

## Extended abstract:

### The effect of prices and income on carbon emission from food

This presentation is a synthesis of three papers

- 1) *The consequences of unemployment on dietary carbon footprints. Work in progress.*
- 2) *Edjabou, L. D., & Smed, S. (2013). The effect of using consumption taxes on foods to promote climate friendly diets—The case of Denmark. Food Policy, 39, 84-96.*
- 3) *Does a consumption tax on greenhouse gases disproportionately hurt the poor? Work in progress.*

#### Introduction

Food consumption is one of the private consumption areas that have the largest impact on the environment and the climate. Emissions associated with food and drink consumption within the EU-27 account for 16% of the region's overall GHG emissions (European Environment Agency, 2012). This implies that the climatic impact of food consumption is increasingly discussed in relation to the politics of sustainable consumption. Some of the main drivers behind the increasing CO<sub>2</sub> emission from food is the considerable loss of biomass from field to fork, mainly in the form of food waste, and the high consumption of animal products as meat and dairy products in the diet (Reisch et al., 2013, Shindell et. al, 2012, European Environment Agency, 2005, OECD and FAO, 2011) as well as the considerable increase in consumption of highly processed food (Harmermesh, 2007). Meat and meat products contribute with between 9 and 14% of total GHG emission within the EU-25 followed by food products as milk, cheese and other types of dairy products (Tukker et al., 2005). Vegetable based products as cereals, fruit and vegetables in contrast contribute comparatively low levels of GHG emissions (Carlsson-Kanyama and Gonzales, 2009). Hence due to the climatic impact of the dietary composition, changes in diets from animal based products to plant based products will lead to a reduction in emission (Aiking et al., 2006, McMichael et al., 2007). The economic growth and falling food prices of especially meat and processed foods has been accused of being at least partly responsible for change in diets and thereby the increased CO<sub>2</sub> emission from food consumption during the last decades (Reisch et al., 2013).

The objective of the first paper: **“The consequences of the economic crises and unemployment on dietary carbon foot-prints”**, is to explore if the economic crises of 2007 – 2009, which led to negative growth and rising unemployment and thereby decreased income for many households, implied a positive effect on climatic sustainability of diets due to its effect on diet composition. Furthermore we explore if the consumers attitude toward the climatic effect of food consumption has any influence on these effects. The dataset which is used is a representative household panel, from GfK panel services Scandinavia covering the period from January 2007 to December 2012. The purchase data is at the brand level, which allows us to link the purchase data with data on carbon emissions in kg CO<sub>2</sub>e per kg for each product. To account for the overall effects of the economic crisis on changes in food consumption, we include the consumer confidence index (CCI), which reflects consumers’ expectations regarding their personal and Denmark’s economic situation. Furthermore the purchase data are matched with individual register data on CPR (Central Person Registration) level from Statistics Denmark, which allows us to identify the date of the occurrence of unemployment in each of the participating households. To account for the fact that adjustment to new economic conditions might be a process that occurs over time, the dummy variable for unemployment in the household is crossed with a trend calculating the length of the unemployment period.

We find that the overall economic crises, measured through the CCI, led to a lowered CO<sub>2</sub> emission from food and hence were positive in terms of the climatic impact of food consumption. This is not surprising as there is a positive and clear relationship between income growth and CO<sub>2</sub> emission from food. Unemployment led to a less CO<sub>2</sub> intensive diet as well as, on a longer term basis, also less energy consumed leading to lower CO<sub>2</sub> emission from food. The decrease in the CO<sub>2</sub> intensity of the diet is due to a shift in the diet from animal based products to vegetable based products. We find no effects of consumers’ attitude towards the climatic effect from food consumption on the reaction to unemployment or the economic crises. This an example of the intention-behavior gap, but also a reflection of a general lack of clear recommendations, policies (labelling) and incentives for food consumers to take climatic effects of food into consideration . Our results show that consumers reduce CO<sub>2</sub> emission from food when income declines. However, lowering income is not a positive solution to reduce CO<sub>2</sub> emissions from food, as reduced income leads to reduced quality of life. It therefore remains an urgent necessity to develop ways to turn

food consumption into a more climatically sustainable direction while maintaining dietary health and quality of life related to food.

In the second paper: **“The effect of using consumption taxes on foods to promote climate friendly diets–The case of Denmark”** we explore the effects of a carbon tax on consumption as one way to promote more climatically sustainable diets. Due to high monitoring costs and low technical potential for emission reductions, a tax on consumption may be a more efficient policy instrument to decrease emissions from agriculture, than a tax based directly on emissions from production. 4 different types of tax-scenarios are analysed to illustrate the effect of a tax on GHG emissions. All four scenarios are based on the idea that the climate-related costs of food consumption for society should be internalised and hence the price of specific food products should be increased based on their climate impact. The A scenarios are based on Tol’s estimate of the damage cost of CO<sub>2</sub> emission on 0.26 DKK per kg (Tol, 2005), whereas the B scenarios are based on Stern’s estimate of the damage cost of CO<sub>2</sub> emission on 0.76 DKK per kg (Stern, 2006). In scenario 1A and 1B, a tax equivalent to the climatic impact of the food is imposed (*uncompensated scenario*), whereas scenarios 2A and 2B are designed so that the total tax revenue derived from food taxation is unaltered (*compensated scenario*). Additional to CO<sub>2</sub> reduction, we consider the welfare economic losses measured as the change in consumer surplus of each of the proposed scenarios, which implies that we can approximate the costs for consumers of a changed diet. Finally, we quantify the changes in daily intake of energy, saturated fat and sugar per person to assess the health consequences of the implied dietary changes. In the most efficient scenario, we find a decrease in the carbon footprint from foods for an average household of 2.3–8.8% at a cost of 0.15–1.73 DKK per kg CO<sub>2</sub> equivalent whereas the most effective scenario led to a decrease in the carbon footprint of 10.4–19.4%, but at a cost of 3.53–6.90 DKK per kg CO<sub>2</sub> equivalent. The derived consequences for health show that scenarios where consumers are not compensated for the increase in taxation level lead to a decrease in the total daily amount of KJ consumed, whereas scenarios where the consumers are compensated lead to an increase. Most scenarios lead to a decrease in the consumption of saturated fat. Compensated scenarios lead to an increase in the consumption of added sugar, whereas there are no changes in the uncompensated scenarios. Generally, the results show a low-cost potential for using consumption taxes to promote climate

friendly diets. Despite the positive outcome of imposing a climate related tax on foods in Denmark the tax has to be imposed on a larger scale in order to have any significant climatic impact since anthropogenic greenhouse gas emissions is a global public bad that are independent of borders.

Finally in the last paper: “ **Does a consumption tax on greenhouse gases disproportionately hurt the poor?**” we investigate if the CO<sub>2</sub> emission reduction effects of a carbon consumption tax as well as the associated potential economic and health consequences of such a tax is regressive or progressive. We do that by modelling the compensated and the uncompensated scenarios from the paper above using the Stern estimate for the damage cost of CO<sub>2</sub> emission for five different social classes. The social classes vary in terms of initial dietary patterns, education and income. The results suggest that taxation is a way to reduce emissions and the effect is larger for higher social classes. This is possible without increasing the tax burden for consumers through a revenue neutral scenario and economically the tax is mainly progressive, independent of which scenario is chosen. However, when assessing the potential health impact the uncompensated scenario provides mixed results. Hence a carbon tax is progressive in terms of economic and climate effects and neutral in terms of health effects.

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