

**Presenter:** Sevil Acar (Bogazici University)

**Title:** Transforming Türkiye's power system: An assessment of economic, social, and external impacts of an energy transition by 2030

**Abstract:**

Türkiye has the long-term goal of transforming its power system to one that is cleaner, more secure and more affordable. According to this paper's scenario analyses, low-cost renewables can supply 55% of Türkiye's total electricity demand. Coupled with the electrification of end-use sectors, energy efficiency can reduce total power demand by 10% compared to a business as usual scenario by 2030. The paper assesses the social, economic, and environmental impacts of this transformation by soft linking a power system model with an applied computable general equilibrium model, using an updated input and output dataset, and employing a novel analysis of job creation and fossil fuel externalities. The power system transformation significantly improves social welfare with net socioeconomic benefits estimated at 1% of GDP by 2030. Positive impacts include a reduction in human health and climate change externalities by a third, which are further enhanced by wage income growth that is driven by higher skilled and better paid jobs. A carbon tax emerges as a critical instrument to realize these benefits whilst reducing the power sector's emissions to 2030. The assessment should be expanded with more ambitious clean energy technology deployment for the entire energy system to operationalize Türkiye's Paris-aligned 2053 net-zero emission target and just transition policies.

**Presenter:** Raavi Aggarwal (Indian Statistical Institute)

**Title:** Input substitution for sustainable industrialisation: Evidence from India

**Abstract:**

The transition to clean energy use in industrial production requires policy measures such as carbon taxes. However, higher prices for electricity and fossil fuels resulting from a carbon tax may adversely impact industrial performance and lead to loss in employment, especially in developing countries. In this article, I examine the possibilities for substitution between labour and fossil energy in the Indian manufacturing sector, to identify sectors where substituting labour for coal (or other fossil fuels) would increase employment and prevent any losses in industrial output from a carbon tax. Estimating the elasticity of substitution between labour and fossil energy, drawing on an industry-state-level panel dataset over the 2008-09 to 2018-19 period, I find labour and coal are substitutes in 12 of the 24 broad manufacturing sectors, while labour and electricity are complements in all sectors. Carbon taxes on coal, combined with subsidies for renewable energy, could galvanise the green energy transition in Indian manufacturing. Further policy support for specific labour-intensive sectors could spur employment creation in Indian industry, ensuring a just energy transition.

**Presenter:** Elsa Amaddeo (University of Bari Aldo Moro)

**Title:** Who really pays for EU Emission Trading Systems? The risk of shifting the tax burden from the firm to the final consumer

**Abstract:**

This paper aims to analyze the relationship between the net price of different fuels in the Italian market and EU emission allowances during phase 2, 3 and part of phase 4 (2008-2023), with each energy price considered as the dependent variable. Considering the EU ETS as a peculiar European tax regime, demonstrating the presence of a cointegrating relationship between the EUA price and energy prices would reveal a shifting of the tax burden from the firm to the final consumer. To achieve this objective, the CCR (Canonical Cointegration Regression) has been estimated for the variables that have shown cointegration with the EU ETS allowances, as determined by the results of the Gregory-Hansen test. Moreover, two different tests stated the presence of Granger causality for all the analyzed variables.

**Presenter:** Patrick Bigler (University of Bern)

**Title:** Extent and Anatomy of the Solar Rebound: Evidence from Swiss Households

**Abstract:**

I examine rebound effects induced by solar photovoltaic (PV) adoption on electricity consumption using detailed panel data of 60,000 Swiss single family home residents (2008-2019). I find that solar PV adoption increases a household's electricity consumption by 8%-11% on average and results are robust to different identification techniques as well as heterogeneous treatment effects between individuals and over time. Parts of the rebound effect can be explained by fuel-switching moderated through co-adoption of other electrified technologies such as electric vehicles. Results suggest that replacing current electricity production capacities one to one will not be sufficient to meet future electricity demand, but solar PV rebound effects should also be viewed through the lens of the complete household's energy portfolio and not just their electricity consumption.

**Presenter:** Justus Böning (KU Leuven)

**Title:** On the Effectiveness of Future Financial Benefits on PV Adoption - Evidence from Belgium

**Abstract:**

We assess the effect of different incentive schemes with future financial benefits on photovoltaic (PV) adoption patterns in the residential sector for the two biggest regions of Belgium - Flanders and Wallonia. Due to variation in benefit schemes across the regions and within regions across months,

we can identify the effect of changes in future benefits on adoption. We combine and compare three distinct and widely used future benefit schemes for PV, namely output-based, capacity-based and electricity cost saving-based. We find that PV adoption in the residential sector is highly sensitive to overall net-benefits and that the different benefit schemes have varying degrees of effectiveness. In particular, capacity- and output-based benefit schemes, which directly compensate households with a fixed price per produced amount of electric energy or per installed capacity annually (direct benefits), respectively, are above 60% more effective than the electricity cost saving-based scheme, which depends on future electricity prices (indirect benefits). Furthermore, depending on the specific benefit scheme and whether additional capacity is compensated or not, the average newly installed capacity can either increase or decrease.

**Presenter:** Marta Castellini (University of Padua)

**Title:** RICE-MED, an integrated assessment model for the Mediterranean basin: assessing the climate-economy-agriculture nexus

**Abstract:**

In this work we update the regionalization and the calibration of the Regional dynamic Integrated model of Climate and the Economy (RICE) in its 1999 version developed by Nordhaus and Boyer (2000), with a focus on the Mediterranean countries. Our aim is to assess the impact of climate change damages on their main macroeconomic variables in a context where all economies are fossil fuel based. In addition, we extend the model by introducing the uncertainty associated with a possible future catastrophic event, triggered by the temperature increase and variation over time, following the approach of Castelnuovo et al. (2003). We then develop an empirical exercise to assess the impact of climate change on the agricultural sector at country level. In this framework, we implement the traditional IAMs scenarios, namely the Business As Usual, the Social Optimum and the Temperature Limit, where population dynamics is calibrated according to the IIASA SSP2 projections. Among our findings, we show that, in the absence of renewable energy sources and breakthrough technologies, meeting the limit of a temperature increase of less than 2°C requires a carbon tax of more than 700 USD/tC by 2050, doubling by the end of this century. When uncertainty is introduced, the higher the probability of a possible catastrophic event and the greater the associated utility loss, the more society is willing to pay for a rising cost of carbon. The upward trend of the carbon tax relative to the no-uncertainty model is reduced by the end of the century in the temperature-limit scenario, due to the benefits associated with this policy and the inclusion in the model of societal awareness of the potential risks of climate change. In both versions of the model, the agricultural sector in the Southern Mediterranean countries is severely affected, and stringent policies can partially mitigate these impacts and reduce damages by 2100.

**Presenter:** Edouard Civel (Climate Economics Chair)

**Title:** Green premium or manipulation? Regression discontinuity design application on French energy labels

**Abstract:**

We investigate if consumers use the information delivered through Energy Performance Certificates (EPC) by exploiting the heuristic thinking they allegedly induced. We match two French national databases, gathering several millions of real estate transactions over 7 recent years. We implement a Regression Discontinuity Design (RDD) to test if an insignificant change in energy consumption can induce a significant one in the market price through a class change in the label. Results of the RDD analysis confirm the heuristic thinking of consumers, but raise the question of EPC manipulation by the certifiers. We suggest that manipulation is mainly driven by local market characteristics rather than intrinsic characteristics of the house.

**Presenter:** Natalia D'Agosti (University of Edinburgh)

**Title:** The Impact of Solar Panel Installation on Electricity Consumption and Production

**Abstract:**

Since 2010, the Uruguayan government has fostered the installation of solar panels by households and firms to increase the small-scale production of renewable electricity. The government allows agents with solar panels to inject any excess of electricity into the grid. We study the environmental and economic consequences of this policy. We collect a novel dataset on electricity extraction and injection into the grid at the household/firm level for the whole country. First, we find that solar panels decrease the electricity extracted from the grid. Second, the amount of electricity injected into the grid increases. Third, we calculate the effects on CO<sub>2</sub> emissions and the rebound effect. We find a reduction between 0.35 and 0.003 kg of CO<sub>2</sub> emissions every month for each agent. We find evidence of a rebound effect: consumption increases between 20% and 26% on average. Finally, we propose an alternative policy that allows agents to store the electricity in batteries instead of immediately injecting it into the grid. According to our model, the best time to inject electricity into the grid is around 9 PM. We leverage household-firm level data to study the effect of a net-metering policy on electricity extraction and injection, showing what countries can expect from such a policy.

**Presenter:** Audric De Bevere (UCLouvain - Center for Applied Public Economics)

**Title:** The Distributional Impacts of EU-ETS 2 on Households: A Microsimulation Approach in Belgium

**Abstract:**

This study presents a novel microsimulation model that evaluates the effects of EU-ETS 2 implementation on household fuel expenditures in Belgium. By highlighting the regressive nature of carbon pricing, our analysis confirms this common result in the literature. However, when the generated carbon payments are equitably redistributed to households, we observe a progressive net monetary impact. Household-based redistribution also delivers the best results in terms of (energy) poverty reduction, compared with other lump-sum designs. Nevertheless, significant heterogeneity emerges, with some households suffering substantial losses, regardless of income category. Particularly affected are those reliant on oil-based heating, residing in houses, and owning at least one car. We also demonstrate that low-income households are better shielded when revenue collection is targeted towards specific groups, especially if transfers encompass larger cohorts or incorporate measures such as lower energy prices. In the absence of targeting, certain well-defined groups face substantial losses that could undermine the public acceptability of such a reform. These findings underscore the importance of carefully considering distributional impacts, and suggest appropriate reforms to mitigate adverse effects of carbon pricing.

**Presenter:** Mahaut De Villeneuve (CY Cergy Paris University)

**Title:** Carbon Border Adjustment Mechanisms under Asymmetric Information

**Abstract:**

The paper investigates the optimal design of a Carbon Border Adjustment Mechanism to mitigate carbon leakage created by the relocation of domestic firms to unregulated countries. Such regulation was proposed by the European Commission in July 2021. However, this system relies on firms self-reporting their emissions to determine the carbon tax to be paid on traded goods. Authorities are unlikely to be able to verify the veracity of such information, inducing firms to falsely report low emissions. With a theoretical model in which the regulator has incomplete information about firms' levels of pollution, we show that he must design a non-linear tax structure to distinguish between dirty and clean firms. In this setup, the "good type" (i.e. clean firm) is also the less cost-efficient, which constrains the regulator to reward dirty firms and impose a decrease in clean production compared to the optimal solution. This feature also uncovers an important friction between incentives: when firms can choose their technology of production, it is impossible for the regulator to reconcile both the incentive to become clean and a truth-revealing tax structure.

**Presenter:** Sonja Dobkowitz (DIW Berlin)

**Title:** Meeting Climate Targets: The Role of Fossil Research Subsidies

**Abstract:**

What is the optimal mix of carbon taxes and research subsidies to meet emission targets? I study a model of directed technical change in which an emission limit renders the use of fossil energy socially costly. I find that taxes and subsidies on fossil research complement carbon taxes and green research subsidies in efficiently meeting emission targets. I quantify the optimal policy mix in a calibration to the US. In the long run, when net emissions have to be zero, a substantial tax on fossil research prevents further fossil research. In the short run, however, the government allows for some fossil research using a research subsidy. A smoother transition away from fossil research benefits green growth through cross-sectoral knowledge spillovers.

**Presenter:** Ingrid Emilie Flessum Ringstad (Norwegian School of Economics)

**Title:** Time and frequency dynamics of connectedness between green bonds, clean energy markets and carbon prices

**Abstract:**

In this paper, we investigate the time and frequency dynamics of connectedness among green assets such as green bonds, clean energy markets, and carbon prices. Using daily price data, we explore return spillovers across these green financial markets by applying the novel framework on time and frequency dynamics proposed by Baruník and Krehlík (2018). This allows us to identify the direction of spillovers among our variables, and decompose the connectedness to differentiate between short-term and long-term return spillovers. Our results indicate that green bonds and carbon prices act as net receivers of shocks, but mainly in the short-term. We also observe a low level of connectedness among our clean energy markets across both low and high frequency bands, even during times of economic or political crisis. Additionally, there are periods in which connectedness between the clean energy assets is driven by the long-term. In periods of economic and political stability, carbon prices may also provide an interesting diversifying tool for short-term investors. Our results should be of interest for investors and portfolio managers who focus on green financial markets, by strengthening the notion that green financial markets can offer diversification opportunities, for both short-term and long-term investors. This paper is the first to use this framework to investigate systematic risks within green financial markets.

**Presenter:** Dana Ghandour (Concordia University)

**Title:** Environmental Cooperation and Trade - The Impact of Heterogeneity in Environmental Damages: An Endogenous Solution

**Abstract:**

Addressing environmental damage heterogeneity, this paper uses a three-country static model of environmental cooperation with trade to analyze the feasibility and stability of partial and global

International Environmental Agreements (IEAs) among heterogeneous countries. Strong incentives to free ride and difficulties in enforcing international environmental agreements make international cooperation a challenging task. With international trade, governments face the trade-off of higher taxes to cooperatively reduce emissions or higher tariffs on exports when acting noncooperatively. Diamantoudi et al. (2018) found that stable coalitions among homogeneous countries are larger and provide more significant welfare gains than the basic model without trade. The paper's objectives, therefore, are: (i) to determine whether environmental cooperation among countries with different environmental damage parameters provides environmental gains, overall welfare gains, or both, (ii) to identify which cooperative scenarios will emerge in a stable environmental coalition to exploit these gains, and (iii) to capture the effect of heterogeneity in environmental damages on the stability and success of such environmental coalitions. The model assumes that each country has a single firm producing an emission-intensive homogeneous good, which results in an equal number of transboundary emissions such as carbon dioxide. The three-stage static coalition formation game is solved by backward induction. In stage one, each country chooses its coalition membership. A coalition is deemed stable if no firm has an incentive to either enter or exit the coalition (D'Aspremont et al. 1983). In stage two, each country determines the optimal emissions tax rate and import tariff that maximize the coalition's welfare. In stage three, each firm chooses non-cooperatively its production rate to maximize its own profits. Firms compete à la Cournot in a segmented market with positive endogenous import tariffs rather than in a free trade setting. The numerical simulations demonstrate that the grand coalition is stable at varying levels of environmental damage heterogeneity. When market sizes are sufficiently small, the grand coalition leads to both environmental and overall welfare gains. However, as market sizes grow sufficiently larger, the grand coalition only yields overall welfare gains. Consequently, this research provides evidence that the coordination of environmental and trade policies can be a valuable strategy to reduce global emissions in sufficiently small markets, even when countries exhibit heterogeneity in their environmental damages.

**Presenter:** Friedemann Gruner (Mercator Research Institute on Global Commons and Climate Change)

**Title:** Pigou's Advice and Sisyphus' Warning: Carbon Pricing with Non-Permanent Carbon Dioxide Removal

**Abstract:**

This paper develops a welfare and public economics perspective on optimal policies for carbon removal and storage (CDR) in non-permanent sinks. Optimal CDR use reduces transition costs, even if the stored carbon is released to the atmosphere eventually but it does not raise the ambition of optimal temperature levels. Its valuation differs from the social cost of carbon when the social cost of carbon removal takes the non-permanent carbon storage into account. Finally, we characterize three

policy regimes that ensure an optimal deployment of CDR regarding their informational and institutional requirements in monitoring, liability and financing.

**Presenter:** Katherine Hassett (OECD)

**Title:** Household behaviour and energy use: Empirical evidence and policy implications

**Abstract:**

Households worldwide account for nearly a quarter of all energy use globally, with OECD household energy use responsible for 14% of all OECD carbon dioxide emissions in 2019. This presentation will focus on published and ongoing analyses of data from the third round of the OECD Survey on Environmental Policies and Individual Behaviour Change (EPIC) on households' residential energy use in nine OECD countries. It will provide a descriptive overview of households' uptake of renewable and low-emissions options and the barriers to further uptake, their engagement in energy conservation, and their support for energy-related policies, including energy efficiency standards, subsidies for housing renovation, purchasing energy-efficient appliances and investing in renewable energy equipment and energy taxes. The presentation will also report emerging results from an econometric analysis of the EPIC Survey data. This will include a profiling of household groups according to their energy conservation behaviour and investment in low-emissions and energy efficiency equipment, an analysis of the determinants of specific energy conservation behaviours and equipment-related investment decisions, as well as cross-country results of a discrete choice experiment to estimate willingness-to-pay for greenhouse gas emissions reductions in electricity consumption. Results to date indicate, for example, that households fall into distinct categories regarding their energy use and investment behaviours, that the determinants of energy-related behaviours differ across the behaviours considered, and that small but positive price premiums exist for the provision of lower emissions electricity.

**Presenter:** Ileri Hernandez Carballo (Bocconi University)

**Title:** The Impact of Green Policies on Local Economic Performance: Evidence from the EU ETS

**Abstract:**

Environmental policies such as the European Union Emissions Trading System (EU ETS) raised concerns about their impact on employment and competitiveness. Yet, existing EU ETS studies focus on firm-level outcomes and the initial phases of the program. We construct a panel dataset of about 900 European NUTS 3 level provinces between 2008 and 2020 to assess, exploiting a significant policy change in Phase III regarding the free allocation mechanism, the impact of the EU ETS on the local economic performance, namely gross value added (GVA), employment, and productivity per employee (PPE) of European provinces. We employ data on the net change of the paid emissions from



phase II to phase III to construct a continuous measure of local level exposure at the NUTS3 level. Using both a binary and a continuous difference-in-differences fixed effects framework, we find that being more exposed to the EU ETS is associated with negative and significant results on employment and GVA. These results are confirmed both at the sector and general NUTS 3 level, suggesting that carbon intensive local economies might face negative externalities of the green transition.

**Presenter:** Kaitoh Hidano (National University of Singapore)

**Title:** Opportunities and Challenges of the Emission Trading System in Japan: An Empirical Study on the Case of Saitama Prefecture

**Abstract:**

The advent of an emission trading system enables entities to transfer their cost of reducing CO<sub>2</sub> emissions rapidly and simply. Behind its unquestionable benefits, governments have adapted to carbon pricing schemes to deal with irregularities associated with non-compliant behaviors. Within this context, empirical research is needed to explore the effectiveness of such strategies and interventions to accelerate the government's sound policymaking. This panel data analysis presents how Japanese government initiatives for emission trading systems mitigate CO<sub>2</sub> emissions. It examines the direct effect of ETS on the reduction rate of CO<sub>2</sub> emissions. The result from this study implies that ETS-targeted facilities in a prefecture where the ETS is not mandatory and another emission reduction reporting system is in place are more likely to slow down the total full commitment. In contrast, non-targeted facilities will likely try to stay outside the ETS by steadily reducing emissions. The study suggests a theoretical approach to the case where voluntary and mandatory frameworks work effectively. Further study is recommended on the impact of the reporting system on a company's commitment to the reduction.

**Presenter:** Gianluca Iannucci (University of Florence)

**Title:** Emission Permits and ECSR Practice in an Evolutionary Duopoly

**Abstract:**

We analyse the steady-state industry configuration of an oligopoly composed of profit-seeking (PS) and environmentally socially responsible (ECSR) firms in an evolutionary setting. In the industry, pollution is regulated through an Emission Trading System (ETS) scheme that allocates emissions' rights to firms. Firms may also invest in emission abatement technology to reduce the cost of emission rights. Our main findings show that, despite the commitment toward emission abatement, an individual ECSR firm may pollute more than its PS counterpart. By contrast, the introduction of the ETS puts competitive pressure to ECSR firms by inducing PS firms to invest in emission abatement.

**Presenter:** Stefania Innocenti (University of Oxford)

**Title:** Increasing the acceptability of carbon taxation: The roles of social norms and economic reasoning

**Abstract:**

Green transitions require ambitious policy. This poses a political economy challenge. Using an online survey experiment with a representative U.S. sample (N = 2,688), we investigate the influence of social norms and economic reasoning on public views about carbon taxes with uniform redistribution. Video interventions that correct misperceived norms about climate action and/or explain how carbon taxation works lead to an initial increase in positive support that fades away after 4-6 months. We also find no evidence for positive effects on incentivised donations. In contrast, the combined intervention persistently reduced strong opposition to carbon taxation by more than 20%, suggesting that jointly delivering social and policy information can be a key first step in shifting the public discourse and, ultimately, bolstering support for climate policies.

**Presenter:** Stephen Jarvis (London School of Economics)

**Title:** The Impact of Climate Policy on Manufacturing Employment: Firm-Level Evidence from Germany

**Abstract:**

Opposition to policies aimed at tackling environmental problems can often hinge on the costs these policies place on firms. We use detailed administrative data on manufacturing establishments in Germany to look at how the costs of two key environmental policies have affected firm performance. Our results indicate no significant adverse impacts on aggregate employment, employee composition or wages due to the two environmental policies we study. This calls into questions the widespread concerns of policymakers that carbon taxes and other similar regulations create significant risks of job losses and closures at affected firms.

**Presenter:** Eugénie Joltreau (RFF-CMCC European Institute on Economics and the Environment (EIEE))

**Title:** Recycling in a Globalised Economy

**Abstract:**

Developing a circular economy (CE) through waste recycling has become the new paradigm to sustain non-renewable resources. But, what does implementing a CE in a globalised economy mean, after all? Waste generated by consumption, i.e., including imports, will not necessarily coincide with material needs of the national production, i.e., including exports. Furthermore, countries may have access to cheap virgin materials. This material mismatch, as well as country heterogeneity in waste disutility and costs, will give rise to international trade strategies or interactions with the environment. In this paper, I offer a new perspective on recycling policies, taking into account international trade and national material imbalances.

**Presenter:** Emilia Lamonaca (University of Foggia)

**Title:** Climate and Non pricing Policies

**Abstract:**

The expansion of climate-related trade regulations is associated with both risks and benefits, amplified by international trade. Pricing mechanisms, largely prevailing, should be complemented with non-price mechanisms so as to achieve both economic and climate ambitions. International cooperation on trade policy and regulation is a powerful tool to achieve shared climate ambitions and improve economic efficiency.

**Presenter:** Marita Laukkanen (VATT Institute for Economic Research)

**Title:** Vehicle replacement subsidies and the environment: evidence from administrative data

**Abstract:**

In order to reduce CO<sub>2</sub> emissions from road transport, many governments have introduced vehicle replacement subsidy programs that seek to encourage consumers to retire older vehicles and purchase new, more energy efficient vehicles. This study analyzes the environmental impacts of such subsidies in the context of a vehicle replacement subsidy program implemented in Finland. Our empirical strategy exploits variation in subsidy eligibility and rich administrative data on vehicles, vehicle owners, new vehicle registrations and vehicle replacement subsidy recipients to estimate program impact on new car emission intensity. The detailed data allow studying whether program impacts differed between rural and urban areas or across income groups. We find that the program increased new car sales during the program period in the group of car owners eligible for the subsidy. The program induced consumers to purchase lower-emission intensity vehicles, but the average reduction in new car emission intensity was small at about 3 percent. The effect of the program was stronger in urban areas than in other locations and in the highest income group.

**Presenter:** Etienne Lorang (Tilburg University)

**Title:** When Pigouvian waste taxes (cannot) implement the first-best in general equilibrium

**Abstract:**

We introduce a framework for the representation of material flows in a competitive equilibrium. Material balances track material flows, and adjust endogenously to economic transactions. The simple theoretical model shows that taxing waste where generated does not restore the optimum while taxing resource extraction does. We show that Hedonic pricing of material content for goods restores the capacity of waste taxes to implement the first-best.

**Presenter:** Maria del Mar Solà (University of the Basque Country (UPV/EHU))

**Title:** Memory effect of appliance rebate programme: evidence from a lab experiment

**Abstract:**

By considering different risk framings that could lead to different cognitive processes, this paper aims to check in a controlled environment of the lab experiment for the evidence of the memory effect (Solà et al., 2023). The experiment was staged at the Bilbao Laboratory of Experimental Analysis (Bilbao-Labean1) in March 2022 and 166 subjects took part, in 4 different sessions. This lab experiment included 3 different parts: (i) a risk-elicitation task to measure subject preferences; (ii) a role-playing exercise to check for evidence of the memory effect in the purchasing decision of a fridge; (iii) a post-experiment survey to control for differences in the choices of participants and explain their decisions as well as other personal factors (e.g. socio-demographic factors). The design of the experiment staged enables the factors that nudge consumers towards investing in EE to be explained. The results show that different characteristics such as age and social class may affect consumer decision-making. The older a participant is, the more likely they are to buy energy-efficient fridges and the less likely it is that RENOVE will have any effect. This could be because older people tend to have a higher economic status and could therefore invest more in EE. Social class has a negative impact on the memory effect but a positive impact on purchasing energy-efficient fridges. The decision criteria underlying the choices made in the lab experiment (e.g. energy consumption criteria, lifetime energy cost criteria, etc) were also significant.

**Presenter:** Massimiliano Mazzanti (University of Ferrara)

**Title:** Climate policy analysis: efficient estimation of a semiparametric panel data model with spatial and factor dependence

**Abstract:**

This paper aims to shed light on the effect of the EU ETS on CO<sub>2</sub> emissions with a semiparametric panel data model where cross-sectional dependence (CSD) arising from a multifactor error structure and spatial dependence along with heteroscedasticity are all allowed simultaneously. A new estimator that extends the common correlated effect (CCE) approach of Pesaran (2006a) to this framework is proposed. However, the initial estimator ignores the CSD and heteroscedasticity, which will lead to a loss of efficiency. Thus Generalized Least Squares (GLS)-type estimators are proposed. Under rather standard conditions, the parametric estimators are shown to be  $\sqrt{NT}$ -consistent and asymptotic normality of the nonparametric estimators is also established. Further, the GLS-type estimators are shown to dominate the others. Small sample properties of the estimators are investigated by Monte Carlo experiments and finally by considering a semiparametric extension of the ECK/STIRPAT model, we apply the proposed approach to the dataset consisting of the EU27 countries plus UK and Iceland, and find evidence that the common carbon price arising from the EU ETS policy has a negative nonlinear effect on CO<sub>2</sub> emissions.

**Presenter:** Coline Metta-Versmessen (Climate Economics Chair)

**Title:** Waste Trading System: managing waste with high population density and low sorting rate

**Abstract:**

Landfilling is known to be responsible for multiple pollution, and thus used as a last resort waste management strategy. Then, by decreasing the landfilling rate, there are potentials for mitigating externalities from the waste sector. Nevertheless, deploying this potential is difficult in the absence of citizen participation in sorting. While market-based tools are of interest to policymakers to internalize negative externalities from waste landfilling, the focus seems to have been mostly on waste taxation. In this study, we present the potential for cap-and-trade systems for municipal solid waste management in the presence of a structured waste treatment chain and low citizens involvement in sorting. First, we set out in detail the theoretical and market design conditions for the effectiveness of a cap-and-trade system for municipal waste management. Using an analytical model, the market equilibrium is presented. Secondly, the case of Hong Kong is used to study the empirical application of such a trading system. We determine the actors concerned, the optimal number of permits for the total period as well as its allocation method, together with the potential market design scenario with regard to the particularities of Hong Kong and its climate regulation in the broad sense.

**Presenter:** Christian Nolde (University of Basel)

**Title:** Who Should Drive Green Technology Transitions in Developing Countries?

**Abstract:**

Green technologies, such as renewable energy, often require adaptation to local conditions, such as high humidity, high altitudes or the specifics of a country's infrastructure, to achieve a maximal technical efficiency and a long lifetime of investments. This poses a problem for green technology transitions, as adaptations usually imply protected intellectual property rights and thus market imperfections that can lead to higher prices and thereby a lower uptake of the green technology. An alternative could be to use state-owned enterprises to adapt and promote green technologies, such as public utilities, which are more easily steered toward pursuing societal objectives. However, many empirical studies find state-owned enterprises to be less efficient. This theoretical contribution investigates the question whether a green technology transition that requires research and development is better driven by private firms or state-owned enterprises. The paper adapts a model to this setting, derives possible market outcomes from this model, investigates research and development and production decisions of private firms and a state-owned enterprise, and compares the welfare implications of the two options. The results show that there are cases where the cost inefficiency of the state-owned enterprise dominates (for example, if competition of directly importing firms reduces possible markups of private innovating firms), but also cases where a state-owned enterprise is the preferred choice (for example, if several private firms would adapt the technology, causing over-innovation). Most importantly, this is not solely a question of comparing costs, but rather of comparing market outcomes. For example, the use of a state-owned enterprise can avoid the often-found problem of overinvestment in research and development by private firms and, in many cases, a state-owned enterprise will induce a wider diffusion of the green technology.

**Presenter:** Sebastian Osorio (Potsdam Institute of Climate Impact Research)

**Title:** Will cutting back on renovating buildings make carbon prices go through the roof?

**Abstract:**

The building sector is notoriously hard to decarbonise, also because energy efficiency measures are costly and have largely failed to deliver. In reaction, policy makers in Europe where decarbonising buildings is at the forefront now increasingly turn to ramping up electrification and district heating (DH) as two of the main alternatives. While this route seems more promising, it also comes with a political risk: increasing demand for clean electricity could push up carbon prices in the EU Emission Trading System (EU ETS), and would thus spill over to electricity consumers and energy-intensive industries regulated under the EU ETS. In light of that, our analysis explores the impact of renovation on ETS prices and the relationship between heat demand and the EU ETS. We expand upon the EU ETS model LIMES-EU, adding a new module that allows us to endogenously compute investments in DH and decentral power to heat technologies, e.g., heat pumps. Contrary to expectations, we find that carbon prices only increase slightly. The main reason is conducive policy sequencing: substantial decarbonisation will already be achieved within the power sector before significant volumes of heat demand are electrified or supplied through DH. However, a new political risk arises because effects heavily depend on enabling substantial expansion of RES and new technologies such as hydrogen.

Failing rapid largescale deployment, the impact of (non) renovation on EUA prices would be up to three times higher. Our findings imply that policy makers must commit to decarbonising electricity on the fast track, including an urgent redirection of financial resources from building to the electricity sector.

**Presenter:** Monika Papięż (Cracow University of Economics)

**Title:** How does the Environmental Policy Stringency affect the CO2 emissions in OECD and BRICS countries?

**Abstract:**

Our study examines the impact of environmental policy stringency on CO2 emissions in OECD and BRICS countries. CO2 emissions are measured using two indicators – production (PBA) and consumption-based accounting (CBA). We analyse not only the main EPS index but also its three components: market-based instruments, non-market-based instruments, and technology support policies. The analysis is carried out using quantile panel models, i.e. the method of moments quantile regression (MMQR). This allows us to show the effectiveness of policies and to assess the role of policies in high, medium and low emission countries. The results show that an increase in environmental policy stringency leads to a reduction in CO2 per capita in OECD and BRICS countries. However, environmental policy stringency has a stronger impact on reducing PBA emissions than on reducing CBA emissions. The main finding is that EPS has a stronger impact in countries with lower per capita carbon emissions (i.e. lower quantiles) than in countries with high per capita pollution. When considering the three components of the EPS index, market-based instruments are the most effective. Interestingly, in countries with lower CO2 emissions per capita, both market-based and non-market-based policy instruments are more effective in reducing CO2 emissions. In contrast, the largest CO2 emitters per capita respond most effectively to technology support to reduce emissions.

**Presenter:** Marco Quatrosi (University of Palermo)

**Title:** Emission Trading in a high dimensional context: to what extent carbon markets are integrated with the broader system?

**Abstract:**

The EU ETS represents the cornerstone of the climate policy framework in the EU. While most of the studies focus on the determinants of carbon price this work will provide further insights into the influence of European Emission Allowance (EUA) prices on carbon dioxide trends and relevant variables of the economic-financial-climate-environmental system considering a large set of time series. Results highlighted how CO2 appears to be more influenced by commodity prices, climate variables, along with past industrial performances. Furthermore, a shock of carbon prices could

potentially exert significant turbulence on the carbon dioxide series, fading in intensity as time goes by. Overall, there appears to be a negative effect on the influence of carbon prices on the system. However, robustness checks identified how the influence of carbon price towards CO<sub>2</sub> and other relevant variables is still weak. This work sheds light on the influence the EU ETS exerts on a set of multidimensional variables. Still, overlapping national policies appear to interfere with the EU ETS effectiveness in the EU.

**Presenter:** Claudia Ranocchia (Universidad Complutense de Madrid)

**Title:** Porter hypothesis vs pollution haven hypothesis: Can an emission tax avoid the pollution haven hypothesis?

**Abstract:**

This work is motivated by two well-known results in environmental economics: the Pollution Haven Hypothesis and the Porter Hypothesis. Both results deal with the effects of environmental policy on firms' strategies profits. We build a simple model to address both stories and ask the question if the design of environmental policy can prevent firms from relocating abroad and induce them to stay in the home country and adopt greener technologies instead. We set up a non-cooperative game model in which two Cournot firms, which are initially located in an industrialized country, must decide whether to stay in the home country or move to a pollution haven. and -in the case of staying- whether to invest in a green technology or stick to the conventional ("brown") one. Although the model is symmetric, we conclude that, under suitable parameter values, all market configurations, both symmetric and asymmetric, can be a subgame perfect Nash equilibrium of the game. This includes the "win-win" solution, in which the two firms decide to stay in the home country and invest in green technology. Interestingly, this solution can occur even in apparently unfavorable conditions, where the tax rate is higher than the unit cost of transportation and the investment cost is higher than the set-up costs of moving to the pollution heaven. We also conclude that the win-win solution is more likely to arise under a tax than under an environmentally equivalent standard, but under some conditions, the tax is also more prone to push the firms to move to the pollution haven.

**Presenter:** Elisa Rottner (Leibniz Centre for European Economic Research)

**Title:** Is Germany becoming the European pollution haven?

**Abstract:**

Despite being a country with comparatively strict climate regulation, carbon emissions in German manufacturing have not decreased between 2005 and 2019. Why is that? In this paper, we focus on the role of regulatory differences between Germany and other EU countries. To back out these differences, we calibrate a Melitz-type model, extended by firms' emissions and abatement decisions.



For quantification, we use aggregate output, trade and emissions data as well as parameter estimates retrieved from the official German Manufacturing Census. The quantitative model reveals that the implicit carbon price paid on emissions, reflecting energy and carbon prices in addition to command-and-control measures, decreased from 2005 to 2019 in most sectors – both in Germany and other EU countries. Yet, the trend has been more pronounced in Germany than in the rest of the EU. In counterfactual analyses, we show that this intra-EU difference has substantially increased German industrial emissions. Had the EU experienced the same decrease in implicit carbon prices as Germany, German emissions would have been substantially lower. Germany hence seems to have increasingly become a pollution haven.

**Presenter:** Stephan Sommer (Bochum University of Applied Sciences)

**Title:** How resilient is public support for carbon pricing? Longitudinal evidence from Germany

**Abstract:**

The success of climate policies depends crucially on the dynamics of public support. Using unique longitudinal data from three surveys conducted between 2019 and 2022, we study the variations of public support for carbon pricing in Germany. The period includes two relevant events: the introduction and ramping up of carbon pricing in Germany and the exogenous increase in energy prices following the Russian invasion of Ukraine. Using panel methods, we show that support is very persistent over time and might have increased slightly more recently. However, people who experience high energy costs display a lower support. Regarding revenue use, we detect that social cushioning has become more popular after the introduction of carbon pricing. Our findings suggest that it is crucial to gather enough support before implementing climate policies.

**Presenter:** Jordi Teixidó (University of Barcelona)

**Title:** Technology Diffusion in Carbon Markets: Evidence from aviation

**Abstract:**

Carbon pricing has been found mainly to foster low-carbon innovation but not low-carbon technology adoption. Focusing on the aviation sector, we find novel evidence that the EU's Emission Trading System is responsible for a greater diffusion of available low-carbon technologies. We find an improvement in emission intensities in the sector driven by the modest substitution of aircraft – more fuel-efficient planes – and the sizeable effect of aircraft retrofitting – use of winglets – compared to the counterfactual. We conclude that while carbon pricing satisfies theoretical predictions in terms of cost-effective emission reductions, complementary policies may be required to ensure full decarbonization is achieved in time.

**Presenter:** Roberta Terranova (RFF-CMCC European Institute on Economics and the Environment)

**Title:** Believe me when I say green! Heterogeneous expectations and climate policy uncertainty

**Abstract:**

We develop a dynamic model where heterogeneous firms take investment decisions depending on their beliefs on future carbon prices. A policy-maker announces a forward-looking carbon price schedule but can decide to default on its plans if perceived transition risks are high. We show that weak policy commitment, especially when combined with ambitious mitigation announcements, can trap the economy into a vicious circle of credibility loss, carbon-intensive investments and increasing risk perceptions, ultimately leading to a failure of the transition. The presence of behavioural frictions and heterogeneity - both in capital investment choices and in the assessment of the policy-maker's credibility - has strong non-linear effects on the transition dynamics and the emergence of 'high-carbon traps'. We identify analytical conditions leading to a successful transition and provide a numerical application for the EU economy.

**Presenter:** Elena Villar (Università Cattolica di Milano)

**Title:** The Intended and Unintended Consequences of Taxing Waste

**Abstract:**

This paper investigates the economic and environmental effects of pay-as-you-throw (PAYT) waste programs. Using a newly constructed longitudinal dataset of Italian municipalities and a staked-by-event design, we obtain three main findings: (i) PAYT programs significantly reduce total waste production; (ii) they further decrease waste management costs and leave municipal finances unaffected; (iii) they generate positive spillover effects on pro-environmental behaviors not directly targeted by the program. Survey evidence suggests that PAYT increases environmental awareness and concerns of the population in treated municipalities.

**Presenter:** Hermann Vollebergh (Tilburg University)

**Title:** Coherence in carbon pricing: The importance of descriptive economics for policy package evaluation

**Abstract:**

Carbon mitigation policies typically exploit multiple instruments like taxes and tradeable permits. Moreover, design characteristics matter for their combined impacts, for instance because they apply

to different agents or at different rates. Therefore, demand exists for descriptive assessments of instrument packages which enables insight in policy coherence in order to enable well-designed policy reform decisions. In this paper we develop a descriptive tool for assessing carbon pricing packages based on several key design attributes and their link to their underlying fossil fuel energy use. We also show how our descriptive tool could be applied to discuss i) how the different instruments potentially complement each other or overlap and might create pre-existing distortions; ii) how the set of instruments performs against benchmarks such as existing externalities, like the Social Cost of Carbon, and iii) enables better informed policy reform related to the role of 'fossil fuel subsidies'. We demonstrate this applicability for the Netherlands which uses a broad mix of carbon (pricing) instruments.