Fair and effective Carbon Pricing in Austria: Insights from model comparison

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Overview

To solve the climate crisis, a **fundamental decarbonisation** of our economy is indispensable. In addition to technological changes, this requires accompanying climate policy measures, most importantly the taxation of carbon emissions. As this instrument leads to manifold indirect effects and uncertainties, FARECarbon employs **a stakeholder-assisted multi model comparison of carbon taxation** in Austria.

In a nutshell, in FARECarbon concerted policy scenarios will be simulated with three different macroeconomic models, which are rooted in different economic theories. These simulations will provide a sound basis for policymaking by illustrating the range of expected effects and related uncertainties, a so called "options space." The close collaboration with stakeholders throughout the project will on the one hand result in the definition of **concerted policy scenarios** and on the other hand ensure the integration of stakeholders' perspectives in the development of a proposal for carbon taxation in Austria. This process substantially enhances the policy-relevance of the outcomes.

Objective

FARECarbon aims

- to reduce model uncertainties and synthesize the debate on the effects of carbon taxes, and
- to develop a sound, concerted proposal on how to implement carbon taxes for **Non-ETS sectors** in Austria.

Co-generation of knowledge

Stakeholder workshop series: Workshops were held at the beginning of the project to develop carbon tax scenarios and will be used at the final stage of the project to develop a policy proposal for carbon taxation in Austria. Additionally, discussion and review of preliminary findings and relevant milestones will be achieved by interaction with a **stakeholder steering committee** that will provide feedback on a quarterly basis.

Design of carbon tax scenarios

Key elements

Carbon tax:

- Uniform tax rate for CO_2 emissions from fossil energy sources in all Non-ETS sectors
- Tax rate at the beginning: € 20 - € 40
- Tax rate at the end of the simulation period (2030): € 65 - € 200

Different schemes of revenue recycling

Baseline: Revenues are used in general budget

Reduction of other taxes or duties:
- Wage and income taxes
- Social security contributions
- Value added tax

Transfers to households:
- Flat transfer
- Targeted transfer

Focus of FARECarbon

Green Spending

Methodological framework

FARECarbon will perform a **multi-model comparison of three macroeconomic models of Austria**. Two different groups of models will be applied in the comparison, two computable general equilibrium (CGE) models and one macro-economic Input-Output (IO) model. The models that will be used are scientifically established and represent the state-of-the-art in the respective modelling class. They have already been used to analyse energy and climate policy in Austria and cover linkages and indirect effects between production and consumption in the Austrian economy.

Overview of macroeconomic models employed in FARECarbon

	WEGDYN_AT	ECON_AT	DYNK
Model type	CGE	CGE	Macroeconomic IO
Sectoral detail	81	45	74
Representation of technologies	Specific consideration of 12 transport and 20 energy technologies	Bottom-up representation of 4 passenger transport technologies	Explicit representation of ambient heating, transport and electricity demand as well as 26 energy sources
Representation of households	12 differentiated by income (quartiles) and location (urban, semi-urban, periphery)	6 differentiated by energy consumption, with heterogeneous preferences	5 household income groups with heterogeneous preferences
Dynamics	Recursive dynamic with 1 year time steps	Recursive dynamic with 5 year time steps	Recursive dynamic with 1 year time steps
Factor markets	Capital is fully employed and mobile across sectors, with flexible rents. Downward rigid wages.	Factors are fully employed and mobile across sectors.	Imperfect labor market with wage bargaining
Representation of trade	Armington assumption of product heterogeneity; small open economy assumption		Fixed import shares by user and product and export price elasticities
CO_2 Emissions	Explicit coverage of ETS and non-ETS CO_2 emissions, including industrial process emissions;	Implicit coverage via CO_2 coefficients of three prime energy goods coal, oil and gas.	CO_2 coefficients of 26 energy sources and full link of physical energy flows and products

WEGDYN_AT: *Bachner, G., Mayer, J., Steininger, K.W., 2019. Costs or benefits? Assessing the economy-wide effects of the electricity sector's low carbon transition – The role of capital costs, divergent risk perceptions and premiums. Energy Strategy Reviews 26, 100373. https://doi.org/10.1016/j.esr.2019.100373*

ECON_AT: *Kulmer V., Seebauer S., 2019. How robust are estimates of the rebound effect of energy efficiency improvements? A sensitivity analysis of consumer heterogeneity and elasticities, Energy Policy 132, 1-14. https://doi.org/10.1016/j.enpol.2019.05.001*

DYNK: *Sommer, M. Kratena, K. 2019. Consumption and production-based CO2 pricing policies: macroeconomic trade-offs and carbon leakage. Economic Systems Research 32(1), 29–57. https://doi.org/10.1080/09535314.2019.1612736*

Model Baseline

As a guideline, the project consortium will make use of the Shared Socioeconomic Pathways (SSPs, O'Neill et al., 2016*) and the associated database offered by IIASA.

Degree of harmonization of critical parameters

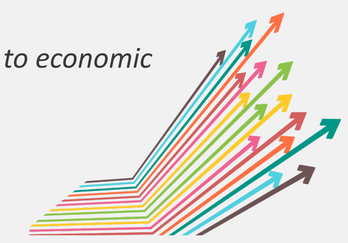
Full	Population growth	Partial	Elasticities in production
Full	Carbon price	Partial	Elasticities in demand
Full	Fossil fuel forecast	Partial	Elasticities in trade
Full	Other growth rates	Partial	Household income structure
		Partial	Closure Rules
No	Sector detail	No	Technological structure
No	Dynamics	No	Household representation

Two Baseline scenarios with different assumptions regarding economic recovery

Economic recovery depends on national protection measures as well as general EU and global economic trends. Forecasts vary regarding the nature and stringency of the recovery path. Therefore FARECarbon applies two different paths of economic recovery.

However, the analysis and evaluation carried out in FARECarbon focuses on relative changes and not differences in absolute terms.

Baseline I
Fast recovery (similar to economic crisis of 2008)



Baseline II
Slow recovery (consumption and investment will be modest in the medium-term)

Next steps

Selection of carbon tax scenario
Refinement and coordination of scenario design workshop results.

Scientific and stakeholder interaction
Regular review and reflection with SAB and SSC.

Model calibration
Calibration of each macroeconomic model to the agreed baseline assumptions.

Final parameter selection for model comparison
Agreement on critical parameters and degree of harmonization thereof.

Output indicator selection for comparison
Agreement on relevant output indicators for comparison and scenario evaluation. Each indicator has to be produced by each model.

Scenario Simulation
In a first round, each model simulates the developed scenarios and analyses the effects thereof based on the selected indicators.

*B.C. O'Neill, E. Kriegler, K.L. Ebi, E. Kemp-Benedict, K. Riahi, D.S. Rothman, B.J. van Ruijven, D.P. van Vuuren, J. Birkmann, K. Kok, M. Levy, W. Solecki, The roads ahead: narratives for Shared Socioeconomic Pathways describing world futures in the 21st century, Global Environ. Change (2016), 10.1016/j.gloenvcha.2015.01.004