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Adjusting VAT rates to promote healthier diets in Norway: A censored quantile regression approach

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ABSTRACT

The effects of health-related taxes and subsidies on food and beverages have mainly been investigated using models that assume identical price responses among high- and low-consuming households. Diet-related health problems are, however, more likely among households with high intakes of unhealthy foods or low intakes of healthy foods than in households with average intakes. In this article, we focus on purchases of healthy and unhealthy foods among low-, median-, and high-purchasing households. The effects of an increase in the Norwegian value-added tax (VAT) on some unhealthy foods and a removal of the VAT on some healthy foods are investigated. Using censored quantile regressions, we reject equality of the own-price elasticities for eight of nine food and beverage groups. We find that a VAT increase is more effective in reducing purchases of unhealthy foods among high-purchasing households than a VAT removal is in increasing the purchases of healthy foods among low-purchasing households.

Introduction

Norwegian obesity rates are on par with those of the other Nordic countries, and approximately 15–20% of Norwegians aged 40–45 are obese (Folkehelseinstituttet, 2010).[1] Obesity leads to increased risk of diseases such as coronary heart disease, type 2 diabetes, and cancer (National Task Force on the Prevention and Treatment of Obesity, 2000). The costs associated with obesity have been estimated to be 0.5–1% of the gross domestic product (Departementene, 2007: 9), and most of those costs are paid publicly. These public costs may justify market interventions such as taxes on unhealthy foods and subsidies for healthy foods.[2] Food taxes and subsidies may also be motivated by people's self-control problems, as discussed by O'Donoghue and Rabin (2006). They argue that food taxes may help people who currently consume large quantities of food without considering the future health costs of such consumption. Furthermore, some studies suggest that certain foods that are high in sugar or fat content could be addictive for some people (e.g., Gearhardt et al., 2009). Some individuals also lack sufficient knowledge about the health effects of their diets (e.g., Cash and Lacanilao, 2007), and taxes and subsidies may provide incentives for dietary changes among such groups, including children and young people.

The effects of health-related food taxes and subsidies have been investigated in controlled experiments, natural experiments, and simulation exercises based on models. Systematic reviews of some of these studies are provided by Thow et al. (2010) and Mytton et al. (2012). As discussed in Mytton et al. (2012), significant effects have been found in controlled experiments; however, the validity of these results outside the controlled environment may be questioned. Natural experiments provide a higher degree of external validity; however, according to Mytton et al. (2012), there are few studies involving such experiments. They refer to two studies that find small effects of low taxes on the prevalence of obesity and one study that found an 11% decrease in the consumption of soft drinks for each 10% increase in the price. Most studies have been based on simulations of economic models, and the reported effects on consumption and obesity are mixed, suggesting that the effects are likely to be product- as well as country-specific. Several studies report small effects of taxes (e.g., Chouinard et al., 2007; Miljkovic et al., 2008; Powell and Han, 2011) and subsidies (e.g., Nordström and Thunström, 2009) on consumption of different foods and beverages or on body weight. Other studies report larger effects of taxes, especially on sugar-sweetened beverages. For example, Zhen et al. (2011) found substantial reductions in store purchases, while Dharmasena and Capps (2011) found that a 20% tax on

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[1] An adult with a body mass index (BMI) between 25 and 29.9 is considered to be overweight; an adult with a BMI of 30 or higher is considered to be obese.

[2] The average household is likely to over-consume nutrients such as sugar and fats. We refer to energy-dense food and beverage groups with little nutritional value as unhealthy foods. However, it should be noted that for households who consume small quantities of these foods, an increased intake is not considered to be unhealthy.

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sugar-sweetened beverages would reduce the US average body weight by between 1.5 and 2.6 lb per year.

The risks of obesity and diet-related diseases are likely to be higher among households with high intakes of unhealthy foods or low intakes of healthy foods, and the distribution of consumption among households is therefore important. The simulation studies discussed above estimated conditional mean effects of price changes on purchases or obesity. The effects may, however, be different among households with high and low intakes of a food group, and estimation of the conditional mean effect may be insufficient for determination of targeted price interventions. For example, a price reduction for vegetables may increase the consumption of vegetables substantially among households who already consume a large quantity of vegetables, while the effect on the consumption of vegetables among low-consuming households may be small. A model that predicts the conditional mean effect would, however, predict a small average increase for all households.

Our objective is to investigate the effects of taxes and subsidies on purchases in different parts of the purchase distributions of different groups of food. Quantile regressions have previously been used to study distributional issues in food consumption (e.g., Auld and Powell, 2009). In our sample, many households did not purchase some food groups, and the data are censored, so we estimate censored quantile regressions (CQR). CQR have been used to investigate the effects of income changes on expenditures on fruits and vegetables in the US (Stewart et al., 2003). Furthermore, the effects of a subsidy on purchases of vegetables (Gustavsen and Rickertsen, 2006), the effects of a tax on purchases of ice cream (Gustavsen et al., 2008), and the effects of a tax on sugar-sweetened carbonated soft drinks (Gustavsen and Rickertsen, 2011) in Norway have been estimated. This work is an extension of these Norwegian studies. However, in the previous studies, no statistical tests for different price and expenditure elasticities among high- and low-purchasing households were conducted. We demonstrate through a bootstrapping test that the elasticities differ across the quantiles. Furthermore, we include six new food and beverage groups: milk, juice, candy, fruits, meat, and fish. We also use one algorithm, identical quantile points, and an updated sample.

We follow the method used in our previous studies and implement the taxes and subsidies through changes in the value-added tax (VAT). This type of change is well adjusted to the current VAT regime that operates with a reduced VAT for food and beverages, compared with most other products. We investigate the effects of increasing the current VAT rate, from 14% to 25%, for some groups of energy-dense foods and beverages with little nutritional value, removing the VAT for some healthy food groups, and maintaining the current rate for the remaining food groups.

Food groups and data

The main goals of the Norwegian Government's Action Plan on Nutrition 2007–2011 are the following: (a) to change people's diets, in line with recommendations of the health authorities and (b) to reduce social inequalities in diet (Departementene, 2007). The Action Plan has defined general and quantitative goals for dietary changes. According to these goals, the average consumption of fruits, vegetables, whole grain bread, fish, and seafood should be increased, and the average consumption of saturated fats, sugar, and salt should be reduced. Some distributional targets concerning consumption are also specified. The distributional targets aim to increase the number of people who consume vegetables and fruits daily and who consume fish weekly by 20%. The number of children who consume sweets and candies daily and the number of people who consume sugar-sweetened soft drinks daily should also be reduced by 20%.

Table 1
Distribution of annual per capita purchases.

	Positive purchases[a]	Quantile			Mean	Trend[b]
		0.25	0.50	0.75		
Milk (l)	97	61	104	156	115	−4.2
CSD (l)	79	7	37	78	56	2.0
Juices (l)	73	0	20	43	32	1.1
Candy (kg)	83	1	4	9	7	0.2
Ice cream (kg)	52	0	0	7	5	0.0
Fruits (kg)	89	13	31	56	42	0.2
Vegetables (kg)	93	14	29	50	38	0.6
Meat (kg)	97	19	34	57	47	0.1
Fish (kg)	84	3	10	22	19	−0.3

[a] Percentage of households with positive purchases in survey period.
[b] Trend is a regression coefficient in a linear regression, with the mean purchases in each year as the dependent variable and the year as the independent variable.

To investigate the effects on purchases of a tax on energy-dense foods with little nutritional value, we increase the VAT rate for carbonated soft drinks (CSD), candy, and ice cream to 25% in our simulation.[3] To investigate the effects of a subsidy on purchases of fruits, vegetables, and fish, we remove the VAT for these groups. In addition, milk, fruit juices, and meat are included in the analysis. However, the health effects of these food groups are mixed, and we maintain their present VAT rate. Although whole milk is high in saturated fat, it is a good source of high-quality protein, calcium, and essential micronutrients and is recommended for small children, while low-fat milk is recommended for adults. Meat is also a heterogeneous group. Certain cuts of red meat are high in saturated fat, but other cuts, as well as poultry, are low in fat. In addition, meat contains healthy proteins and other important nutrients. Finally, fruit juices provide most of the nutrients of their natural sources, but have high energy contents.[4]

The data used are from the consumer expenditure surveys of Statistics Norway from 1986 to 2005 and are described in Statistics Norway (1996). Each year, 2200 persons were selected for participation. The non-response rate varied between 33% and 52%, and our total sample consists of 25,023 cross-sectional observations. The data are described in more detail in Gustavsen et al. (2008).

The distribution of purchases in the sample is shown in Table 1. The table shows the average percentage of households reporting positive purchases of each good during the 2-week survey period; the distribution of per capita purchases, in litres, of milk, CSD, and juices, and, in kilograms, of items from the other food groups; the mean purchases; and trends in purchases.[5] Some goods, such as milk and meat, were purchased by almost all households. However, more than 20% of the households did not purchase CSD or juices, and nearly half did not purchase ice cream. We also note a substantial variation in purchases. For example, the annual per capita purchase of fish was less than 3 kg in 25% of households, 50% of households

[3] The current Norwegian VAT system has four rates. The VAT is 25% for most goods and services, 14% for food and beverages (it was increased to 15% on January 1, 2012), 8% for some services, and zero for some products such as books.

[4] Most of the CSD group consists of sugar-sweetened CSD, and we treat CSD as one beverage group because the data only distinguish between sugar-sweetened CSD and sugar-free CSD after 1989. In our sample, sugar-sweetened CSD purchases vary between 82% and 91% of total CSD purchases. In addition, it is not obvious that sugar-sweetened CSD and diet CSD are substitutes. Zhen et al. (2011: 187), rather surprisingly, report a complementary relationship. Furthermore, milk is treated as one group because of high censoring of some milk types such as non-fat milk, which only 23% of the households purchased in some of the years. The juices group also includes mineral water and light beer. Fats and oils are not included as a specific group in the analysis because most fats and oils are consumed as a part of other products such as meat and milk that also contain healthy components. Some types of fats are also healthier than other types of fats.

[5] In our household expenditure survey data, the per capita purchases of each household are multiplied by 26 to approximate annual per capita consumption.