Grasping Argentina's Green Transition

Insights from a Stock-Flow Consistent Input-Output Model

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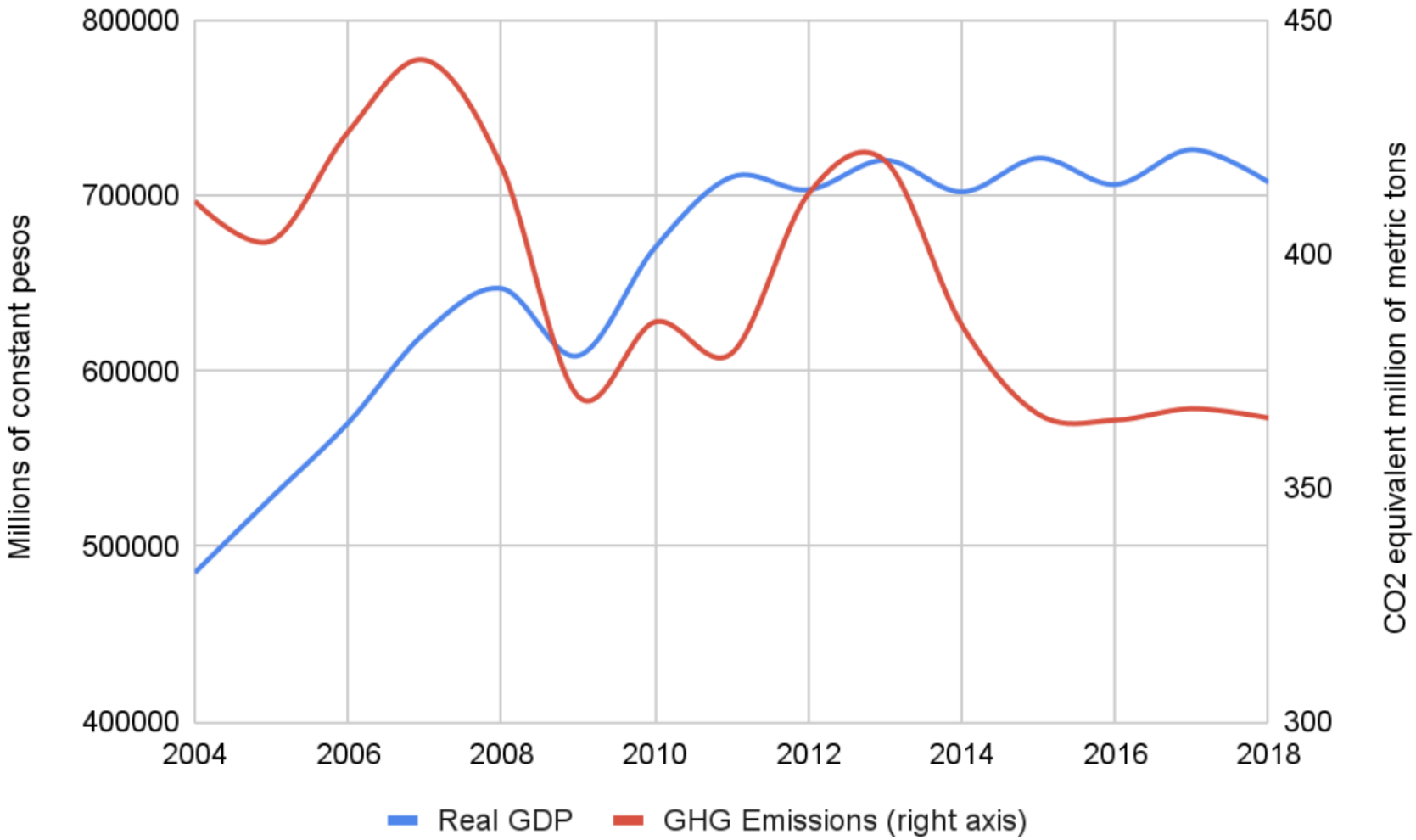
Outline

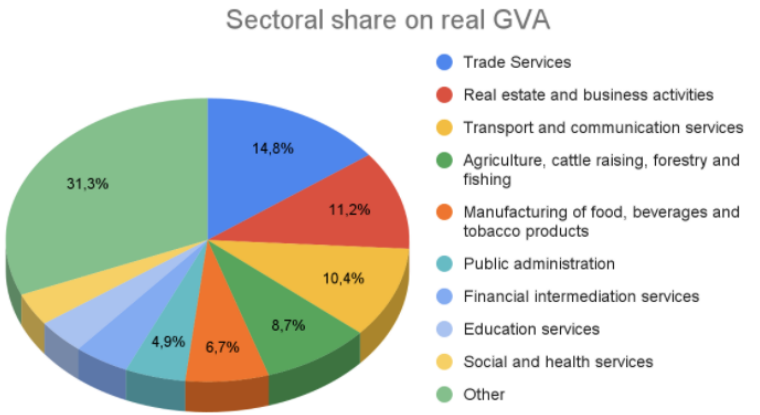
The Problem

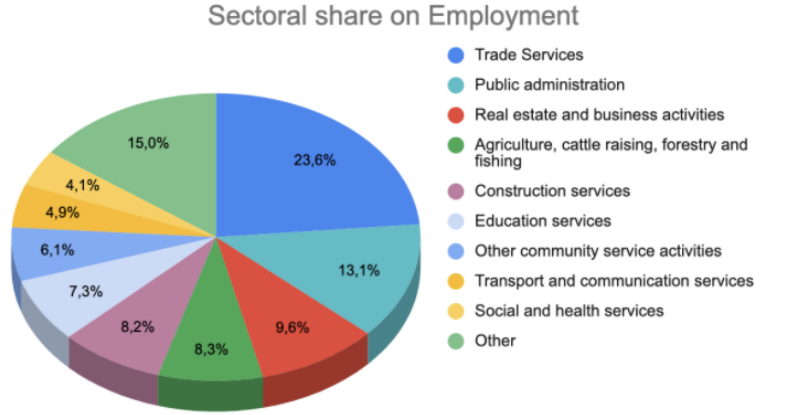
- In December 2020, Argentina updated its NDC of greenhouse gas emissions to 359 MMTCDE in 2030, which is 25.7% lower than the initial target set four years before.
- Latest figure: 365 MMTCDE (2018).
- Dilemma: remaining stagnant (such that GHG emissions do not increase any further) or shifting the productive structure away from high emitting activities (like agriculture and cattle raising), most probably entailing severe consequences in terms of the balance of payments?
- Are there any other alternatives?
    - Energy transition

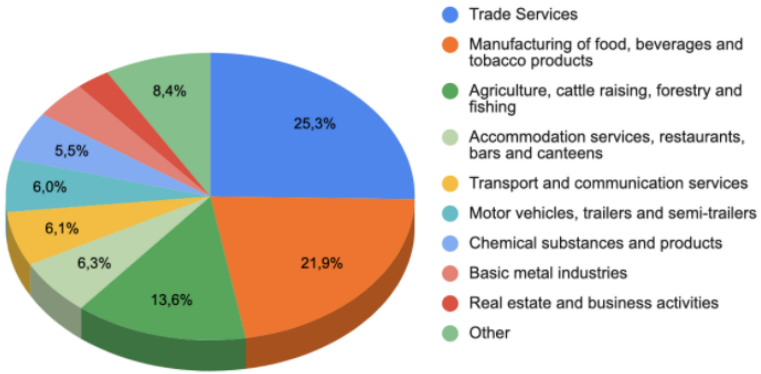
Starting Point

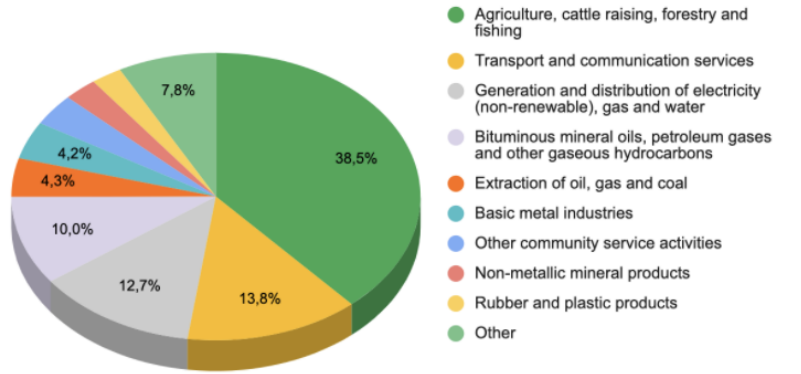


Reliance on Primary Goods Exports

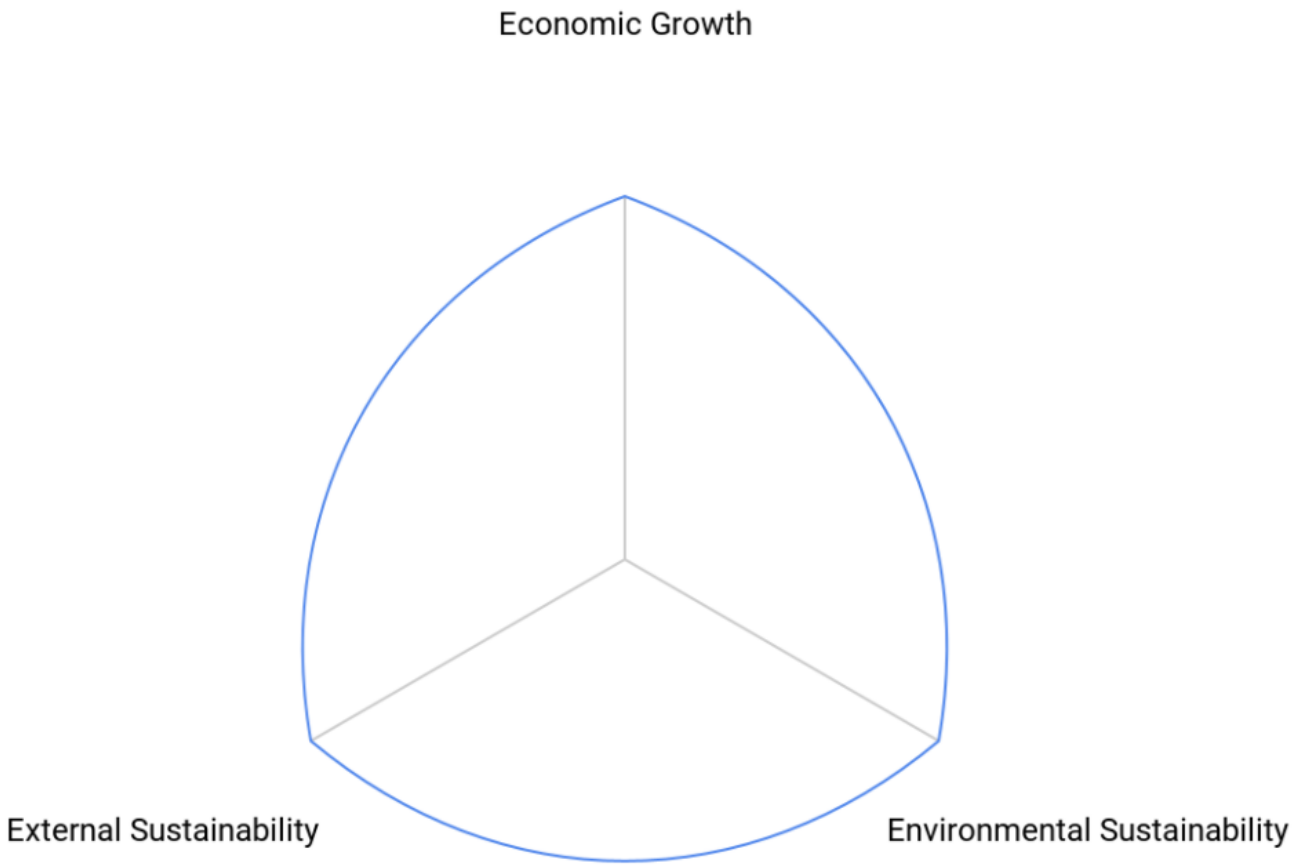








The Green Transition Trilemma



Research Proposal

- **Hypothesis:** Argentina's only way out of the Green Transition Trilemma is through a structural change in its productive structure.
- Structural Change
  - Energy transition
    - Higher energy efficiency (lower energy intensity).
    - Greener energy matrix (less reliant on fossil fuels).
  - Lower income elasticity of imports (higher intermediate demand of domestically produced inputs).
- **Research Question:** what are the economic, external and environmental impacts of the different forms the Green Transition could take? Is there any specific form of the Green Transition that can be deemed sustainable in the three dimensions?

Outline

Environmental SFC-IO Model

- High level of disaggregation both at the production and the household level.
- Integration of environmental and financial accounts with macroeconomic accounts (national accounts).
- Allows to address the sectoral effects of macroeconomic policies and, most importantly, to design and test fine-tuned sector specific policies.
- The explicit modeling of the main financial assets and liabilities of the key sectors of the economy allow for a coherent description of the multiple ways of financing climate policies.

The Model

- 4 institutional agents: private non-financial sector, private financial sector, government and rest of the world.
- Production: GVA, final demand and intermediate consumption disaggregated at 31 sectors
- 7 financial assets.
- SAM: **one observation** for 2017, based on Chisari et al (2020).
- 3120 equations (most of them are accounting identities).
- "Static calibration" based on the available SAM and other researchers' estimates.

GHG Emissions

- Linear relationship between production and emissions.

$$EMIS_i = \theta_i gva_i$$

- Households' also entail GHG emissions. It is assumed that consumption related emissions are a fixed proportion of total final consumption.

$$EMIS_c = (\sum_{i=1}^{31} c_i^{H1} + \sum_{i=1}^{31} c_i^{H2})\theta_c$$

GHG Emissions

- θ defined as the sum of two components: energy consumption related emissions and production process related emissions.

$$\theta_i = \theta_i^E + \bar{\theta_i^P}$$

- Energy related emissions coefficient varies depending on energy efficiency and the type of energy (renewable and non-renewable) that is used in the production process.

$$\theta_i^E = \theta_{i_{-1}}^E \frac{EnergyIntensity_t}{EnergyIntensity_{t-1}} \frac{ShareNonRenewables_t}{ShareNonRenewables_{t-1}}$$

$$\theta_i^E = \theta_{i_{-1}}^E \frac{a_{i10} + a_{i20} + a_{i31}}{a_{i10_{-1}} + a_{i20_{-1}} + a_{i31_{-1}}} \frac{1 - \frac{a_{i31}}{a_{i10}+a_{i20}+a_{i31}}}{1 - \frac{a_{i31_{-1}}}{a_{i10_{-1}}+a_{i20_{-1}}+a_{i31_{-1}}}}$$

Outline

Scenarios

- **BAU**: no specific policies (macroeconomic and environmental) are implemented.
- **BAU without financing constraints**: BAU + Public external indebtedness increases 2% per year.
- **Balanced Green Transition**
  - BAU without financing constraints +
  - Annual increase in energy efficiency +
  - Annual substitution of non-renewable for renewable energies +
  - Annual decrease in all sector's production process related emissions +
  - Annual increase of investment to reflect these mitigation efforts.

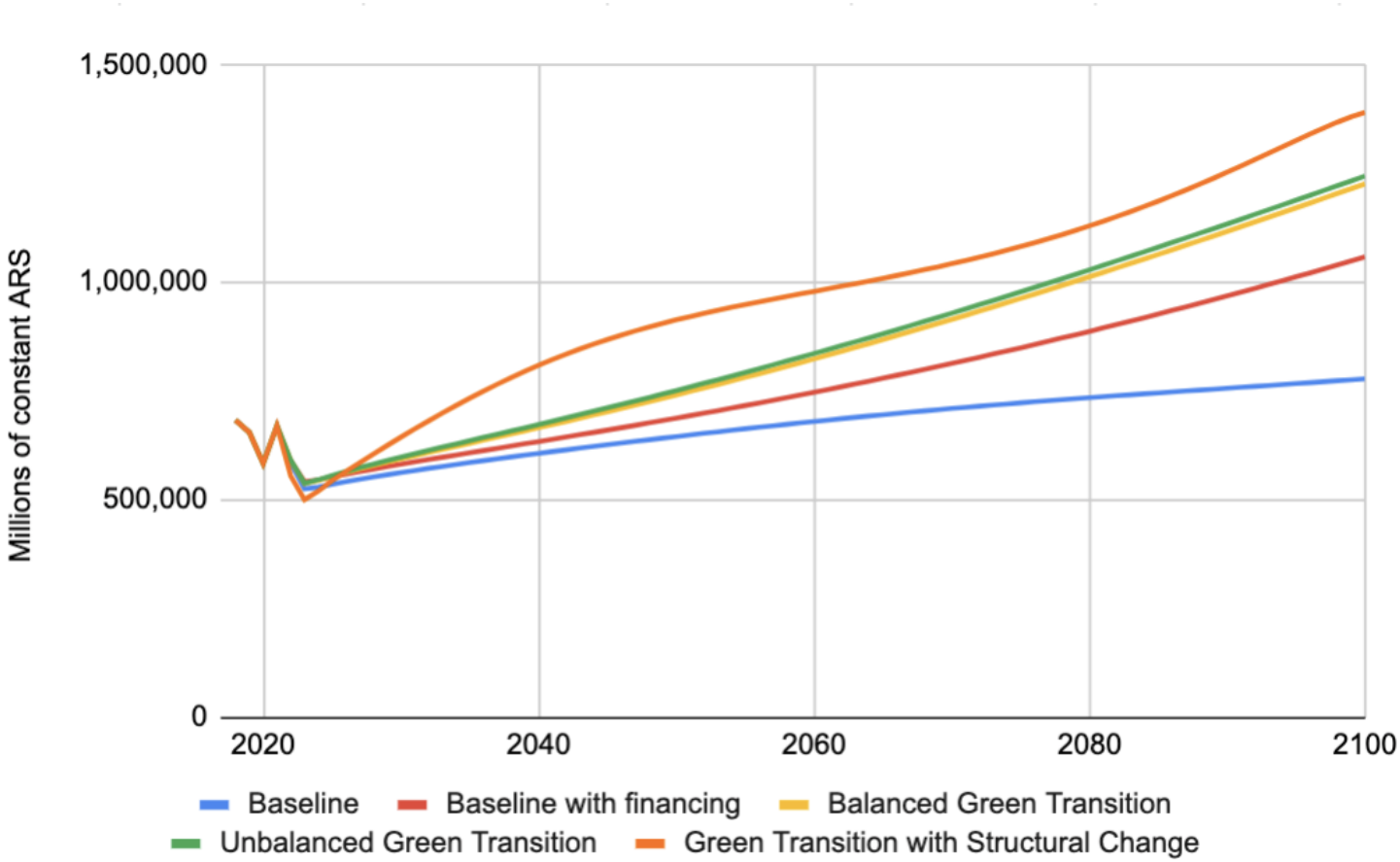
Scenarios

- **Unbalanced Green Transition**
  - The transition is led by the Top 5 sectors in terms of:
    - Exports
    - Employment
    - GHG emissions
  - Same shocks as in the previous scenario, but with with higher intensity.
  - Selected sectors
    - Agriculture and manufacturing of food.
    - Mineral oils, petroleum gases and other gaseous hydrocarbons.
    - Basic metal industries
    - Generation and distribution of electricity and gas
    - Construction and Trade services
    - Transport, IT and Real Estate

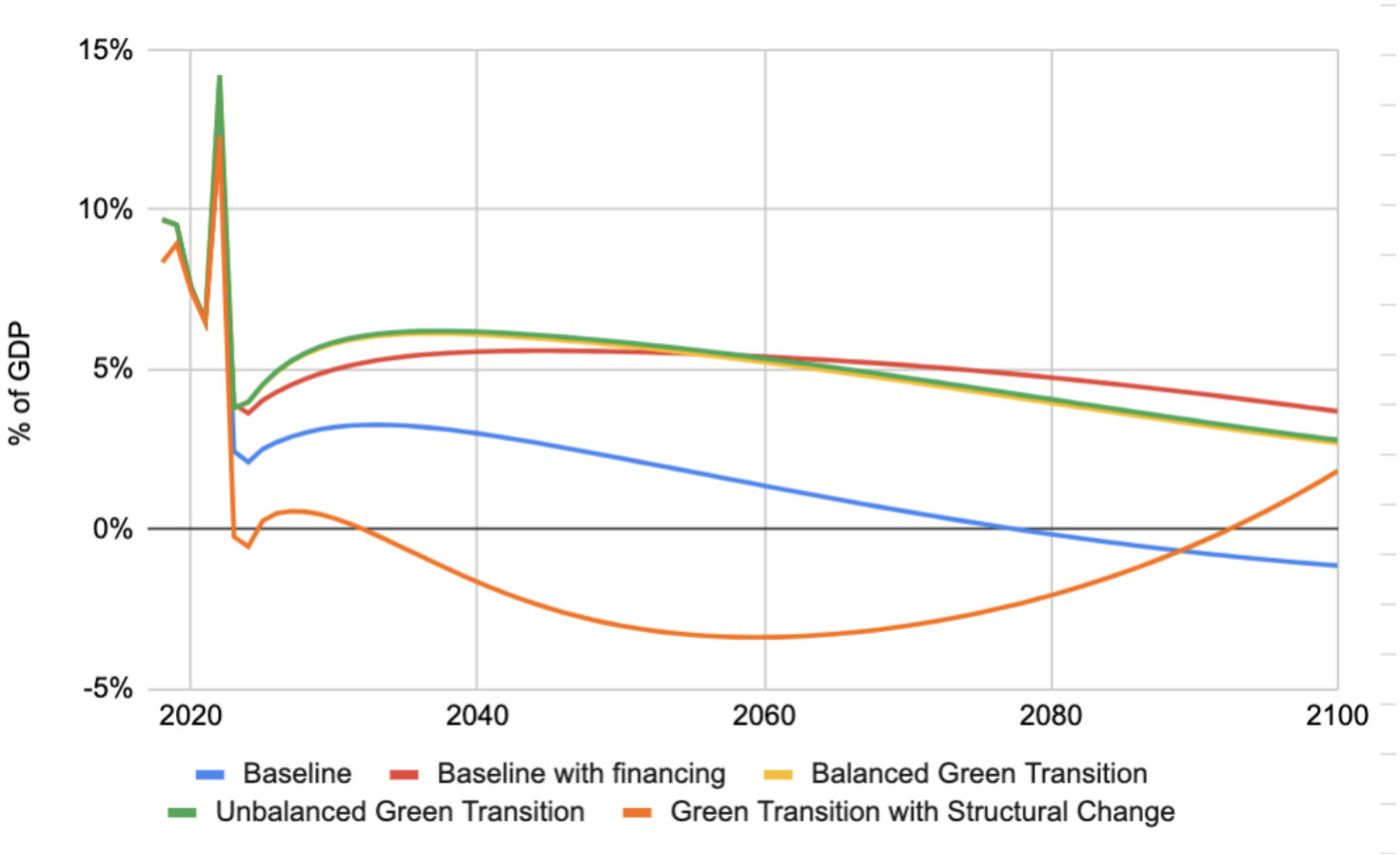
Unbalanced Green Transition with Structural Change

- Starting point: Unbalanced Green Transition
- **Decreasing Technical Dependency**: 1% yearly decrease of the imports propensities of private consumption, investment and intermediate consumption.
- **Intermediate Consumption Substitution**: 1% yearly increase of the technical coefficients defining the intermediate sales of:
  - Manufactured metal products
  - Machinery and equipment
  - Motor vehicles, trailers and semi-trailers and other transport equipment
- **Export Basket Diversification**:
  - Increase in the autonomous component of non-primary exports.
  - Reduction in the autonomous component of primary exports.
- Higher investment (increase in its autonomous component).

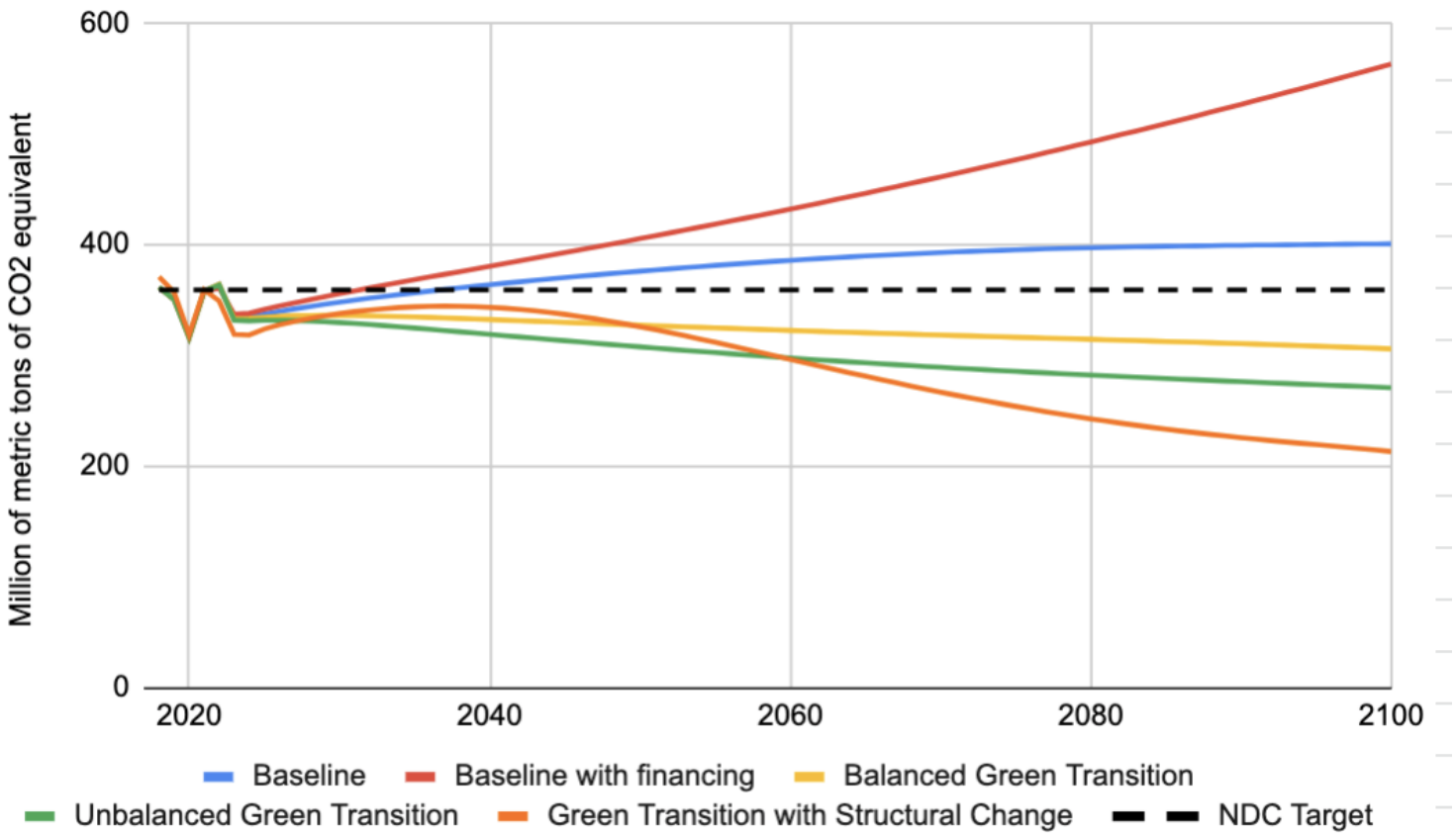
Impact on GDP



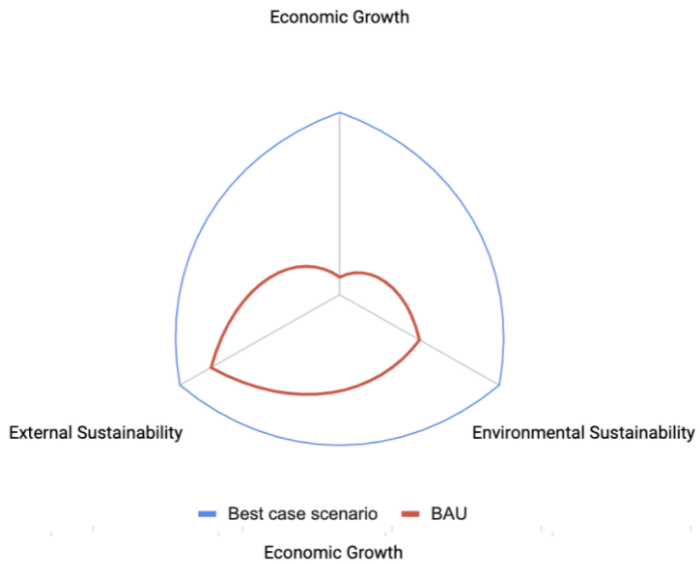
Impact on the Current Account

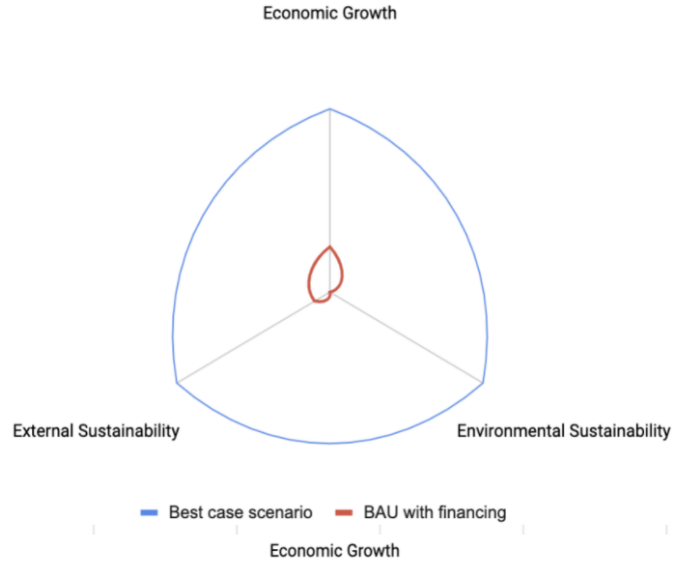


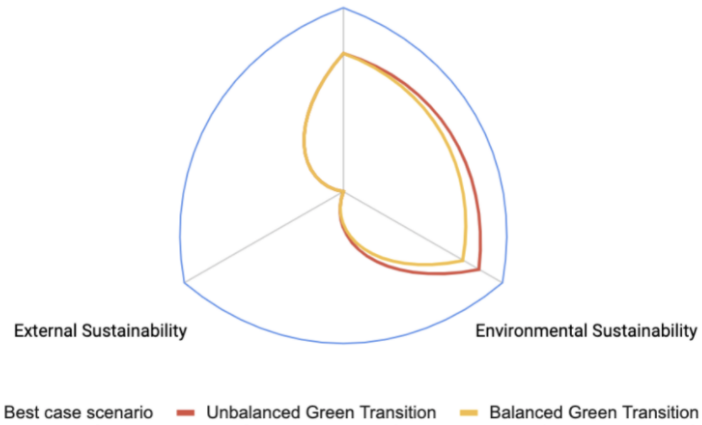
Impact on GHG Emissions

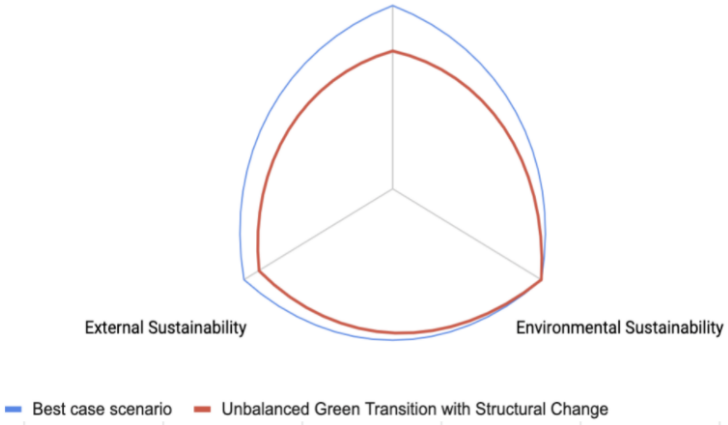


The Green Transition Trilemma









Outline

Conclusions

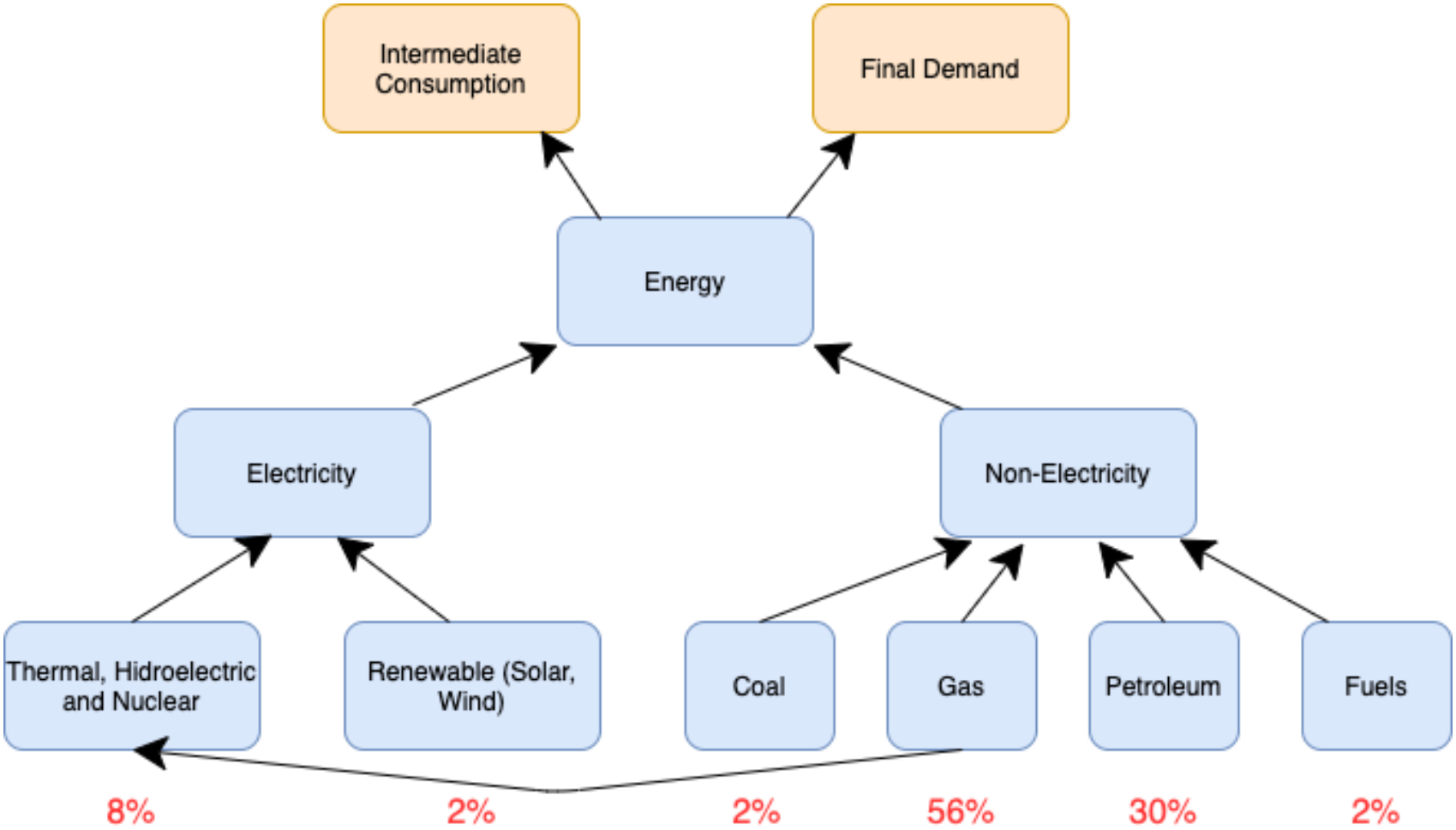
- Integrating National Accounts with Environmental data and IO matrices seems to provide interesting insights for the analysis of the challenges that the Green Transition entails.
- The results found in this first version of an ESFCIO model for Argentina look compatible with the the stylized facts of the last 50 years (mainly BoP constrained growth).
- The results also suggest that besides the efforts to shift the energy matrix away from fossil fuels, in order to grow sustainably Argentina has to go through the long delayed process of structural change.
- Regardless of how reasonable the results of the simulations look, important improvements are still ahead:
  - Dynamic calibration using more observations.
  - More up-to-date data (new IO matrix will be available soon).

The Social Accounting Matrix

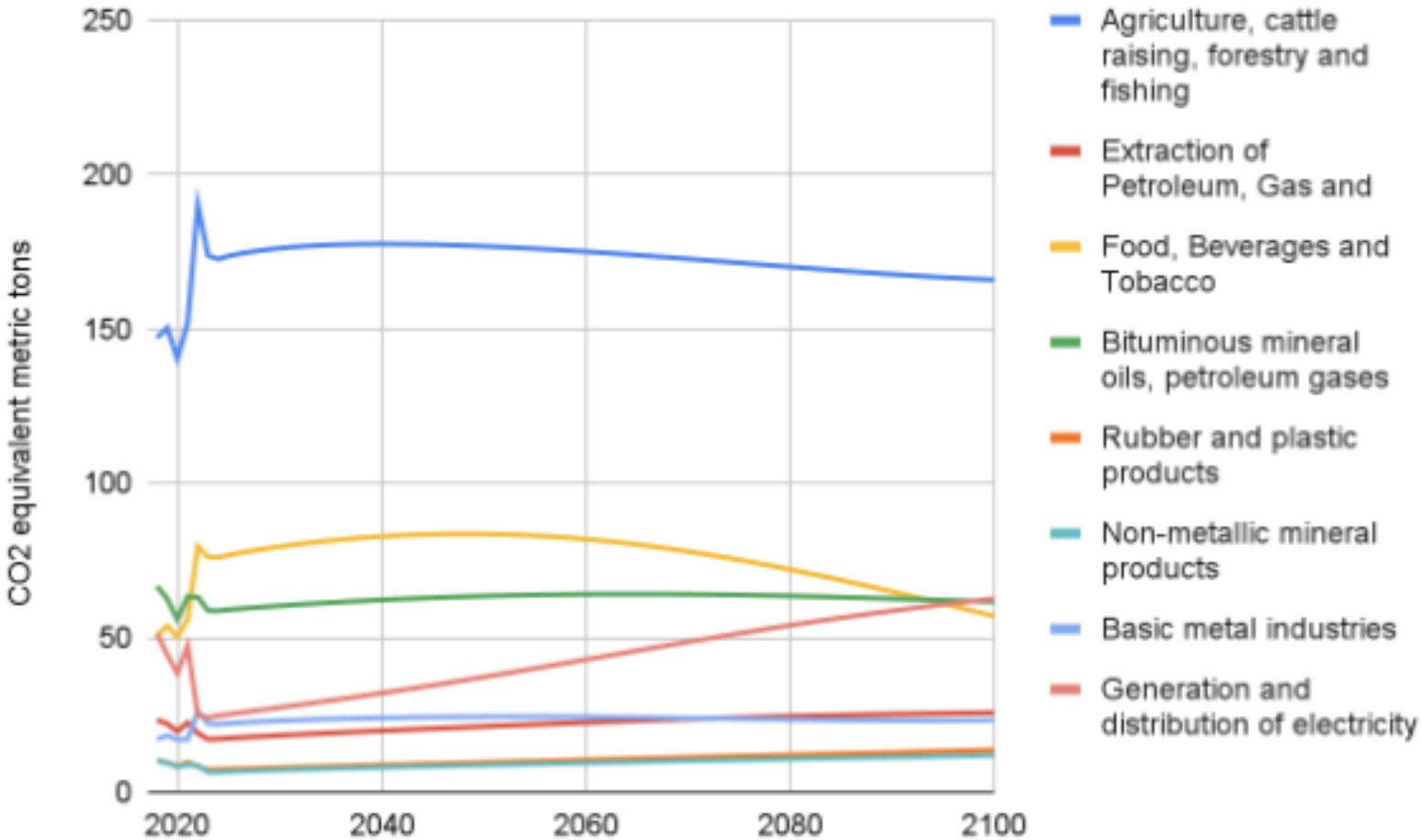
Table 2: Macro SAM for 2017 (in millions of current pesos)

		Sectors	Value added		Taxes	Interest payments			Households		Government	Capital Accumulation		Financial Sector	Rest of the World	Total
			Labor	Capital		Bills and Bonds	External Debt	Green Bonds	Type 1	Type 2		Private	Public			
Sectors		Table 3							2,388,957	4,102,586	1,880,517	1,203,278	504		1,196,764	6.937.925
Value added	Labor	4,033,922														0
	Capital	3,922,299														0
Taxes	Indirect taxes	1,317,597							42	73		20				135
	Labor contrib.	679							0	0						679
	Income taxes Firms	558							0	0						558
	Income taxes Households	0							31	48						79
Interest payments	Bills and Bonds										93					93
	External Debt									36	132					168
	Green Bonds									0	0					0
Households	Type 1		882	491							472					1.844
	Type 2		3,042,109	2,292,167							1,334,691					0
Government				829	2,768,021											829
Capital Accumulation	Private								45	1,447,306						45
	Public										504	0	0		0	504
Financial Sector				176		93										269
Rest of the World		766	110	135			168	0	167	286	0	269	0	4	0	1.905
Net Saving									-829	676	-820	0	0	265	708	0
Total		**6.939.424**	**992**	**1.630**	**2,768,021**	**93**	**168**	**0**	**-545**	**1.119**	**382**	**289**	**504**	**269**	**708**	**0**

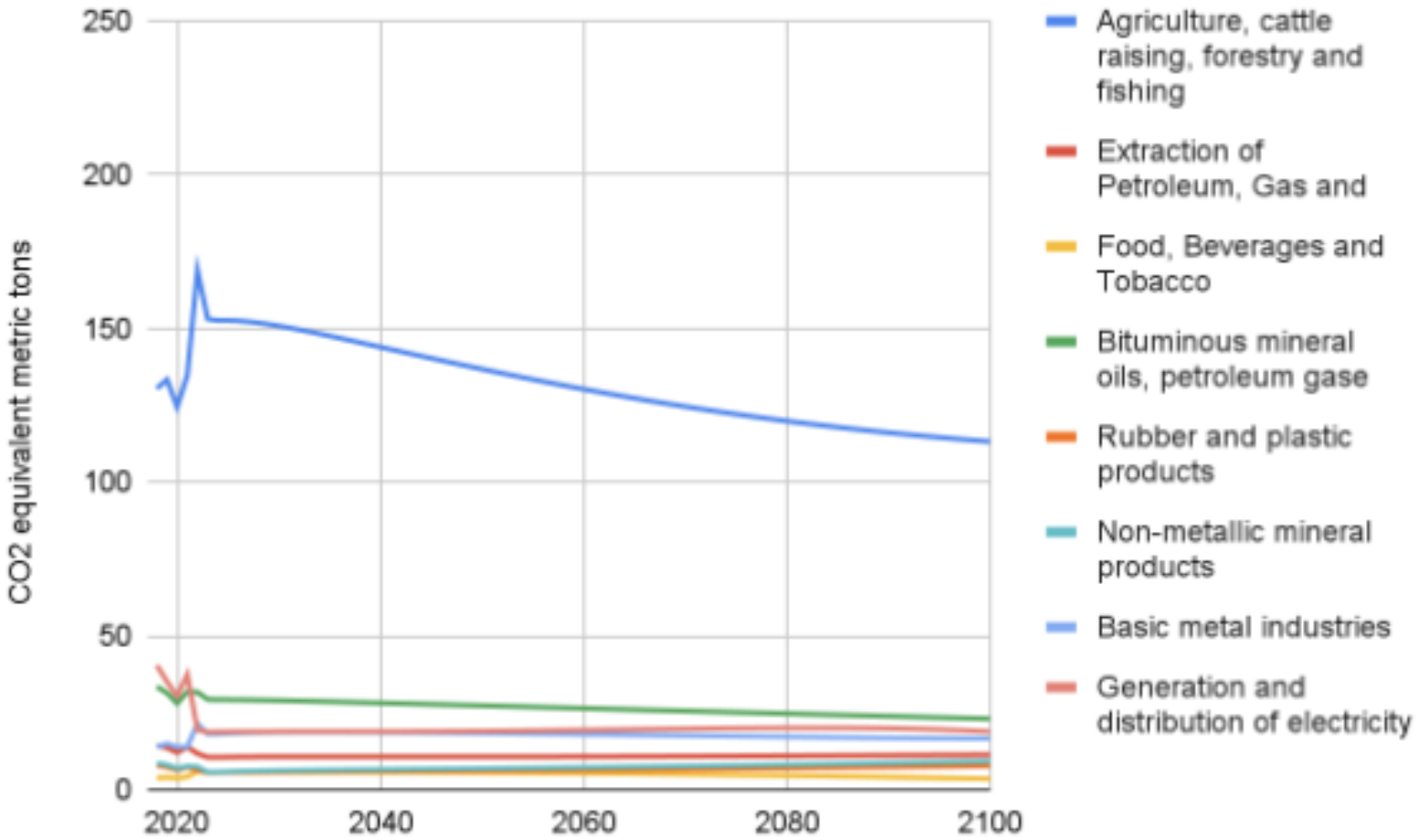
The Energy Block



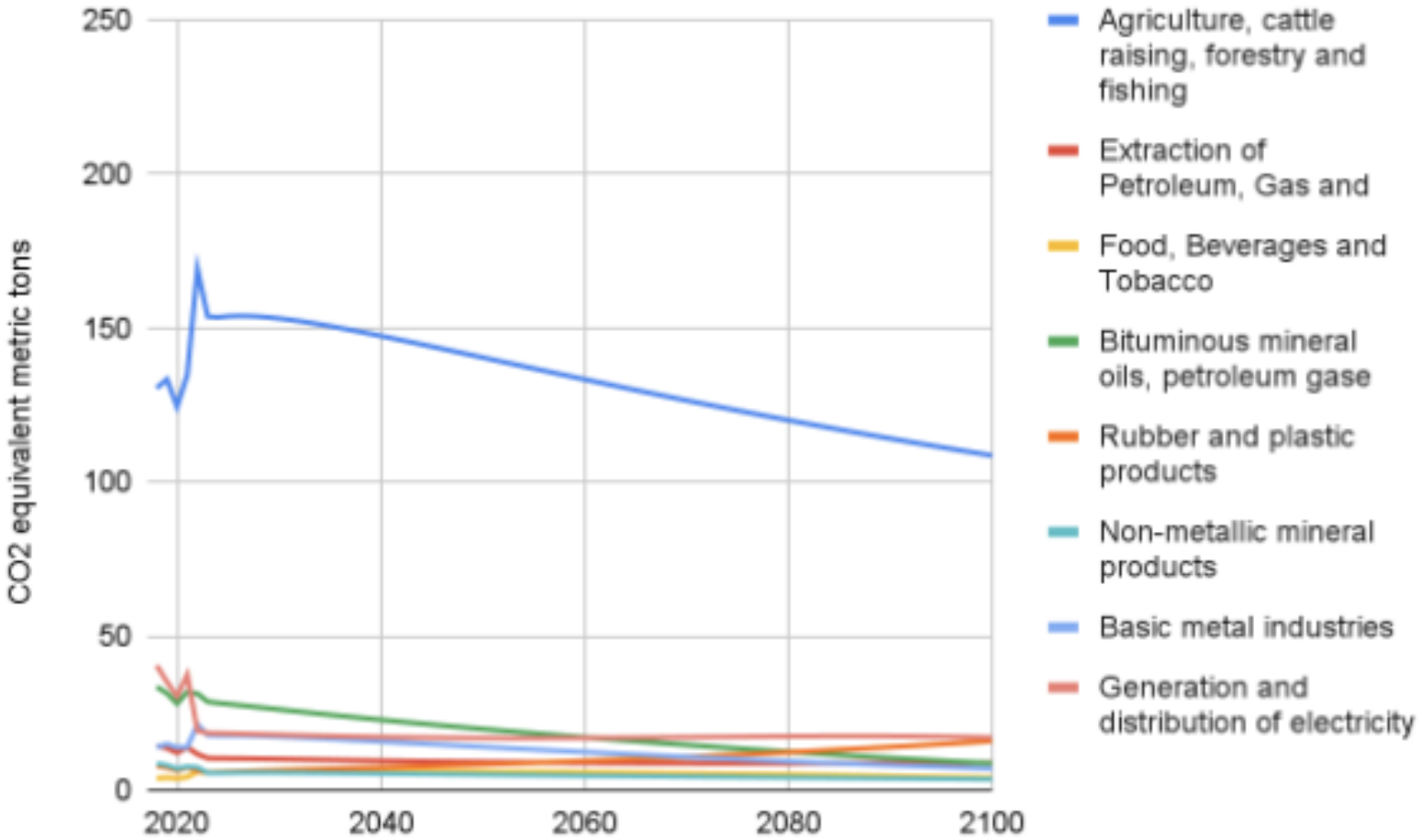
Sectoral GHG Emissions: Baseline



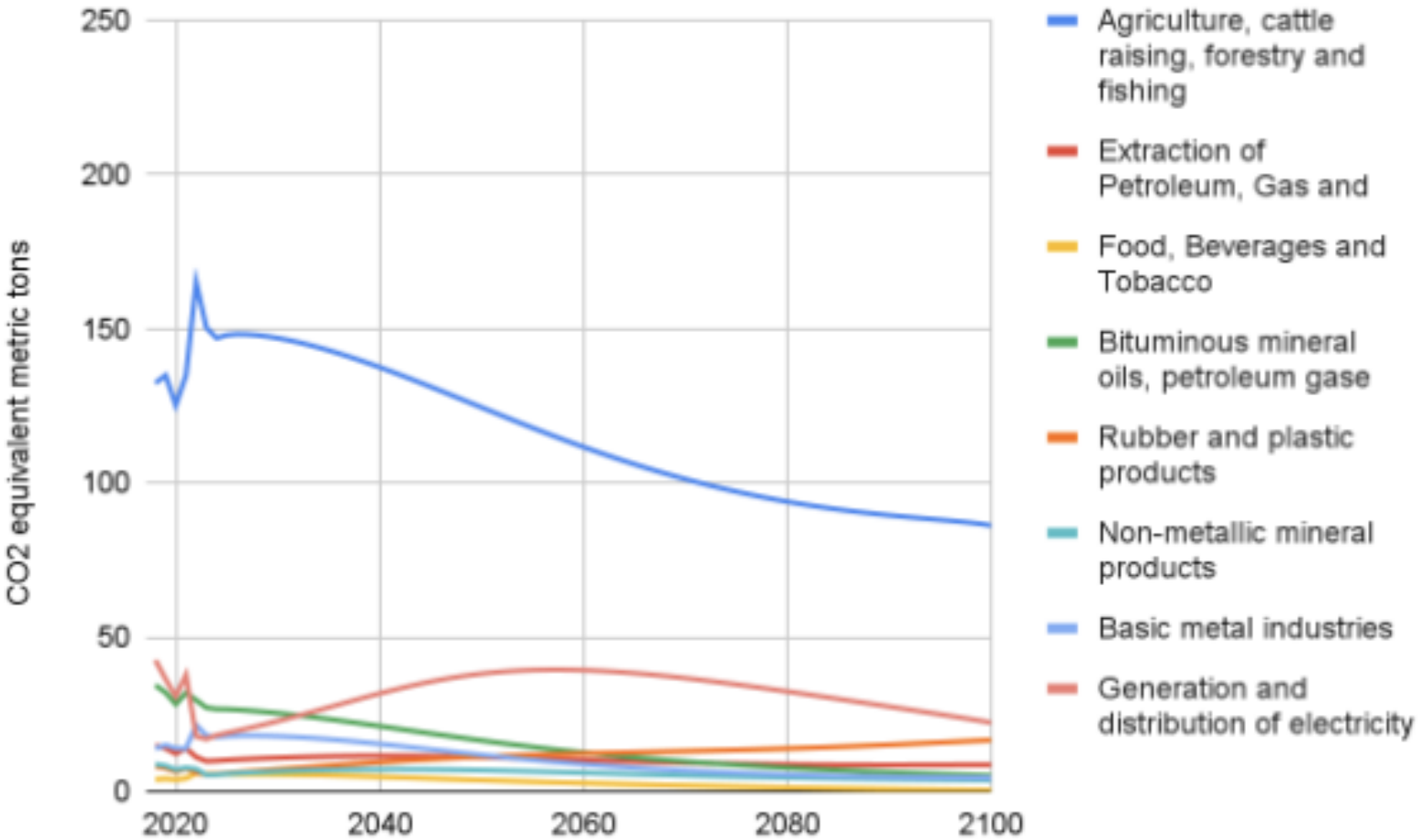
Sectoral GHG Emissions: Balanced Transition



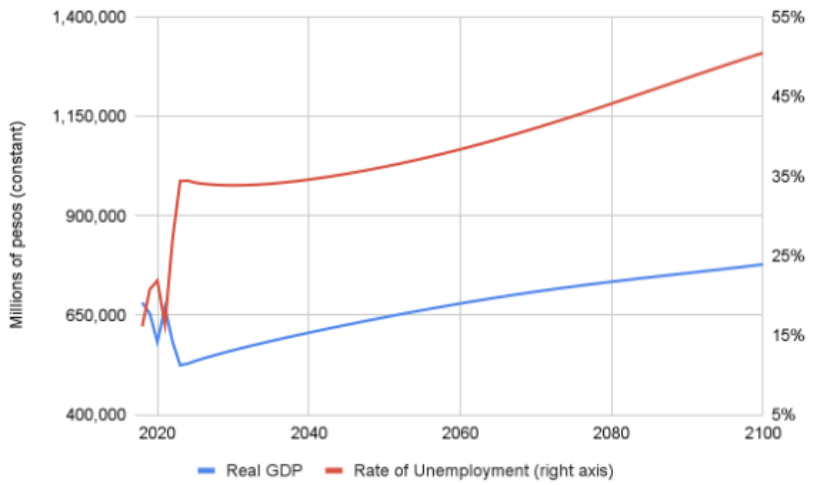
Sectoral GHG Emissions: Unbalanced Transition

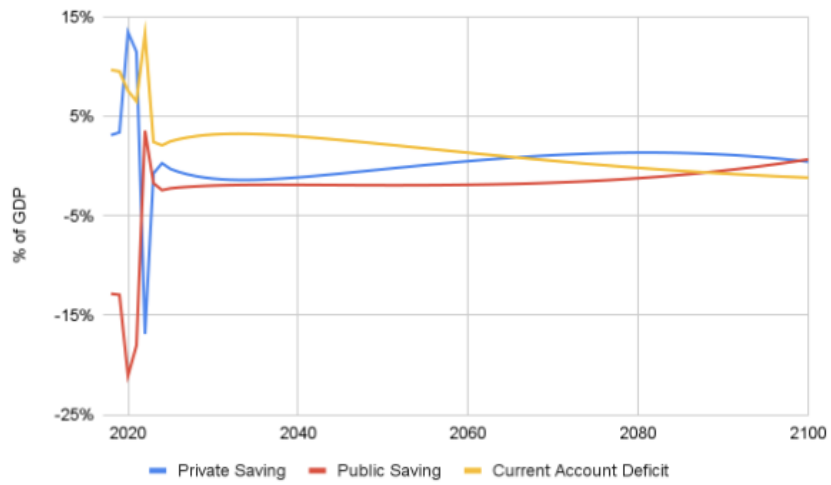


Sectoral GHG Emissions: Structural Change

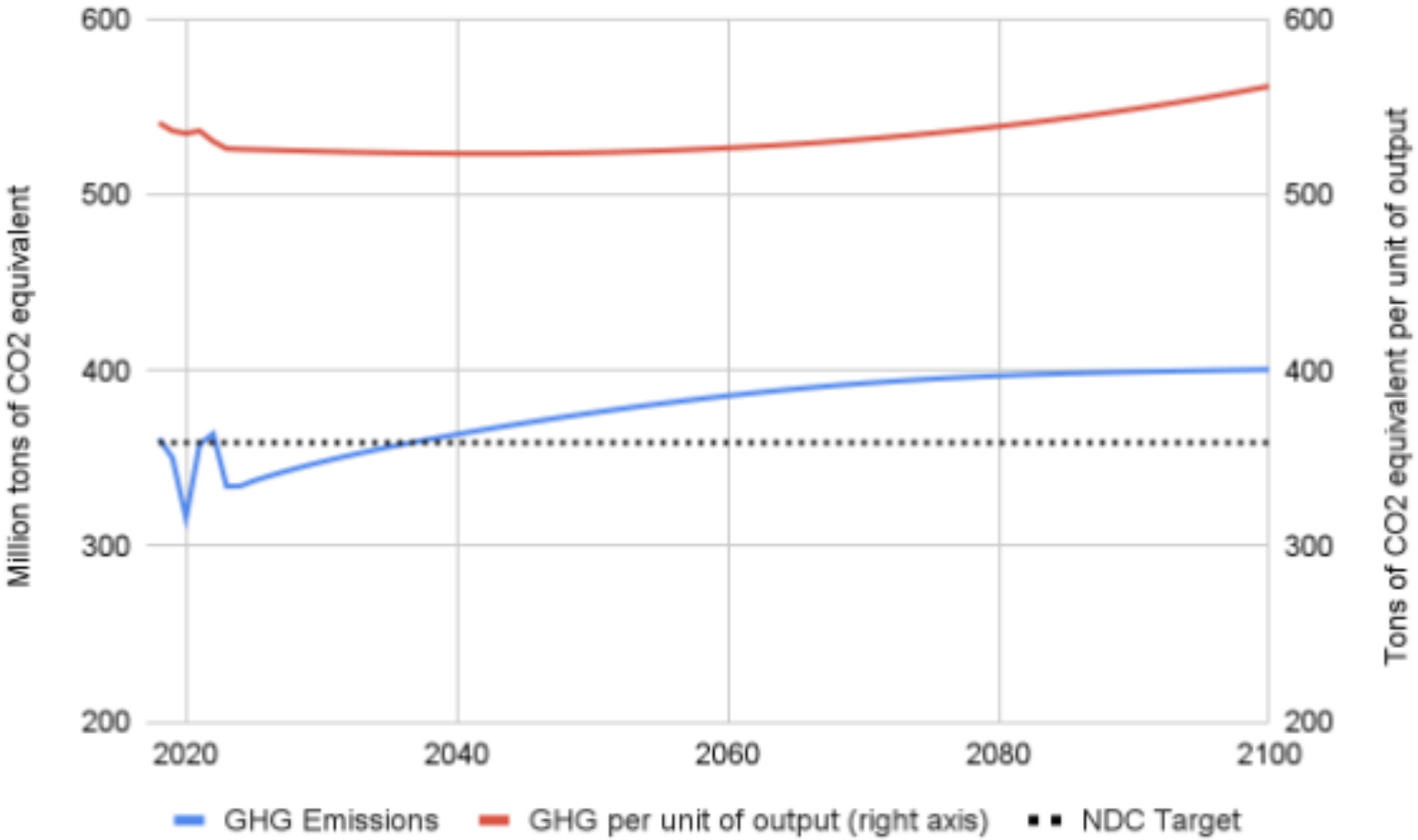


Baseline

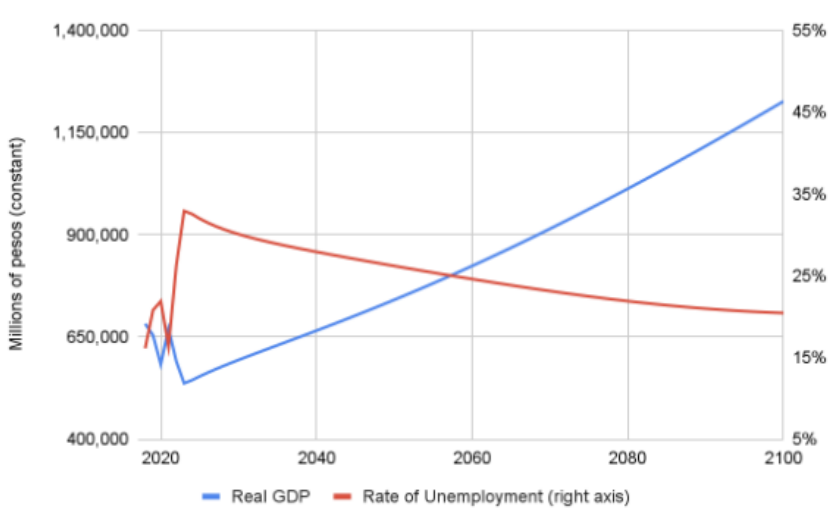

1,400,000
1,150,000
900,000
650,000
400,000
Millions of pesos (constant)
55%
45%
35%
25%
15%
5%
2020
2040
2060
2080
2100
Real GDP
Rate of Unemployment (right axis)

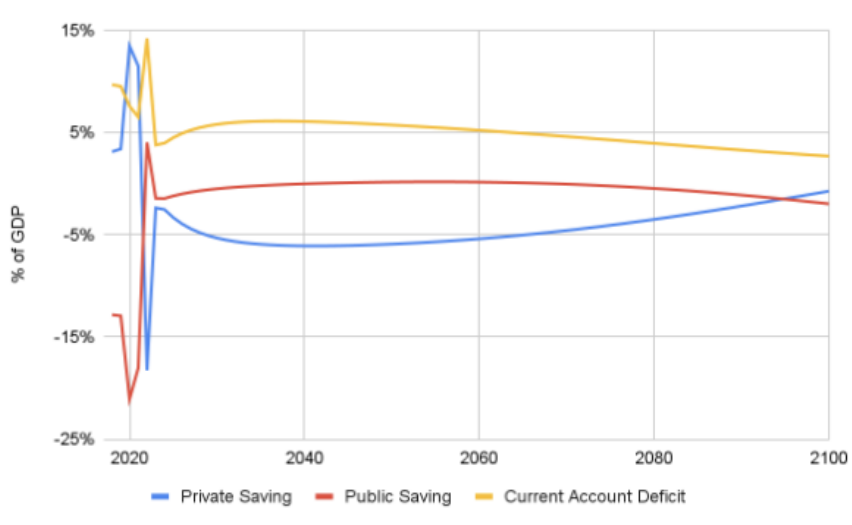

15%
5%
-5%
-15%
-25%
% of GDP
2020
2040
2060
2080
2100
Private Saving
Public Saving
Current Account Deficit

Baseline

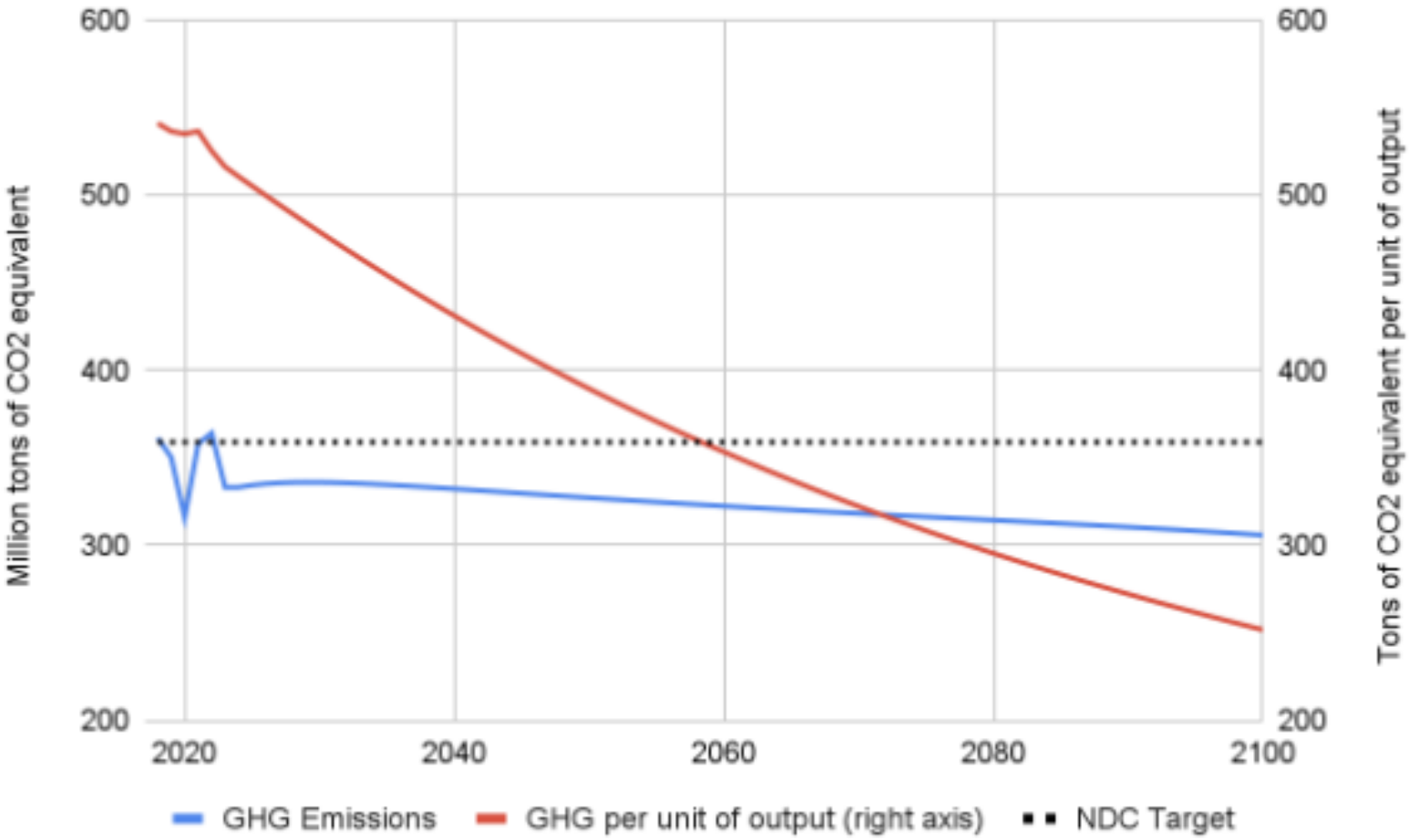

600
500
400
300
200
Million tons of CO2 equivalent
Tons of CO2 equivalent per unit of output
2020
2040
2060
2080
2100
GHG Emissions
GHG per unit of output (right axis)
NDC Target

Balanced Green Transition

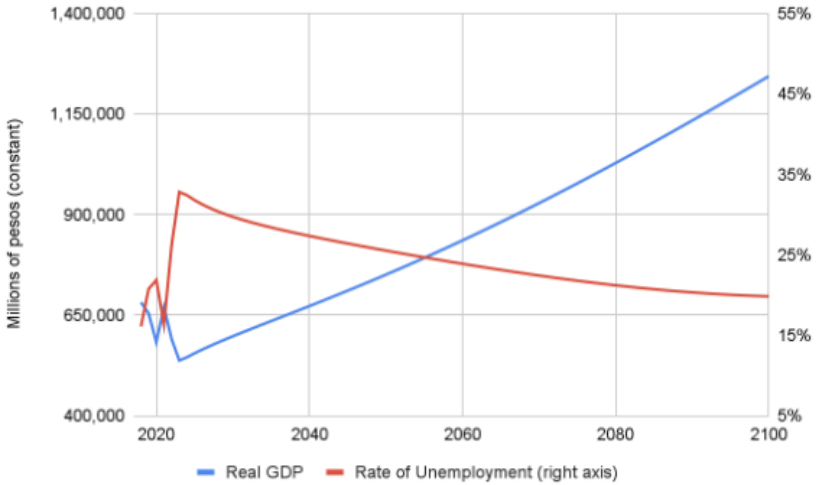


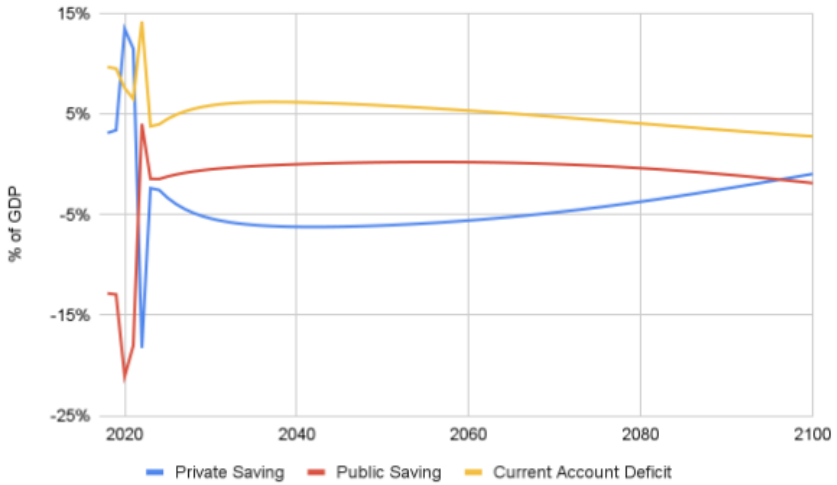


Balanced Green Transition

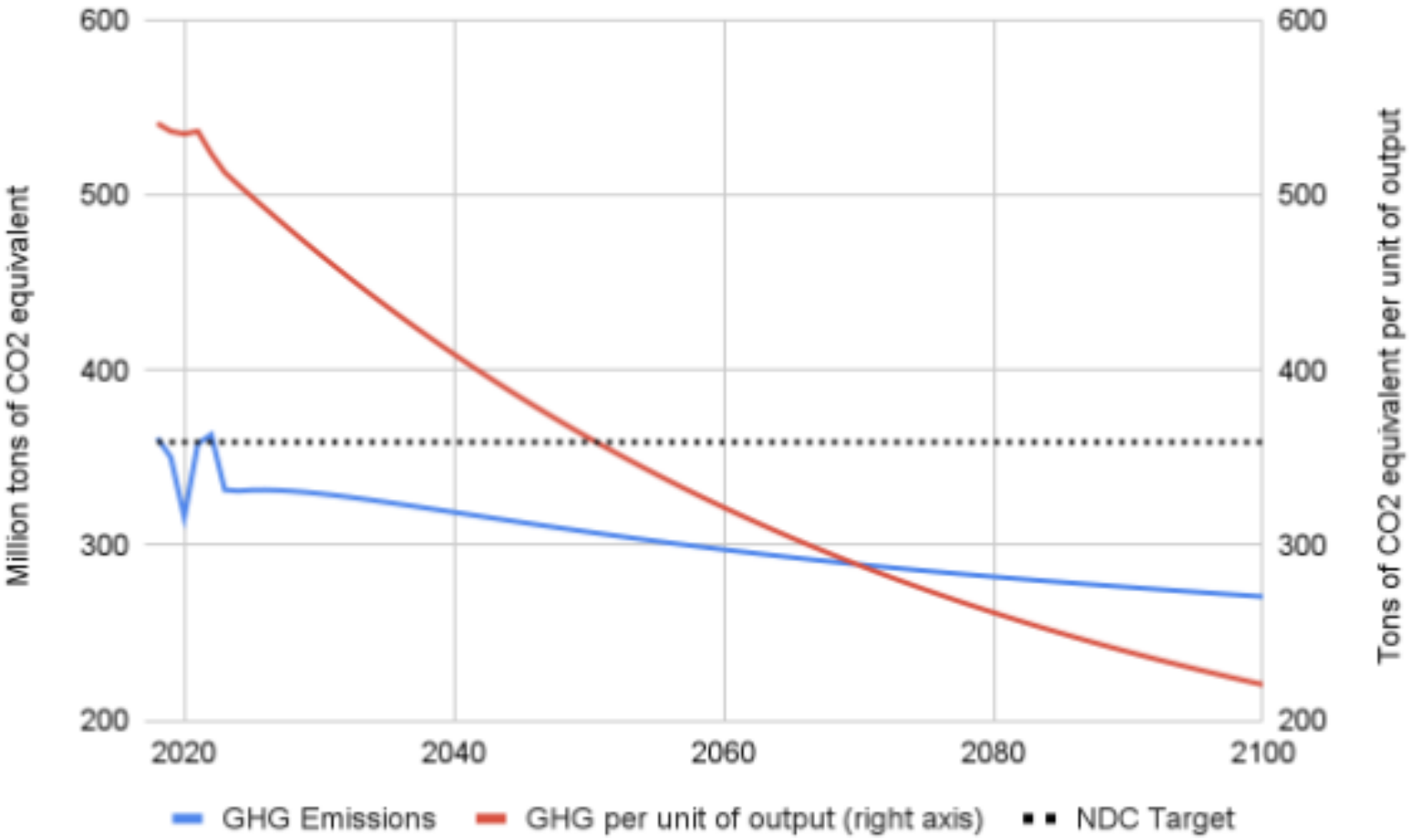


Focalized Green Transition

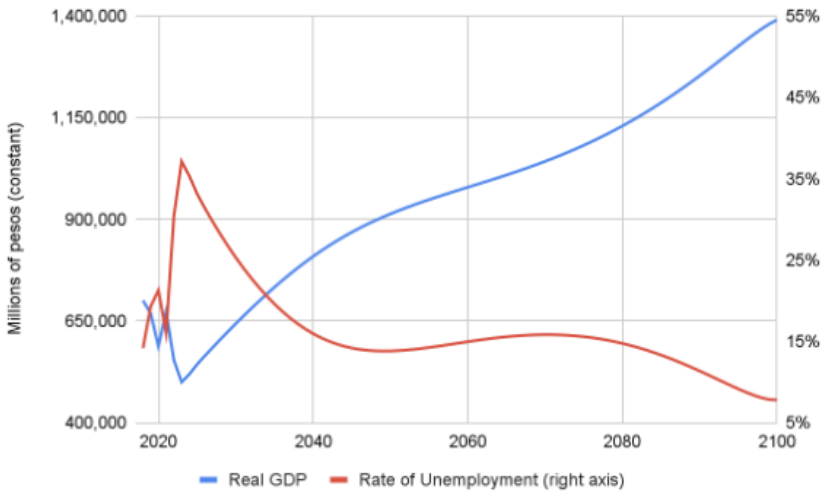


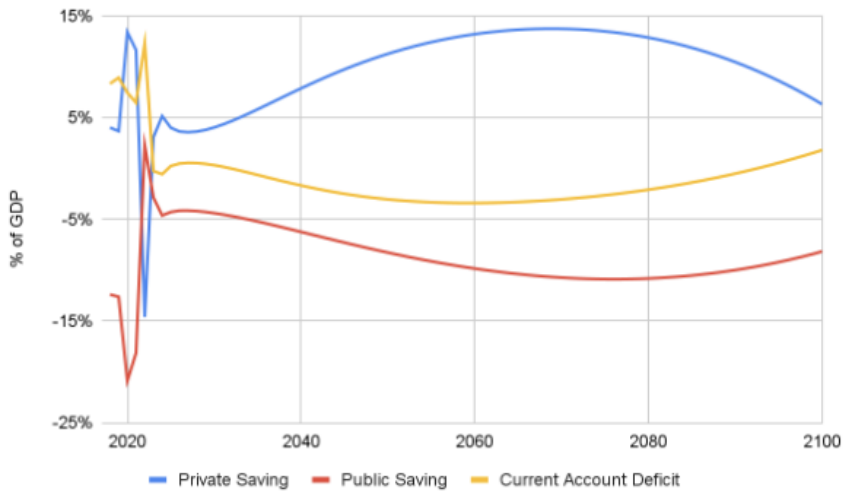


Focalized Green Transition



Focalized Green Transition with Structural Change





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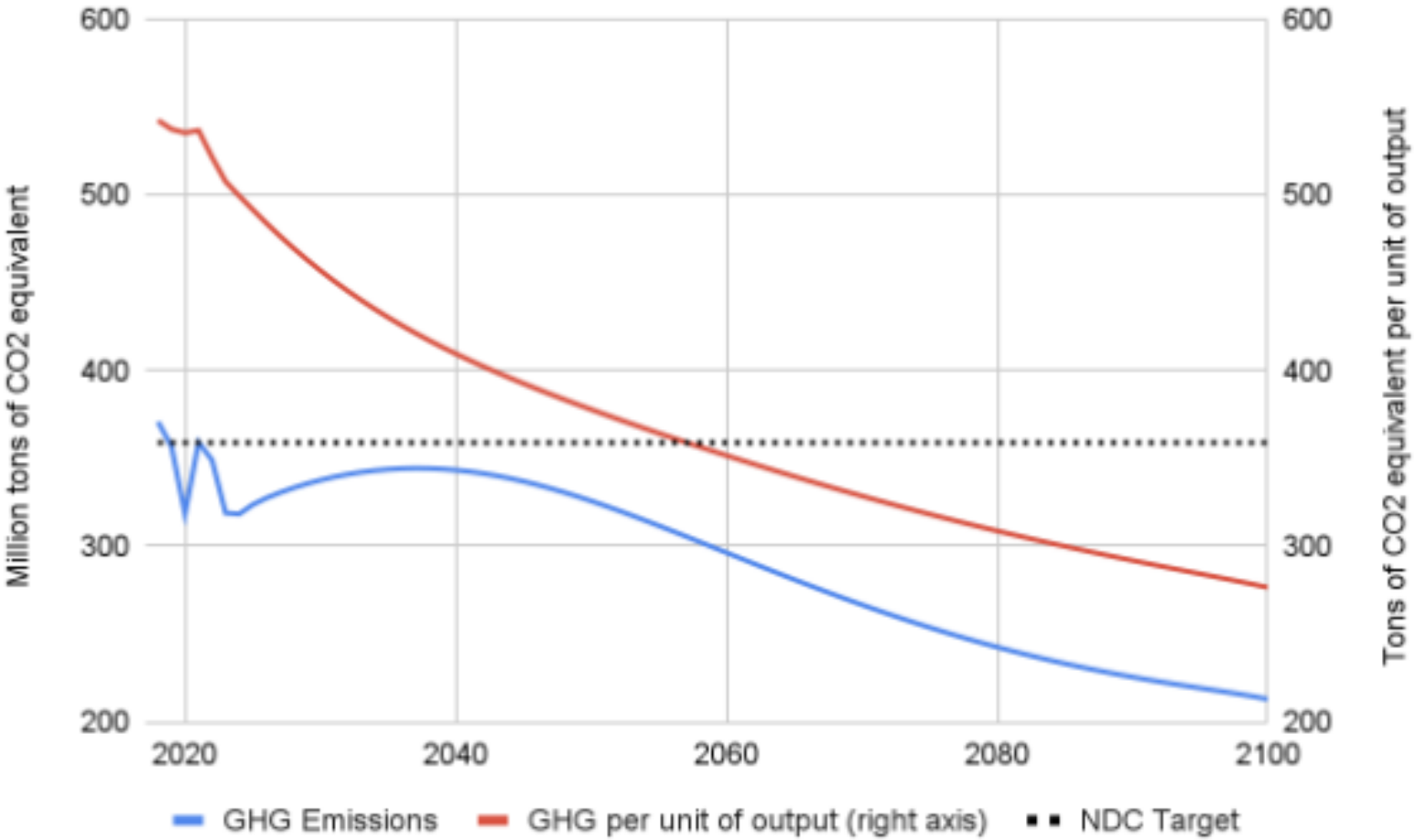

Prices and Exchange Rate

- Mark-up pricing

$$p_i = (1 + \mu_i)[\sum_{j=1}^{31} a_{ij} p_j + a_{il} w_i + \tau_i^I + \tau_i^L + \eta_i p^M E]$$

- Flexible exchange rate closure

$$E = \frac{FA_{PNF}^{d,ARS}}{FA_{RW}^{s} - FA_{G}^{d} - FA_{FS}^{d}}$$