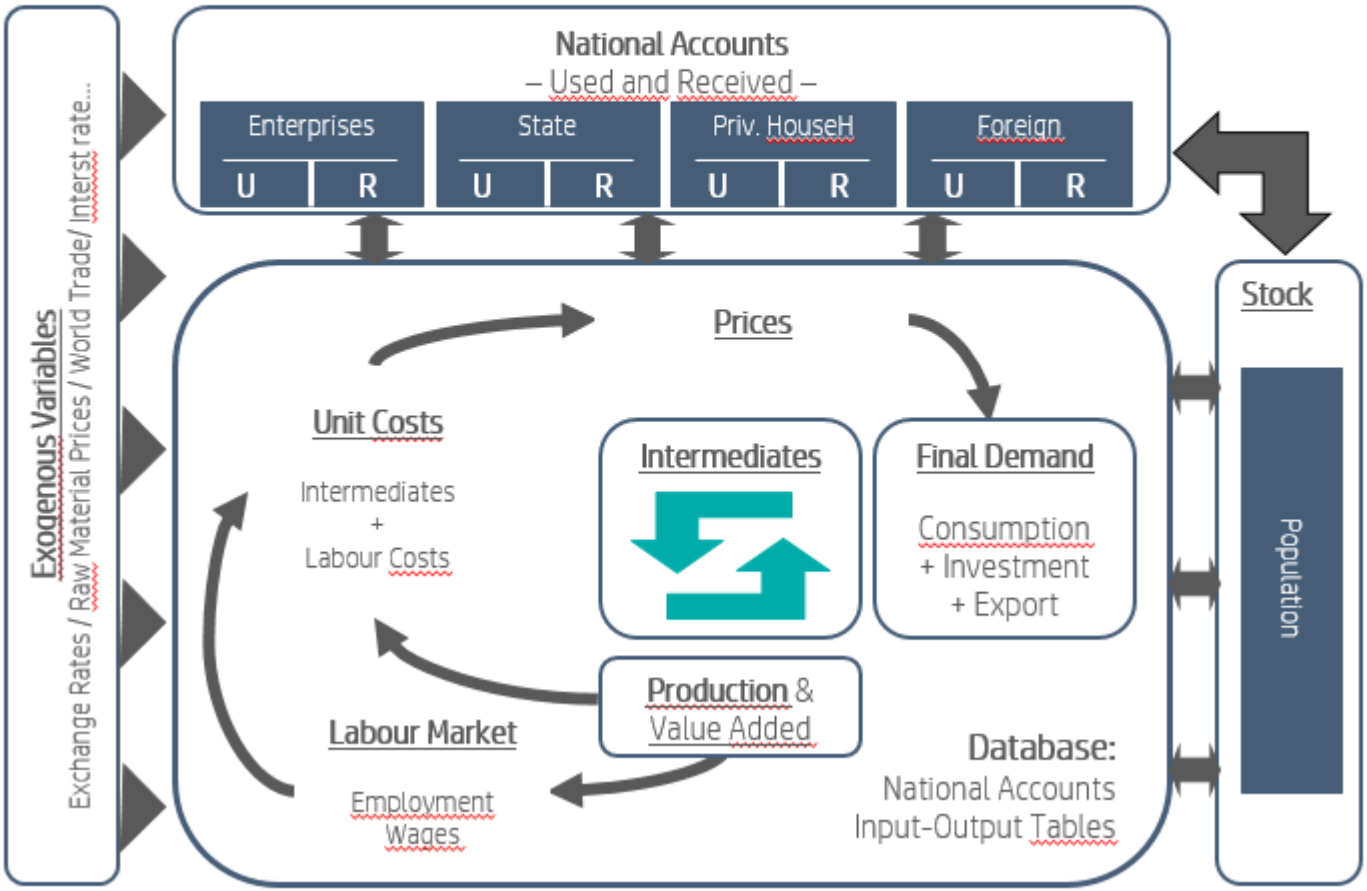
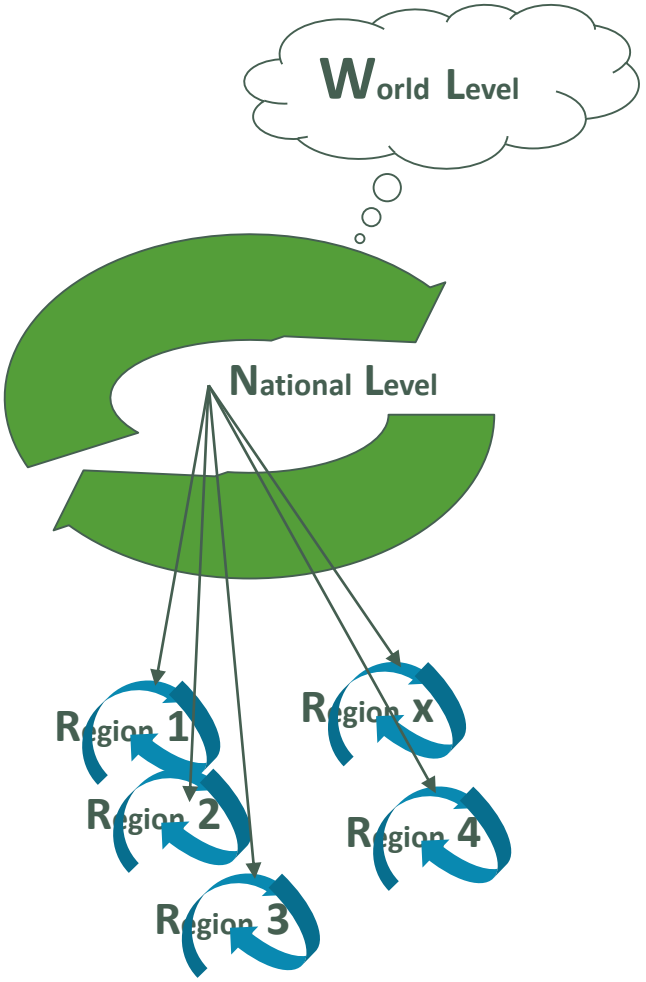
COFORCE

- Introducing the model



Project CONICYT – BMBF

- World model
  - ⇨ Determines world trade
  - ⇨ Tiny Chile model included
- National COFORCE model
  - ⇨ Receives export demand and import prices from world model
  - ⇨ Comprehensive economic model
- Regional models
  - ⇨ Economic development of regional models determined by the national model (top-down)
  - ⇨ Differences in regional growth determined by industry and population structure



Applications

- Energy matrix change and copper production in Chile.
- Special tax to mining profits in Chile.
- Water consumptions in Chile.

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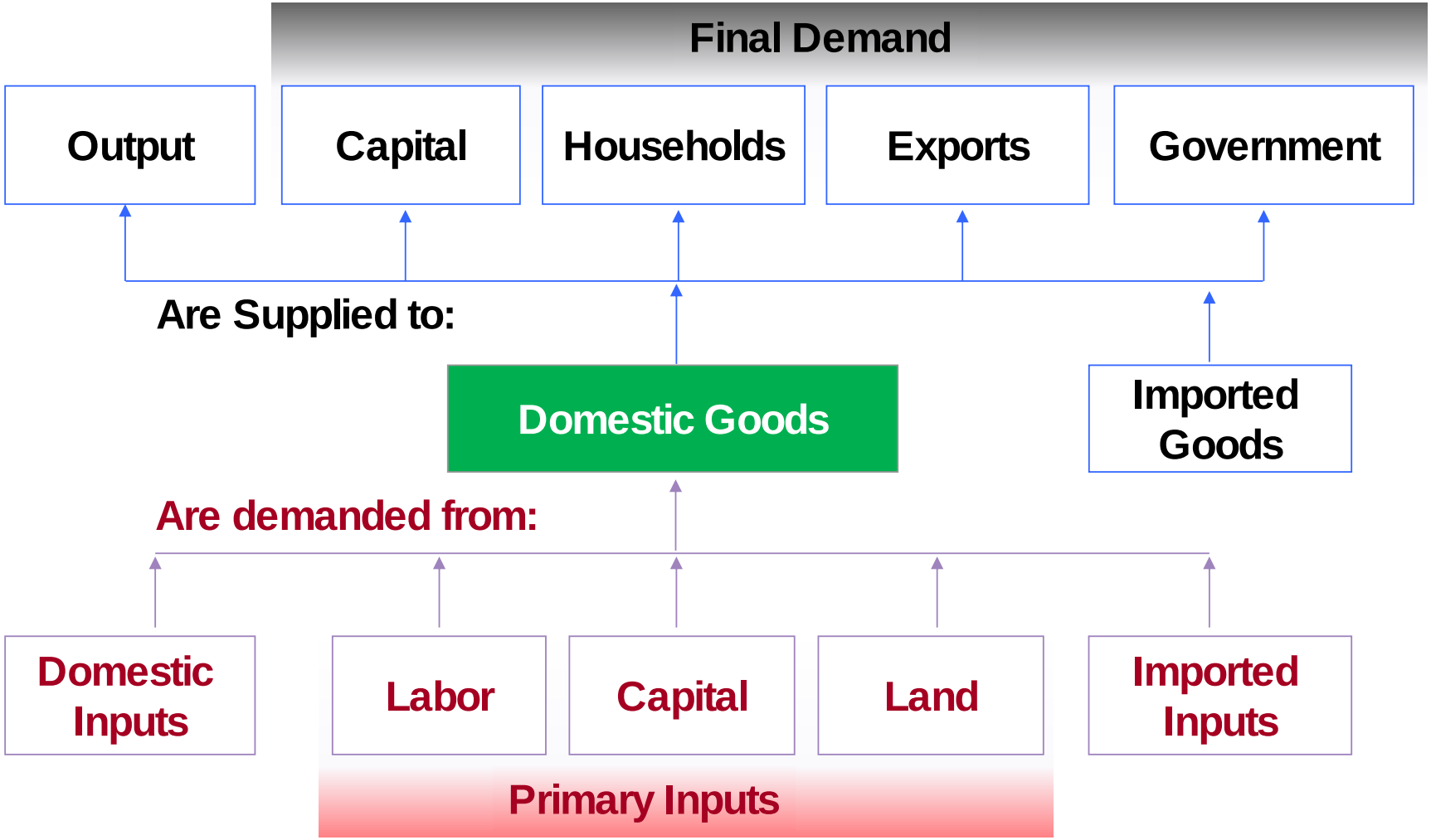
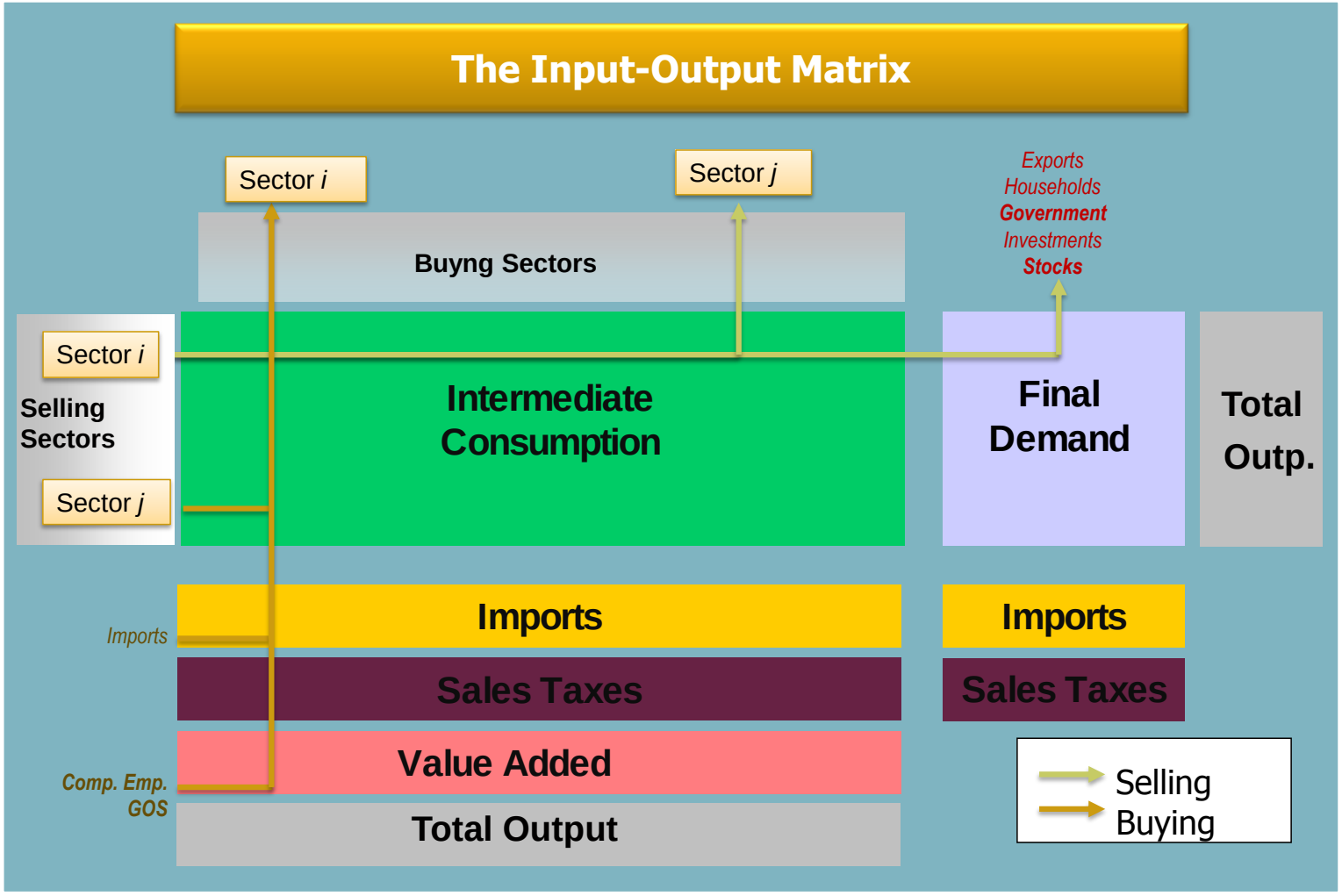
Input-output flows



Input-output table



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Interregional IO models

	Buying Sectors Region L	Buying Sectors Region M			
Selling sectors **Region L**	Interindustry Inputs LL	Interindustry Inputs LM	FD LL	FD LM	TO L
Selling sectors **Region M**	Interindustry Inputs ML	Interindustry Inputs MM	FD ML	FD MM	TO M
	Imports from the World	Imports from the World	M	M	M
	Sales Taxes	Sales Taxes	T	T	T
	Value Added	Value Added			
	Total Output L	Total Output M			

Industries and commodities

- 111 industries:
  - 12 industries - Agriculture and fishing
  - 6 industries – Mining
  - 45 industries – Manufacturing
  - 6 industries – Public Utilities
  - 42 industries – Services

3 - Cultivo de uva

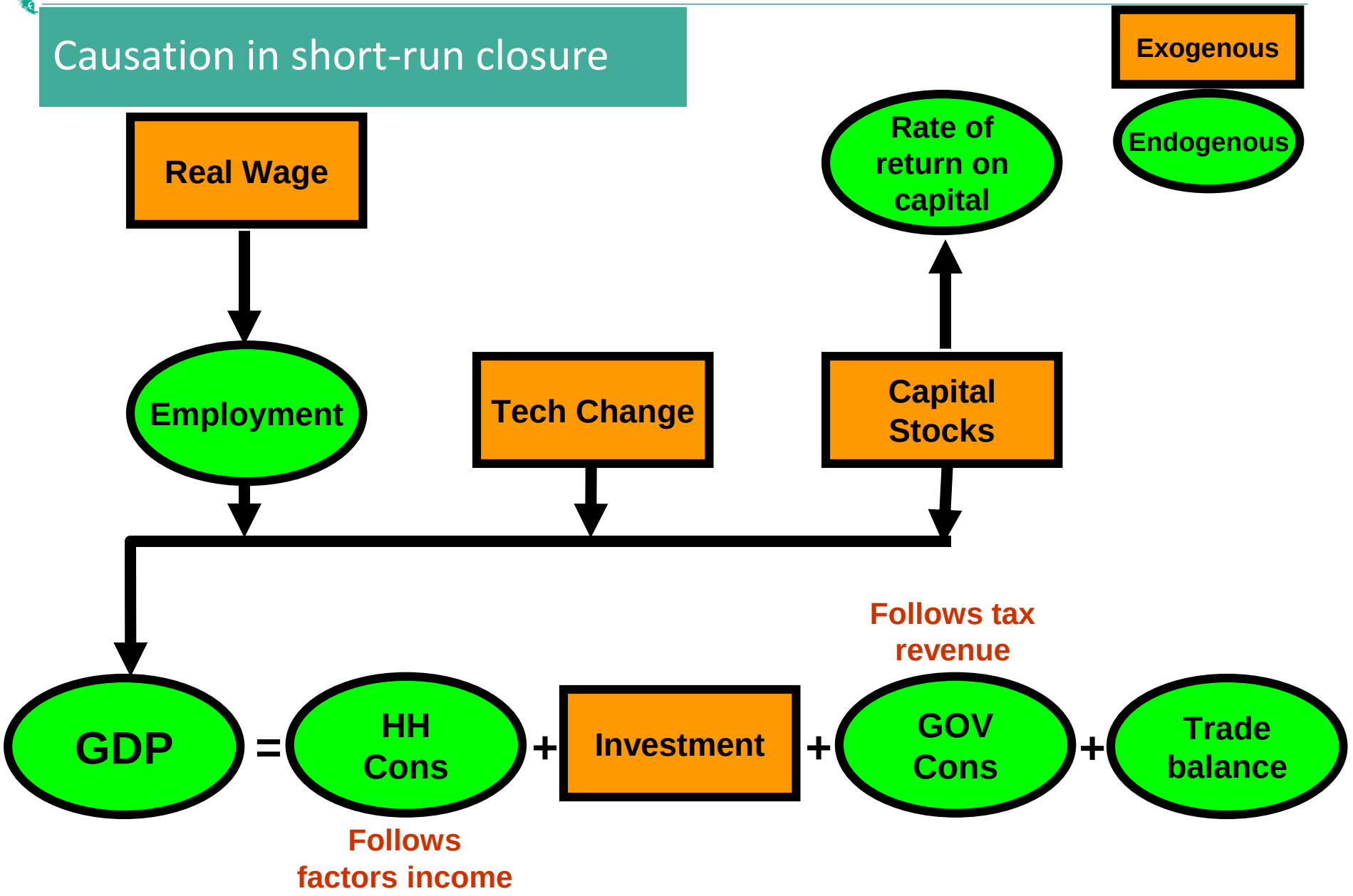
13 - Extracción de carbón
14 - Extracción de petróleo y gas natural
15 - Minería del cobre
16 - Minería del hierro
17 - Minería de otros metalíferos no ferrosos …

- 179 products
  - 26 products - Agriculture and fishing
  - 10 products – Mining
  - 82 products – Manufacturing
  - 6 products - Public Utilities
  - 55 products - Services

7 - Uva vinífera y pisquera
8 - Uva de mesa

27 - Carbón
30 - Cobre
32 – Hierro
(…)

Causation in short-run closure



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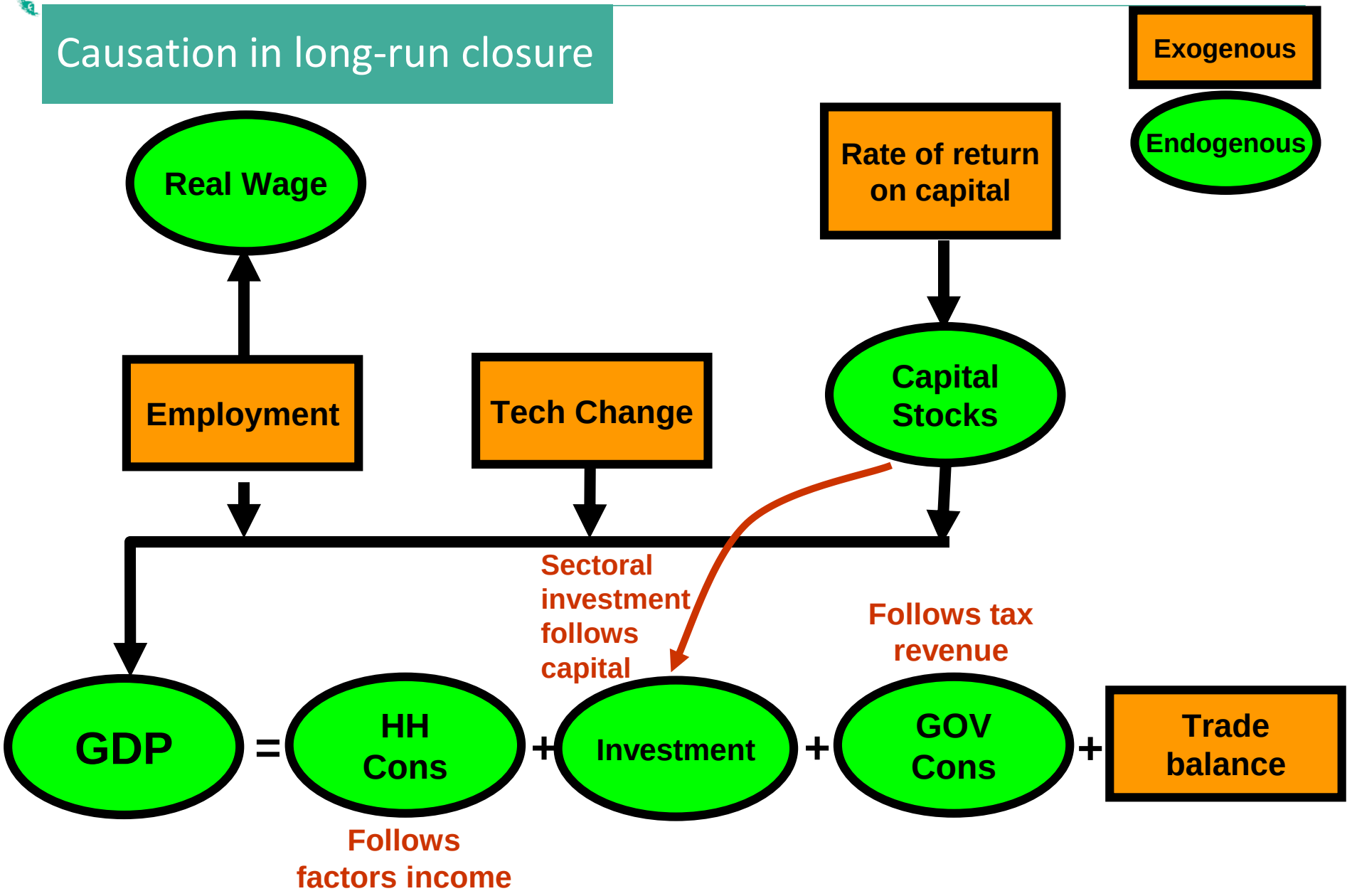
Causation in long-run closure



Interregional CGE Model for Chile

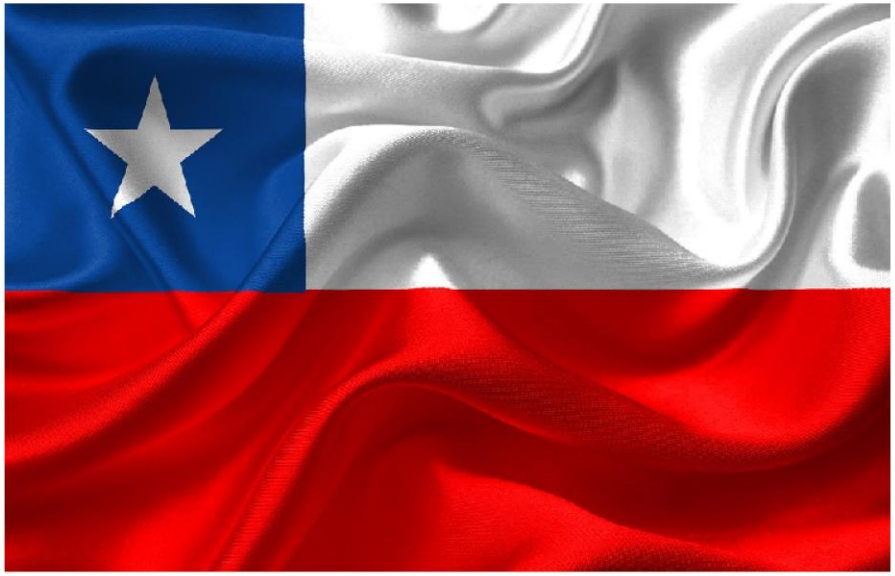
CRunGEM - BMCH

File Copy View Options Help

Picture | Text | Model/Data | Closure | Shocks | Output files | Solve | Results

BM-CH Model

Interregional Computable General Equilibrium Model for Chile



The University of Sao Paulo Regional and Urban Economics Lab - NEREUS

November 2018

Systemic Resilience to Climate Shocks: Impacts of a Drought in Central Chile

•Drought, which occurs in nearly all regions, has affected more people worldwide in the last 40 years than any other natural hazard. It is a complex natural phenomenon with varying levels of intensity, duration, spatial extent and impacts.

•Severe drought episodes have drastic socio-economic and environmental impacts, including, for example, massive famines and migration, natural resource degradation, and weak economic performance.

•Agriculture is the first sector affected when drought hits and also the most affected sector, absorbing up to 80 percent of all direct impacts, with multiple effects on agricultural production, food security and rural livelihoods.

source: http://www.fao.org/land-water/water/drought/en/ access on 11/22/2018

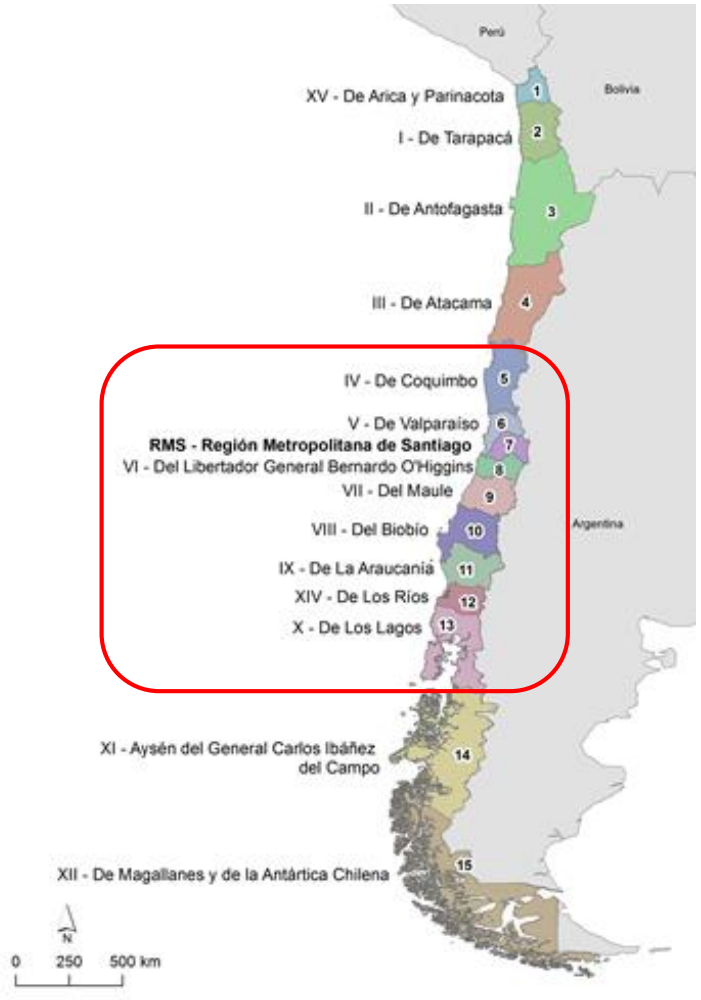
- The drought of the 1960s (1967-1969)
- The drought of the 1990s (1994, 1995, 1996, 1998)
- The “megadrought” (2010-2015)

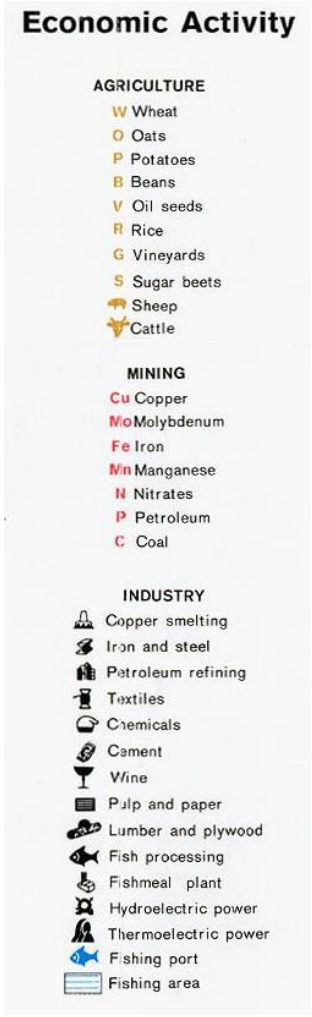
- Affected the Central Chile, that experienced a water deficit of around 30%.

- The most frequently mentioned impacts were those related to a decrease in the quality and the quantity of food production; loss of crops and animals; reduction of irrigated land; decrease in the size of agricultural products; the impossibility of seeding on traditional dates; and, hydric stress in crops (Aldunce et al, 2017).

- Affected labor market and cost of living, quality of life, and social conflicts (Aldunce et al, 2017).

Central Chile





Source: Perry-Castañeda Library Map Collection

Central Chile

•The region has a Mediterranean-like climate with precipitation concentrated in winter: April to September and a marked seasonal cycle.

•Rainfall exhibits substantial interannual variability historically associated with El Niño-Southern Oscillation (Garreaud, 2017).

•Since the early 1980s, a precipitation decline has been evident along the coast and the Andes Cordillera (Garreaud, 2017).

Central Chile

Region	Region's proportion of national GDP (%)	Region's proportion of agriculture, silviculture and fishing output (%)	Agriculture, silviculture and fishing share of regional GDP (%)
XV	0.70	1.40	9.58
I	2.40	0.90	1.76
II	10.60	0.40	0.19
III	2.50	1.50	3.07
IV	2.90	5.10	8.58
V	9.40	8.30	4.31
RMS	44.20	9.20	1.02
VI	5.00	16.20	15.88
VII	3.60	10.40	14.14
VIII	8.90	12.60	6.92
IX	2.60	6.60	12.51
XIV	1.60	4.40	13.67
X	3.70	14.00	15.57
XI	0.80	7.70	49.03
XII	1.20	1.30	5.50

*2014 data
Source: Banco Central de Chile.

Sectors and regions in the B-MARIA CHILE

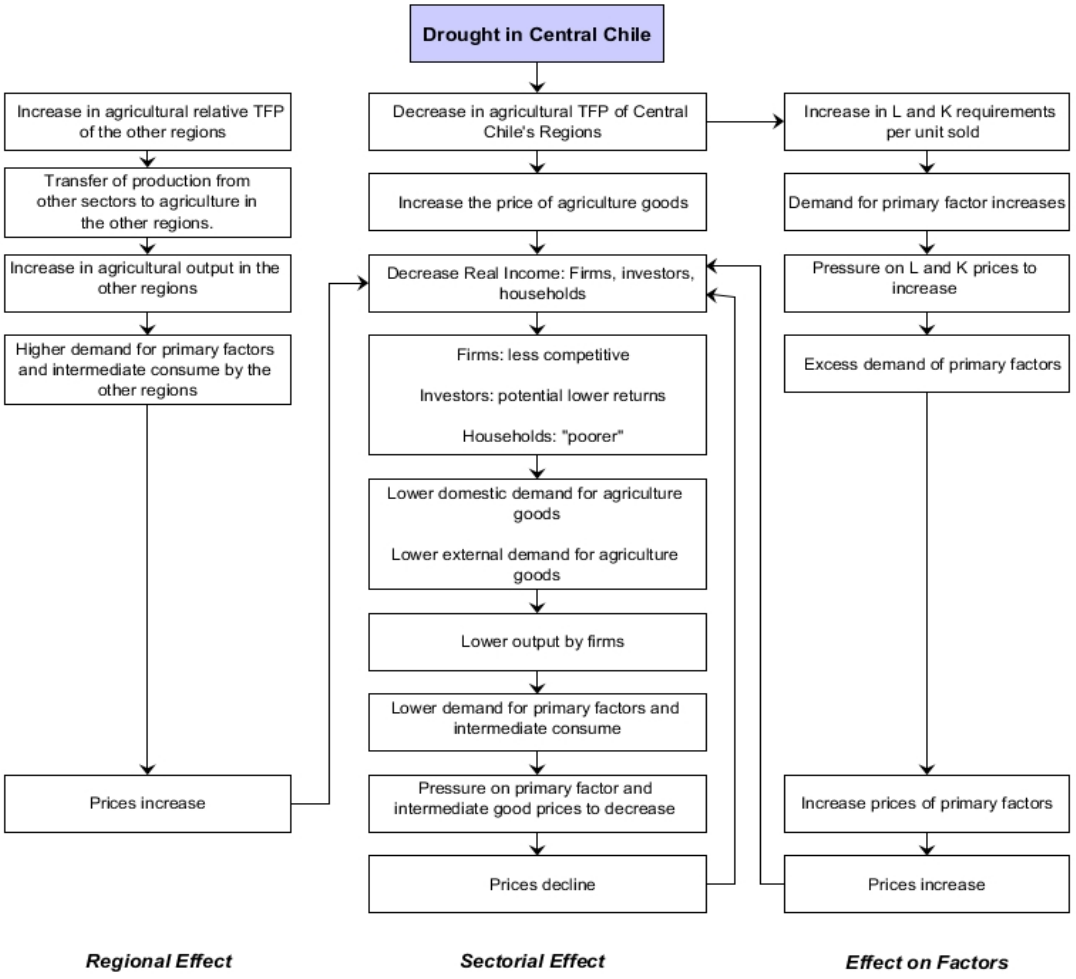
List of sectors:

S1	Agropecuario-silvícola y Pesca
S2	Minería
S3	Industria manufacturera
S4	Electricidad, gas, agua y gestión de desechos
S5	Construcción
S6	Comercio, hoteles y restaurantes
S7	Transporte, comunicaciones y servicios de información
S8	Intermediación financiera
S9	Servicios inmobiliarios y de vivienda
S10	Servicios empresariales
S11	Servicios personales
S12	Administración pública

List of regions:

XV	De Arica y Parinacota
I	De Tarapacá
II	De Antofagasta
III	De Atacama
IV	De Coquimbo
V	De Valparaíso
RMS	Región Metropolitana de Santiago
VI	Del Libertador General Bernardo O'Higgins
VII	Del Maule
VIII	Del Biobío
IX	De La Araucanía
XIV	De Los Ríos
X	De Los Lagos
XI	Aysén del General Carlos Ibáñez del Campo
XII	De Magallanes y de la Antártica Chilena

Nested structure of production



How do we implement S1 productivity decline?

Which industries are affected?

Which regions are affected?

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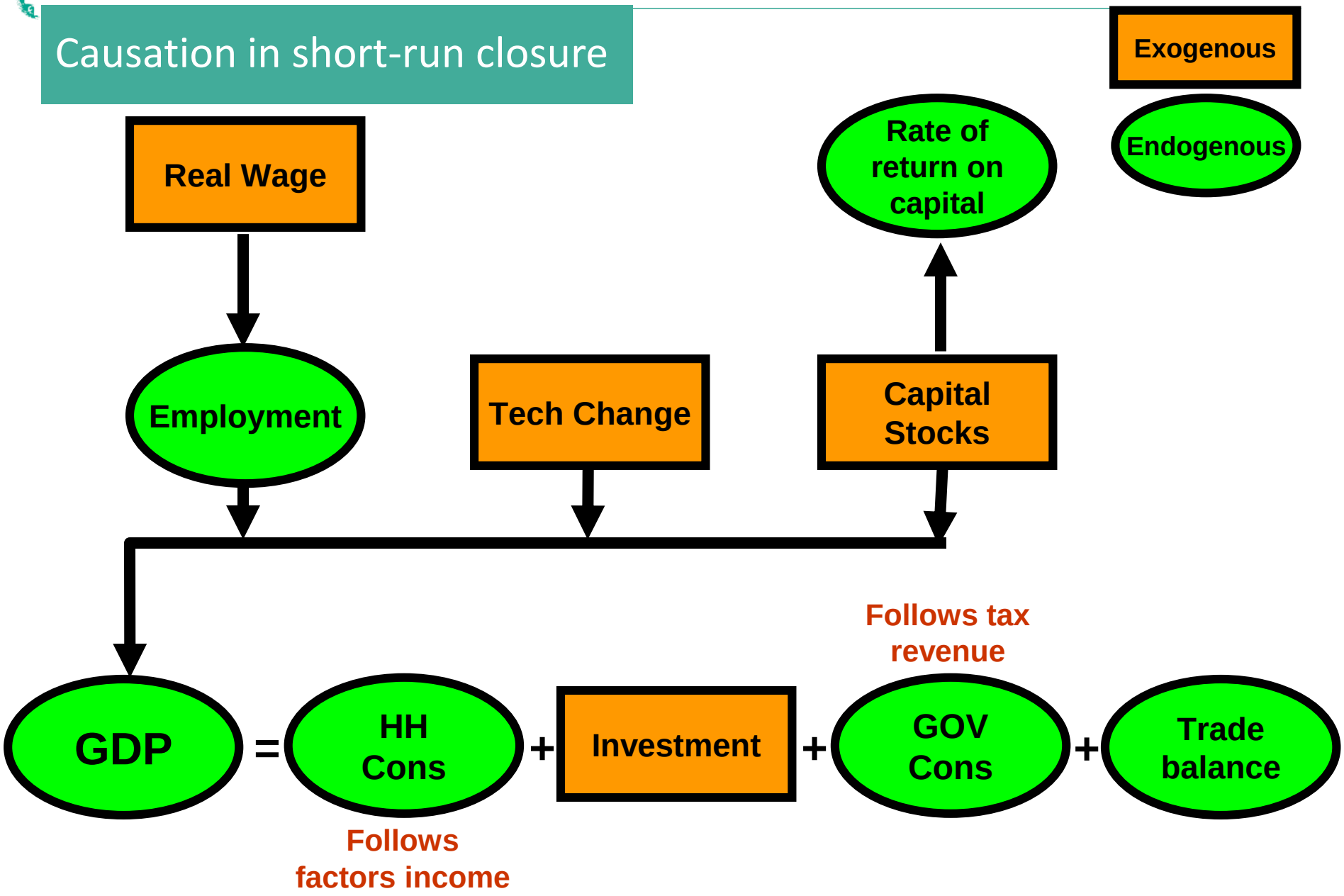
 shock a1("S1","V") = 10;
 shock a1("S1","RMS") = 10;
 shock a1("S1","VI") = 10;
 shock a1("S1","VII") = 10;
 shock a1("S1","VIII") = 10;
 shock a1("S1","IX") = 10;
```

10% more inputs needed to produce the same level of output

Productivity of inputs to production

Causation in short-run closure



Aggregate results (in percentage change)

	Total	Subtotal						
		IV	V	RMS	VI	VII	VIII	IX
Aggregates								
Real GDP from expenditure side	**-0.808**	-0.061	-0.099	-0.106	-0.188	-0.125	-0.148	-0.08
Aggregate employment, wage bill weights	**-0.512**	-0.040	-0.063	-0.065	-0.116	-0.081	-0.094	-0.053
Economy-wide terms of trade	**0.281**	0.017	0.033	0.043	0.075	0.038	0.054	0.02
GDP price index, expenditure side	**0.101**	0.002	0.01	0.025	0.045	0.005	0.018	-0.004
GDP components								
Real household consumption	**-0.505**	-0.046	-0.065	-0.056	-0.098	-0.088	-0.089	-0.064
Aggregate real regional government demand	**-0.132**	-0.022	-0.016	0.026	0.018	-0.043	-0.051	-0.044
Aggregate real federal government demand	**-0.217**	-0.019	-0.027	-0.028	-0.05	-0.034	-0.037	-0.022
Export volume	**-1.207**	-0.084	-0.145	-0.169	-0.298	-0.178	-0.225	-0.108
Import volume	**0.232**	0.009	0.025	0.043	0.079	0.024	0.045	0.007
Activity level								
Agropecuario-silvícola y Pesca	**-5.346**	-0.397	-0.647	-0.721	-1.270	-0.817	-0.980	-0.515
Minería	**-0.039**	-0.003	-0.005	-0.007	-0.012	-0.005	-0.007	-0.002
Industria manufacturera	**-1.058**	-0.072	-0.129	-0.146	-0.257	-0.158	-0.200	-0.096
Electricidad, gas, agua y gestión de desechos	**-0.273**	-0.022	-0.034	-0.034	-0.059	-0.044	-0.050	-0.030
Construcción	**-0.019**	-0.002	-0.002	-0.002	-0.004	-0.003	-0.003	-0.002
Comercio, hoteles y restaurantes	**-0.141**	-0.011	-0.017	-0.019	-0.035	-0.021	-0.025	-0.013
Transporte, comunicaciones y servicios de información	**-0.209**	-0.017	-0.025	-0.026	-0.048	-0.033	-0.038	-0.022
Intermediación financiera	**-0.243**	-0.021	-0.031	-0.028	-0.05	-0.041	-0.043	-0.029
Servicios inmobiliarios y de vivienda	**-0.036**	-0.003	-0.005	-0.004	-0.007	-0.006	-0.006	-0.004
Servicios empresariales	**-0.156**	-0.011	-0.019	-0.021	-0.039	-0.023	-0.029	-0.014
Servicios personales	**-0.403**	-0.037	-0.051	-0.043	-0.077	-0.071	-0.073	-0.051
Administración pública	**-0.276**	-0.025	-0.035	-0.028	-0.054	-0.048	-0.051	-0.034
Share in total output (%)	**76.60**	2.88	9.44	44.21	4.99	3.61	8.89	2.58
Share in agriculture output (%)	**68.36**	5.05	8.32	9.18	16.20	10.45	12.57	6.59

Spatial results - percentage change in gross regional product

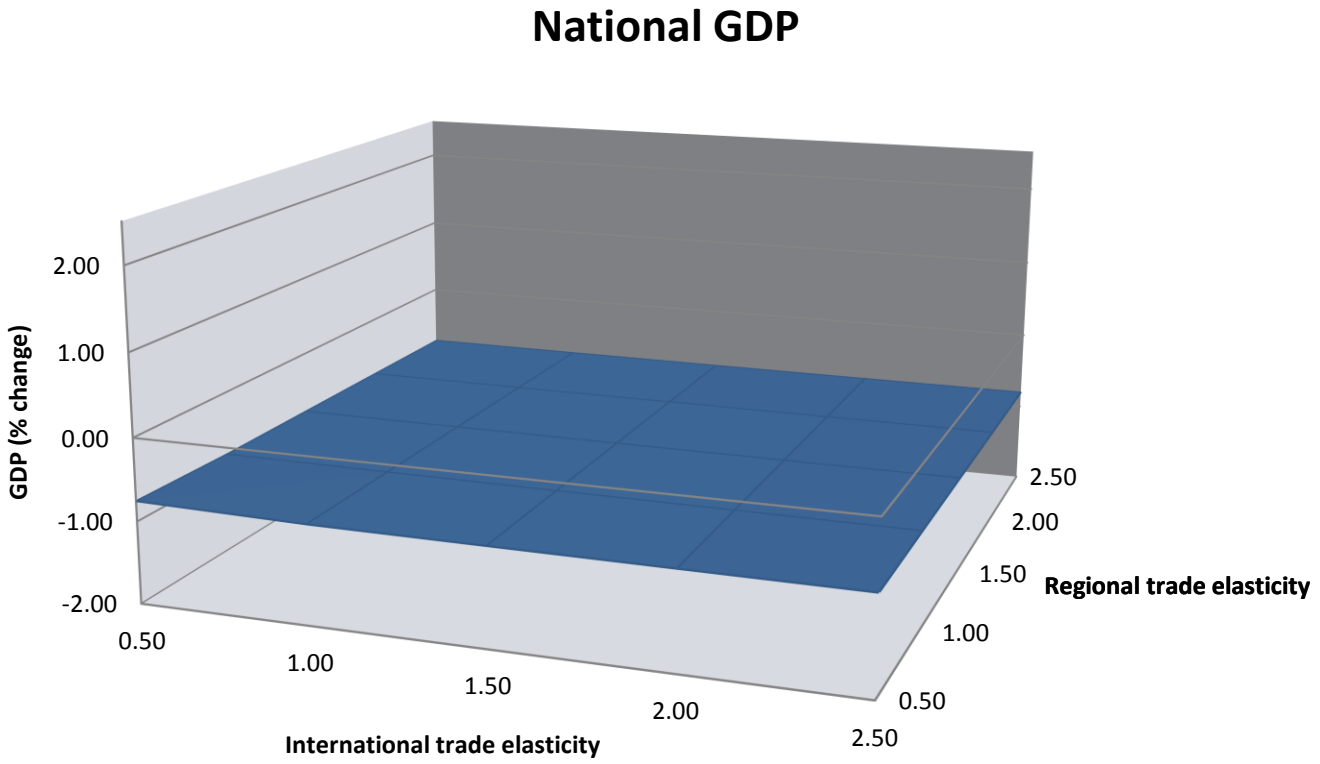
	Total	Subtotal						
		IV	V	RMS	VI	VII	VIII	IX
XV	**0.176**	0.015	0.022	0.025	0.041	0.026	0.031	0.016
I	**-0.062**	-0.007	-0.006	-0.009	-0.014	-0.008	-0.012	-0.007
II	**-0.102**	-0.012	-0.010	-0.014	-0.022	-0.014	-0.019	-0.010
III	**0.016**	0.001	0.003	0.002	0.004	0.003	0.002	0.001
IV	**-1.519**	-1.753	0.035	0.036	0.066	0.038	0.040	0.021
V	**-1.223**	-0.017	-1.058	-0.056	-0.035	-0.023	-0.022	-0.012
RMS	**-0.493**	-0.021	-0.039	-0.251	-0.080	-0.043	-0.039	-0.021
VI	**-3.112**	0.036	0.072	0.050	-3.451	0.068	0.074	0.039
VII	**-2.941**	0.032	0.062	0.060	0.112	-3.310	0.069	0.034
VIII	**-1.847**	0.000	0.009	0.002	0.010	-0.014	-1.833	-0.022
IX	**-2.381**	0.027	0.048	0.053	0.095	0.059	0.074	-2.737
XIV	**0.421**	0.030	0.053	0.057	0.102	0.066	0.082	0.031
X	**0.726**	0.052	0.089	0.096	0.171	0.112	0.140	0.065
XI	**1.767**	0.135	0.212	0.235	0.411	0.269	0.331	0.174
XII	**0.003**	0.000	0.002	0.000	0.002	0.001	0.000	-0.002

Sensitivity analysis

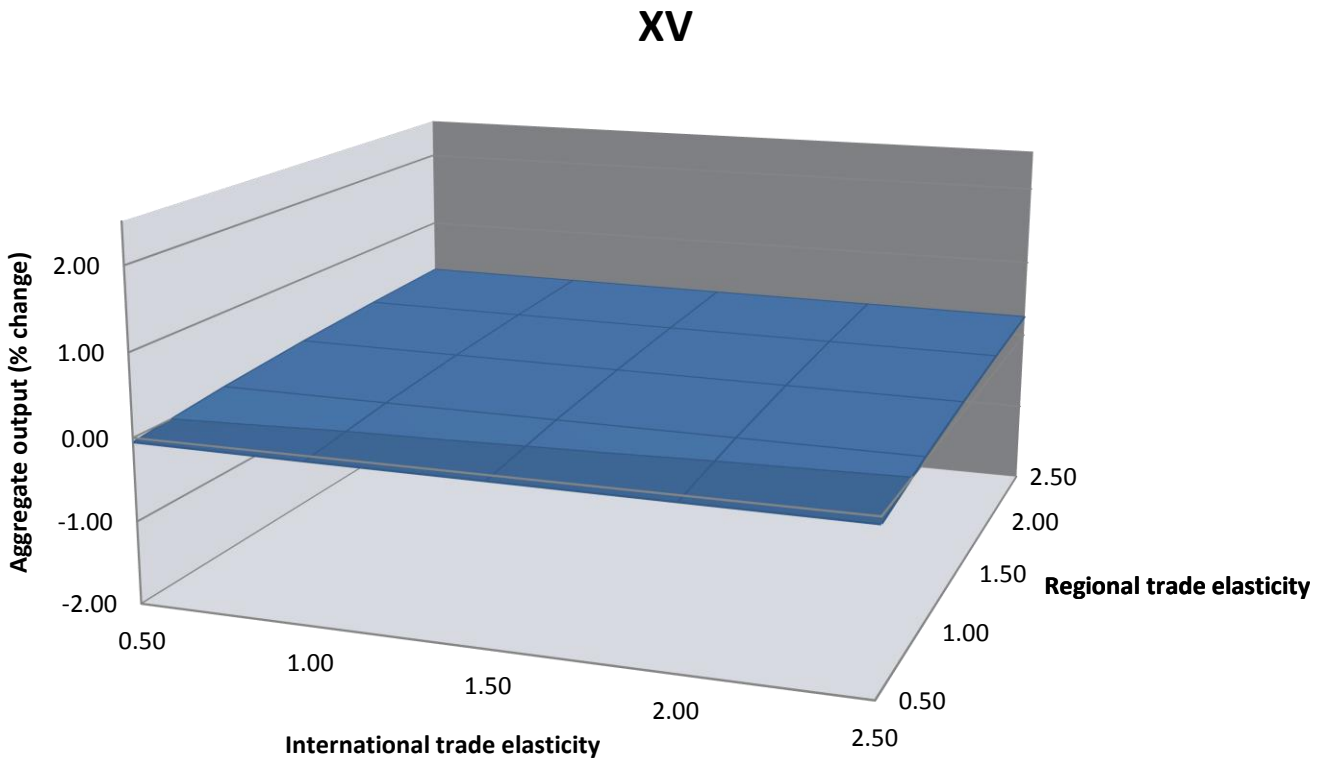
- Qualitative sensitive analysis to look at the potential range of the **total impacts under different degrees of spatial resilience.**

- Altering the **regional and international substitution elasticities** allows the modeling of the economy under different (unknown) scenarios of adjustment after a drought period.

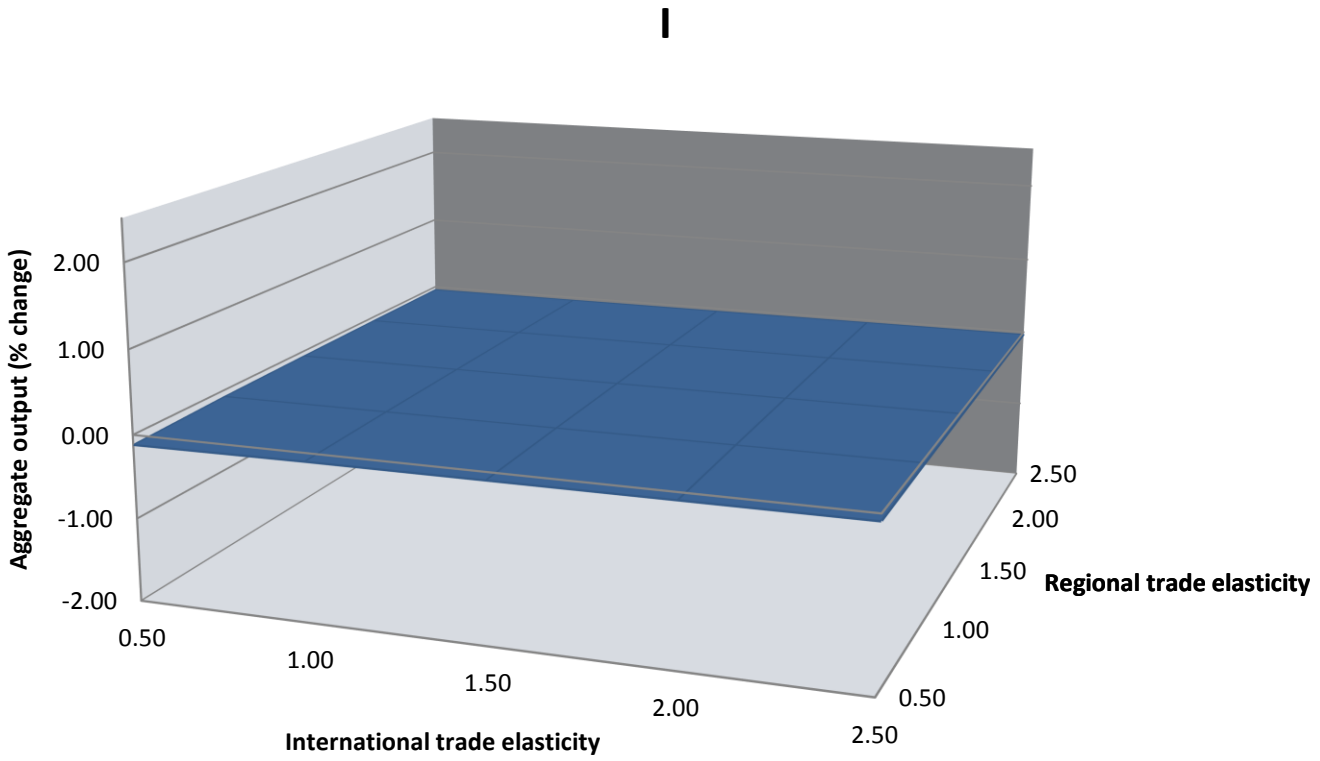
Regional impacts under different assumptions of regional resilience



Regional impacts under different assumptions of regional resilience

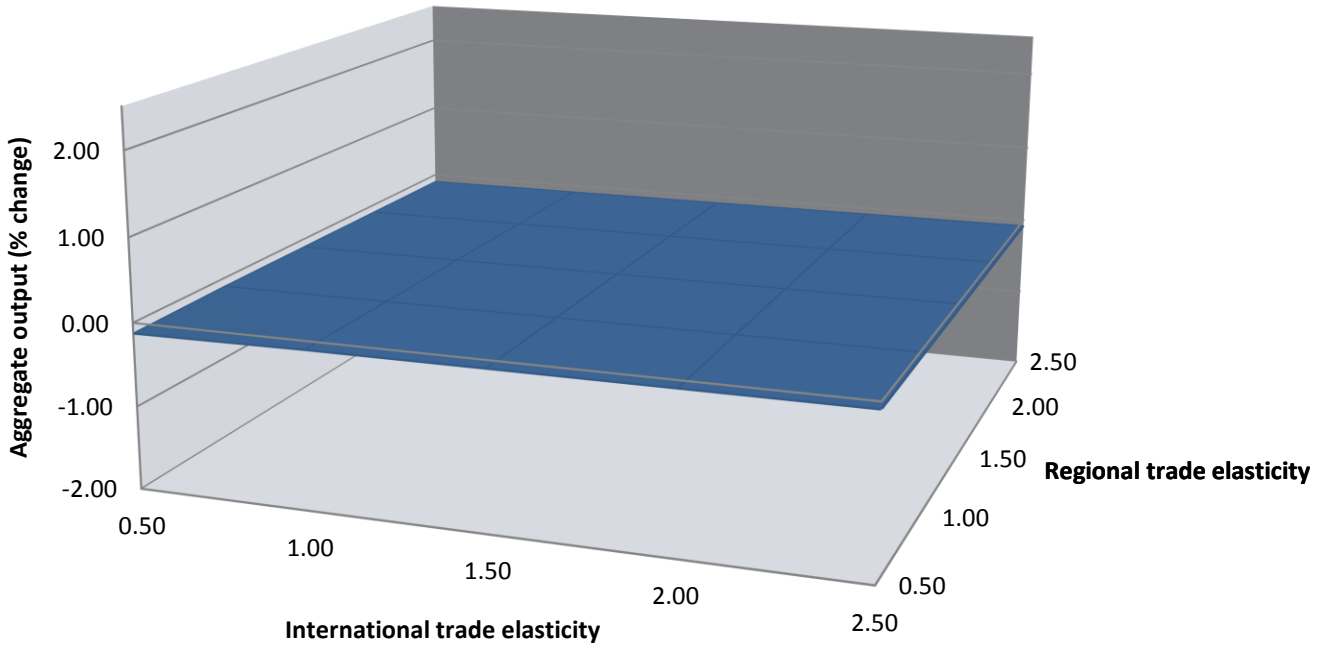


Regional impacts under different assumptions of regional resilience



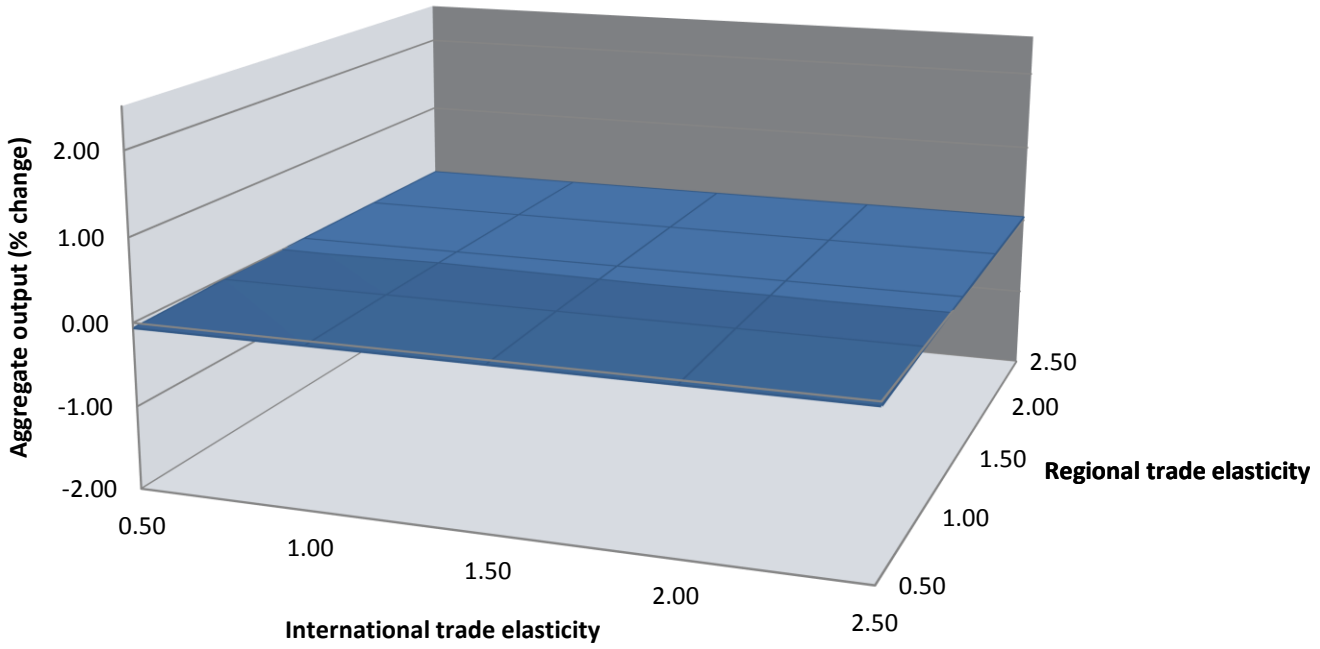
Regional impacts under different assumptions of regional resilience

II

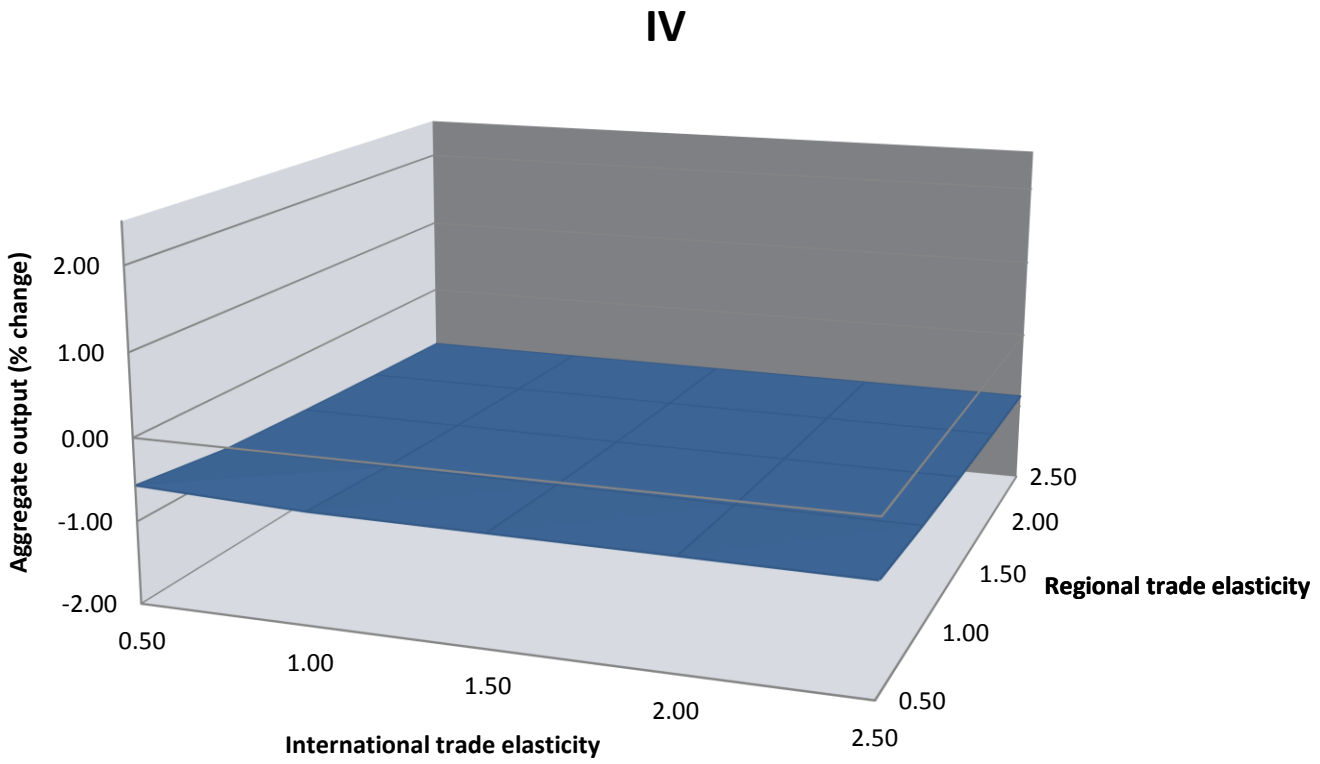


Regional impacts under different assumptions of regional resilience

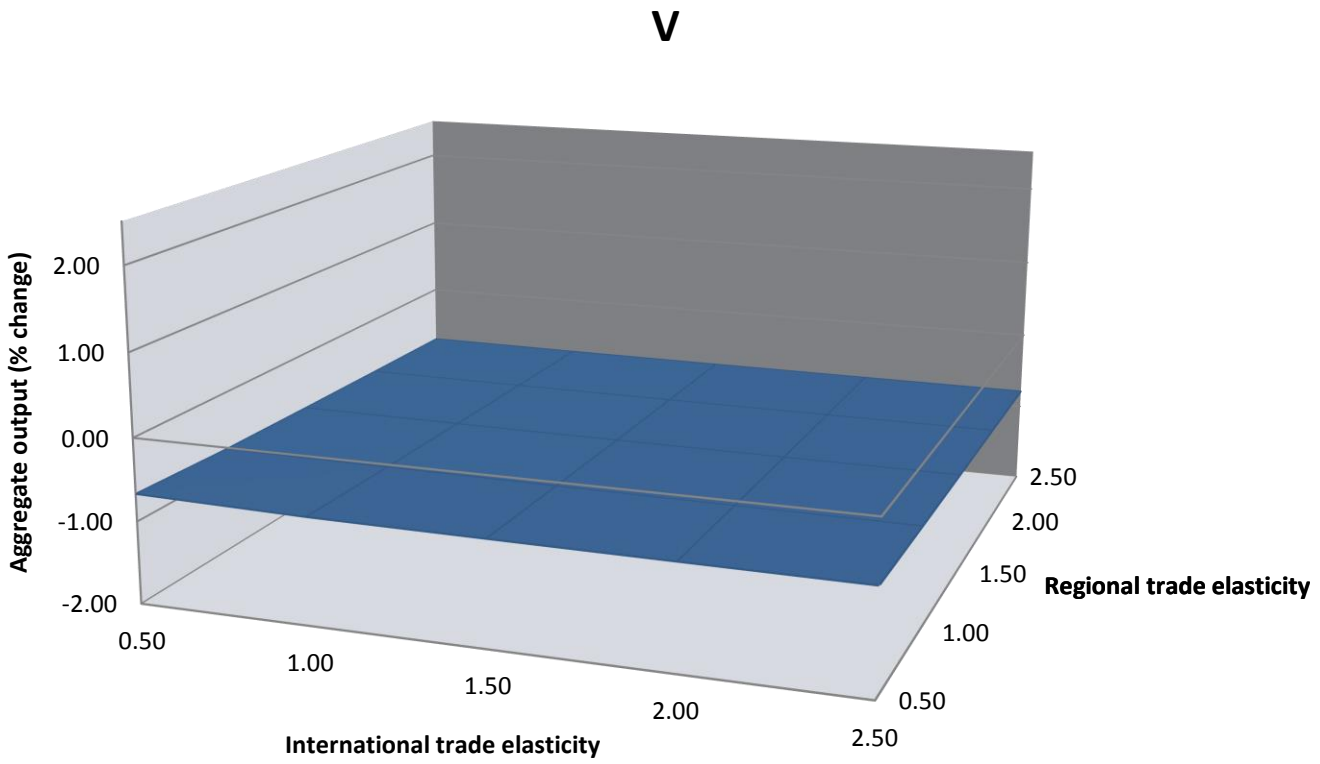
III



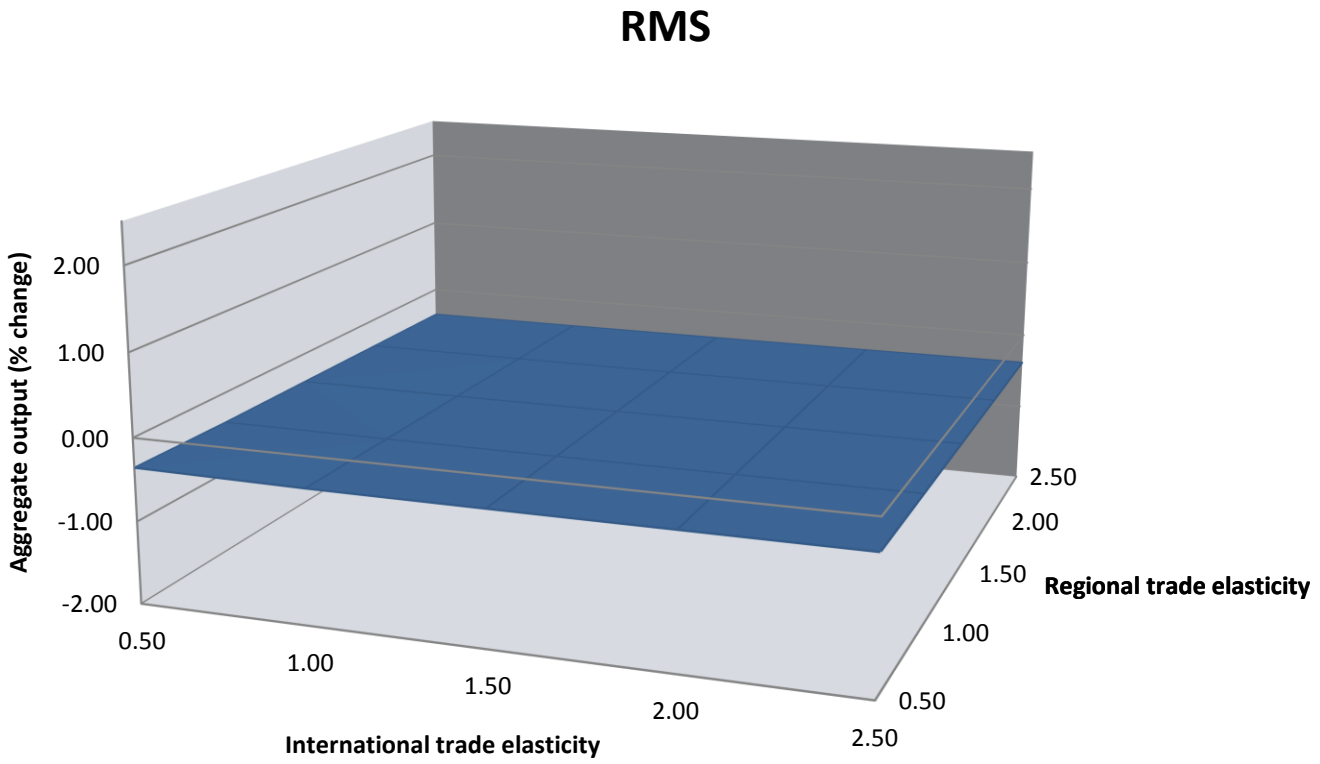
Regional impacts under different assumptions of regional resilience



Regional impacts under different assumptions of regional resilience



Regional impacts under different assumptions of regional resilience



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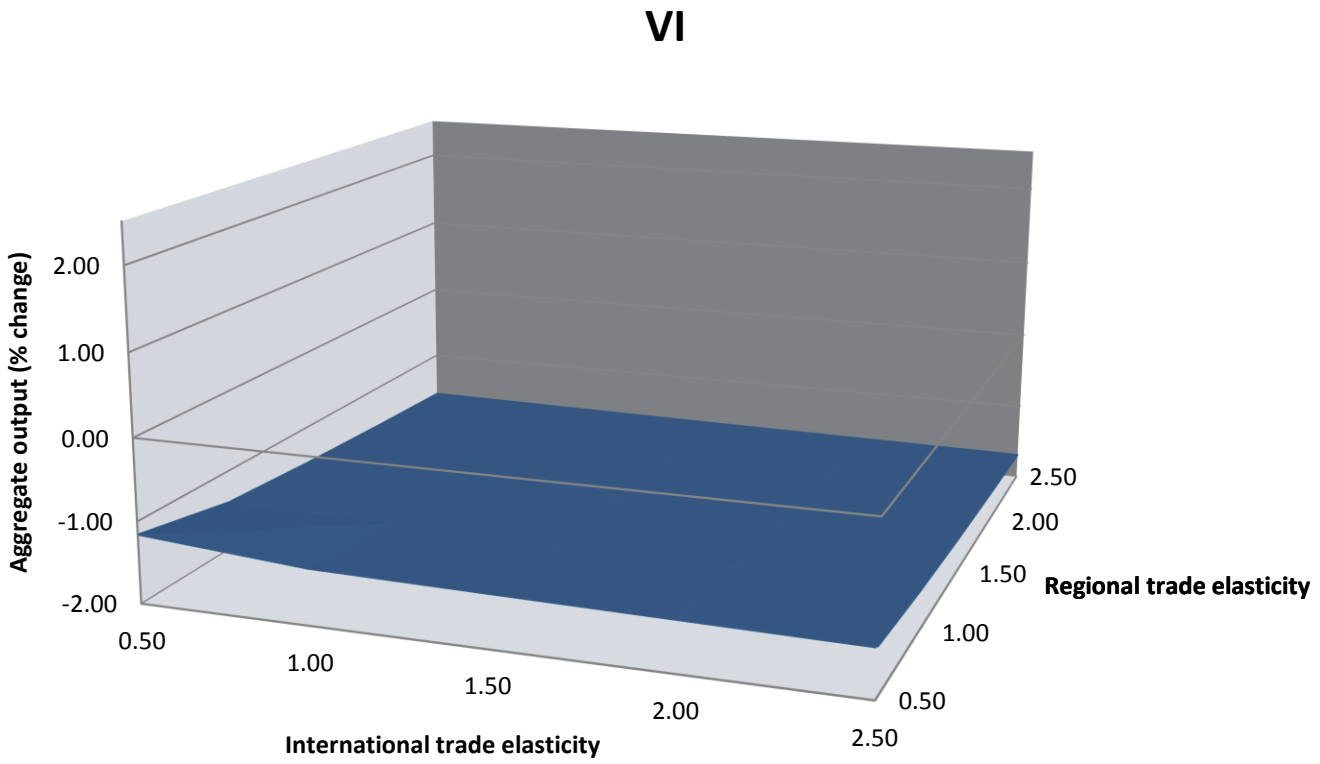

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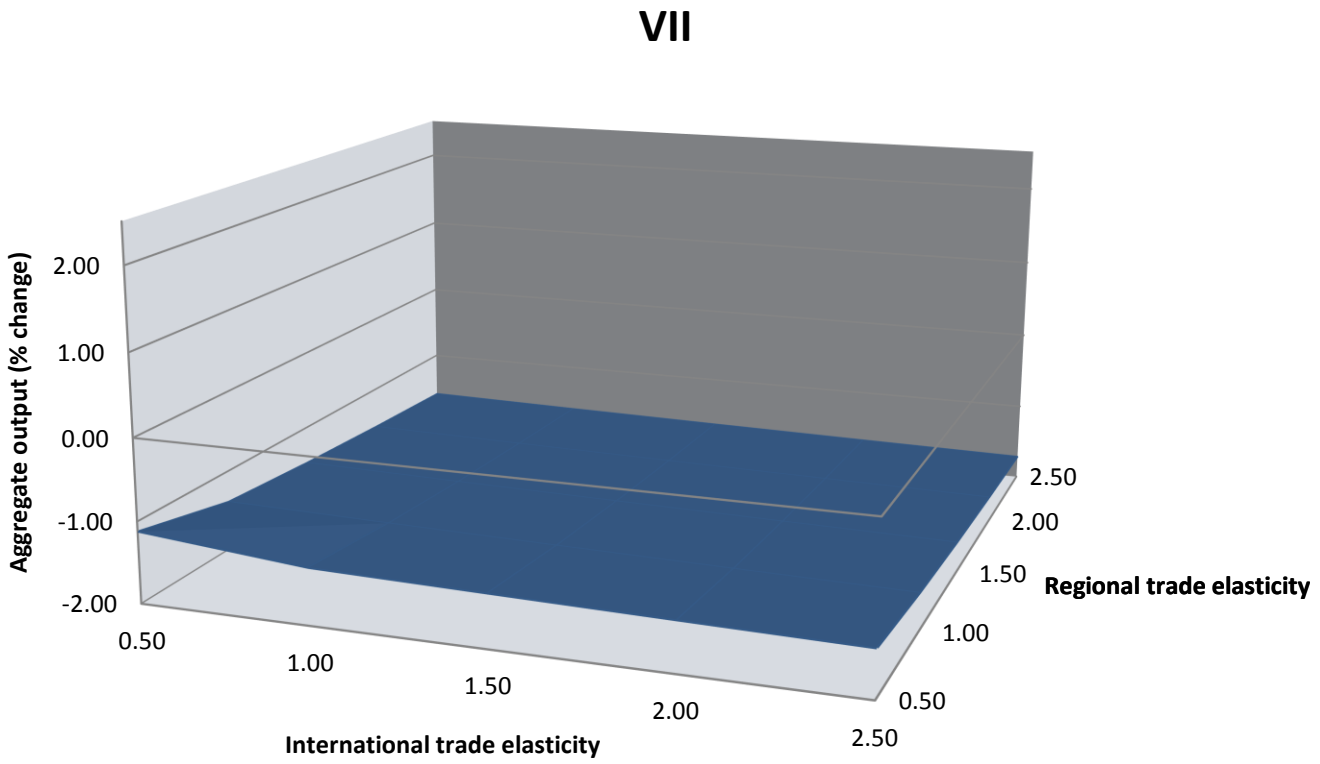

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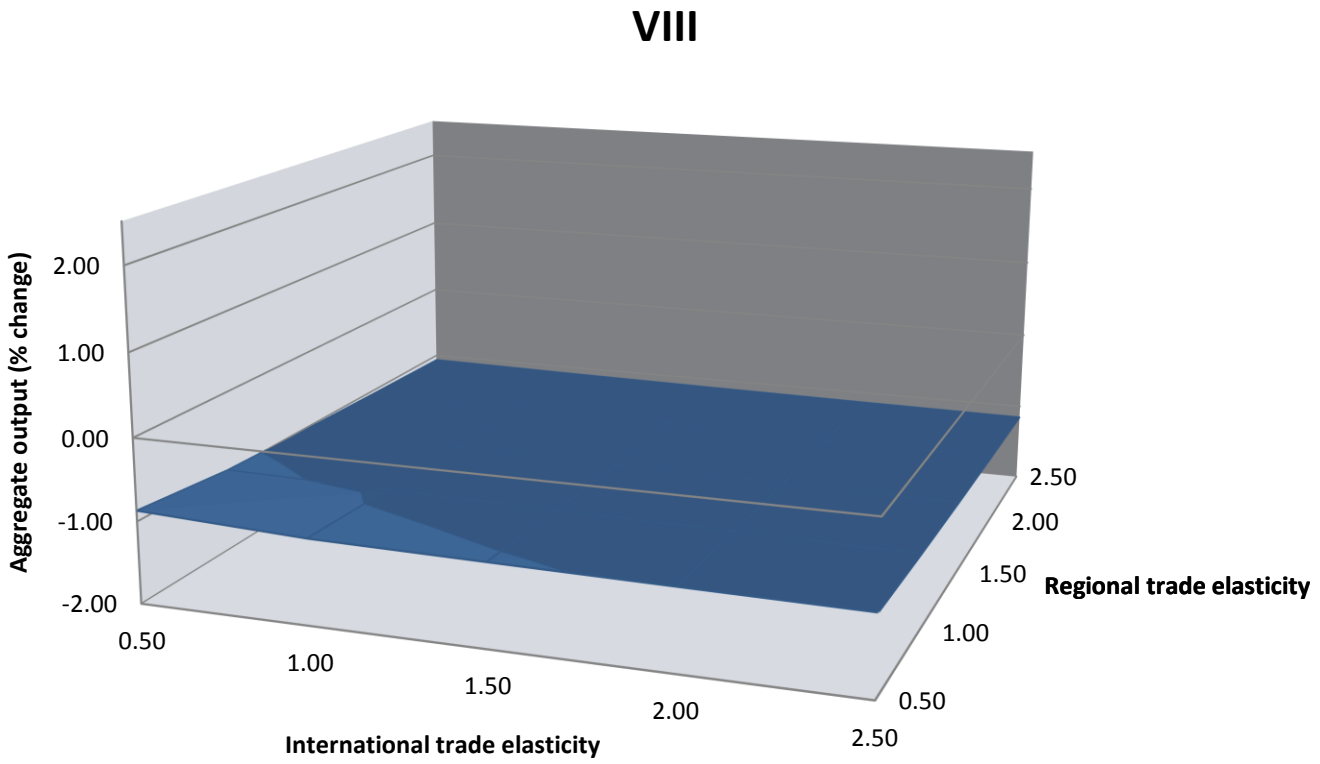

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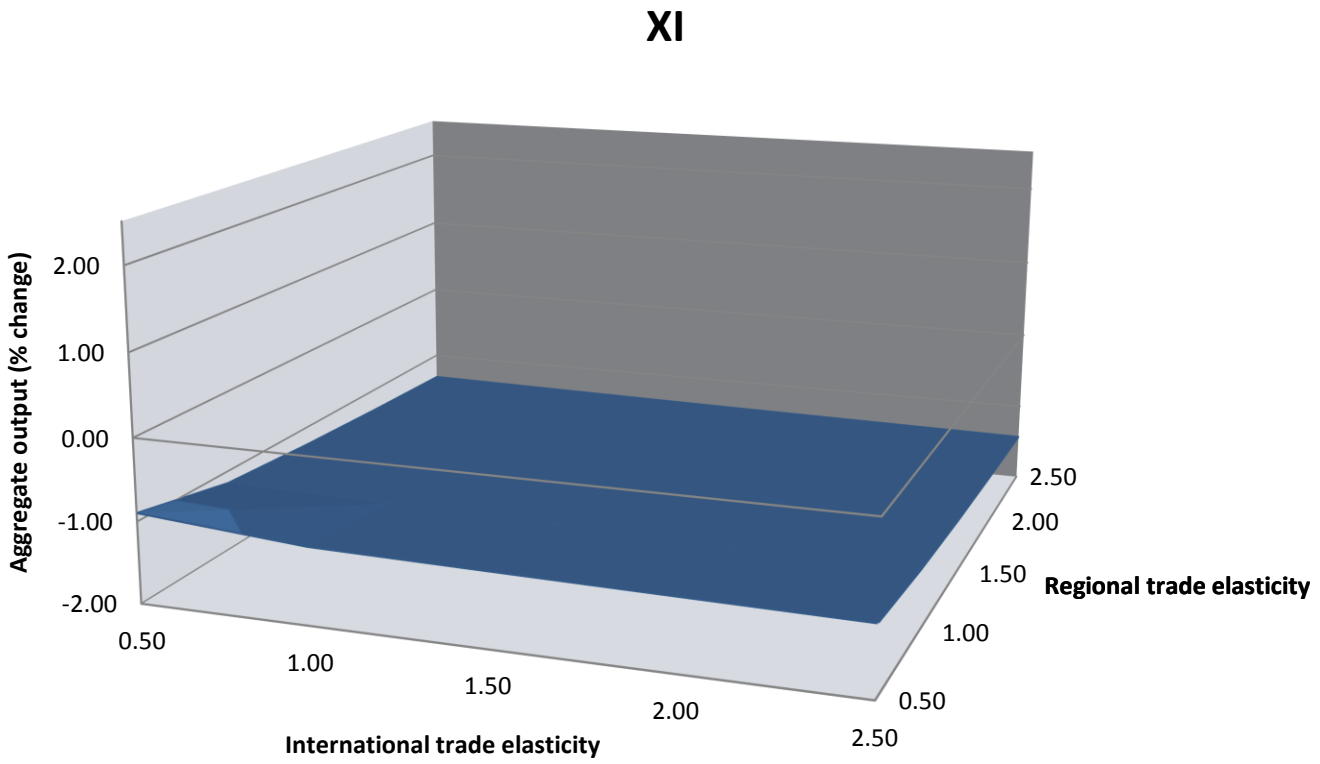
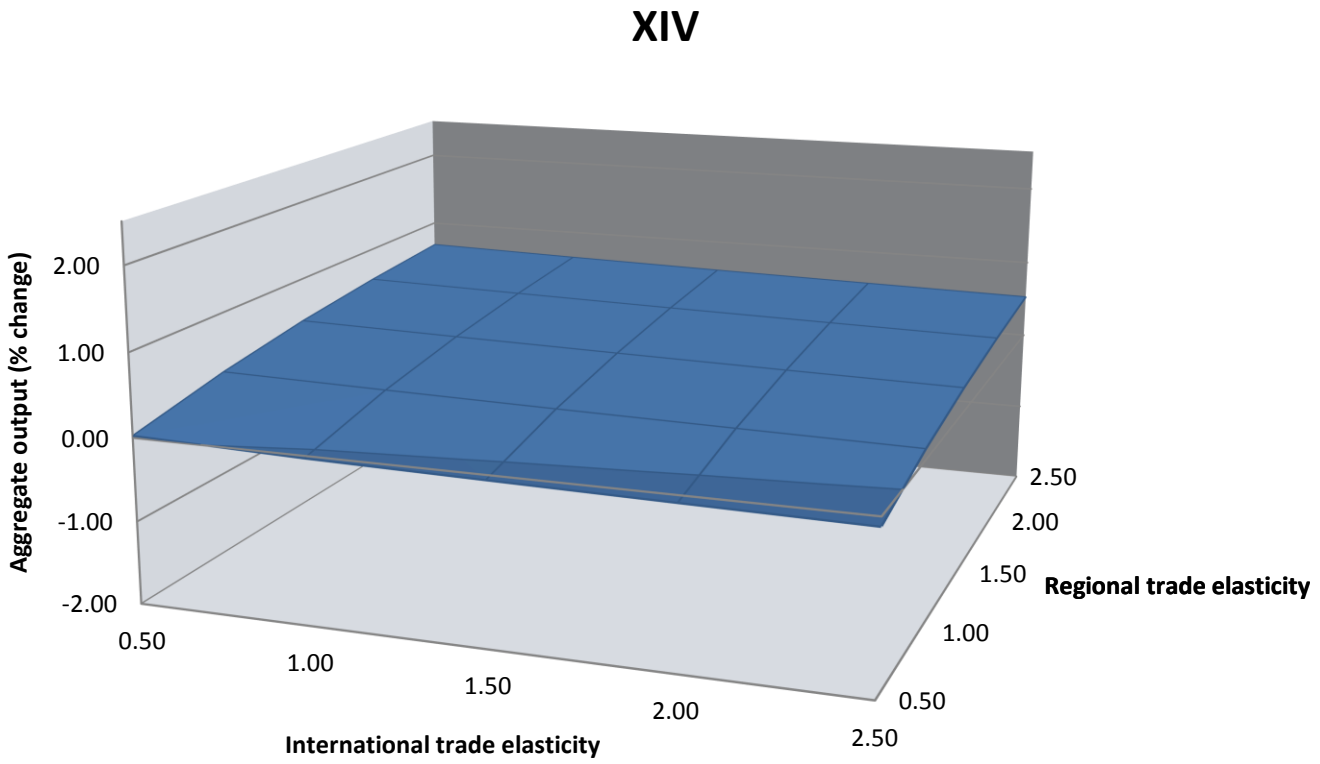
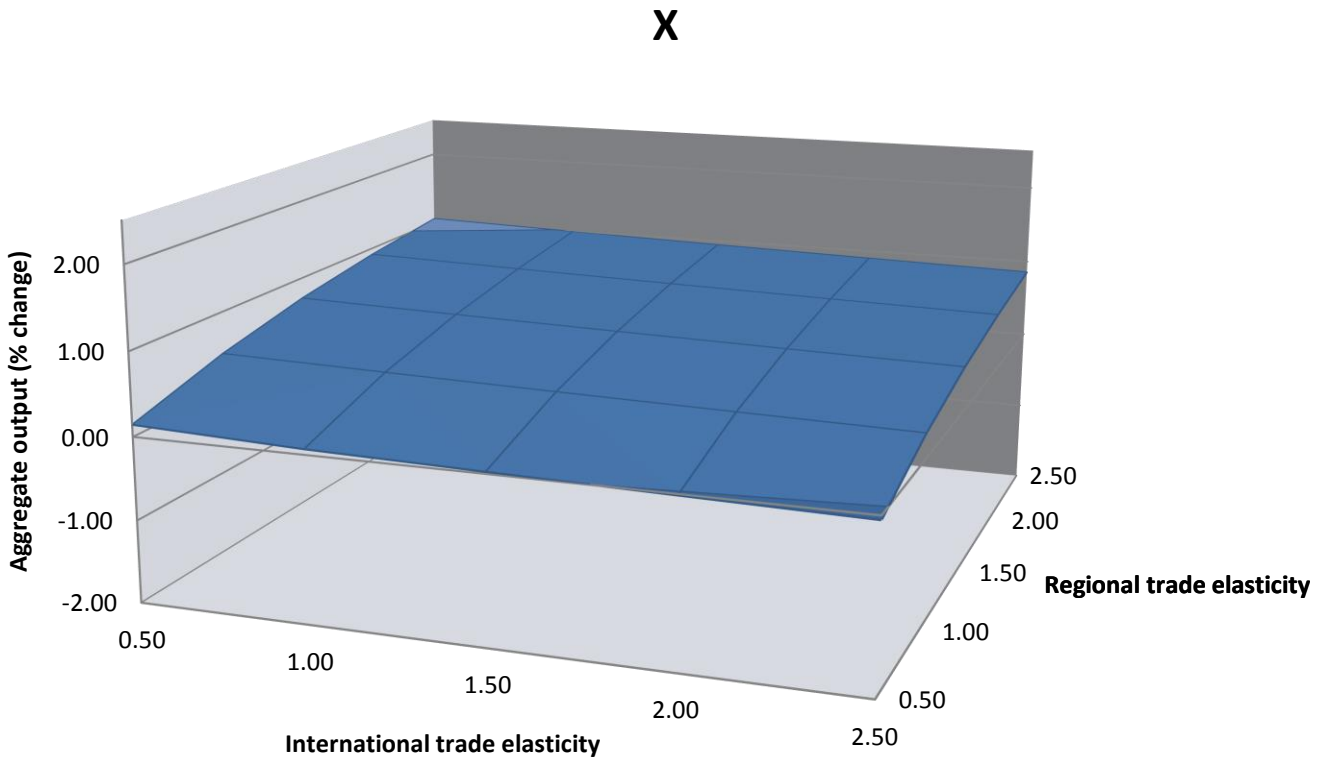


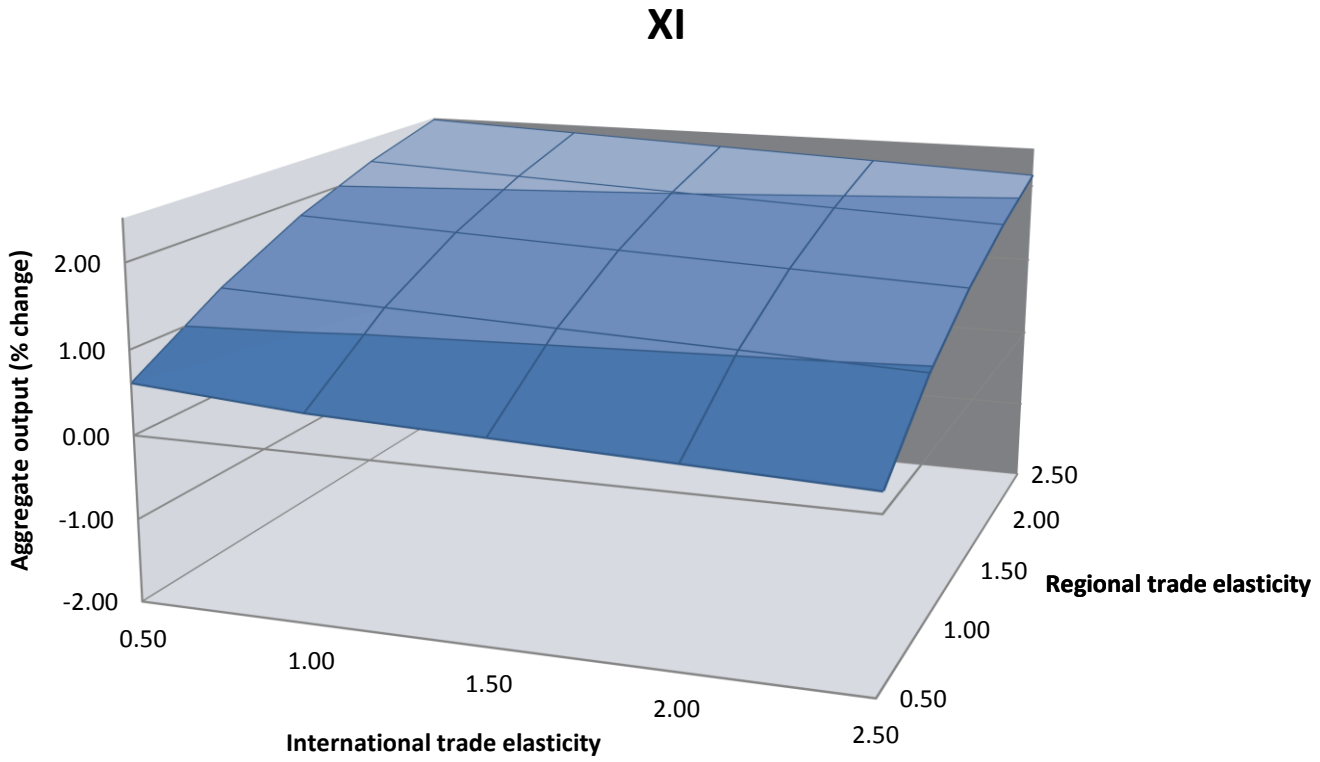
Regional impacts under different assumptions of regional resilience



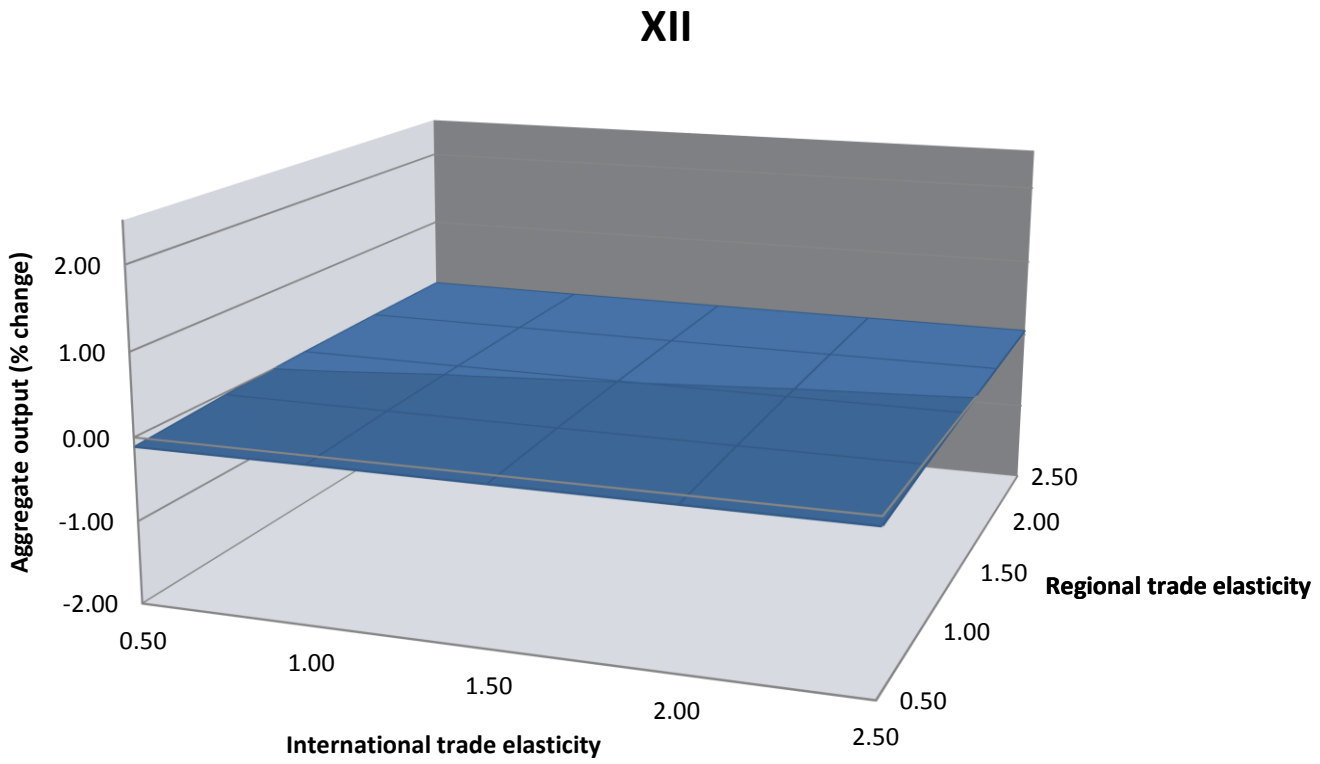
Regional impacts under different assumptions of regional resilience



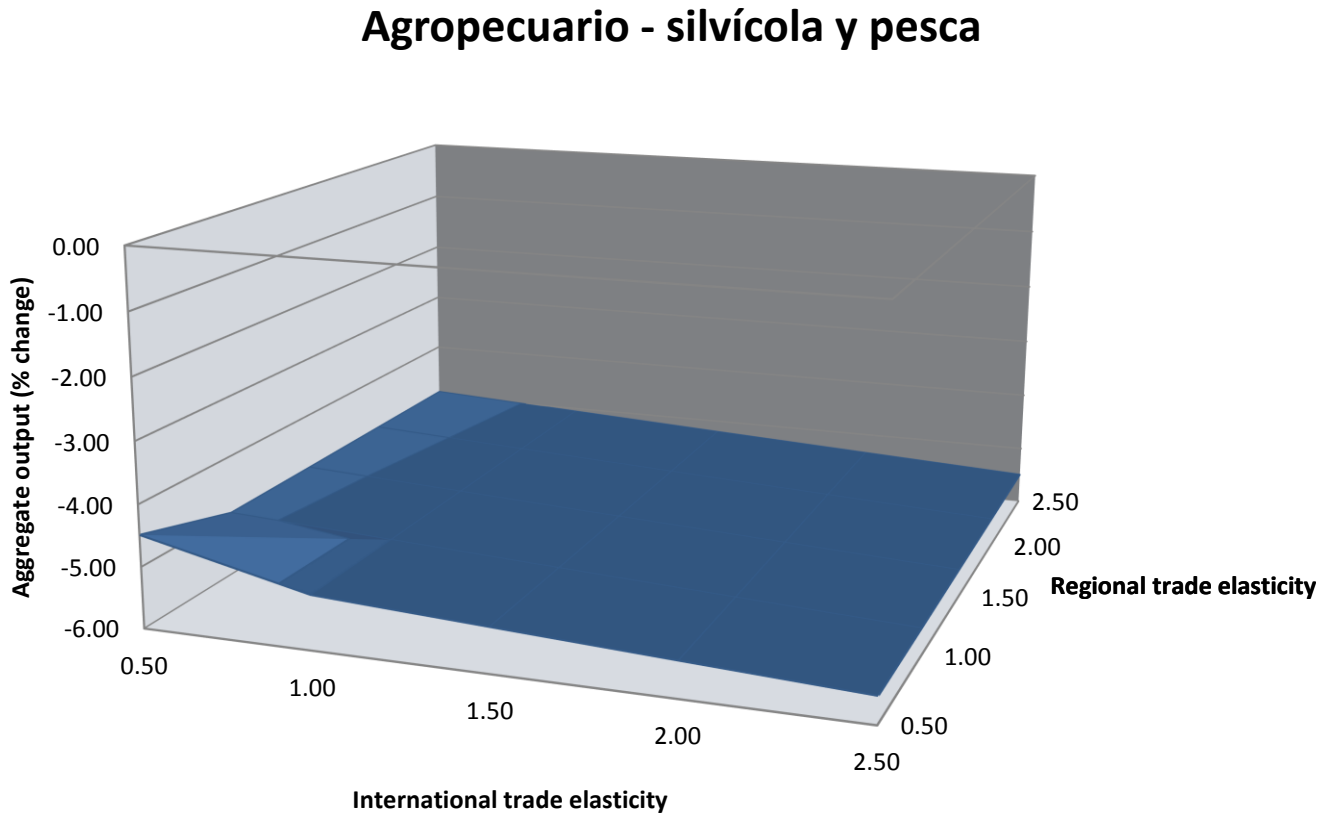
Regional impacts under different assumptions of regional resilience



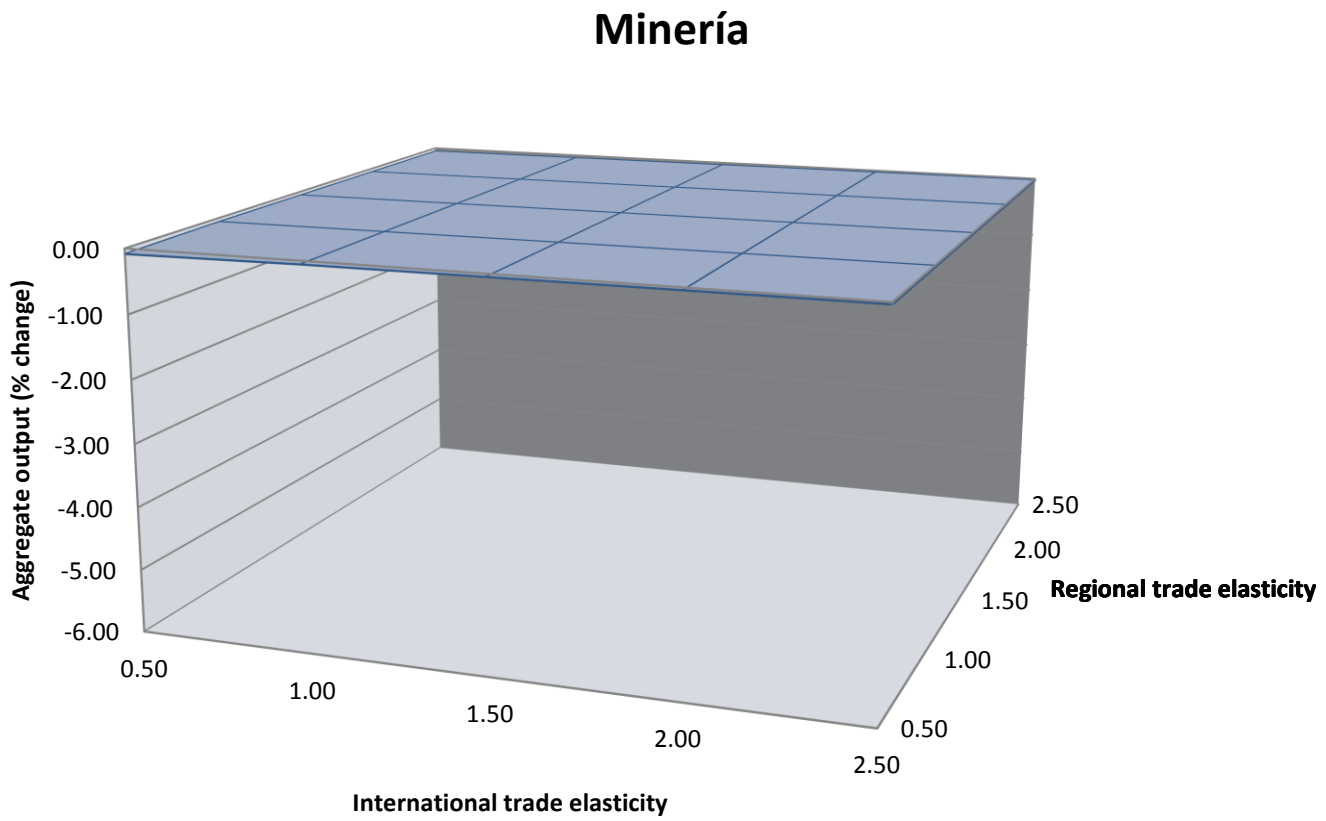
Regional impacts under different assumptions of regional resilience



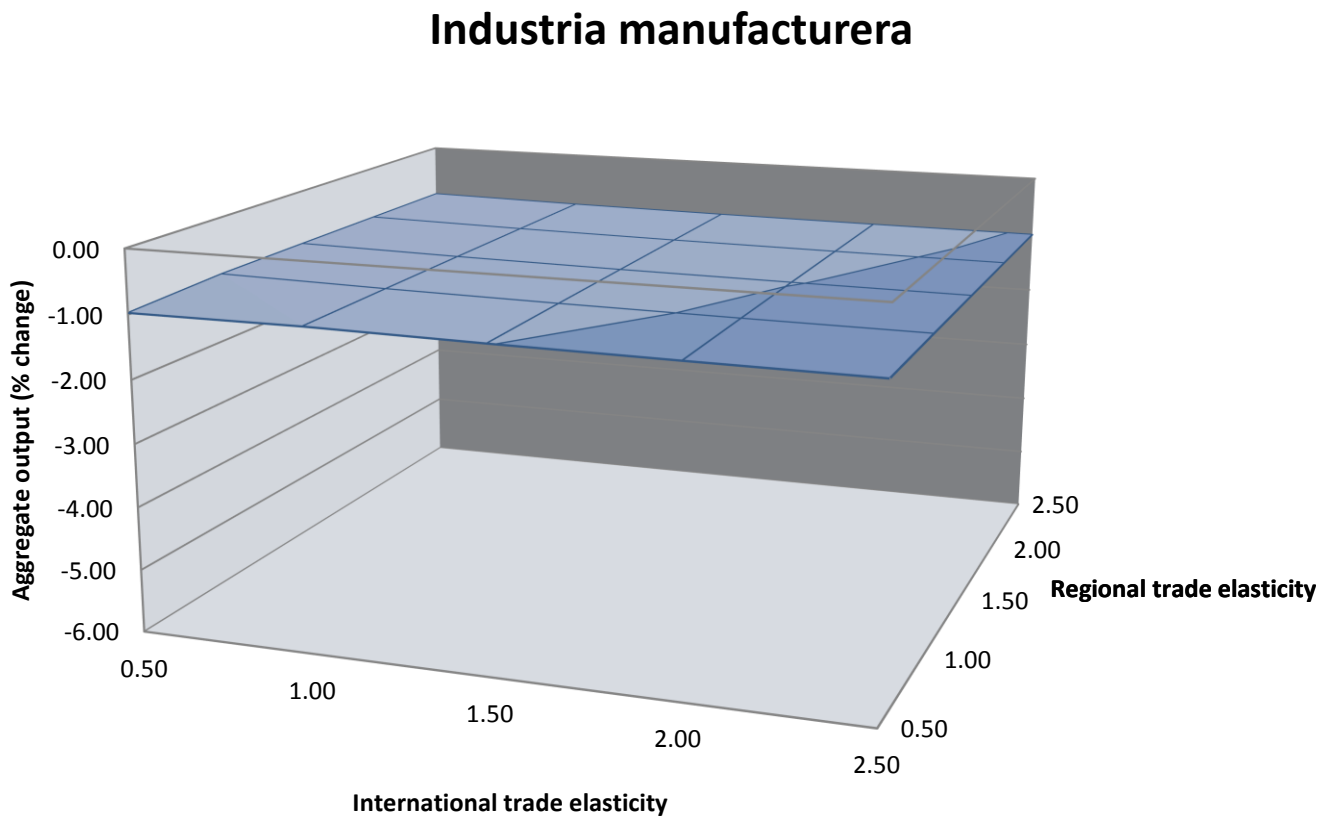
Sectoral impacts under different assumptions of regional resilience



Sectoral impacts under different assumptions of regional resilience

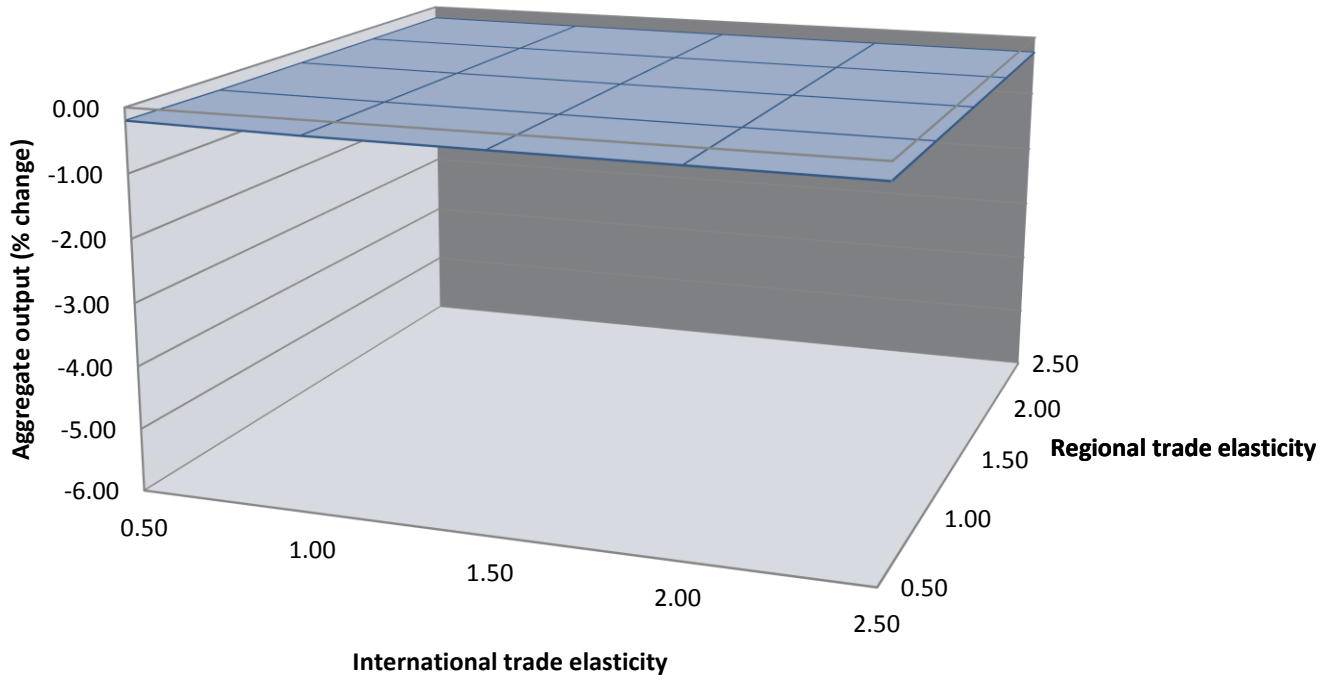


Sectoral impacts under different assumptions of regional resilience

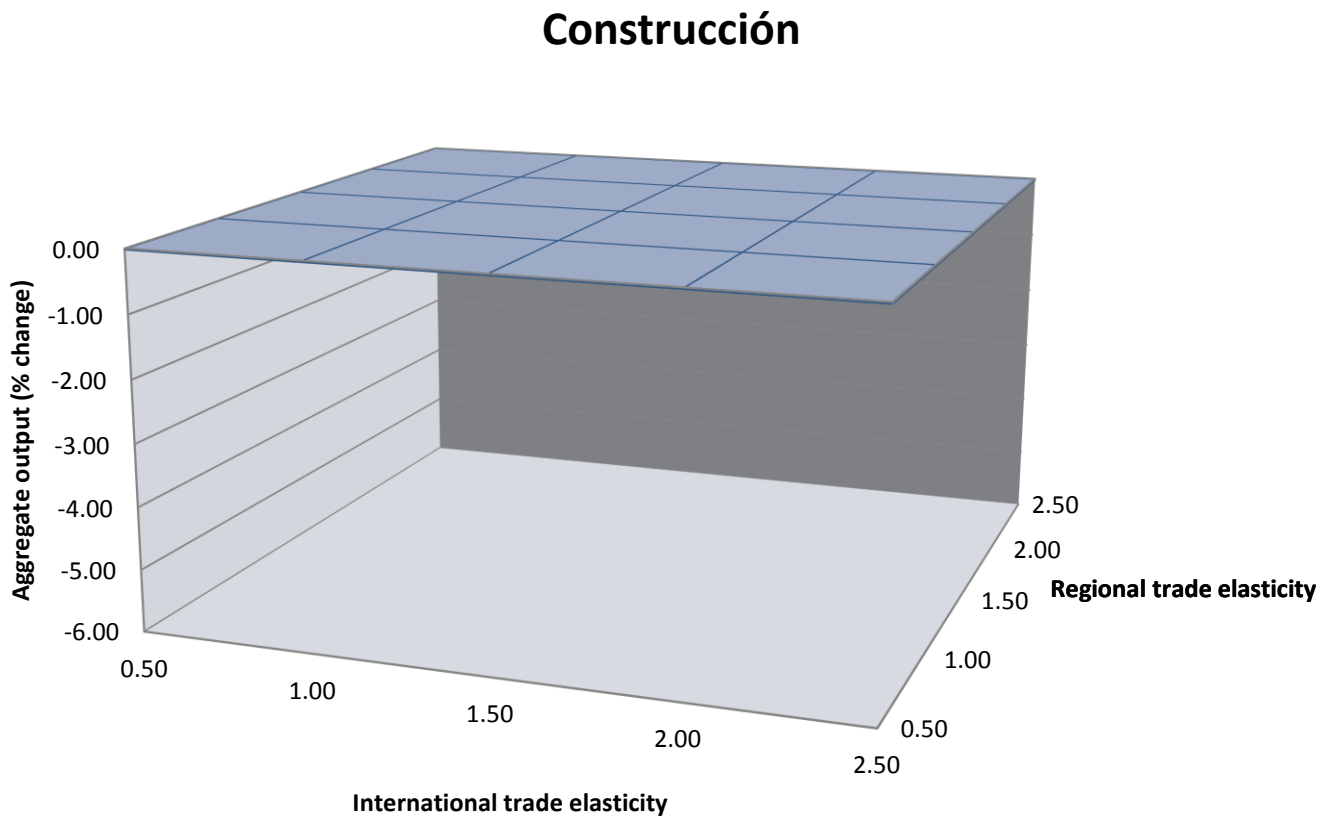


Sectoral impacts under different assumptions of regional resilience

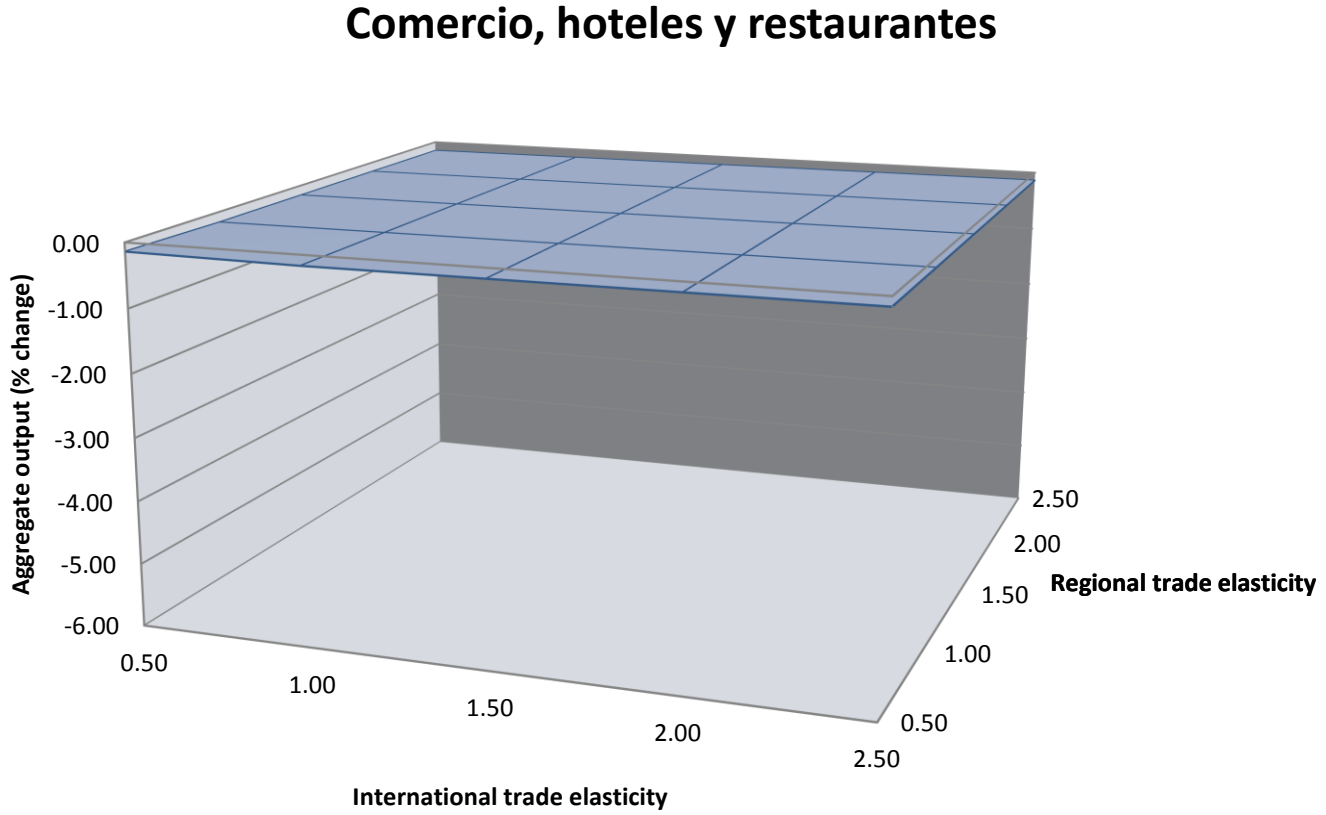
Electricidad, gas, agua y gestión de desechos



Sectoral impacts under different assumptions of regional resilience

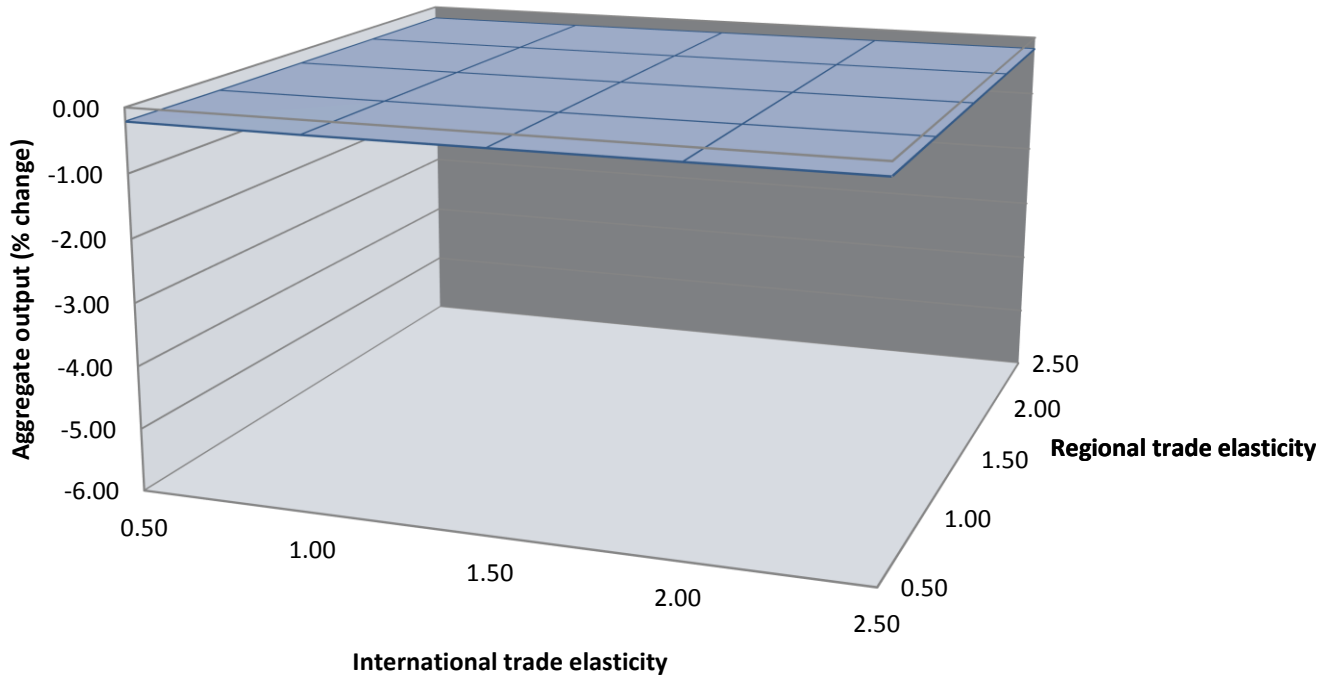


Sectoral impacts under different assumptions of regional resilience

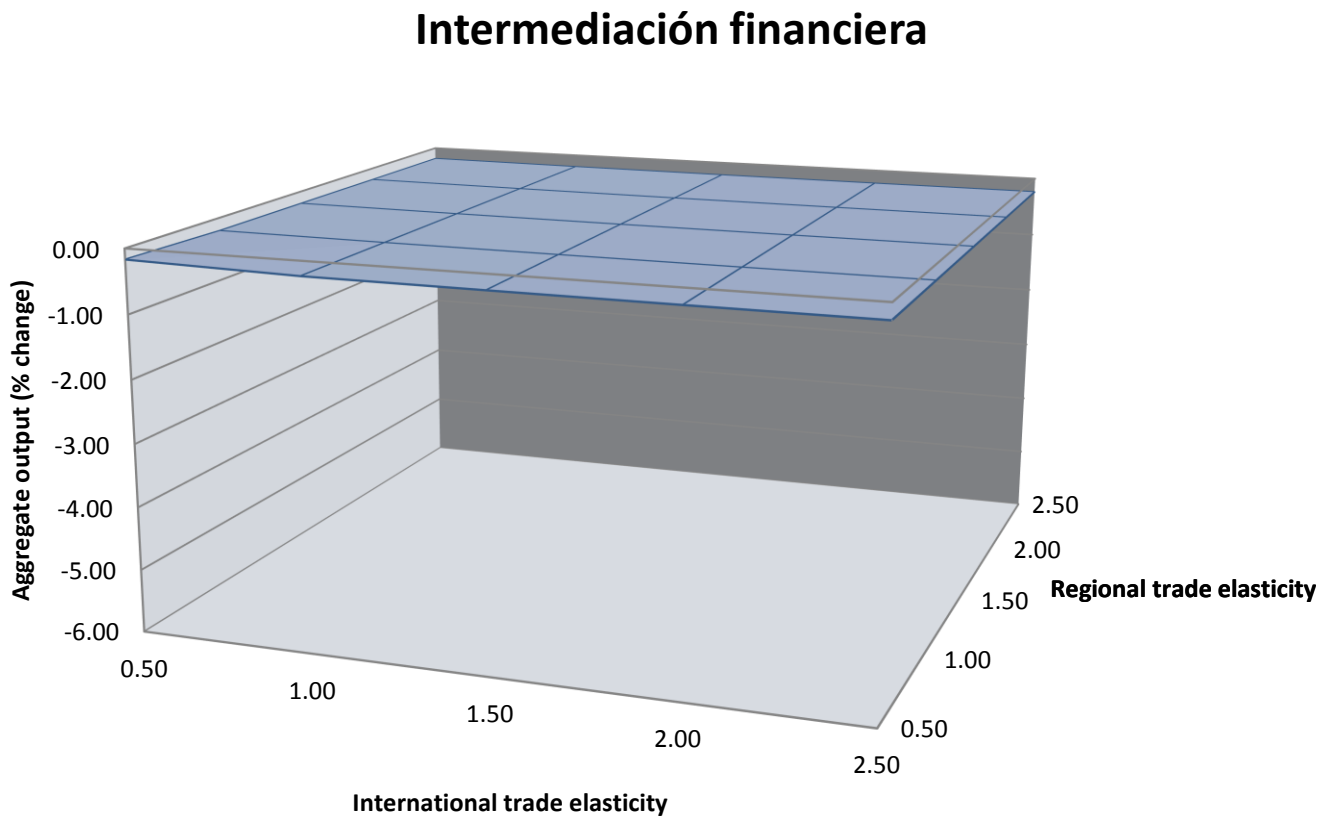


Sectoral impacts under different assumptions of regional resilience

Transporte, comunicaciones y servicios de información

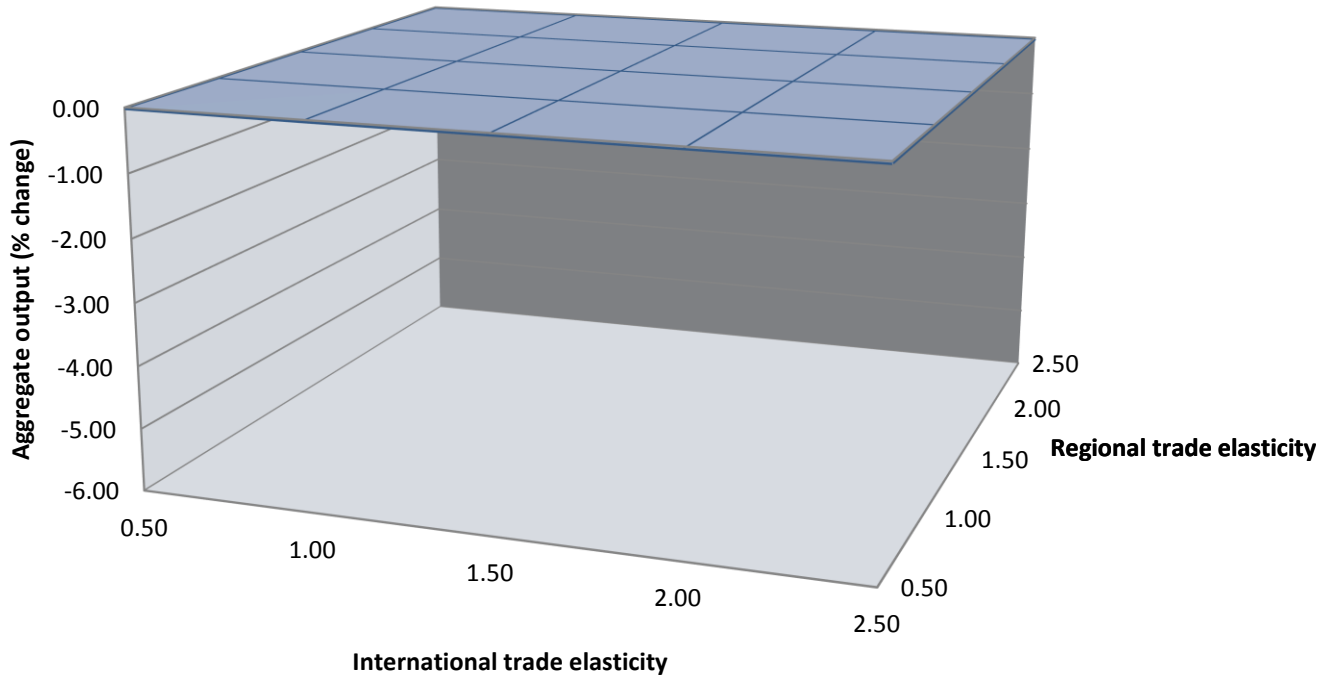


Sectoral impacts under different assumptions of regional resilience

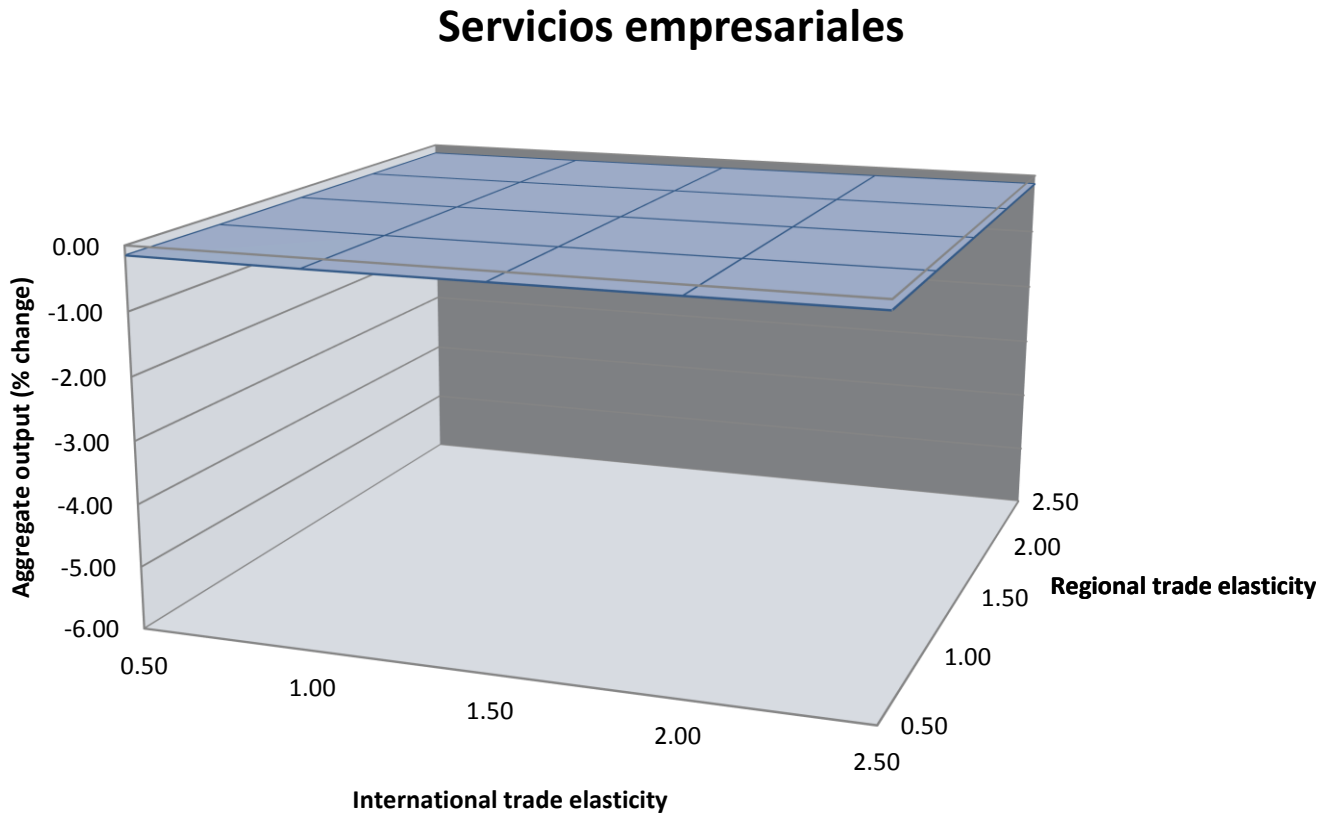


Sectoral impacts under different assumptions of regional resilience

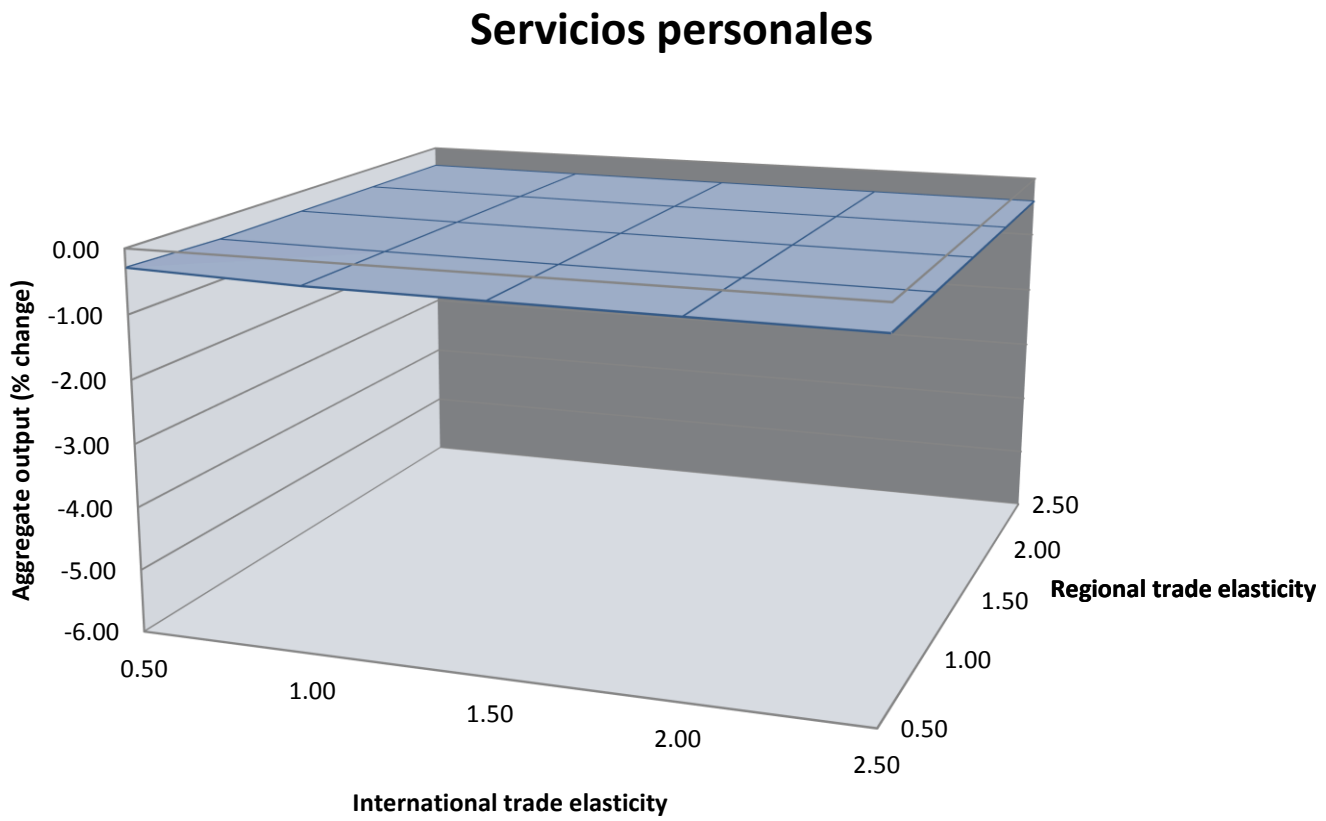
Servicios inmobiliarios y de vivienda



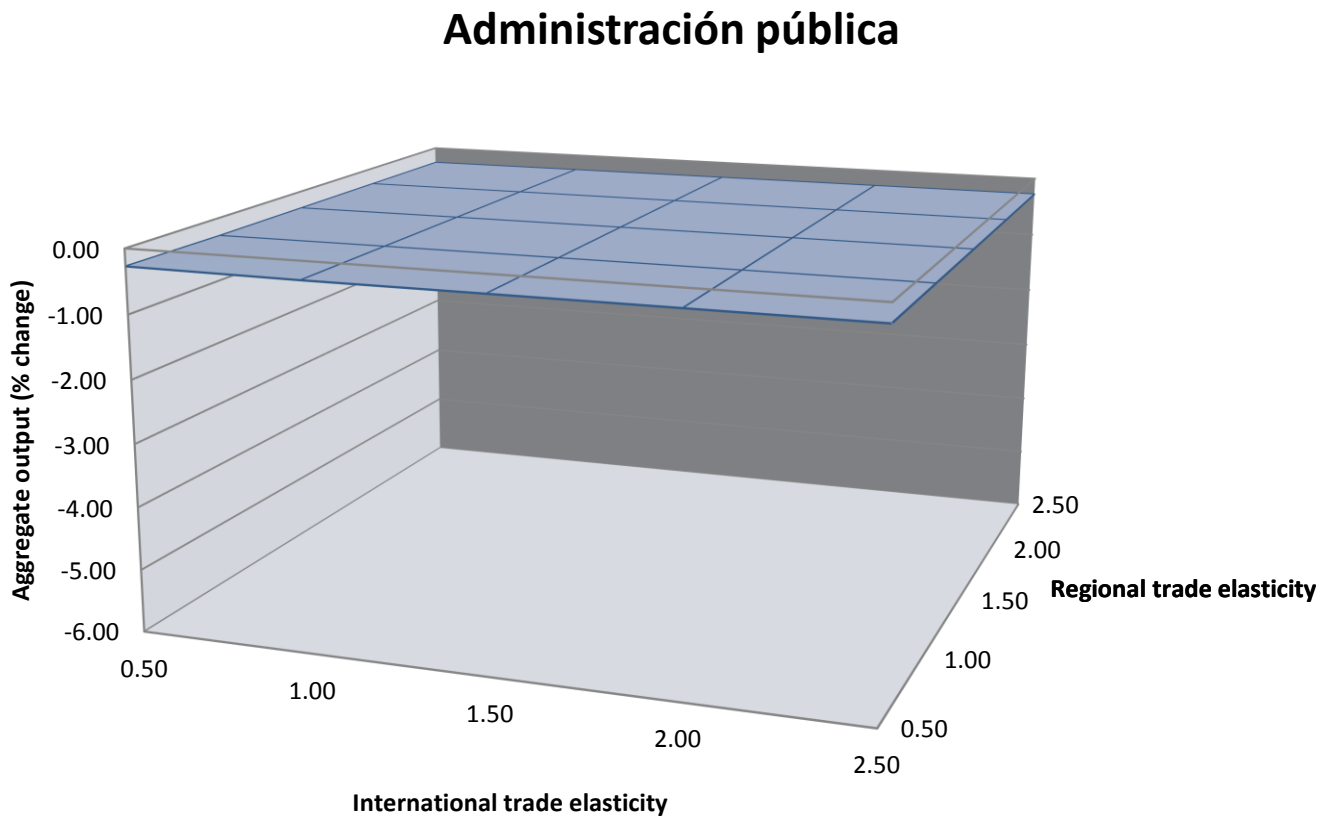
Sectoral impacts under different assumptions of regional resilience



Sectoral impacts under different assumptions of regional resilience



Sectoral impacts under different assumptions of regional resilience



Conclusions

- Small aggregate impact (GDP).
- Regional impacts show increasing disparities (Central Chile versus rest of the country) as regional trade elasticities increase.
- Higher interregional substitution with stronger imports penetration in the affected regions.
- Agricultural sector more affected with higher international trade elasticities (foreign imports penetration).
- Impacts on tradables decrease with higher resilience.
- Performance of non-tradable sectors not heavily influenced.

Conclusions and Challenges

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ESCUELA DE NEGOCIOS

Chile: Socio Economic Impacts from Climate Policies

By
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Viña del Mar, CHILE, http://cepr.uai.cl

Latin America and Caribbean (LAC) awareness creation workshop to maximize the positive and minimize the negative impacts of implementation of Climate Change response measures.

May 22th to 24th, 2019, Santiago, Chile.

United Nations Climate Change Secretariat

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