Extended Abstract
Please do not add your name or affiliation

Paper/Poster Title	From Fork to Footprint: Unveiling the Environmental Impact of Food Consumption across Income Divides

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	***200 words max***

This study investigates the impact of Austria's food consumption patterns on environmental outcomes, particularly greenhouse gas (GHG) emissions. It explores disparities in food system dynamics and identifies potential leverage points for innovative policy interventions. The research focuses on two policy scenarios aimed at mitigating emissions from the food sector: a carbon tax on high-impact foods and a reduced VAT rate on lower-impact foods combined with a carbon tax.

The study's methodology includes analysing household spending patterns from the Austrian Household Budget Survey (HBS) and assessing environmental impacts. It takes into account socioeconomic factors such as education, urbanization, and age to understand dietary variations across income groups. The analysis involves estimating a demand system using price variations over time, calculating non-linear Engel curves, and determining cross-elasticities à la Lewbel & Pendakur (2009).

To quantify GHG emissions and blue water consumption from food, the study matches HBS product data with life-cycle analysis estimates from a database compiled by Petersson et al. (2021). The findings are presented by simulating the proposed policy scenarios on five different consumer types, identified through cluster analysis using random forests.

Keywords	Environmental Impact of Diet, Economic Demand Analysis, Exact Affine Stone Index, Price Elasticities of Food, Socioeconomic Disparities in Consumption, Greenhouse Gas Emissions from Food, Agricultural and Food Policy, Consumer Behaviour in Food Markets, Sustainable Food Systems
JEL Code	Q18: Agricultural Policy; Food Policy Q51: Valuation of Environmental Effects D12: Consumer Economics: Empirical Analysis see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction ***100 – 250 words***

This study investigates the impact of Austria's food consumption patterns across socioeconomic lines on environmental outcomes, and derives policy implications. For analysing the reactions of consumers to price changes, the estimation of demand systems and demand elasticities are essential. The knowledge about such key parameters of the Austrian economy is very

fragmented. Whereas recent analyses are available in other countries (e.g., Rosen et al., 2022), the most recent study for Austria dates back almost a decade (Widenhorn & Salhofer, 2014). A comprehensive and detailed study for several types of food is even much older (Wüger, 1989). For Austrian data, Eisner et al. (2021) estimate a demand system, however, they include all products, not only food.

There are numerous demand systems like Deaton and Muellbauer (1980)'s Almost Ideal Demand System (AIDS), Banks et al. (1997)'s Quadratic Almost Ideal Demand System (QAIDS) and Lewbel and Pendakur (2009)'s Exact Affine Stone Index (EASI), which are parametric consumer demand models.

This study uses the latter, as it has the benefit of allowing the Engel curves to take on a variety of different shapes, including unobserved preference heterogeneity. We use the EASI demand system to estimate price elasticities of different type of food for Austrian data as formulated by Castellón et al. (2015).

To our knowledge, this is the first study to estimate such a demand system specifically for food in Austria. Additionally, it explores the uncharted territory of the relationship between environmental outcomes and socioeconomic divides in Austria. Our findings contribute to the literature on Just Transition.

Methodology

100 – 250 words

To answer the research question of how environmental outcomes from food consumption differ between income groups and what it implies for policy makers, three steps were taken:

In the first step, an EASI demand system from microdata is estimated for Austria, using the HBS from several years as inputs. We can calculate several elasticities, namely with respect to the price, the measure of real total expenditures and observable household characteristics. We provide compensated quantity price elasticities describing how sensitive the quantity is to its price taking into account the income effect. Furthermore, we differentiate households according to characteristics and compute for each of it the respective elasticities.

Next, we link each food group to an environmental impact. The dataset from Petersson et al. (2021) includes information on GHG emissions and freshwater. To quantify the cost of emitting GHG, we use prices from the EU Emission Trading Scheme.

In the last step, we show how the introduction of a carbon tax levied on a range of products such as red meat might change consumer behaviour across socioeconomic groups. These groups are defined using a classical random forest approach.

Results

100 – 250 words

The table below displays the compensated price elasticities for four household income types. For every household income quartile, it contains the compensated quantity own-price elasticities for the different food groups. For example, a price increase of Cereals & Bakery of 1% results in a decrease of its quantity of 0.445% for the group of households with the lowest income. Not that these values are long-term price elasticities as we used data from 2004-2020.

The most inelastic values of each food type are marked in bold. In general, we observe that nonalcoholic beverages are the most inelastic ones and miscellaneous foods the most elastic ones. Furthermore, the lower income households react less to price increases of Cereals & Bakery, animal-based foods, Fruit & Vegetables and Nonalcoholic Bev., but more to Fats & Oils, Sugar & other Sweets and Miscellaneous Foods. The reason for this could be that the first ones are staples, and the lower income households cannot restrict much.

Table 1. Compensated price elasticities for four household income types

Types of food	**lowest**	**low**	**high**	**highest**
Cereals & Bakery	**-0.445**	-0.480	-0.516	-0.538
Meats & Eggs	**-0.374**	-0.420	-0.463	-0.486
Dairy	**-0.465**	-0.495	-0.525	-0.548
Fruit & Vegetables	**-0.433**	-0.469	-0.506	-0.528
Nonalcoholic Bev.	**-0.323**	-0.337	-0.344	-0.375
Fats & Oils	-0.487	-0.404	-0.349	**-0.231**
Sugar & other Sweets	-0.494	-0.471	-0.464	**-0.448**
Miscellaneous Foods	-0.755	-0.740	-0.722	**-0.706**

In the next step, food groups will be disaggregated further to allow for a more granular estimation of elasticities for carbon-intensive foods, especially red meat and dairy products.

Discussion and Conclusion

100 – 250 words

As we move towards unveiling substitutions among broader food groups, this study's exploration of Austria's food consumption patterns across socioeconomic divisions offers vital insights into environmental outcomes and policy implications.

Our preliminary results indicate that lower-income households are less responsive to price increases in staple foods. In contrast, their consumption of fats, oils, sugar, sweets, and miscellaneous foods is more price-elastic. This is because they are restricted in their choices, hence challenging lower-income groups in adapting their consumption patterns.

This study underscores the need for targeted policy interventions that consider the varying elasticities across different food groups and socioeconomic brackets. Implementing measures such as a carbon tax on high-emission food products like red meat could lead to significant shifts in consumption patterns, as well as potentially acting as a regressive tax.