Which Climate Change Mitigation Policy-mix to Argentina? A General Computable Equilibrium Approach

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Introduction

Context/Motivation

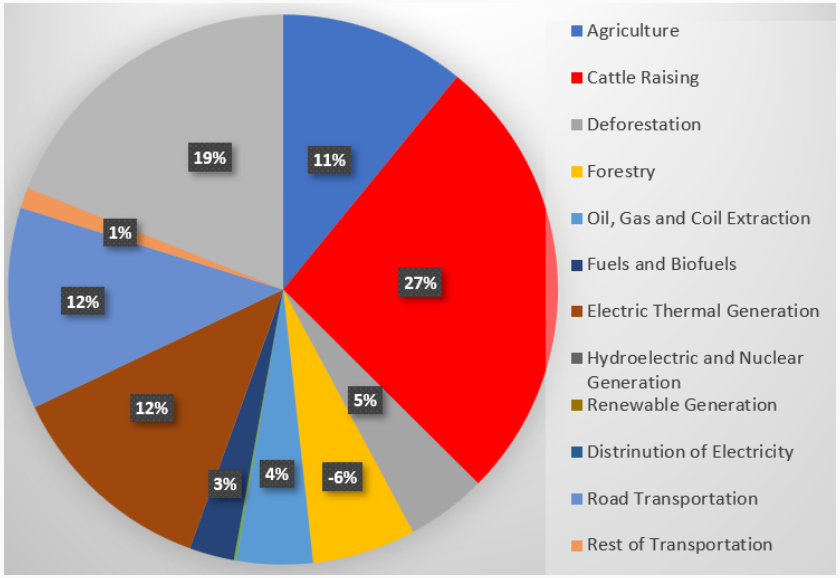
- Climate Change has become a recurrent subject when it comes to ensuring long-run sustainability.
- Nations world-wide have started to embark on policies that aim to mitigate the detrimental effects of Greenhouse Gases (GHG).
- Nonetheless, policies that may result successful for some countries may be harmful for others.
- Countries such as Argentina are subject to macroeconomic restrictions that should be taken into account when designing optimal policies for GHG mitigation.

Literature review: subject& approach

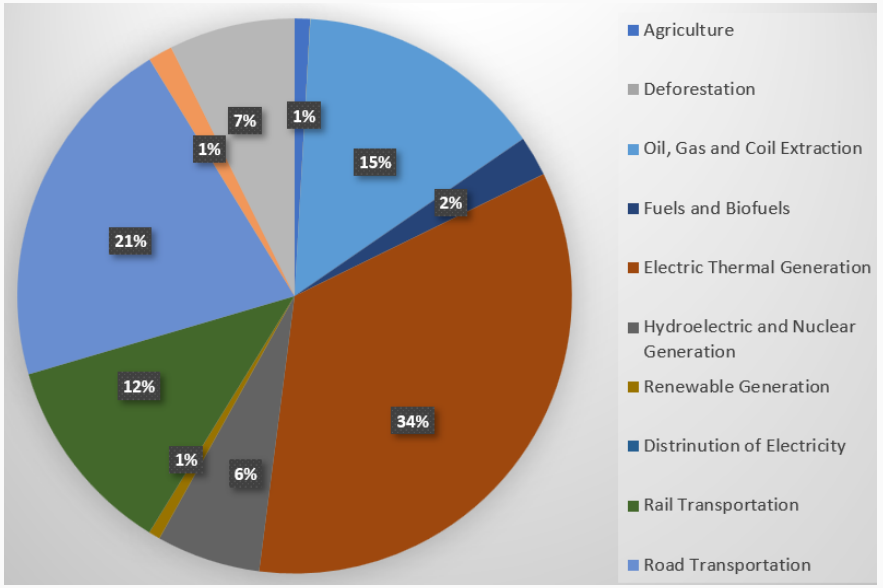
- **Chisari et. al. (2013)** have studied the impact of mitigation policies y Brazil, Chile and the USA. They conclude that similar policies may have extremely different results depending on the size of the economy.
- **Chisari and Miller (2014)** studied the repercussions of carbon taxes in Argentina and Mexico. They show that such policies may have different impacts when tax evasion and factor mobility are allowed.
- **Madrones and Lipski (2019)** have tested how different carbon taxations may influence the Chilean agricultural sector. They arrive at the conclusion that such measures may not only be harmful to the agricultural sector but also be unable to meet the environmental goals.

Facts

GHG emission per sector



Subsidies per sector



Land-intensive sectors represent the 49% of the overall emissions. Non-renewable energy sectors represent the 19% of the overall emissions.

51% of subsidies are destined to polluting energy sources.

Objectives

This work aims to shed some light over what would be the optimal policy-mix for Argentina in order to meet the environmental goals whilist minimizing the negative reverberations in the economy.

- For this reason, we have developed a Dynamic Computable General Equilibrium Model with special interest in the energy and land sectors.
- By doing so, we are able to properly portray the impact of different policies on this vital sectors.

Methodological Approach

Methodological insights

1. CGE model

2. Calibration data

Dynamic CGE model to Argentina for CC policy evaluation

1. Model structure
   - Small open economy.
   - 2 regions: Argentina and Rest of the World.
   - 56 sectors and 10 households divided by per-capita income.
   - Government.
   - 4 factors: L, K (mobile and specific) and T.
   - Unemployment.
2. Dynamic calibration of the baseline 2017-2030
   - TFP Growth= 1.5%.
   - Capital/product ratio =2.43.
   - Active population growth= 1.09%. This rate also determines the evolution of government´s transfers.
   - Real wage inflexible downwards and adjusts partially according to GDP growths.

Dynamic CGE model to Argentina for CC policy evaluation

Firm's Production Function

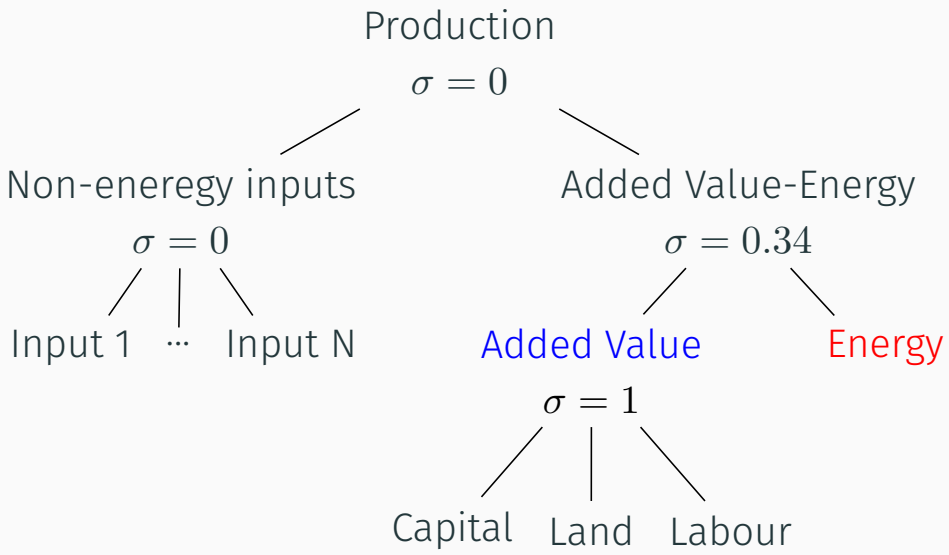


Figure 1: Firm's Production Function.

Added Value: emissions by production process.

Energy: emissions from energy consumption.

Dynamic CGE model to Argentina for CC policy evaluation
Energy modelling

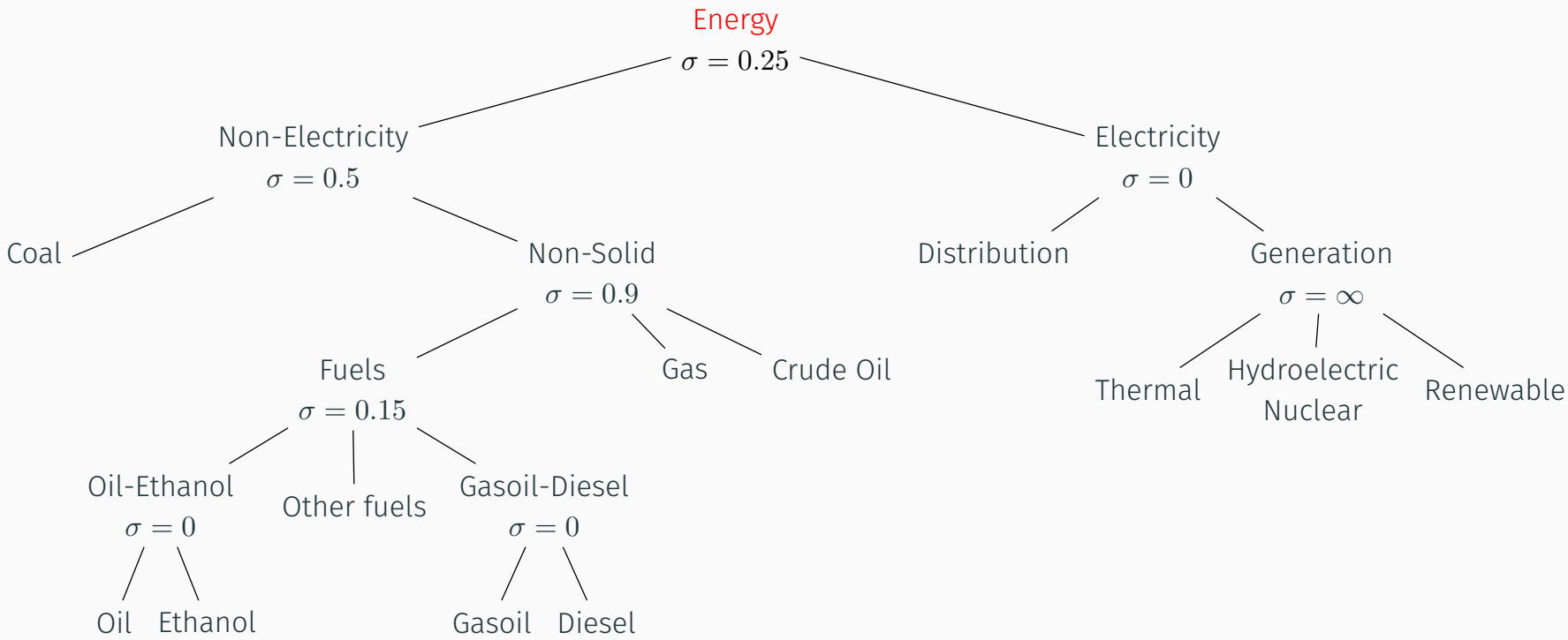


Figure 2: Nesting of the energy package demanded by the firms.
Each firm has its own package according to their production technology.

Dynamic CGE model to Argentina for CC policy evaluation

Land use and deforestation modelling

- Deforested land in **t** is incorporated into the production process in **t + 1**.
- Land transformation by uses:

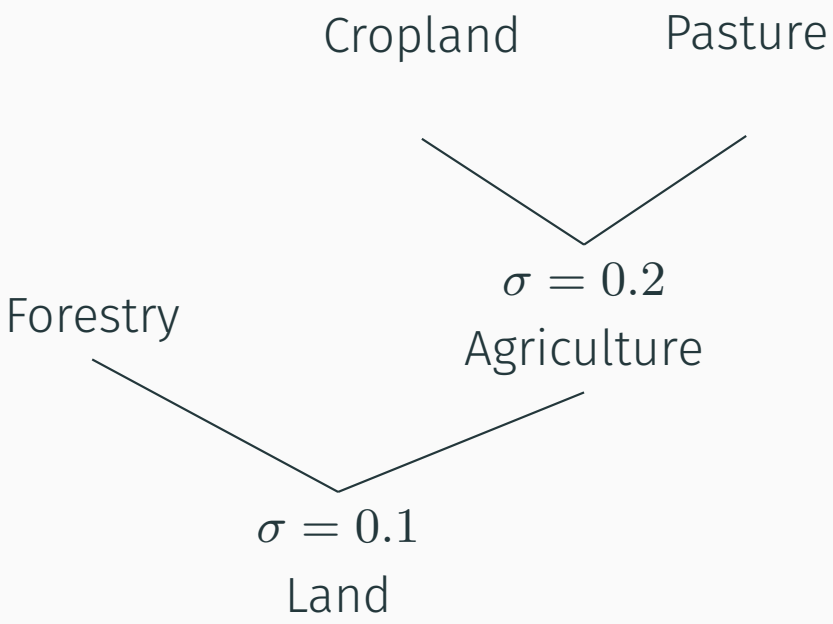


Figure 3: Land allocation.

Dynamic CGE model to Argentina for CC policy evaluation
Demand

- Households maximize welfare given their income.

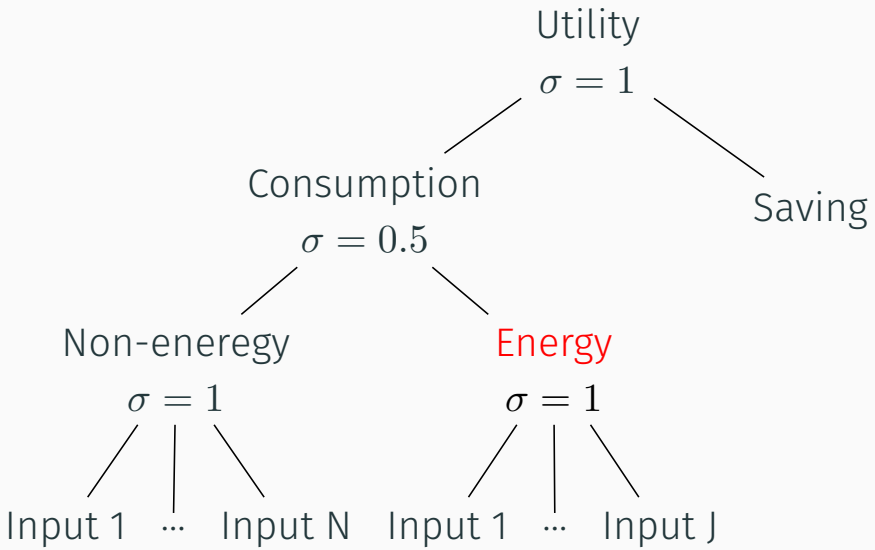


Figure 4: Nesting of the energy package demanded by the Households.

Energy: emissions from energy consumption.

Dynamic CGE model to Argentina for CC policy evaluation

GHG emissions computation

The estimation of GHG emissions takes into account:

- Intermediate energy consumption.
- Final energy consumption.
- Emissions from production processes depending of each sector's carbon intensity

Methodological insights - Data

Calibration data to Argentina 2017

- To develop and calibrate this CGE model we used the SAM for Argentina described in Chisari et al. (2020) that has 30 productive sectors.
- Nevertheless, this matrix was modify to allow us to model energetic consumption and land use.
- The current matrix has 56 productive sectors.

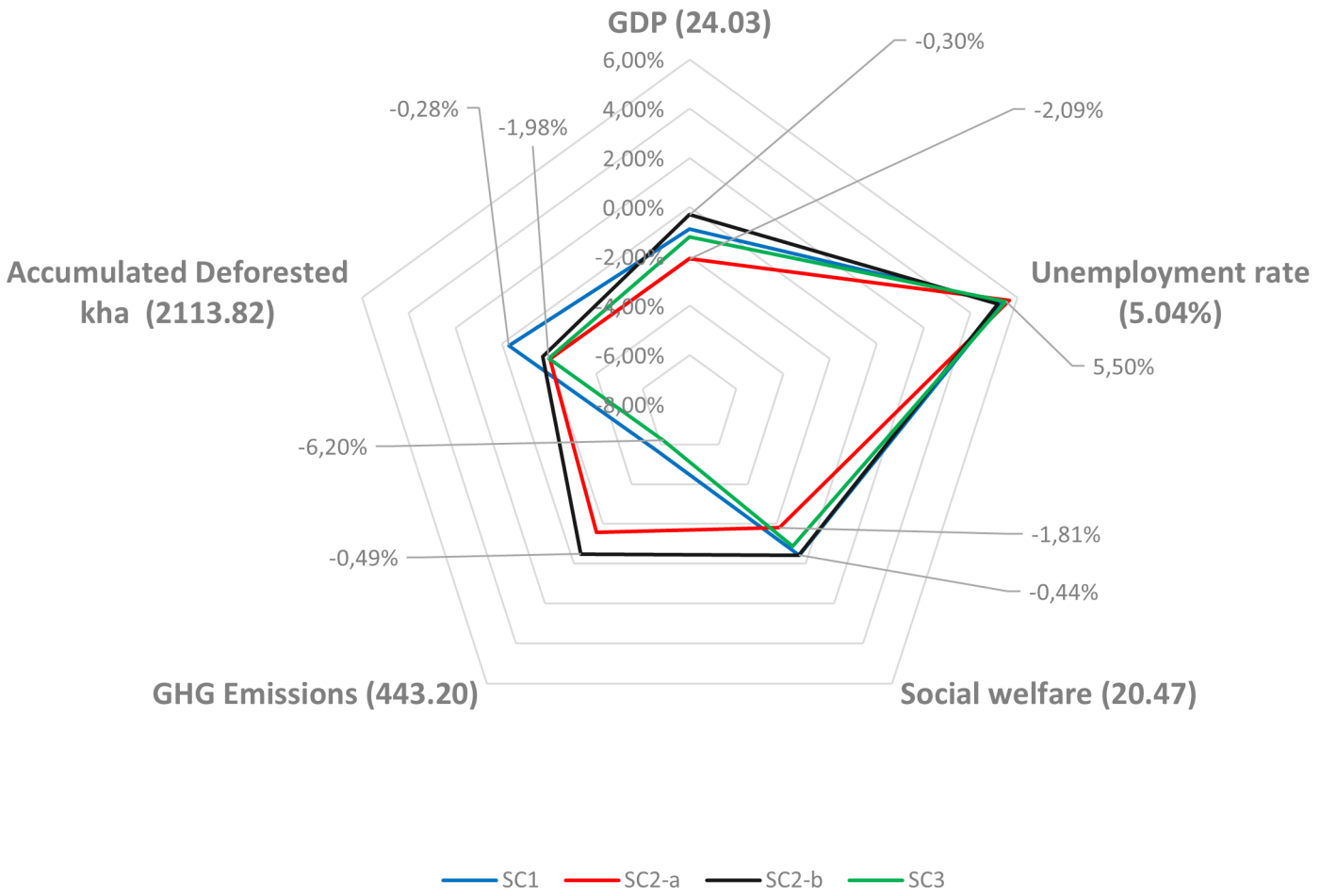
CC Mitigation Policy scenarios

Scenarios	Shock description
SC1	Reduction of subsidies to polluting energy (-75%).
SC2-a	13.68 USD/tCO2eq additional carbon tax.
SC2-b	13.68 USD/tCO2eq additional carbon tax. AGFO targeted.
SC3	SC1 + SC2-b.

All shocks are simulated from 2020 and results are presented for 2030.

Results

CC Mitigation Policy scenario - Macroeconomic results



CC Mitigation Policy scenario - Sectors' results

GHG, GO and VA results by sectors (% change to the baseline - 2030)

	Scenario 1			Scenario 2-a			Scenario 2-b			Scenario 3		
	GHG	GO	VA	GHG	GO	VA	GHG	GO	VA	GHG	GO	VA
Agriculture-Forestry	-0.1	-0.1	-0.1	-1.1	-0.7	-0.7	-1.0	-0.5	-0.6	-1.1	-0.6	-0.7
Silviculture	0.2	-0.2	-0.2	1.9	-2.2	-2.0	0.3	-0.3	-0.3	0.5	-0.5	-0.5
Fuels & other energy	-10.6	-1.7	-1.5	-1.2	-0.7	0.1	0.1	0.1	0.3	-10.5	-1.6	-1.2
Thermal electricity	-31.2	-31.6	-26.8	-3.4	-2.9	-2.3	0.0	0.0	0.0	-31.5	-32.0	-27.1
H-N-R Electricity	0.0	17.7	17.3	0.0	2.2	2.1	0.0	0.9	0.8	0.0	18.4	17.9
Transport	-1.8	-0.5	-0.5	-2.5	-1.4	-1.4	-0.3	-0.1	0.0	-2.1	-0.7	-0.7
Rest-Primary goods	-1.7	-0.1	-0.1	-0.7	-0.3	-0.3	-0.5	-0.2	-0.2	-2.2	-0.4	-0.3
Rest-Manufactures	-2.0	-0.5	-0.4	-2.1	-2.8	-2.3	-0.3	-1.8	-1.6	-2.3	-2.3	-1.9
Rest-Services	-1.1	0.0	0.0	-0.6	0.1	0.2	0.0	0.2	0.3	-1.1	0.2	0.3

Conclusions

Final comments

Objectives and Contributions

- We have developed a CGE model for the Argentinean Economy with an appropiate sector detail and characterization.
- A policy package that includes subsidy reduction in GHG emitting energies and an increase in the carbon tax for land-intensive sectors would be suitable for Argentina.

Policy relevance results

- A subsidy reduction may motivate the use of renewable energies.
- An increase of carbon taxation in the land-intensive sector may reduce the amount of deforested land.

Extensions

- Re estimation of parameters would mean more precise results.
- An interesting extension would be integrating R&D within the modelling structure.

Thank you for your attention
Questions, comments and suggestions are welcome!