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Candidate session number

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Examination session (May or November)

MAY

Year

2013

Diploma Programme subject in which this extended essay is registered: ECONOMICS

(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)

Title of the extended essay: To what extent would the imposition
of a 10% fat tax reduce health care costs
in Britain?

Candidate's declaration

This declaration must be signed by the candidate; otherwise a grade may not be issued.

The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

I have acknowledged each use of the words, graphics or ideas of another person, whether written, oral or visual.

I am aware that the word limit for all extended essays is 4000 words and that examiners are not required to read beyond this limit.

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I very much doubt that many other students have put as much thought, time and effort into their extended essay as she has done.

She has tried to incorporate her maths skills into the various calculations + ideas, on the whole successfully.

Her real strength was her appreciation of her own limitations in terms of what she could actually prove. This reflection on their own work is generally rare so I was much impressed by her evaluative response to her research.

An excellent essay, in my opinion.

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I have read the final version of the extended essay that will be submitted to the examiner.

To the best of my knowledge, the extended essay is the authentic work of the candidate.

I spent

| |
|---|
| 3 |
|---|

 hours with the candidate discussing the progress of the extended essay.

Supervisor's signature:

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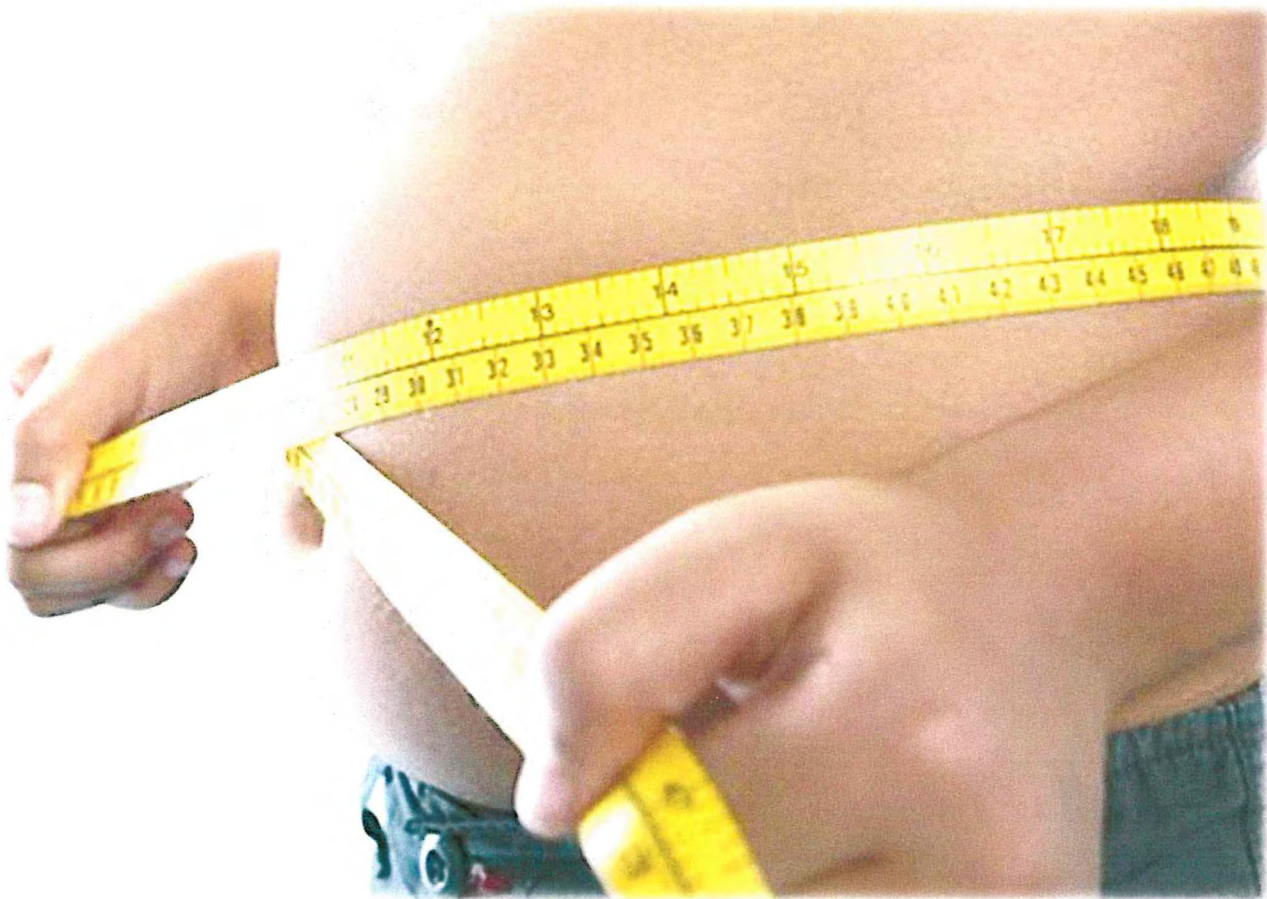
Assessment form (for examiner use only)

Achievement level

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To what extent would the imposition of a 10% fat tax reduce health care costs in Britain?

– Extended Essay in Economics HL



For Examination Session in May 2013

Word count: 3999

Candidate Number:

Centre Number:

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Abstract

For my extended essay, I chose to investigate health care cost changes of the NHS in Britain upon a 10% fat tax on all saturated fat products. Thus my research question is **“To what extent would the imposition of a 10% fat tax reduce health care costs in Britain?”**. A 4.5% reduction in the fatty food consumption was found by analysing (i) consumption changes in the fatty food market, identifying inelastic demand with a PED-value of $(-)0.56$, and (ii) firms’ strategic behaviour upon a 10% fat tax, determining incomplete pass-through of 81% in this oligopolistic market. Hence, the market failure of health care costs due to excessive saturated fat consumption 20% above the social optimum is only partially corrected. It was then found that obesity rates would decrease between a range of 0% and 1.75% upon a 4.5% reduction in saturated fat consumption to 26.00%-24.25% for adults and 16.00%-14.25% for children. As a result, obesity-related annual health care costs would decrease by the same range to £5.10bn and £5.01bn, *ceteris paribus*. All other NHS costs kept equal, my research findings show that a 10% fat tax leads to an annual reduction in total costs of the NHS of 0%-0.085%, the maximum cost reduction possible being £90m, which brings total costs from £106bn to £105.91bn. Hence, my hypothesis of a 20% reduction in total NHS costs was not fully supported and I came to the conclusion that **health care costs in Britain would decrease annually by 0% - 0.085% to a range between £106bn (£0 reduction) and £105.91bn (£90m reduction)**. Finally, the essay could be improved using data from Denmark and Hungary, where a fat tax/junk-food tax has been recently imposed as well as considering the cost balance between reduced obesity-related health care costs and longer life expectancy in the long-term.

Word count: 300 words

Introduction

Britain is the fattest nation in Europe.ⁱ Obesity¹ has significantly risen in the past two decades with just over a quarter of adults² (26%) and 16% of children³ being classified as obese in Britain in 2010.ⁱⁱ According to the NHS, the national health system in Britain, 30,000 people die prematurely every year due to obesity-related health conditions and hospital admissions caused by obesity have risen by more than 30% from 2010 to 2011.ⁱⁱⁱ Obesity is a long-term concern and if trends continue at the current rate, 55% of adults could be obese by 2050.^{iv}

Economists often believe that the free market allocates scarce resources efficiently, as consumers themselves are best suited to make decisions of the quantity and type of food consumption, i.e. trade off costs and benefits, which maximises their private utility. However, fatty food markets fail to deliver the social optimal outcome as consumers make suboptimal choices due to two reasons:

1. Asymmetric information
2. Externalities

These two types of market failure create an inefficient outcome and have led to Britons consuming 20% more saturated fat than the official Government recommended amount, according to the Food Standards Agency (FSA). Excessive amounts of saturated fat raise obesity rates and obesity-related illnesses such as cholesterol in the blood and the likelihood of developing heart diseases.

A recent analysis estimates that obesity costs account for £5.1 billion per year of the total NHS costs with a potential increase to £9.7 billion in 2050 if no intervention by the government into the fatty food market is considered.^v Since the NHS is funded from tax revenues raised by the government, the entire British society would have to bear the burden of increasing obesity.

In this case, social welfare may be improved by government intervention into the fatty food market. One policy option would be the imposition of a 10% tax on saturated fat, where the more saturated fat a product contains, the more it would be taxed. This follows the examples of Denmark's introduction of a specific *fat tax* in October last year^{vi} and Hungary's *junk-food tax* imposed in September last year^{vii}.

¹ The most common method of measuring obesity is the Body Mass Index (BMI). BMI is calculated by dividing a person's weight measurement (in kilograms) by the square of their height (in metres). In adults, a BMI of 25 to 29.9 means that person is considered to be overweight, and a BMI of 30 or above means that person is considered to be obese. *Source: The NHS Information Centre, Health Survey for England 2010, December 2011*

² Men and Women aged 16 or over

³ Boys and Girls aged 2-15

The idea relies on the assumption that price is an important determinant of food choices and diet. Hence, an increase in the relative price of fatty food will in theory encourage consumers to decrease their fatty food consumption and switch to healthier substitutes. This would decrease obesity rates and reduce the cost burden of obesity-related illnesses on the health services, improving social welfare in the long-term and thereby correcting, to some extent, both market failures.

However, the effectiveness of such a fat tax depends mainly on two factors:

1. Consumers' consumption behaviour to price changes of fatty food (price elasticity of demand)
2. Firms' response to both prices and saturated fat content of their fatty products (pass-through of tax)

Using these two factors, I therefore seek to consider the effectiveness of a fat tax as a government policy to counteract the market failures, reduce obesity and thereby decrease health care costs in Britain, which would promote social welfare.

My research question can thus be stated as the following:

"To what extent would the imposition of a 10% fat tax reduce health care costs in Britain?"

This topic is of great relevance, as the British government is currently considering policy options to address the rising obesity rates and its consequences on public health and social welfare. Assessing the effectiveness of a fat tax as a policy option is therefore central to the government's decision of which policy, if any, to introduce to tackle the long-term effects of obesity.

Economic Theory 1.1: Asymmetric Information and Externalities

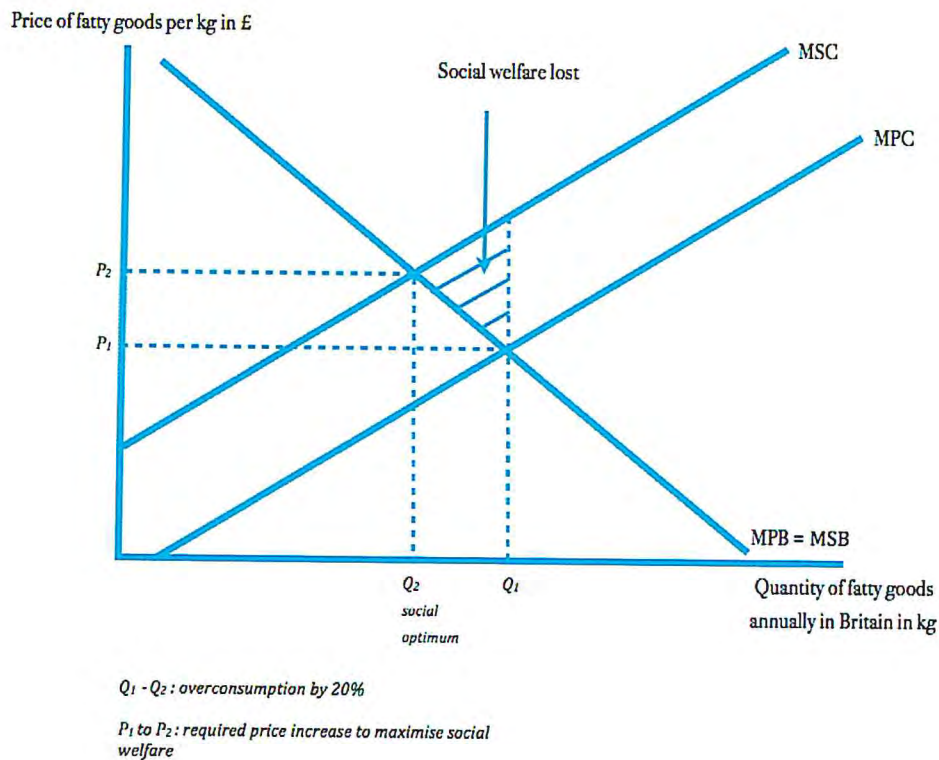
Currently, the fatty food market as a free exchange market, where firms and consumers interact without government interference, leads to an inefficient allocation of resources. The pricing mechanism has failed to deliver the social optimum, defined by the NHS as a maximum of 30g of saturated fat daily for men and a maximum of 20g daily for women.^{viii} Hence, the market for fatty food represents a market failure, as fatty goods are over-consumed by the market mechanism, i.e. they are demerit goods.^{ix} The two causes for the market failure are:

1. Asymmetric information and cognitive failure
2. Externalities

Consumers make suboptimal choices, as they may not be fully informed about the amount of saturated fat present in products and the negative long-term health effects of excessive saturated fat intake. Consumers, especially children, may also be unable or unwilling to process nutritional information. Also, consumers might not be able to weigh the short-term benefits of fatty food consumption against the future costs, such as negative health consequences. Thereby, consumers impose a future externality on themselves.

It has to be noted that the impact of a 10% fat tax to correct the market failure of asymmetric information cannot be numerically determined from existing data and is therefore beyond the scope of this paper.

Fatty goods represent a negative externality of consumption, where $MSC > MPC$, as consumers do not take into account external costs, such as decreasing productivity and increasing health care costs caused by obesity.

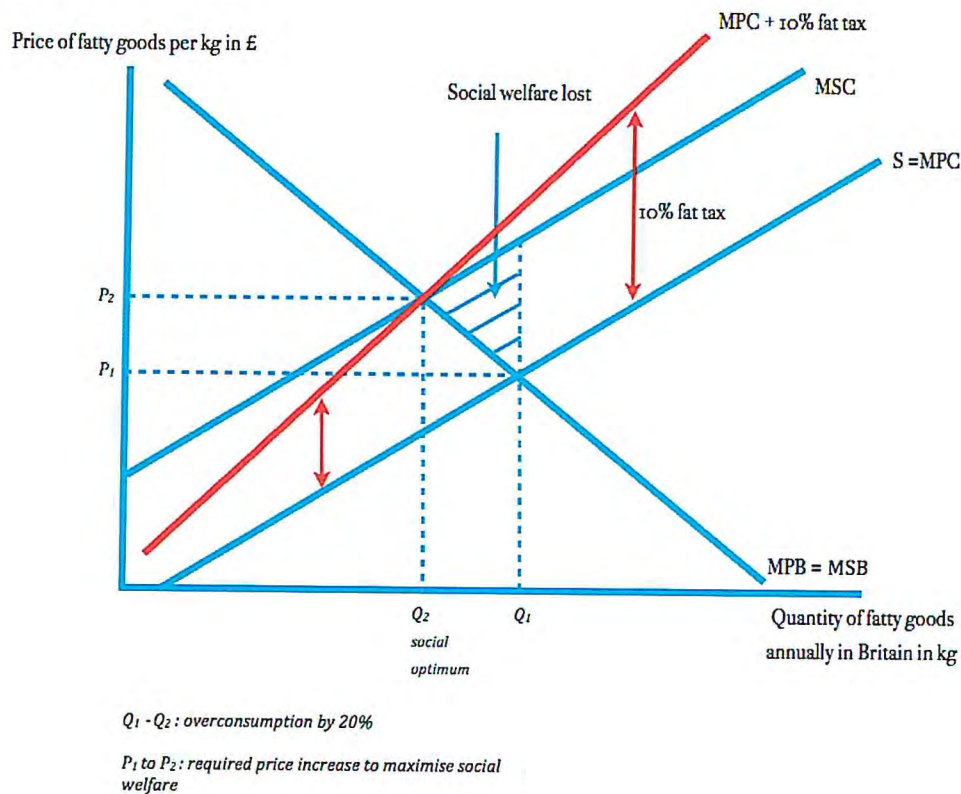


Currently, the free market equilibrium of fatty goods is at the average market price of P_1 , where Q_1 amounts of fatty goods in kg are consumed annually in Britain. This is determined by the market mechanism, where consumers maximise private utility and firms maximise profits, i.e. where $MPC=MPB$.

As the consumption of fatty goods imposes an external cost on society, the consumption exceeds the social optimum, Q_2 , by 20%. The overconsumption of $Q_1 - Q_2$ kg of fatty goods causes a loss in social welfare due to the misallocation of resources from society's view. According to the law of demand, the social optimum is only reached when the average market price of fatty goods increases from P_1 to P_2 .

Economic Theory 1.2: Effect of Government Intervention of a 10% Fat Tax on Externalities

One policy option is the imposition of an Ad Valorem 10% fat tax on products containing saturated fat, aiming to increase the market price to P_2 , which would reduce fatty food consumption to the desired social level.



Upon the imposition of a 10% fat tax, the supply curve (MPC) shifts upwards with the wedge widening at higher prices due to the Ad Valorem fat tax. This causes the average market price to increase from P_1 to P_2 , which reduces the consumption of fatty food to Q_2 , where social welfare is maximised. The 10% fat tax would then eliminate the market failure arisen due to the external costs of fatty food consumption.

Economic Theory 1.3: Price Elasticity of Demand for Fatty Food

The outcome of the socially efficient fatty food consumption assumes that a 10% fat tax reduces the fatty food consumption by 20% to the social optimum. Thus, the price elasticity of demand, the measure of the responsiveness of demand to a change in price^x, would be:

$$PED = -20\% \div 10\% = (-) 2$$

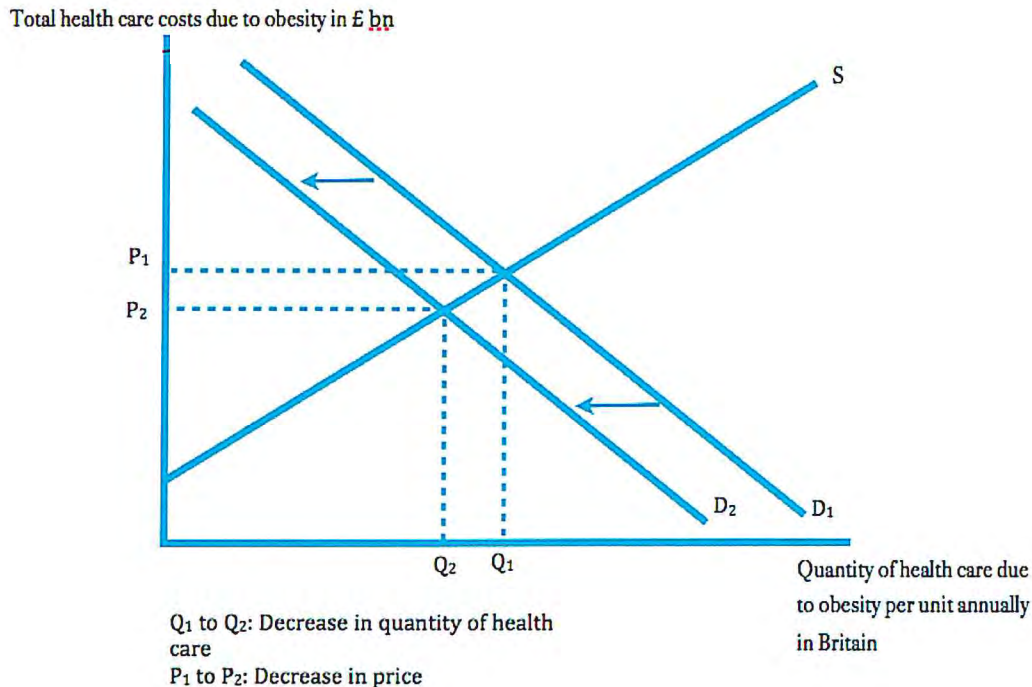
The hypothesis assumes that the demand for fatty food is elastic, i.e. an increase in price leads to a proportionally greater decrease in the quantity of fatty food demanded.

Economic Theory 1.4: Firms' Behaviour (Pass-Through of a 10% Fat Tax)

The hypothesis also assumes that firms in the market of fatty food will pass 100% of the fat tax onto consumers, i.e. pass-through is complete. Hence, the price of fatty goods rises by 10% for all products. Pass-through is defined as the scope of a firm to choose how to change their prices in response to a tax.^{xi}

Economic Theory 1.5: Effect of Government Intervention of a 10% Fat Tax on Health Care Costs in Britain

Ceteris paribus, a 20% reduced average saturated fat intake decreases obesity rates. If less people are obese, there will be a reduction in the obesity-related illnesses, which decreases the demand for health care. This then causes a decline in the total costs for the NHS, ceteris paribus.



The current market equilibrium of obesity-related health care in Britain lies at an annual quantity of Q₁ with a total cost for the NHS of P₁ (£ 5.1bn^{xii}). Upon the government imposition of a 10% fat tax, there will be an inward shift of the demand for obesity-related health care from D₁ to D₂ due to the decline in obesity-triggered diseases. As a result, the quantity of obesity-related health care will fall to Q₂ and the total obesity-related cost for the NHS will decrease by 20% to P₂ (£ 4.08 bn⁴).

Economic Theory 1.6: Economic Hypothesis

Economic theory therefore predicts that the government intervention of a 10% fat tax into the market of fatty food corrects the market failure and reduces saturated fat consumption by 20% to the social optimum. The theory also predicts that the price elasticity of demand is (-)2 and firms' pass-through 100%. This leads to reduced obesity and obesity-related health care costs will decrease proportionally to the reduction in fatty food consumption, by 20%, to £ 4.08 bn.

⁴ 20% decline: £ 5.1bn × 0.8 = £ 4.08bn

Research Methodology

To test the above stated hypothesis, research of the different components that have to be considered for the research question to be answered, has to be completed. For this, a particular research method was designed:

1. Firstly, current saturated fat consumption levels, obesity rates, obesity-related health care costs and health care costs in Britain are researched, using the NHS and newspapers.
2. Then, the consumption behaviour of saturated fat intakes with a 10% fat tax is assessed, collecting available data from Denmark's fat tax and Hungary's junk-food tax. However, despite extensive research⁵, I was unable to obtain any relevant data about Denmark or Hungary, as the impacts in both countries are only considered yearly, and will firstly become available at the beginning of 2013.
3. To determine the price elasticity of demand of fatty food and firms' behaviour of prices and saturated fat content in Britain, I am examining models and academic work on a hypothetical fat tax, primarily from the Institute of Fiscal Studies and the Department of Public Health.
4. To determine any unavailable data, I am conducting a questionnaire with a sample of 20 people on their consumption behaviour of fatty food with a 10% fat tax.
5. The relationships between saturated fat consumption and obesity rates, and obesity rates and health care costs are determined by interviewing professors and researchers working in this specific field.
6. To consider any limitations of my research findings, interviews with relevant researchers are used. Regarding income, age and geographical consequences, only income differences will be assessed using governmental reports.

⁵ Appendix 1

Research Findings

To evaluate the effectiveness of a 10% fat tax to reduce health care costs in Britain, there are intermediate components that have to be considered, which are listed below:



Research Findings 1.1: Saturated Fat Consumption

The success of a 10% fat tax to reduce the excessive saturated fat consumption depends mainly on two factors:

1. Price elasticity of demand
2. Nature of competition of market and adjustment of market prices

Research findings 1.11: Price elasticity of demand

Data from the British Heart Foundation suggests that fatty food consumption is relatively insensitive to price changes^{xiii}, which means that a 10% price increase of fatty goods leads to a proportionally smaller percentage decrease in the consumption of fatty food. Blundell, Pashardes and Weber estimate that the average elasticity of demand of fatty food for the UK is (-)0.56.^{xiv} However, there is also data of different price elasticity values e.g. -(1)^{xv}, which suggests that (-) 0.56 might only be an approximation and the price elasticity of demand is likely to change constantly according to the performance of the economy and people's income. In fact, a research experiment has shown that fatty food is an inferior good and hence if consumers have less disposable income their amount of saturated fat intake increases, as fatty food is generally cheaper than healthier substitutes suggesting that consumers are more price-sensitive.^{xvi}

Considering a **price elasticity of demand value of (-)0.56 on average**, a 10% fat tax would lead to a **5.6% reduction in the consumption of saturated fat**.⁶ However, products high in saturated fat, e.g. butter, can be substituted with products low in saturated fat, e.g. margarine, as price increases will be smaller for these products. Hence, the reduction of fatty food consumption is likely to be less than 5.6%. Demand for high saturated fat products with close substitutes is elastic, (-)2.443^{xvii} due to a substitution effect from high saturated fat products to low saturated fat products instead of switching to healthy options.

⁶ $10\% \times (-)0.56 = -5.6\%$

Research findings 1.12: Firms' behaviour (pass-through of fat tax)

The impact of a fat tax to reduce saturated fat consumption also depends on how firms pass the tax onto consumer prices. According to the University of Warwick, the fatty food market is an oligopolistic market^{xviii} with differentiated products. This means that firms enjoy some market power, which could cause taxes to be either under- or over- shifted^{lxix}.

Assuming that firms are profit-maximisers, oligopolistic firms may increase prices by less than the tax, i.e. pass-through is incomplete, which would reduce demand by a smaller amount than with complete pass-through and hence cause a smaller decrease in profits. In this case, relative prices of fatty food would increase by a smaller amount than the 10% fat tax. As a result, there would be a smaller incentive for consumers to switch to healthier substitutes.

A study considering the model of symmetric differentiated demand and Bertrand competition has shown that **pass-through would be 81%** with an Ad Valorem tax on fatty goods.^{xx}

Effect of 81% pass-through of tax on firm and consumer:

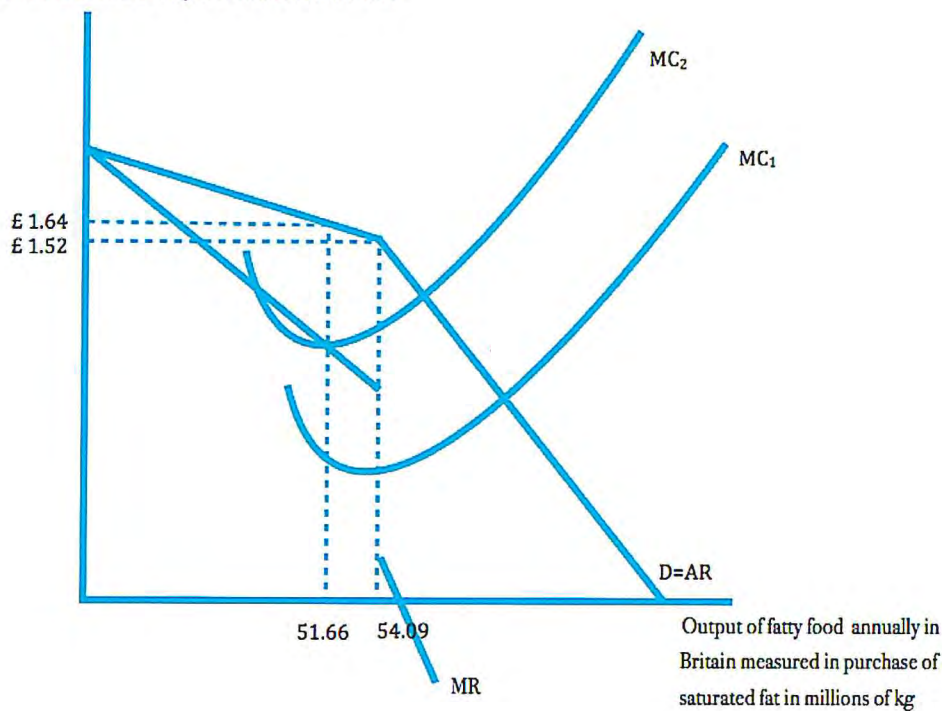
| | Firm | Consumer |
|--|---------------------------------|---|
| 81% pass through of 10% fat tax | - 14.68% profits ^{xxi} | -4.5% reduction in saturated fat consumption ⁷ |

The change upon a 10% fat tax on firms and consumers can be visualised using the kinked-demand curve model in oligopolistic competition:

⁷ Step 1: $10\% \times 0.81 = 8.1\%$

Step 2: $8.1\% \times (-)0.56 = -4.5\%$

Costs/Revenues/Profits of fatty food firms in Britain in £



8

The data of the current average price in the fatty food market was taken from a questionnaire⁹ with a sample of 20 people, as no data from a bigger sample was provided. The current average price was estimated using the formula:

$$\text{Mean price} = \frac{\text{Mean expenditure } \left(\frac{\sum p}{n} \right), \text{ where } p \text{ is the different expenditures collected}}{\text{Mean quantity of consumption of fatty goods } \left(\frac{\sum q}{n} \right), \text{ where } q \text{ is the different quantities collected}}$$

xxii

Given oligopolistic competition, a 10% fat tax would shift the marginal cost curve upwards from MC_1 to MC_2 by 10%, considering *ceteris paribus* and would cause average prices of fatty food to rise by 8.1% to £1.64, where 51 600 000 kg of saturated fat are now purchased (a 4.5% reduction in fatty food consumption).

⁸ Legend:

£ 1.52: Current average price in the market of fatty food

£ 1.64: Average price in the market of fatty food with 10% fat tax and pass-through 81% ($£ 1.52 \times 1.081 = £ 1.64$)

54.09m kg⁸: Current saturated fat purchase annually in Britain

51.66m kg: Saturated fat purchase annually in Britain with 10% fat tax and PED (-)0.56 ($54.09 \times 0.955 = 51.66$)

⁹ Appendix 2; Age Range: 8-64, Income Range: £8,900 - £150,000 Per Month; Geographical Distribution: South-East Britain

This is approximately $\frac{1}{4}$ of the estimated 20% decline in the fatty food consumption and hence a fat tax would only partially correct the market failure.

Due to firms' lost profit by 14.68% on average, firms might reformulate existing fatty products and introduce new products into the market to avoid taxation in the long-term. This change in product portfolio is likely to decrease saturated fat consumption by more than 4.5%, as a decline in the supply of fatty food will increase prices by more than 8.1% in the long-term. On the other hand, along with price rises for fatty food, the price of other goods may rise as well, increasing profits of the suppliers and reducing the desired price differential, which encourages consumers to switch to healthier substitutes. Only the balance of these two effects would give a more precise estimate of fatty food consumption reductions but is however limited due non-existent data.

Research Findings 1.2: Impact on Low-Income Households

Research suggests that a fat tax has distributional consequences^{xxiii} due to two reasons:

1. Low income households spend a greater percentage of their disposable income on food
2. Consumption of fatty food is higher than in middle- or high-income households

1.

The Institute for Fiscal Studies has simulated the introduction of a fat tax to show the effect on different income households.^{xxiv} This shows that a fat tax would be regressive, i.e. poorer people pay a greater proportion of their income than richer people. It was shown that the poorest 2% would spend 0.7% of their total disposable income on the fat tax, whilst the richest 2%¹⁰ would pay less than 0.1% of their total disposable income.¹¹ As some of the fatty goods are necessities, e.g. milk, where demand is nearly perfectly inelastic, increasing the price of these goods would make them less accessible for low-income households. This might result in negative health effects and increase total health care costs for the NHS in the long run.

2.

M. O'Connell¹² estimates that households with lower incomes are most likely to buy excessive quantities of saturated fat.^{xxv,13} As a result, low-income households will bear a greater burden of the fat tax than middle-, or high-income households. Hence, low-income households will be more price-sensitive and might switch to healthier products with smaller price increases than higher income households. This might cause health care gains that are progressive, leading to reduced health care costs especially from low-income households.

¹⁰ Income more than £ 519 per week

¹¹ Appendix 5

¹² Senior research economist at the Institute of Fiscal Studies

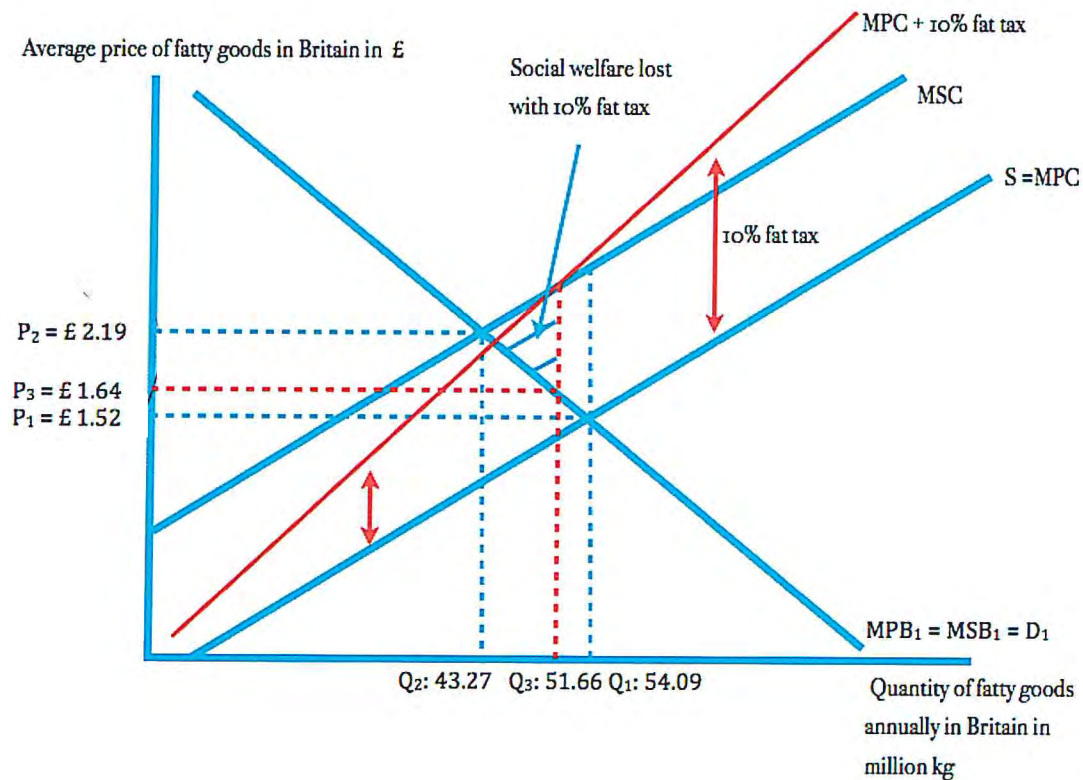
¹³ Appendix 2

However, the overall impact of aspect 1 and 2 on fatty food consumption has to be assessed for a more precise value of the reduction.

Research Findings 1.3: Reductions in Fatty Food Consumption with 10% Fat Tax

Despite all the identified limitations, my best estimate of fatty food consumption in Britain upon a 10% fat tax is a decline by 4.5%, considering firms' and consumers' behaviour. To reduce fatty food consumption by the desired level of 20% however, an average price increase in the market of fatty food of 44.4%¹⁴ is necessary, ceteris paribus.

My best estimate can be visualised using a graph to illustrate the impact of a 10% fat tax to correct the market failure:



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¹⁴ Step 1: $20\% \div x = (-)0.45$ Step 2: $(-)0.45 \times x = 20\%$ Step 3: $x = 44.4\%$

¹⁵ Legend:

P₁ to P₂: Required average price of fatty food to maximise social welfare

P₁ to P₃: Actual price increase with 10% fat tax

Q₁ to Q₂: Required decline of fatty food consumption to maximise social welfare (-20%)

Q₁ to Q₃: Actual decline of fatty food consumption with 10% fat tax (-4.5%)

According to my findings, only 22.5%¹⁶ of the desired elimination of the market failure to the social optimum is corrected.

Research Findings 1.4: Obesity Rates

An interview¹⁷ with Dr Peter Scarborough¹⁸ explains that obesity levels are related to overall calories that are consumed, whether they are from saturated fat products or fruits. He assumes that fat taxes would result in an improved dietary quality, i.e. lower saturated fat intakes, but no reduced calorie intake due to calorie-containing substitutes. According to Dr Scarborough then, a fat tax would not reduce obesity levels. In contrast to this, US models predict that a 20% fat tax would reduce obesity rates by 3.5%^{xxvi}, as consumers would reduce and not substitute the purchase of saturated fat products, which would result in less calories consumed and a decrease in obesity rates. These two controversial studies suggest that obesity could be reduced between a range of 0%-1.75% upon the introduction of a 10% fat tax, *ceteris paribus*.

| | Obesity rates adults | Obesity rates children |
|------------------|-------------------------------|-------------------------------|
| Currently | 26.00% | 16.00% |
| With 10% fat tax | 26.00% - 24.25% ¹⁹ | 16.00% - 14.25% ²⁰ |

However, obesity rates are also influenced by other factors, such as the level of physical activity and genetic and medical conditions (e.g. Prader-Willi syndrome and Cushing's syndrome).^{xxvii} Changes in these factors also lead to obesity rate changes and should be assessed for more precise estimates.

Research Findings 1.5: Obesity Related Health-Care Costs and Total Costs of the NHS

Total annual costs of the NHS are constantly rising²¹ and are currently at £106 billion annually,^{xxviii} where obesity-related health care costs account for £5.10 billion.^{xxix} Considering a 0%-1.75% decrease in obesity rates upon a 10% fat tax, obesity-related health care costs would be either kept constant at £5.10 billion or maximally decrease to £5.01 billion annually.

| | Obesity-related health care costs (0% reduction) | Obesity related-health care costs (1.75% reduction) |
|------------------|--|---|
| Currently | £5.10 billion | £5.10 billion |
| With 10% fat tax | £5.10 billion | £5.01 billion ²² |

¹⁶ $(4.5\% \div 20\%) \times 100 = 22.5\%$

¹⁷ Appendix 6

¹⁸ Senior Researcher at British Heart Foundation Health Promotion Research Group and Lecturer on the evidence supporting health-related taxes at University of Oxford

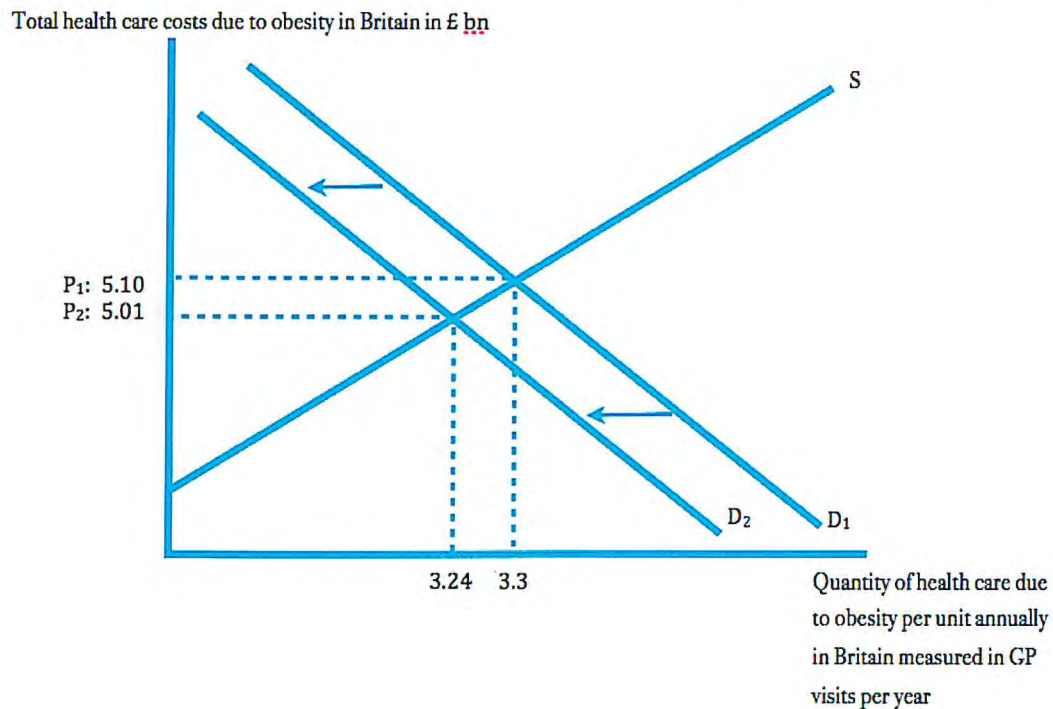
¹⁹ Step 1: $3.5\% \div 2 = 1.75\%$ Step 2: $26.0\% - 1.75\% = 24.25\%$

²⁰ Step 1: $3.5\% \div 2 = 1.75\%$ Step 2: $16.00\% - 1.75\% = 14.25\%$

²¹ Appendix 7

²² Step 1: $100\% - 1.75\% = 98.25\%$ Step 2: $5.1 \times 0.9825 = 5.01075$

The maximum decrease of obesity-related health care costs of 1.75% annually can be shown on a supply and demand graph for obesity-related health care:



23

The data for the quantity of health care used was measured in GP visits per year and taken from the questionnaire.²⁴

Seen in terms of total NHS annual costs, these are kept constant at £106 billion and decrease, by a maximum, to total annual health care costs of £105.91 billion²⁵, i.e. a decrease by £90.0 million,²⁶ ceteris paribus.

It can then be concluded that the total annual costs of the NHS will decrease by a range of 0.000% and 0.085% in the short-term,²⁷ assuming all other health care costs are kept equal.

However, it is questionable, whether health care costs due to reduced obesity levels will decrease in the long-term. As obesity levels decline, consumers will have a higher life expectancy, and older people are more costly to the NHS. Therefore, reduced obesity levels could eventually increase health care costs in

²³ Legend:

D_1 to D_2 : Decrease in health care demand due to 10% fat tax

Q_1 : Health care units currently

Q_2 : Health care units with 10% fat tax

²⁴ Appendix 3/4

²⁵ Step 1: £106 bn - £5.1 bn = £100.9bn

Step 2: £100.9 bn + £5.01 bn = £105.91bn

²⁶ £106 bn - £105.91 bn = £0.09 bn

²⁷ Step 1: $(£105.61 \div £106) \times 100 = 99.915\%$

Step 2: $100\% - 99.915\% = 0.085\%$

Britain in the long run. According to Dr Allender,²⁸ however, decreasing obesity rates might also result in proportional reductions in obesity-related health care costs, as assumed in this paper.

For more precise numerical values of costs in the long-term the balance between the cost reduction due to obesity and the cost increase due to higher life expectancy has to be weighed.

Finally, information about the entry and exit of firms in the fatty food market is needed, as firms are likely to leave the market in the long run due to reduced profits, which creates shortages and thereby increases prices of fatty food even further. This would lead to greater reductions in the fatty food consumption, obesity rates and national health care costs. However, this needs implementation of the fat tax first to assess the market structure changes.

Research Findings 1.6: Government Revenue with 10% Fat Tax

Finally, an Ad Valorem fat tax would also be efficient at raising government revenue.^{xxx} Research undertaken by the ESRC Research Centre has shown that tax revenues would account for £44.11 million annually in Britain.^{xxxi} This has two effects:

1. The negative externality of excessive fatty food consumption would partly be internalised, i.e. consumers pay for their own health care costs.
2. The tax revenues can be redistributed in the form of subsidies to promote healthy food consumption and advertisement campaigns. This might then further decrease fatty food consumption and reduce health care costs in the long run.

Research Findings 1.7: Further Possible Disadvantages of a 10% Fat Tax

A fat tax is likely to damage the industry of fatty food, which leads to job losses and more unemployment in the British economy. This goes against the macroeconomic policy goals of Britain. Furthermore, taxing one nutrient (saturated fat) might increase the consumption of other nutrients such as salt and fibre and thereby inducing negative health effects and increased costs on the NHS. Lastly then, the Ministry of Health in Denmark²⁹ further suggested that the administrative costs of the introduction of a fat tax and the collection of government revenues are high and impose an opportunity cost in terms of subsidies on healthier food. The considerations of these effects, however, go beyond the scope of this paper.

²⁸ Senior Researcher at the British Heart Foundation Health Promotion Research Group

²⁹ Appendix 1

Conclusion

The research findings suggest that the free-market view, where consumers maximise their private utility, leads to an inefficient outcome due to a socially excessive consumption of saturated fat. It was identified that government intervention into the market of fatty food is needed to correct the market failure and improve social welfare.

Data reveals that the imposition of a 10% fat tax as a government policy would lead to a reduction in the fatty food consumption by 4.5% due to consumers' inelastic demand of (-)0.56 and firms' incomplete pass-through of 81% in an oligopolistic market. As a result, obesity rates would decrease by a range of 0%-1.75%, as they are influenced by total calorie intake, where saturated fat consumption is only one determining factor. Related to health care, this would, in turn, lead to a decline in obesity-related health care costs by 0%-1.75% to £5.1bn - £5.01bn. Finally, total health care costs would minimally stay constant at £106bn (0% reduction) and maximally decrease to £105.91bn (0.085% reduction) annually in Britain, ceteris paribus.

The intermediate components considered in this paper can now be numerically presented:



Upon these effects, the market failure identified from obesity-related external health care costs would only be corrected by approximately $\frac{1}{4}$ (22.5%) of the desired decrease of consumption by 20% to the social optimum. Therefore, improvements in social welfare are small and the burden on British taxpayers is reduced by an even smaller amount with a 10% fat tax, ceteris paribus. It then becomes evident that a 10% fat tax as a government policy to tackle obesity and reduce health care costs is ineffective at reaching its desired outcome.

My research question, ***To what extent would the imposition of a 10% fat tax reduce health care costs in Britain?***, can now be numerically answered with a range of £0 - 90m, where total annual health care costs in Britain would minimally stay constant at £106 billion (0% reduction) and maximally decrease to £105.91 billion (0.085% reduction), ceteris paribus.

However, there are considerable limitations of my research findings, which significantly reduce the accountability of my results:

1. My findings do not account for substitution effects from high saturated fat products to low saturated fat products and firms' portfolio changes, which might diminish the estimated reduction in health care costs.
2. The relationship between fatty food consumption and obesity rates is controversial and only a range between the two extreme studies was considered.
3. The price elasticity of demand, firms' pass-through of the tax and my questionnaire are only estimates taken from a sample and might therefore not precisely represent actual changes upon a 10% fat tax.
4. The effect of a 10% fat tax to correct the market failure of asymmetric information was not assessed.

These limitations exceed this study and should be examined in further research.

To make more precise estimates of health care cost impacts with the imposition of a 10% fat tax, the behaviour of different income groups and their relative size has to be considered. Furthermore, variable costs of other factors influencing the NHS budget have to be assumed and the balance between reduced obesity rates and higher life expectancy in the long run evaluated.

As a fat tax is likely to be regressive and total health care cost reductions would only decrease by a maximum of £90 million and according to Dr Allender might even increase, other policy options such as advertisement and provision of dietary information, subsidising healthy food, promoting physical activity and a specific tax must be considered. In future research therefore, I would like to also explore the effectiveness of other policy options, as only the comparison of their effectiveness will reveal which policy option could most efficiently cure the British love for saturated fat.

Appendices

Appendix 1:

Mail to Institute of Food Research:

-----Original Message-----

From:

Sent: 30 August 2012 15:40

To: NBI Communications (NBI)

Subject: Information for Research Paper

Dear Sir or Madam,

my name is _____ and I am a current student at _____ in my final year of the IB Diploma. I am momentarily completing my extended essay, a 4000 words long research paper, with the title: "To what extent does the imposition of a 10% fat tax reduce health care costs in Britain?"

I would be extremely grateful if you could provide me with some information about my extended essay. I am especially interested in information about the development of the fast food intake of adults and teenagers, as well as the average price of fatty food meals in the UK. It would also be great to be provided with information about the amount of fast food consumed in Britain and its effects on obesity.

I would be extremely delighted if you could provide me with some information. Thank you very much in advance and looking forward hearing from you.

Sincerely,

Mail to Danish Health and Medicines Authority:

-----Original Message-----

From:

Sent: 29 August 2012 14:31

To: sst@sst.dk

Subject: Information for Research Paper

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Denmark and then reflect it onto Britain.

Thank you.
Sincerely,

-----Original Message-----

Dear

It is great that you have shown an interest in such a topic. Unfortunately, the numerical impact of our fat tax comes out beginning of 2013. But there are still a number of things that play a role and which might be useful for your research. My personal opinion is that I haven't noticed a particular impact on consumption of the products with our fat tax. But the administrative costs of actually imposing the fat tax and then collecting the money from all our domestic producers is very difficult and the government and ministry of health has spend millions on this. But even more important, we have seen a trend in consumers simply buying products from Schleswig-Holstein. This is damaging for the Danish economy and we are currently considering to cancel the fat tax again.

I am sorry for not providing you with further data. I hope this helps.
Kind regards,
Marita Hoydal

Mail to Danish Agriculture and Food Council in Denmark:

-----Original Message-----

From:
Sent: 5 September 2012 10:12
To: info@lf.dk
Subject: Information for Research Paper

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be

incredibly helpful for my research, as I could use the data from Denmark and then reflect it onto Britain.

Thank you.
Sincerely,

Mail to Frank Juul Agerholm at Department of Education in Denmark:

-----Original Message-----

From:
Sent: 30 August 2012 12:47
To: frag@dpu.dk
Subject: Information for Research Paper

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I have recently come across your paper about the imposition of a fat tax in Denmark. I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Denmark and then reflect it onto Britain.

Thank you.
Sincerely,

Mail to Association of Danish Margarine Manufacturers and Importers in Denmark:

-----Original Message-----

From:
Sent: 30 August 2012 13:04
To: info@mifu.dk
Subject: Fat tax in Denmark

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I have recently come across your paper about the imposition of a fat tax in Denmark. I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Denmark and then reflect it onto Britain.

Thank you.
Sincerely,

Mail to Ministry of Health in Hungary No.1:

-----Original Message-----

From:
Sent: 30 August 2012 13:18
To: szerkeszto@eum.gov.hu
Subject: Junk food tax in Hungary

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Hungary and then reflect it onto Britain.

Thank you.
Sincerely,

Mail to Ministry of Health in Hungary No.2:

-----Original Message-----

From:
Sent: 30 August 2012 13:22
To: egeszsegugy@nefmi.gov.hu
Subject: Junk food tax in Hungary

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper

with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Hungary and then reflect it onto Britain.

Thank you.
Sincerely,

Mail to Corvinus University of Budapest (CUB), Faculty of Food in Hungary:

-----Original Message-----

From:
Sent: 16 October 2012 19:25
To: vil@life.ku.dk
Subject: Junk food tax in Hungary

To whom it may concern,

my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Hungary and then reflect it onto Britain.

Thank you.
Sincerely,

Mail to University of West Hungary: Faculty of Agricultural and Food Sciences in Hungary:

-----Original Message-----

From:
Sent: 16 October 2012 19:29
To: rectoro@nyme.hu
Subject: Junk food tax in Hungary

To whom it may concern,

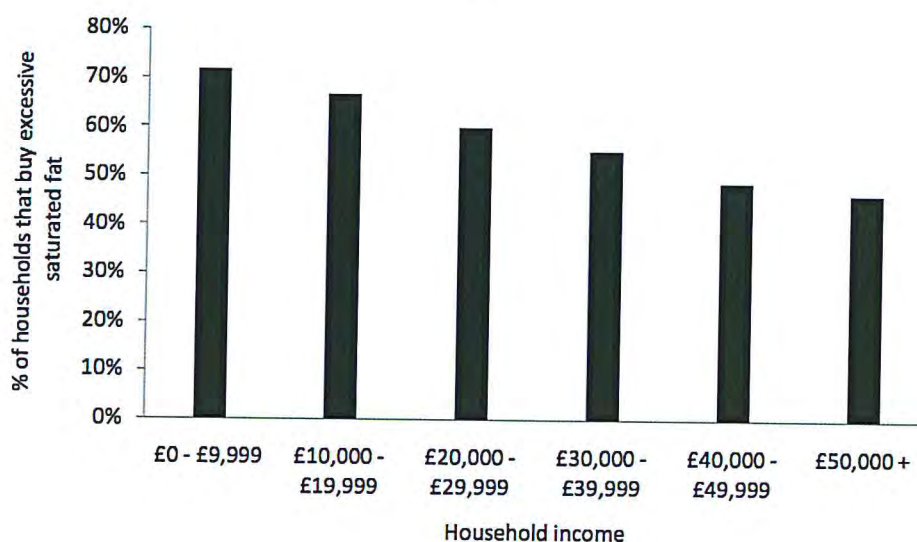
my name is _____ and I am a student at _____ currently undergoing my final year of the IB. I am momentarily writing a research paper with the title "To what extent would the imposition of a 10% fat tax reduce health care costs in Britain".

I would be extremely grateful if you could provide me with some information about the imposition of the specific tax in Denmark and its effect on the consumption behaviour of consumers and the changes in prices. This would be incredibly helpful for my research, as I could use the data from Hungary and then reflect it onto Britain.

Thank you.
Sincerely,

Appendix 2:

Low income households are most likely to buy too much saturated fat



Source: IFS Briefing Note

Appendix 3:

Extended Essay: To what extent would the imposition of a 10% fat tax reduce health care costs in Britain?

Year 2012/2013

Please note that all information given is anonymous and will only be used for evaluation purposes of the above named extended essay.

Please note that a fat tax is defined as a tax on products, which contain saturated fat (e.g. butter, milk, cheese, oil, fast food etc.).

Questionnaire

Gender:

Age:

Weight:

Height:

Occupation:

Region:

Part 1

1. How much money do you approximately spend on food per month?

.....

2. How much money do you approximately spend on fatty food per month?

.....

3. How many fatty goods do you approximately consume per month?

.....

4. If the price of all fatty food products would rise by 10% (i.e. price of a hamburger would be 1.10£ instead of 1.00£), how many times would you now eat fatty food per month (given in amount of meals)?

.....

5. If the price of fatty food would double (i.e. increase by 100%), how many times would you now eat fatty food per month (given in amount of meals)?

.....

6. If you have answered that you would decrease your fatty food consumption, what would you eat instead?

.....

7. What is the main reason for you to choose to eat fatty food? (e.g. lack of time, cheap, you like the taste, you want to gain weight etc.)

.....

8. How does fatty food, in your opinion, influence your health? (0= positive influence i.e. feel-good factor, energy deliverer; 5= no influence; 10= negative influence, i.e. serious health problems)

0 1 2 3 4 5 6 7 8 9 10

Part 2

1. How many times per year do you visit your GP or go to the hospital?

.....

2. Do you feel weaker or sick after having eaten fatty food?

Yes

No

Sometimes

3. How many times per year would you visit your GP or go to the hospital if you would eat healthier and loose weight (within your BMI-range)?

.....

4. How many times per week do you do sports?

5. If you would get a free membership at a gym, how many times per week would you do sports?

.....

6. Would you be in favor of imposing a 10% fat tax?

Yes No Reason:

Thank you very much for taking the time to complete this questionnaire.

Appendix 4:

Evaluation of data obtained from questionnaire:

Part 1:

| Question | Average per person |
|---|---------------------------|
| Money spent on food (per month, in £) | £ 562.75 |
| Money spent on fatty food (per month, in £) | £ 45.60 |

| Question | Average per person |
|--|---------------------------|
| Fatty food meals (per month) | 4.65 |
| Fatty food meals with 10% fat tax (per month) | 4.45 |
| Fatty food meals with 100% fat tax (per month) | 2.55 |

| | |
|--|---------|
| Decrease in fatty food meals with 10% fat tax | -4.3% |
| Decrease in fatty food meals with 100% fat tax | -44.94% |

Part 2:

| Question | Average per person |
|--|---------------------------|
| GP visits (per year) | 3.3 |
| GP visits (per year, with 10% fat tax) | 3.0 |

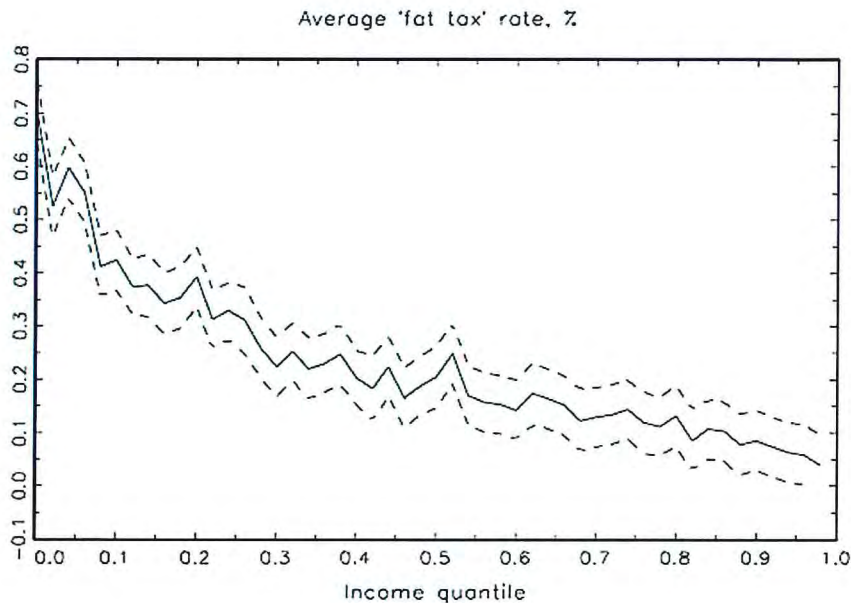
| | |
|--|--------|
| Decrease in GP visits with 10% fat tax | -9.01% |
|--|--------|

| Question | Average |
|---|----------------|
| Amount of physical activity (per week) | 3.25 |
| Amount of physical activity with free gym membership (per week) | 3.55 |

| | |
|--|--------|
| Increase of physical activity with free gym membership | +9.23% |
|--|--------|

Appendix 5:

Figure 9. Distributional effects of a 'fat tax'



Source: Authors' calculations from the National Food Survey.

Appendix 6:

There are a number of problems here. First of all, obesity levels are related to overall calories that are consumed (whether they are from fat, sugar, cereals, fruit or whatever), and different models of fat taxes often predict that total energy levels will change, but it is not clear how plausible that is (would people really eat less calories if you introduced a fat tax? Or would they just waste less food?). Most modellers assume that fat taxes would result in improved dietary quality (e.g. lower saturated fat) but not reduced calorie intake. But taxes on sugary drinks work through a different mechanism - here modellers are happy to assume that any reduction in purchases of sugary drinks would result in less calories consumed. The basic assumption here is that people would replace any calories from food that are knocked out of the diet by a fat tax, but calories from soft drinks are 'extra' anyway, so they would not necessarily be replaced.

The second problem (which gets to the core of your research question) is about whether reduced obesity levels would actually result in reduced NHS costs in the long term. If you reduce obesity levels then people live longer, and older people cost the NHS more money than younger people. It's a similar argument to that about smoking, where it is often suggested that (contrary to common sense) smokers actually cost the NHS less over a life time than non-smokers. However, that's a very controversial area. For your dissertation, I would have thought that it would be adequate to make an assumption that reducing obesity rates would result in proportional reductions in the NHS obesity-related economic costs.

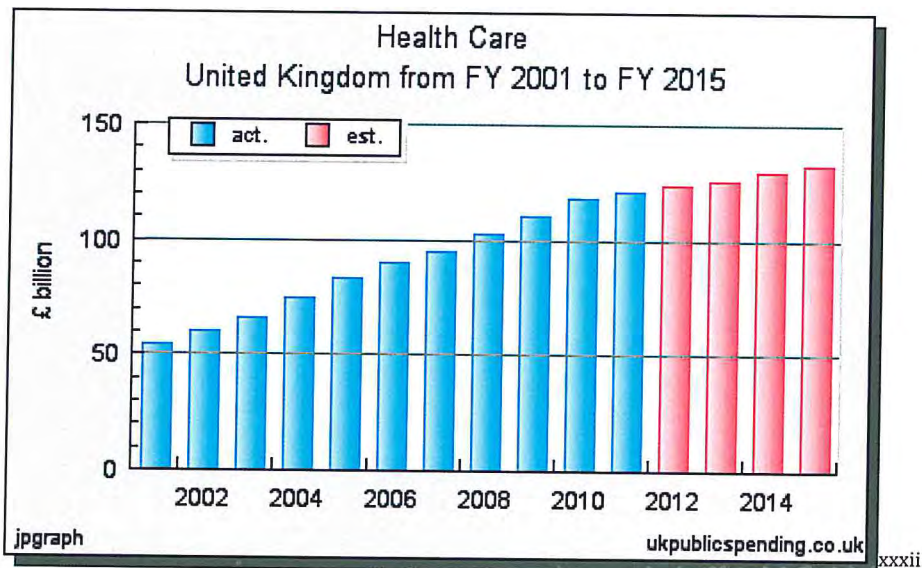
It may be necessary for your paper to make a rough estimate of the percentage obesity reduction associated with intro of a fat tax, based on general findings reported in the literature (the paper by Mytton et al maybe useful here).

Pete

Dr Peter Scarborough

British Heart Foundation Health Promotion Research Group
Department of Public Health
University of Oxford
Old Road Campus
Headington
Oxford
OX3 7LF
Tel: 01865 289248

Appendix 7:



Bibliography

- ⁱ Smith, H., 2010. *UK is the fattest nation*. [Website] www.metro.co.uk/news/845538-uk-is-the-fattest-nation-in-europe [accessed 28 August 2012]
- ⁱⁱ The Health and Social Care Information Centre, *Statistics on obesity, physical activity and diet: England, 2012*, 2012
- ⁱⁱⁱ Anon. (n.d.) *Hospital admissions related to obesity up 30 per cent in a year, says NHS Information Centre* Available at: <http://www.ic.nhs.uk/news-and-events/news/hospital-admissions-related-to-obesity-up-30-per-cent-in-a-year-says-the-nhs-information-centre> [accessed 10th October 2012]
- ^{iv} Government Office for Science, Foresight Report, *Tackling Obesities: Future Choices – Project Report*, 2nd Edition, October 2007
- ^v P Scarborough, P Bhatnagar, K Wickramasinghe et al. „The economic burden of ill health due to diet, physical activity, smoking, alcohol and obesity in the UK: an update to 2006-07 costs“ *Journal of Public Health*, vol. 33 no.4, May 2011, pp. 527-535
- ^{vi} Anon. (n.d.), 1.10.2011. *Denmark introduces world's first food fat tax*, available at <http://www.bbc.co.uk/news/world-europe-15137948> [accessed 26th October 2012]
- ^{vii} Cain, P., 21.6.2011., *Hungary for a fat tax*, available at <http://www.globalpost.com/dispatch/news/regions/europe/110620/hungary-fat-tax-junk-food> [accessed 26th October 2012]
- ^{viii} NHS, 31.01.2011, *Fat: The facts*, available at <http://www.nhs.uk/Livewell/Goodfood/Pages/Fat.aspx> [accessed 27th October 2012]
- ^{ix} Blink, J. & Dorton, I., p.144 ff., 2011. *Economics Course Companion*. Oxford: Oxford University Press
- ^x Riley, G., 2012. *Price elasticity of demand*, available at <http://www.tutor2u.net/economics/revision-notes/as-markets-price-elasticity-of-demand.html> [accessed 27th October 2012]
- ^{xi} O'Connell, M., 2009, *Tackling the British love for fat*, *Economic Review*, vol.27, no.2, p.2
- ^{xii} P Scarborough, P Bhatnagar, K Wickramasinghe et al. *The economic burden of ill health due to diet, physical activity, smoking, alcohol and obesity in the UK: an*

update to 2006-07 costs, *Journal of Public Health*, vol. 33 no.4, May 2011, pp. 527-535

xiii British Heart Foundation Health Promotion Research Group, Mytton, O. et al, 2012, *Taxing unhealthy food and drinks to improve health*, Oxford: Department of Public Health

xiv Griffith, R., & O'Connell, M., 2010, *Public Policy towards Food Consumption*, *Fiscal studies*, vol.31, no., pp.481-507 (2010), Oxford: Institute for Fiscal Studies

xv British Heart Foundation Health Promotion Research Group, Mytton, O. et al, 2012, Table 3: *Summary of work modeling the effects of health related food taxes on food consumption*, Oxford: Department of Public Health

xvi Epstein, L., Handley, E., Dearing, K. et al. 2006, *Purchases of Food in Youth*, Volume 17, no.1 p. 86 ff. Oxford: Association for Psychological Science

xvii Griffith, R., Nesheim, L., O'Connell, M., 2010, Table 3: Matrix of selected aggregate own and cross-price elasticities: *Sin taxes in differentiated product oligopoly: an application to the butter and margarine market*, London: The Institute for Fiscal Studies Department of Economics, UCL

xviii Sault, J., Toivanen, O., Waterson, M., 2003, *Market Structure and Entry in Fast Food* Warwick: University of Warwick, Department of Economics

xix Anderson et al. 2001, *Guide to Taxonomies of Learning outcomes*, available at: <http://www.ucd.ie/t4cms/taxonomies3.pdf> [accessed 27th October 2012]

xx Griffith, R., Nesheim, L., O'Connell, M., 2010, *Sin taxes in differentiated product oligopoly: an application to the butter and margarine market*, London: The Institute for Fiscal Studies Department of Economics, UCL

xxi Griffith, R., Nesheim, L., O'Connell, M., 2010, *Sin taxes in differentiated product oligopoly: an application to the butter and margarine market*, London: The Institute for Fiscal Studies Department of Economics, UCL

xxii Mathematics Higher Level (Core), IBID Press, page 611

xxiii O'Connell, M., 2009, *Tackling the British love for fat*, *Economic Review*, vol.27, no.2, p.1 ff.

xxiv Leicester, A., Windmeijer, F., 2010, *The „Fat tax“: Economic incentives to reduce obesity*, London: The Institute for Fiscal Studies, Briefing Note No.49, p. 12ff.

xxv O'Connell, M., 2009, *Tackling the British love for fat*, *Economic Review*, vol.27, no.2, p. 1 ff.

^{xxvi} Mytton, O., Clarke, D., Rayner, M., 2012, *Taxing unhealthy food and drinks to improve health*, Oxford: British Heart Foundation Health Promotion Research Group, Department of Public Health, University of Oxford

^{xxvii} Anon., (n.d.), 2012, *Causes of Obesity*, available at: <http://www.nhs.uk/Conditions/Obesity/Pages/Causes.aspx> [accessed 7th October 2012]

^{xxviii} Anon., (n.d.), 2011, *About the NHS*, available at: <http://www.nhs.uk/NHSEngland/thenhs/about/Pages/overview.aspx> [accessed 28th October 2012]

^{xxix} P Scarborough, P Bhatnagar, K Wickramasinghe et al. *The economic burden of ill health due to diet, physical activity, smoking, alcohol and obesity in the UK: an update to 2006-07 costs*, Journal of Public Health, vol. 33 no.4, May 2011, pp. 527-535

^{xxx} Griffith, R., Nesheim, L., O'Connell, M., 2010, *Sin taxes in differentiated product oligopoly: an application to the butter and margarine market*, London: The Institute for Fiscal Studies Department of Economics, UCL

^{xxxi} Griffith, R., Nesheim, L., O'Connell, M., 2010, Table 8: Equilibrium after introduction of tax, overall results, *Sin taxes in differentiated product oligopoly: an application to the butter and margarine market*, London: The Institute for Fiscal Studies Department of Economics, UCL

^{xxxii} Pettinger, T., *How should the NHS be funded*, available at: www.economicshelp.org/blog/5476/economics/how-should-the-nhs-be-funded/ [accessed 1 September 2012]