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The effect of using consumption taxes on foods to promote climate friendly diets – The case of Denmark

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ABSTRACT

Agriculture is responsible for 17–35% of global anthropogenic greenhouse gas emissions with livestock production contributing by approximately 18–22% of global emissions. 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. In this study, we look at the effect of internalising the social costs of greenhouse gas emissions through a tax based on CO_2 equivalents for 23 different foods. Furthermore, we compare the loss in consumer surplus and the changed dietary composition for different taxation scenarios. 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_2 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_2 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 leads to an increase in the consumption of added sugar, whereas uncompensated scenarios lead to almost no change or a decrease. Generally, the results show a low cost potential for using consumption taxes to promote climate friendly diets.

Introduction

Greenhouse gas (GHG) mitigation has increasingly been put on the political agenda as global climate change can lead to comprehensive global problems if GHG emissions are not limited in the near future. Most effort has so far been directed toward reducing emissions of carbon dioxide from the energy and transport sectors by means of policies such as subsidies for substitution towards renewable energy, energy efficiency policies, CO_2 emission trading schemes and emission taxes. Even though CO_2 emissions from the energy and transport sectors are still the largest contributors to GHG emissions, contributions from agricultural land-use, energy use on farms and in fertiliser production and methane and nitrous oxide emissions from meat and dairy production are considerable (IPCC, 2007a). On a global scale, agriculture has been estimated to contribute to 17–35% of total GHG emissions (IPCC, 2007b; Houghton, 1999; Steinfeld et al., 2006; McMichael et al., 2007), while the livestock production alone is estimated to contribute by approximately 18–22% of global GHG emissions (Steinfeld et al., 2006; McMichael et al., 2007). For a comparison, the Danish agriculture is assumed to contribute to 16% of total Danish GHG emissions (Olesen, 2010) while the total emission of GHG from food consumption (export subtracted and import added) is estimated to constitute 19 million tons of CO_2 equivalents annually, which corresponds to approximately 27% of total GHG emissions (Olesen, 2010). On a global scale meat and dairy products currently supply about one-third of the dietary energy intake globally in high income populations, but they contribute far more than one third of GHG emissions from food consumption (McMichael et al., 2007). Hence due to the climatic impact of the dietary composition, dietary changes may lead to reductions in emissions (Aiking et al., 2006; McMichael et al., 2007). Friel et al. (2008) conclude, in an article describing the link between meat consumption and global warming, that there is a need to reduce the average daily meat consumption from about 100 g to 90 g per day per person if the world community is to meet its target of reducing greenhouse gas emissions to the 2005 level by 2050. Furthermore dietary changes may not only be attractive from a climate perspective, the impacts they might have on human health are also of great interest from a public health perspective. In recent decades, there has been a marked increase in the prevalence of lifestyle related illnesses due to excess consumption of saturated fats and sugar and the consumption of red meats as beef and pork are assumed to increase the risk of intestinal cancer (WHO, 2003; WCRF and AICR, 2007; Sinha et al., 2009; Li et al., 2005; Ding, 2006). This implies that major possible

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gains exist in terms of GHG mitigation and in terms of health effects from a reduction in the consumption of meat and dairy products in favour of vegetable based products.

Overall, policymakers with the aim of regulating food consumption have the choice between command and control instruments, information provision and price-based approaches (Lorek et al., 2008). In relation to the adverse effects of food consumption command and control instruments are economically inefficient and have mainly been used in relation to cases where there is an acute threat to the life and health of citizens (Reich et al., 2011). Information campaigns have been widely used to improve general health, such as to decrease smoking or to increase consumption of fruits and vegetables, but in relation to GHG emission information campaigns are considered to have a limited effect since the consumption of meat and dairy is deeply rooted in our culture (Olesen, 2010). The lack of suitability of the two former policy instruments leaves price based instruments as the most appropriate to reduce GHG emissions from food consumption. In terms of reducing emissions, a tax placed directly on the source is theoretically preferable since it directly address the discrepancy between the private and social cost. However, when monitoring costs are high, there are limited options for cutting back on emissions apart from output reduction and when there are a considerable number of output substitution possibilities emission taxes may be less cost-effective than taxes on either outputs or inputs (Schmutzler and Goulder, 1997). All three conditions are assumed to be fulfilled concerning GHG emissions from agriculture in countries with a technologically fairly advanced agricultural sector, since the GHG mitigation potential of improving agricultural productivity or technological enhancements is considered to be small (Wirsenius et al., 2010).[1] Furthermore, according to Wirsenius et al. (2010), there is a limited potential in agriculture for dedicated mitigation measures due to the fact that most of the GHG emissions are related to the intrinsic characteristics of the agricultural system as e.g. nitrous oxide from fertilised soils or methane from enteric fermentation in ruminants. The exact level of these emissions varies considerably with a number of factors and has a non-point source character. In addition, a wide range of substitution possibilities exist at the output level, e.g. the substitution of red meat with either white meat or vegetables such as beans resulting in large reductions in GHG emissions. This implies in the case of GHG mitigation taxes on food that the conditions for the cost-effective use of output taxes compared to input taxes or emission taxes are fulfilled.

Regulation of consumer behaviour through taxation is not new in relation to food consumption. Taxes on stimulants like alcohol, tobacco and soft drinks have been used in many countries during the last decades. Recently a controversial tax on consumption of saturated fat has been introduced in Denmark with the aim of increasing health, a tax which was accompanied by increased taxes on sugar products, soft drinks and cigarettes (Smed, 2012). This tax was removed again 1st of January 2013. Furthermore a planned increase in the taxation of several sugar products that was planned to take place from January 2013 (Skat 2012). The tax on saturated fat was the object of a huge debate concerning the justification for public intervention in food consumption (Smed, 2012) and the issue has attracted huge attention worldwide.

The purpose of this paper is to estimate the magnitude of the GHG mitigation potential of implementing consumption taxes on foods differentiated with respect to average GHG emission per kg of each type of food product consumed in Denmark. This issue has still only been quantified to a limited extent in the literature. Furthermore, 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. The remainder part of this paper is organised as follow. In section "Model and data", we describe the model and the data used. In section "Simulation scenarios", we consider the simulation scenarios, whereas in section "Results" we discuss the results from these simulations. Section "Discussion and conclusion" is dedicated to a discussion and the conclusion.

Model and data

Model

Emissions of greenhouse gases from agricultural food production impose externalities on society as the damage costs caused by the emissions are not reflected in the price of foods. This leads to excess production and consumption from a societal perspective. GHGs from food production can, in the same manner as other forms of pollution, be subject to taxation in the form of a "Pigouvian tax" (Pigou, 1957), which internalises the externalities. According to regulation theory, the cost-efficient reductions of greenhouse gas emissions are achieved by taxing production according to the level of emissions per unit of food for the individual producers multiplied by the social cost of emitting 1 kg GHG.

In reality, this is not possible due to the cost of information and administration implied in this form of monitoring so instead, the imposed taxes are based on the average emission levels for each food category representing all food producers in the entire market rather than individual producers' specific emission levels. The bias introduced here is minor since the variation in GHG emissions between individual food producers of the same product is generally much smaller than the difference between food categories (Wirsenius et al., 2010). In addition, according to Wirsenius et al. (2010), a tax should be imposed on consumers rather than producers in order to avoid a so-called "carbon leakage", meaning that CO_2 emissions in a country increase because of another country's effort to reduce its CO_2 emissions. If producers are taxed in Denmark based on their products' emissions, it will reduce the Danish producers' competitiveness. This will give the producers an incentive to move production abroad and an incentive for consumers in Danish supermarkets to choose some now relatively cheaper foreign products. This would not only hurt Danish agriculture and the Danish trade balance, but would probably just move the GHG emissions caused by Danish food consumption abroad, which would not be beneficial for the global climate. If consumers are taxed instead of producers, the competitiveness of Danish producers would not be affected, since the products in the supermarket are taxed equally hard regardless of where they are produced. Furthermore, it is worth noting that as markets for food products are characterised by near-perfect competition, one must assume that the tax burden between food producer and consumer does not depend on whether it is the producer or the consumer who is taxed since, on a long term basis, the tax in both cases is likely to end at the consumer. This implies that the modelling framework used in this paper is a tax on consumer level based on the average emission coefficient for the particular food in question in CO_2 equivalents per kg and the social cost of CO_2 emissions.

Data

To predict the assumed tax induced changes in food consumption, GHG emissions as well as consumption of health related nutrients such as saturated fat and sugar a number of different

[1] On a global scale it is assumed that mitigation technologies could reduce emission per unit of animal product by up to 20% at a reasonable cost, and that reductions above that level are unreasonably expensive (DeAngelo et al., 2006).