Different paths to 2050

Alejandra Elizondo (CIDE, MX)

María Eugenia Ibarrarán (IBERO Puebla, MX)

Roy Boyd (Ohio University, US)

Santiago, March, 2023

Introduction

- We analyze different Policy packages that reach the target for 2050
- All of our scenarios achieve a reduction in emissions
- The impact on welfare changes
- Compensating mechanisms are the differentiating factor
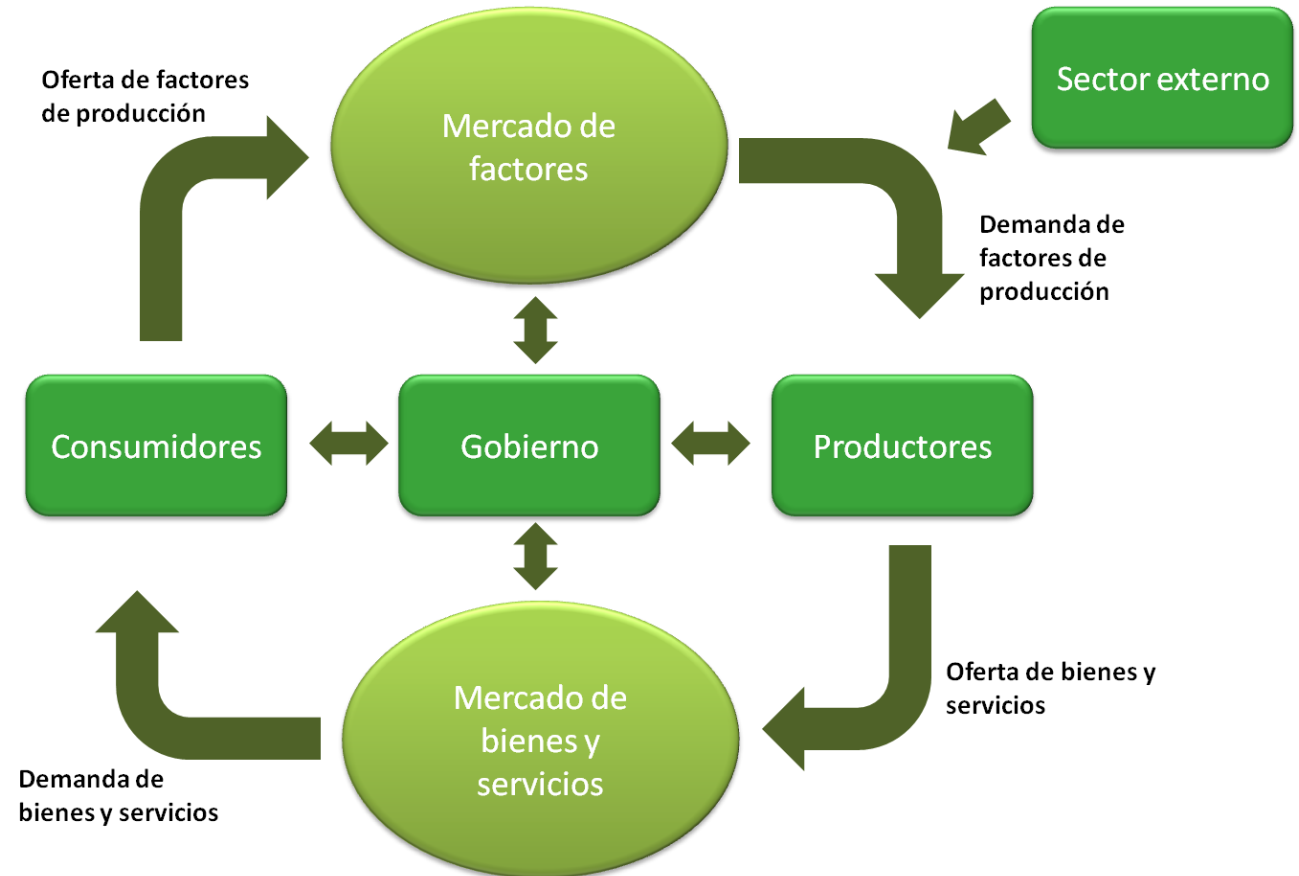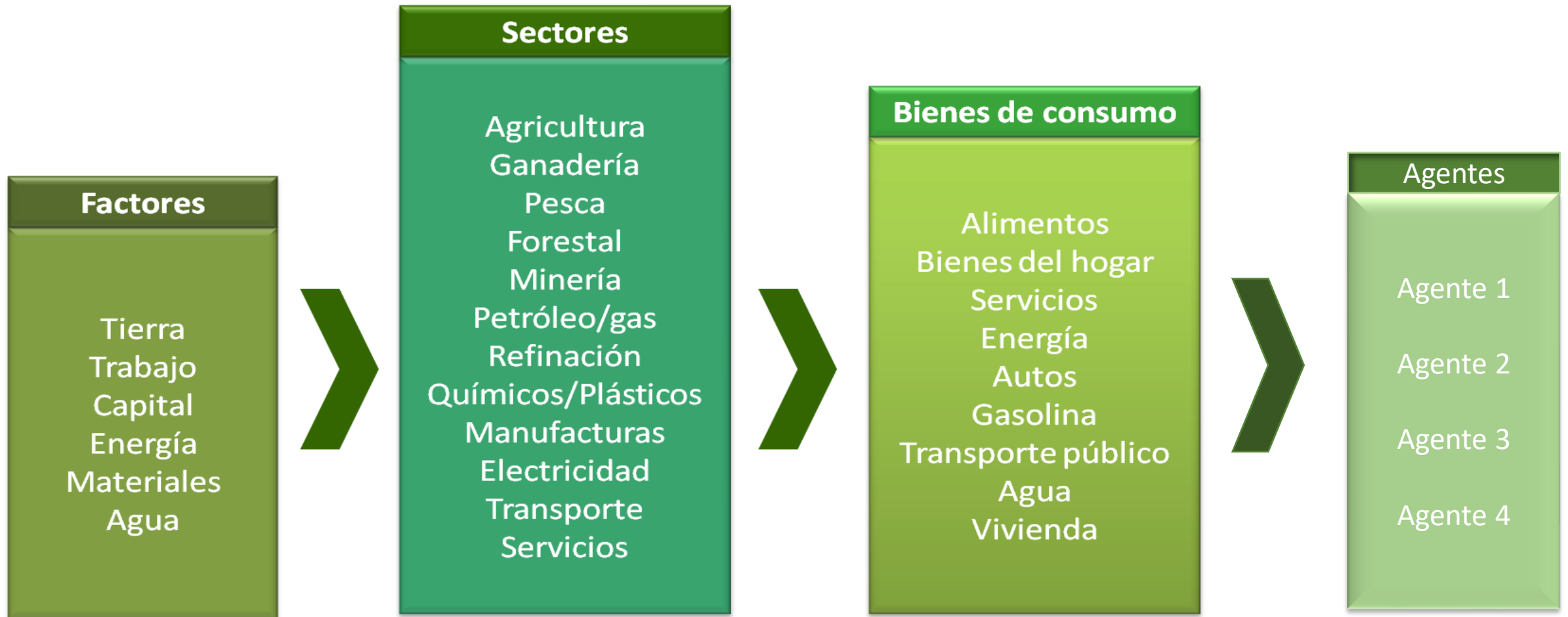
Our approach

- Information on the **estimated shadow price of environmental regulation** (NGFS, 2020)

- We analyzed the **economic effect** of implementing "**early" measures** as of **2020** vs starting implementation in **2030**

- In the **early implementation scenario**, we developed **different actions** that prevent costs from escalating

The General Equilibrium Model

- Resembles the **Mexican economy**, for **2020-2050**
- It incorporates the **behavior** of households, industry, government and foreign transactions
- The **sources** are the input-output matrixes, income-spending surveys, and official reports and statistics
- **Public policies** and external shocks change the **BAU** trajectory (direct and indirect effects)

Players and structure of the model

Factores

Tierra
Trabajo
Capital
Energía
Materiales
Agua

Sectores

Agricultura
Ganadería
Pesca
Forestal
Minería
Petróleo/gas
Refinación
Químicos/Plásticos
Manufacturas
Electricidad
Transporte
Servicios

Bienes de consumo

Alimentos
Bienes del hogar
Servicios
Energía
Autos
Gasolina
Transporte público
Agua
Vivienda

Agentes

Agente 1

Agente 2

Agente 3

Agente 4

Players and structure of the model

Producing Sectors	Production Goods	Consumer Goods and Services
Manufacturing	Manufacturing Goods	Food
Manufacturing for renewables	Manufacturing Goods	Energy
Chemicals and Plastics	Chemicals and Plastics	Autos
Other minerals	Mineral inputs	Gasoline
Agriculture	Agricultural goods	Consumer Transport
Transportation	Transportation for production	Consumer Services
Services	Producer Services	Housing and Household goods
Oil and Gas	Crude Petroleum	Consumer Goods
	Natural Gas	Water
Coal Mining	Coal	Health services
Electricity	Electricity	
Refining output	Refined output	
Livestock	Livestock	
Forestry	Wood and forest products	
Fisheries	Fish and fishery products	

Category	Income
Agent 1	Bottom 2 deciles: 1-2
Agent 2	Deciles 3-5
Agent 3	Deciles 6-8
Agent 4	Top 2 deciles: 9-10

$$V = \phi \, [\, \delta_L L^{(\sigma-1)/\sigma} + \delta_K K^{(\sigma-1)/\sigma} + \delta_M M^{(\sigma-1)/\sigma} \,]^{(\sigma/\sigma-1)}$$
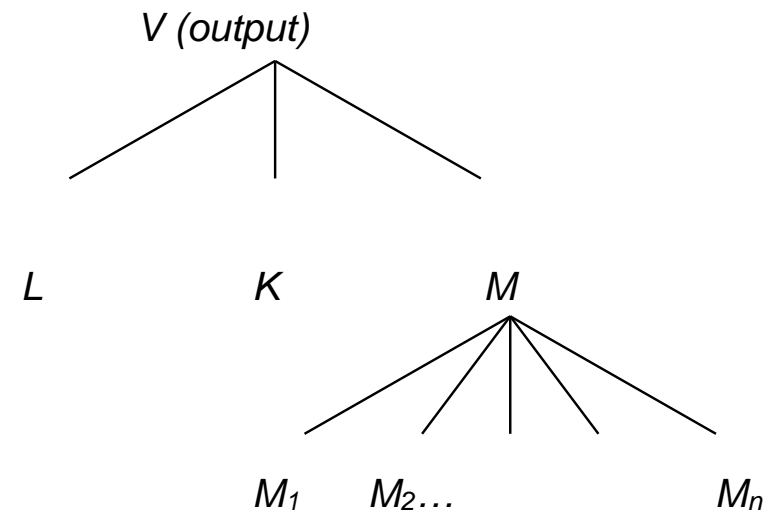
GDP and Investment under different timing

- **Orderly Scenario**: Carbon tax starts in **2020** and rises until **2050** to attain NDCs
- **Disorderly Scenario**: Policies are **posponed until 2030**, then tax rises **abruptly**
    - **GDP** is not hit as hard in the **Orderly** Scenario and **converges** to Business as Usual
    - In **Orderly, investment** actually **grows** at a **faster** rate than under Business as Usual
    - Under the **Disorderly** scenario both **GDP and investment plummet**
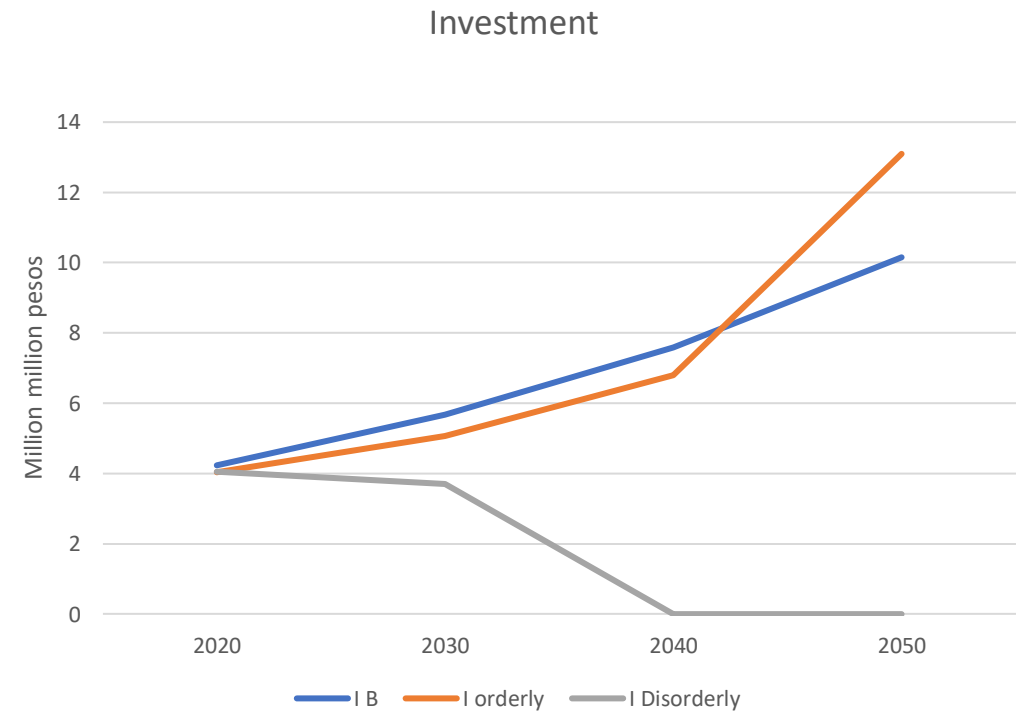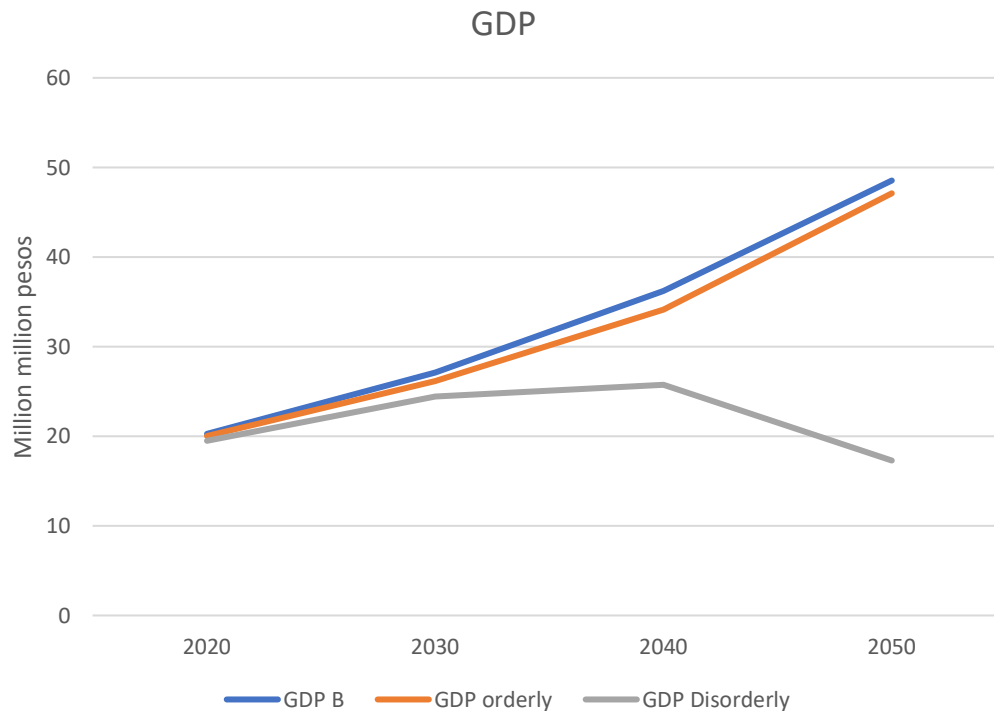
Welfare

We have **four income groups, Agent 1** is the **poorest** and **Agent 4** the **richest**

- **Orderly Scenario**: welfare falls significantly less tan in the Disorderly (see scale)
- **Early implementation** of a carbon tax is **far less damaging and progressive**
- **Late implementation** of a carbon tax is **regressive**

Percentage changes in welfare
Orderly case

Percentage change in welfare
Disorderly case
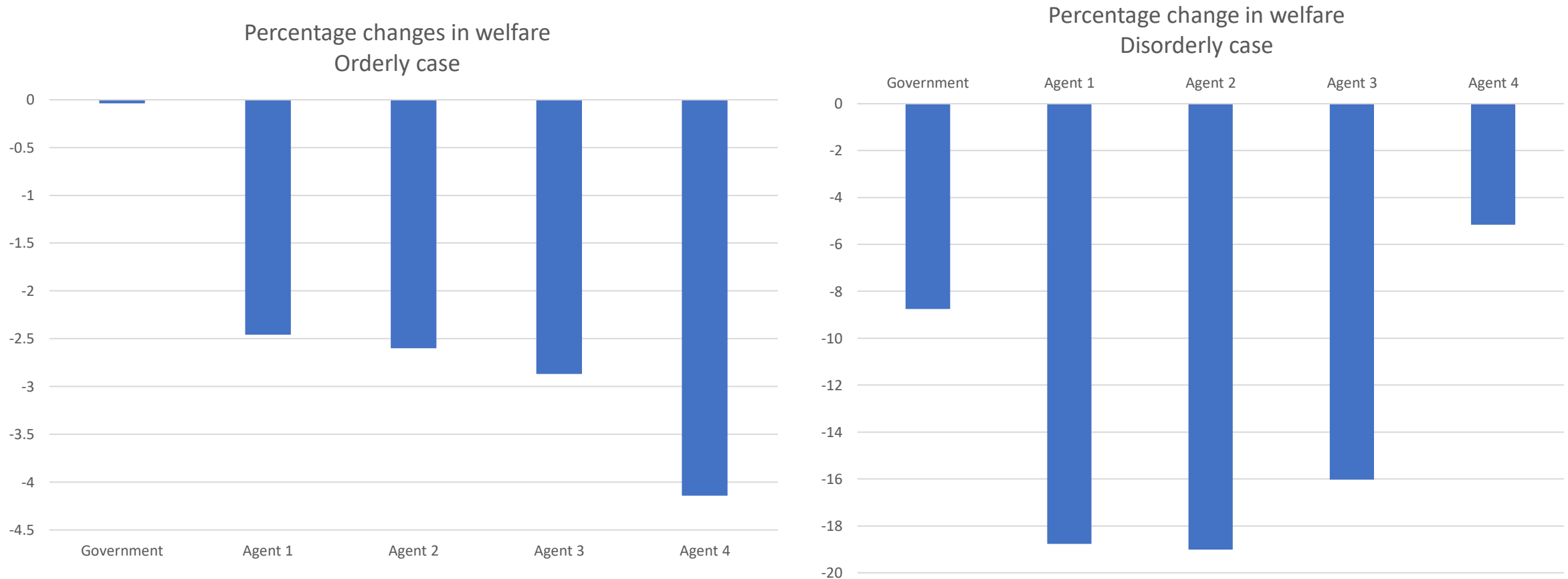
Orderly and different compensating mechanisms

Our Scenarios

Benchmark: Business as Usual

1. **Carbon tax:** funds raised by the **carbon tax**

2. **Carbon tax (revenue neutral):** same as **1**, but **revenues from taxes are given back to the households** as **subsidies**

3. **Investment:** Same as **2**, but **revenues from taxes are invested in sectors of the Mexican economy**. Producers and transmitters of **"Clean Energy"** receive just **over six times the subsidy** granted to the agricultural sectors.

4. **Technical change**: Same as scenario **3**, but there are **technological changes in renewables manufacturing, cars, and renewables electricity**

Results

Similarities among scenarios

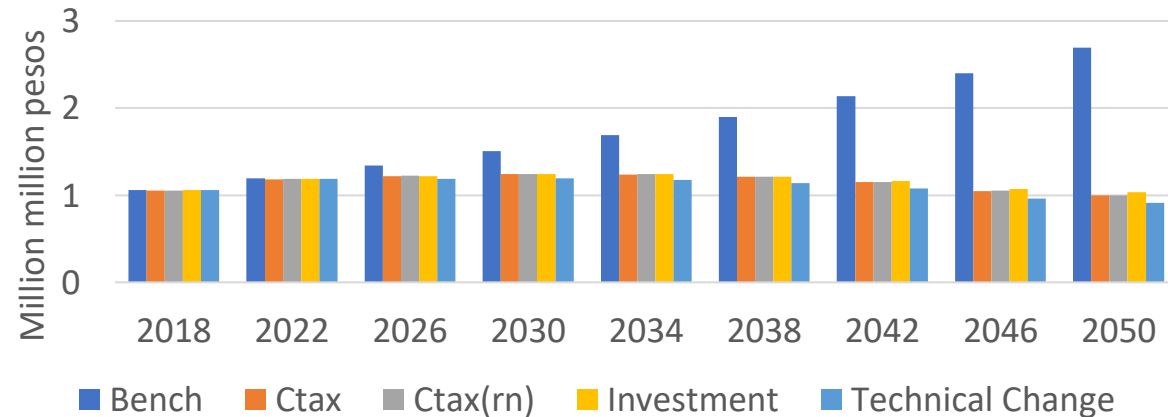# Decrease in fossil fuels production

Petroleum
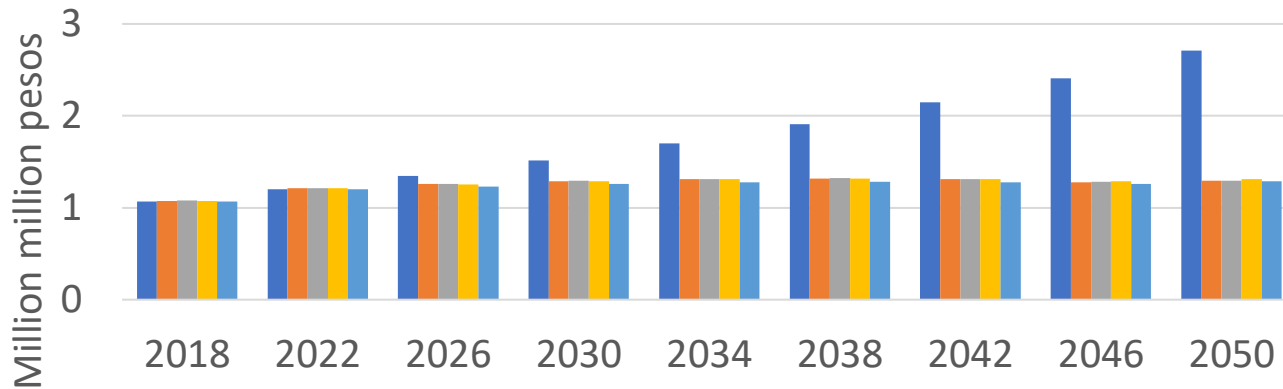
Natural Gas
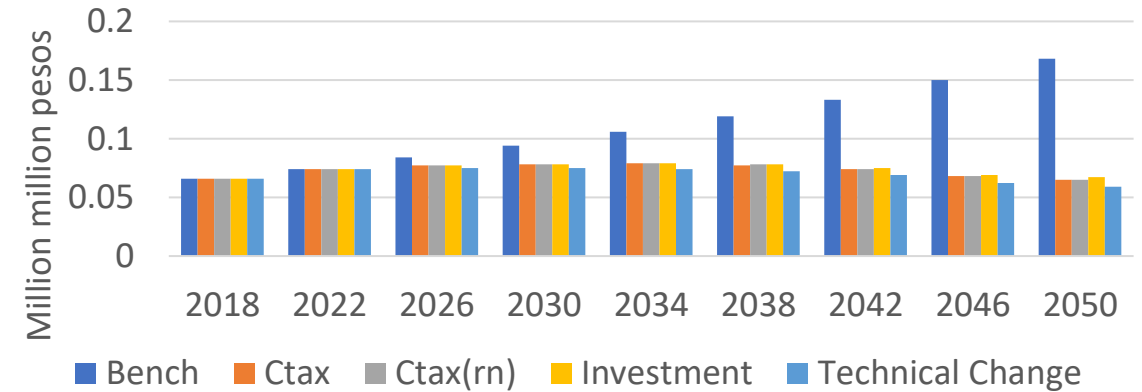
Refinery

Elimination of coal production

Coal
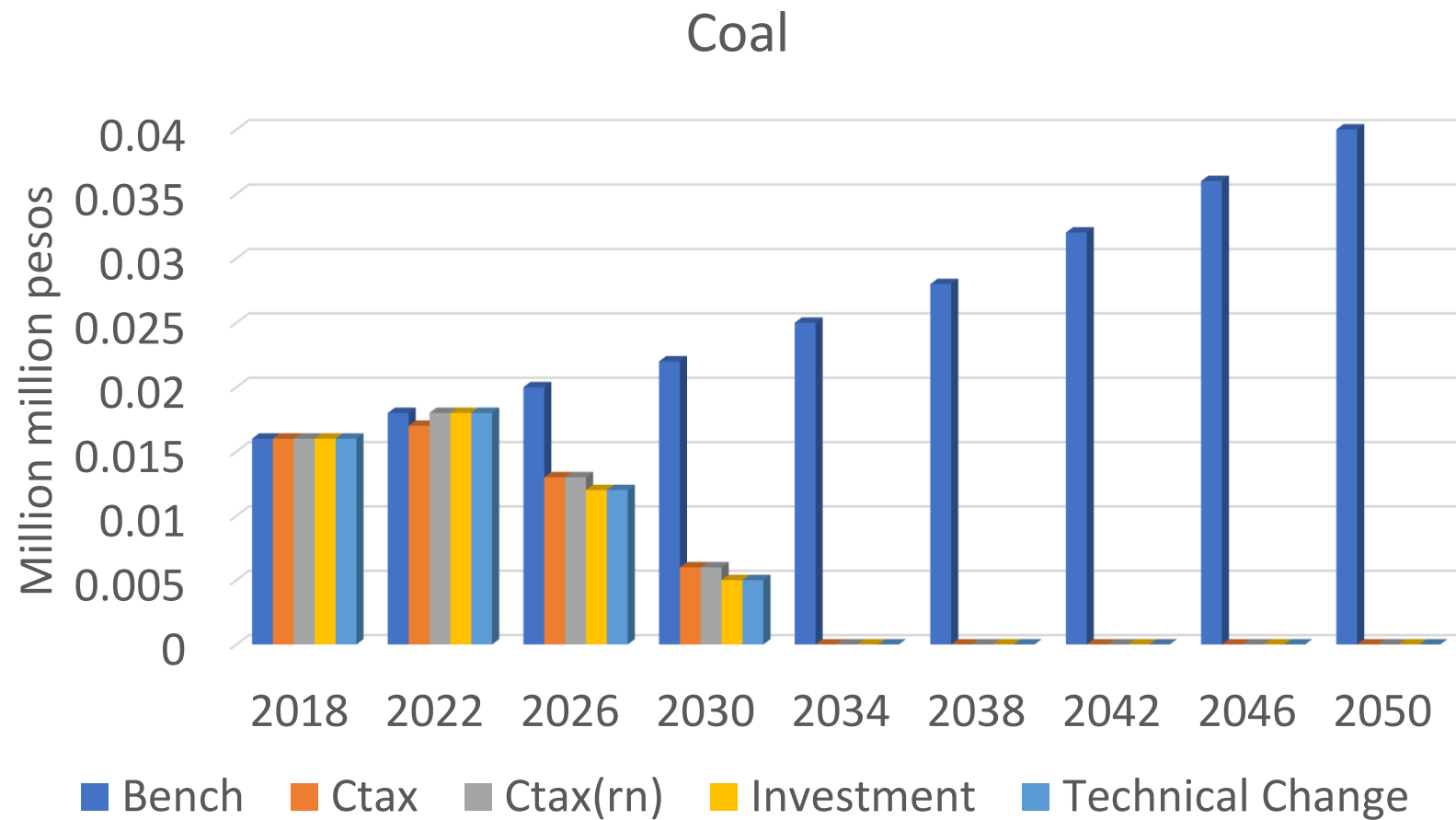
Slight differences among scenarios

Availability of energy services
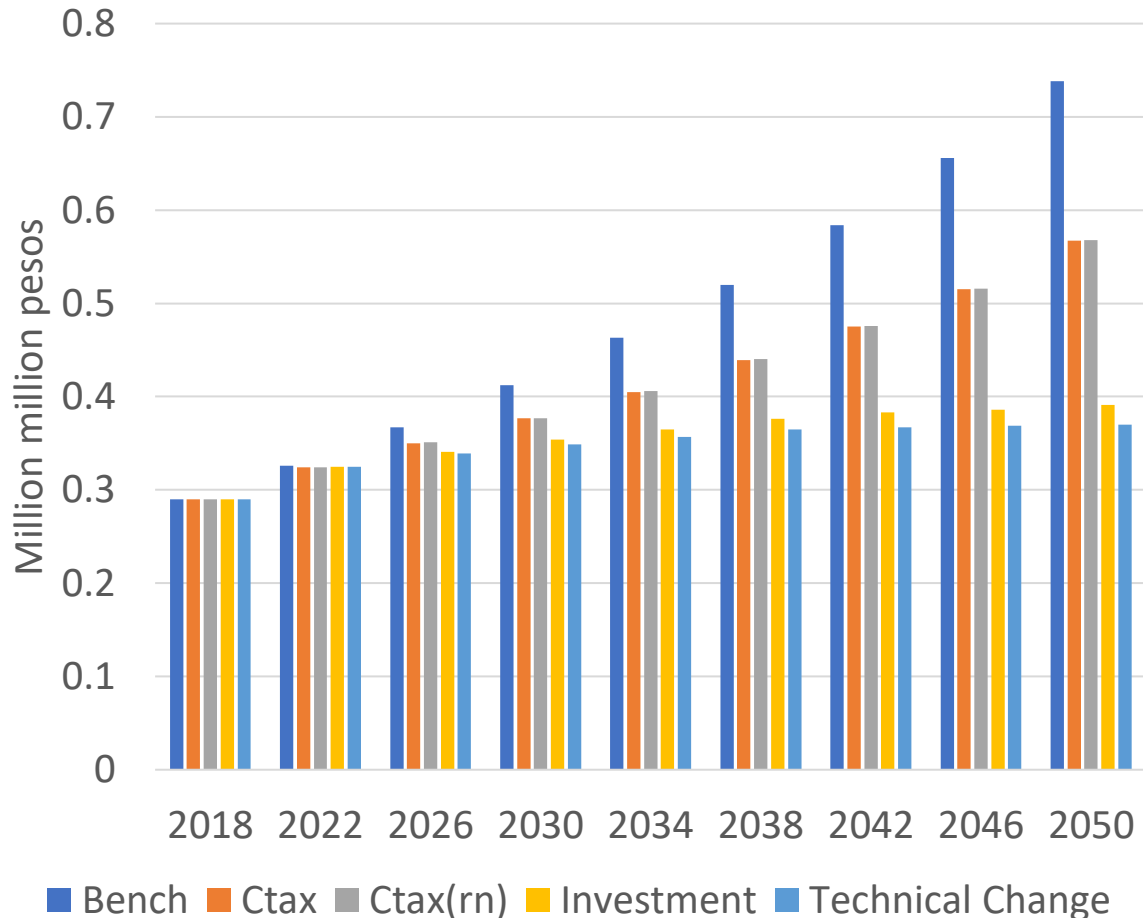

Energy for households
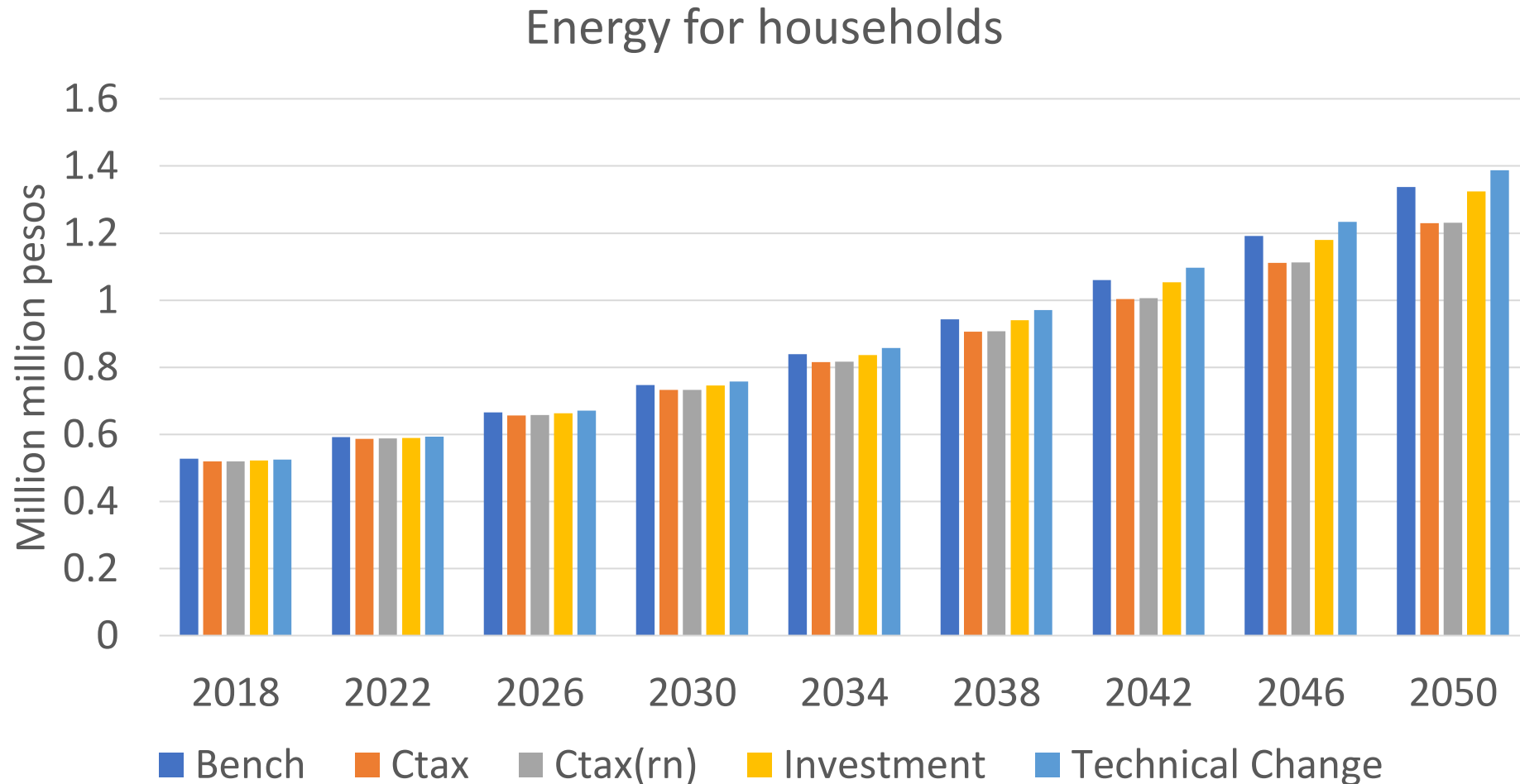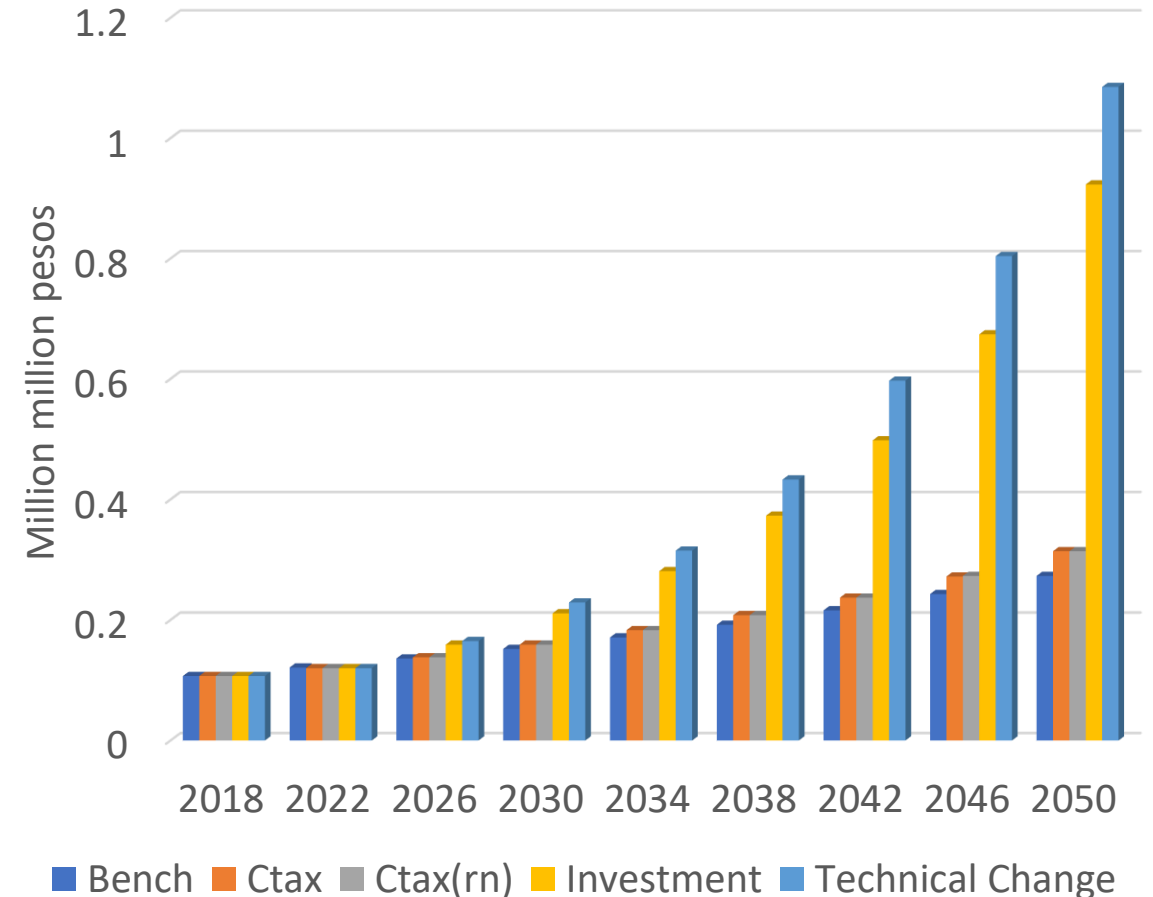
Gasoline consumption

Gasoline
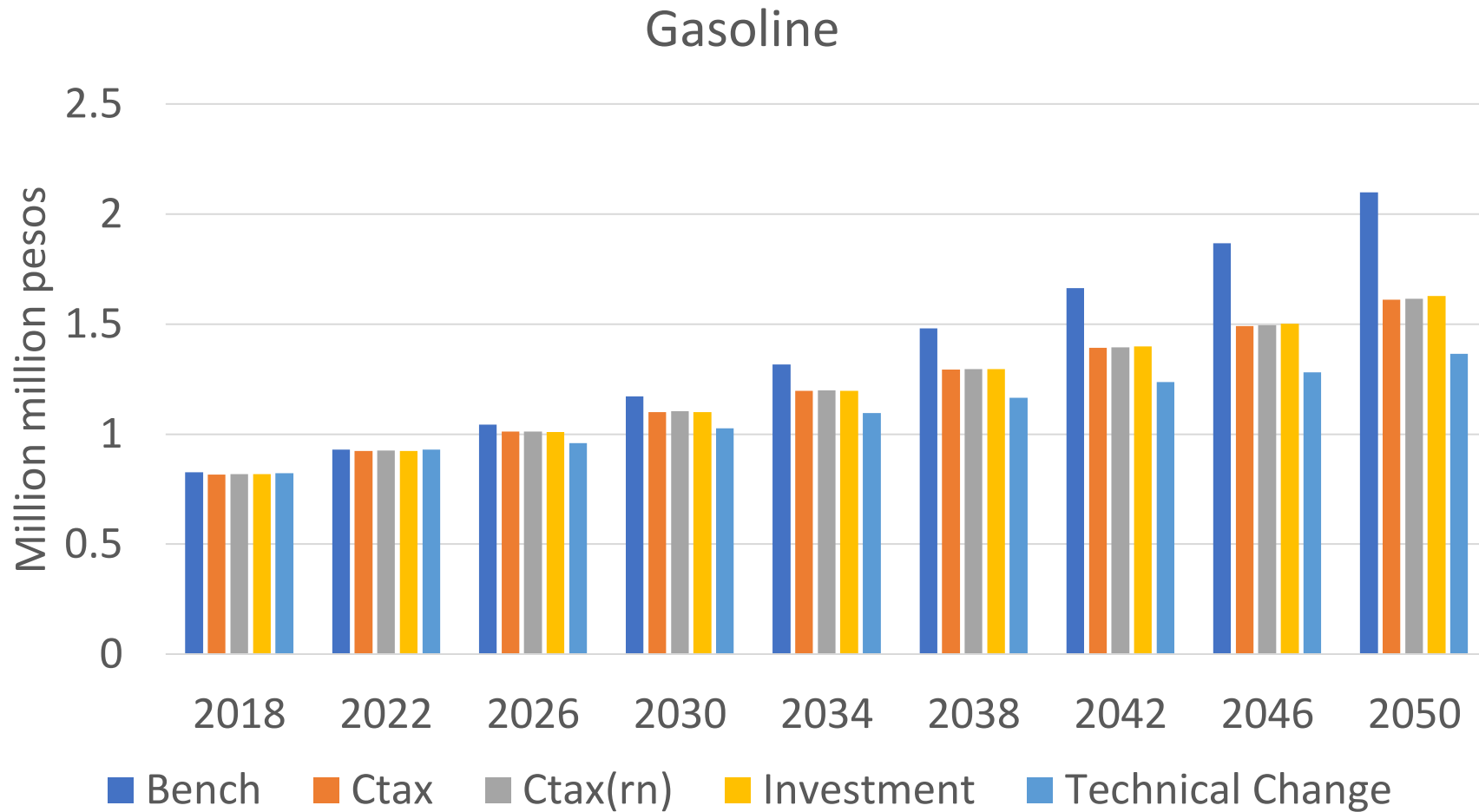
Strong differences among scenarios

Electricity sources: from a point where about 3/4 of all electricity is from fossil fuels to a point where over 2/3 of all electricity comes from renewables
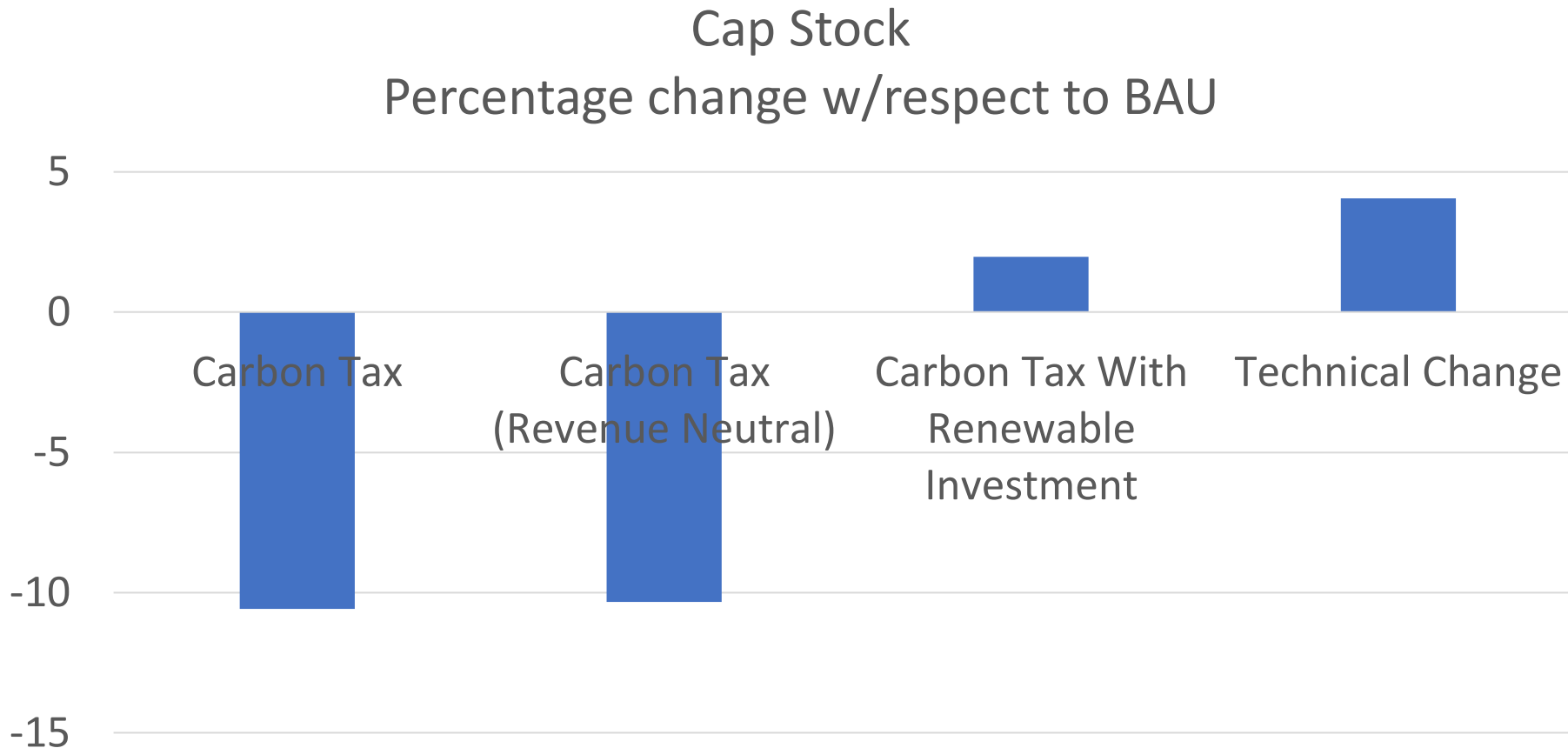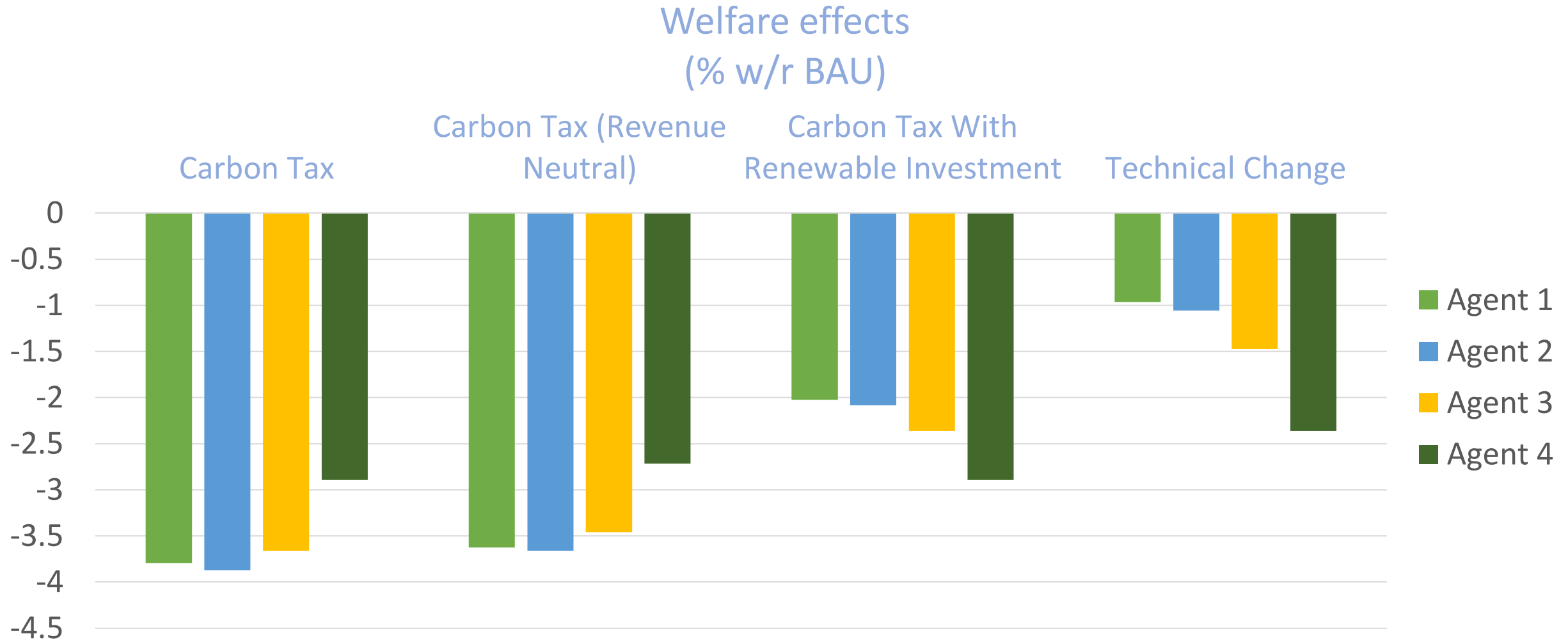
Growth of capital: When money is diverted to capital investment it enhances economic growth and higher welfare

Cap Stock
Percentage change w/respect to BAU

Welfare: The tax/subsidy scheme is slightly progressive in nature with the poorest agents getting hurt less (helped more) than the richest agents

Final thoughts

- Impact of acting late not only on the global environment
- Benefits of acting early depend on the compensating mechanisms (investment and technological change)
    - Electricity services are delivered through a cleaner sources
    - Welfare impact is progressive under the last two scenarios
- Environmental and health effects are underestimated
- There is no way around renewables

Next Steps

Thinking about integrating cobenefits into the picture (health/local pollution) and investment in public goods (efficient transportation, public Parks/green areas)