Primer on Fat Taxes and Thin Subsidies: A Graphical Analysis

Brandon Schaufele, Post-doctoral Research Associate
David Sparling, Chair in Agri-Food Regulation and Innovation
Pamela Laughland, Research Associate

ABSTRACT

Fat taxes and thin subsidies have attracted attention of both policy-makers and the general public in recent years. This primer uses graphical models to highlight the economic implications of these proposals. Concentrating on the intuition of the underlying concepts, the strengths, weaknesses and unintended consequences of these policies are presented within the familiar and accessible partial equilibrium framework.

INTRODUCTION

Cardiovascular disease is still the leading cause of death in Canada (Public Health Agency of Canada, 2009). Rates of diabetes are increasing and medical obesity afflicts approximately 1 in 5 Canadians (World Health Organization, 2004). Within the decade, nearly half of the U.S. population will be considered obese (Acs and Lyles, 2007). Strong evidence supports the link between diet and health, particularly with respect to the incidence of heart disease, obesity and diabetes (Strnad, 2004). Yet, the precise relationship between food consumption and health outcomes is complex and using policy to solve the food-health equation poses serious challenges for governments.

In general, promotion of high nutrient, low calorie foods is viewed positively while the consumption of empty calorie products such as fast food is discouraged. People do not always heed this advice however. Recently, there has been increasing interest in so-called fat taxes and thin subsidies as tools to alter food consumption behaviour (e.g., Taylor, 2009). Lakdawalla and Philipson (2002) claim that approximately half of the increase in weight can be attributed to declining relative food prices, implying that price-based based policies may be effective in altering diet incentives. Designing and applying food policies in pursuit of heath goals is not a trivial undertaking however. Policy-makers and legislators must be conscious of the implications of price-based instruments.

This paper is meant to be a primer in the economics of using policy instruments to address obesity and chronic health issues. Intended as a resource for policy-makers and students, it presents a series a partial equilibrium graphs to illustrate the economic impacts of fat taxes and thin subsidies. Traditional supply and demand diagrams are employed making the discussion accessible to those with a basic understanding of economics. Approaching the problem using market fundamentals highlights both the strengths and weaknesses of these proposals. Three key issues are explored. First, the basic fat tax and thin subsidy are introduced. Next, some unique features of food – namely, the potential for over-consumption of healthy foods or under-consumption of unhealthy products – are reviewed. Finally, the implications of the price-based policies, when consumers can be classified into healthy and unhealthy categories, are presented. The discussion in this paper is not comprehensive. Instead, it offers a framework that organizes the key concepts of fat taxes and thin subsidies, while highlighting potential complications of these and other food and health policies.

BASIC FAT TAXES AND THIN SUBSIDIES

An externality is traditionally defined as a situation where the decisions made by one individual adversely affect the utility of another individual (Gravelle and Rees, 2004). One consumer may impose costs on others (negative externality) that are not accounted for in market prices. In other words, these costs are "external" to the consumer but must be borne by the populace.

Individual's food consumption decisions have the potential to generate negative externalities for society. This can occur several ways. For example, over-consumption of unhealthy foods or under-consumption of nutritious foods may lead to illness. If this illness requires treatment, additional health care costs must be paid by all taxpayers. Similarly, lost productivity from poor health represents an economic cost to society via irretrievable output. For these and other reasons, individual food consumption decisions have the potential to impose negative externalities on the public in much the same way as the decision to smoke by individuals imposes healthcare costs on society.

If the costs from over- or under-consumption of certain foods are large, policy may be used to "internalize" the externality. That is, a fat tax or thin subsidy may be introduced so that the social and private implications of consumer decisions are equalized. To understand the logic underlying fat taxes and thin subsidies, it is necessary to distinguish between private and social marginal benefits and costs. The traditional demand and supply curves represent the private costs of consumers and firms. A demand curve is simply the locus of consumers' marginal benefits from consuming the next unit of a good. Similarly, the supply function is the horizontal sum of firms' marginal cost curves. Market failure due to an externality occurs when private costs and benefits do not equal social marginal benefits – i.e., additional non-market costs are imposed on society via the externality.

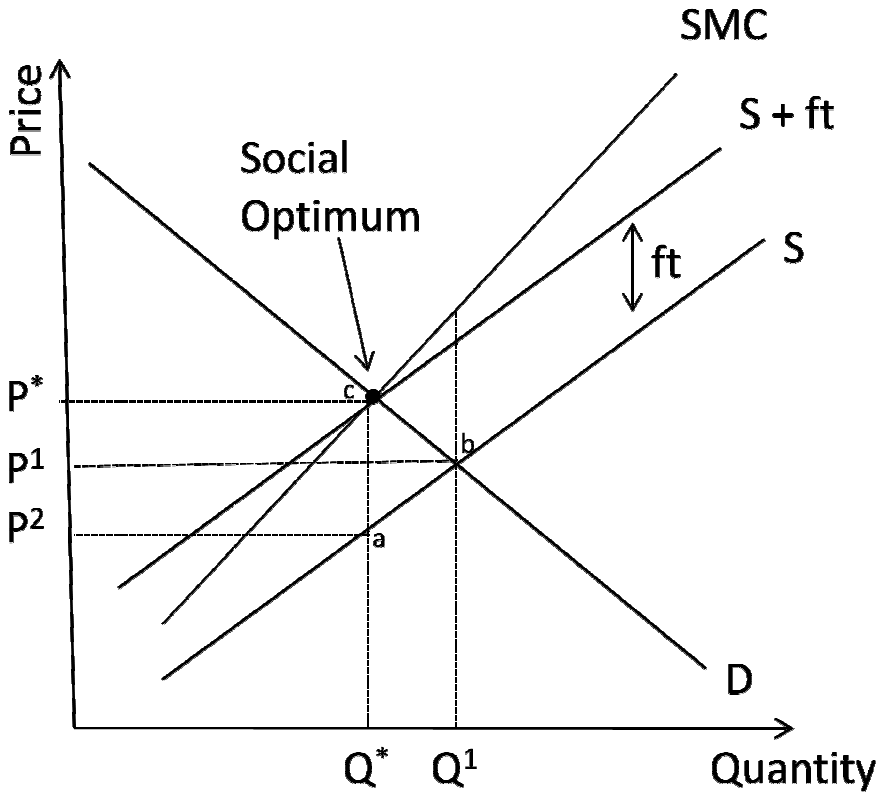

Figure 1: Basic Fat Tax

Figure 1 illustrates the basic fat tax. The diagram includes a demand (D) and supply (S) curve in addition to a curve representing the social marginal costs (SMC). The initial, competitive equilibrium occurs at the point (Q^1, P^1), where the demand and supply curves intersect. However, this initial equilibrium point is not socially optimal – market failure due to the food-based externality generates costs equal to the triangle *a-b-c*. Society has to bear the cost of an individual's over-consumption. A per unit fat tax (ft) shifts the supply curve leftward until the point where the social marginal costs from over-consumption of the unhealthy food equals the private marginal benefits of consumption. This point is labelled as the social optimum, (Q^*, P^*), and is where the social marginal cost and demand curves intersect.

A fat tax yields two benefits which can be observed in Figure 1. First, higher prices lead to less quantity of the unhealthy food being consumed. This is the shift from Q^1 to Q^* along the horizontal axis. The second advantage is that the tax revenue that is collected can be used to reduce the costs of the externality or to support educational and information dissemination policies. Tax revenue in Figure 1 is represented by the rectangle *a-c-*P^**-*P^2. In sum, the advantages of a fat tax policy are: a) people consume less of an unhealthy food and b) revenue is generated which can be allocated towards health-promoting projects.

A thin subsidy is the twin of the fat tax. In this case however, the policy is designed to encourage additional consumption of healthy foods. Rather than shifting the supply curve to the left as in the fat tax scenario, a per unit thin subsidy shifts the supply curve (S) rightward. Figure 2 illustrates the socially optimal equilibrium for a thin subsidy, (Q^*, P^*). This point is reached by increasing the subsidy on the healthy food until the social marginal benefit (SMB) curve intersects the original supply curve. Consumers pay a lower price, P^*, and consume a greater quantity of the product – Q^1 shifts rightward to Q^* along the horizontal axis – than under the competitive equilibrium. The size of the per unit subsidy is the vertical distance between the original supply curve (S) and the subsidized supply curve (S + sub). The total cost to the government for implementing this subsidy is given by the rectangle *a-b-*P^2*-*P^*.

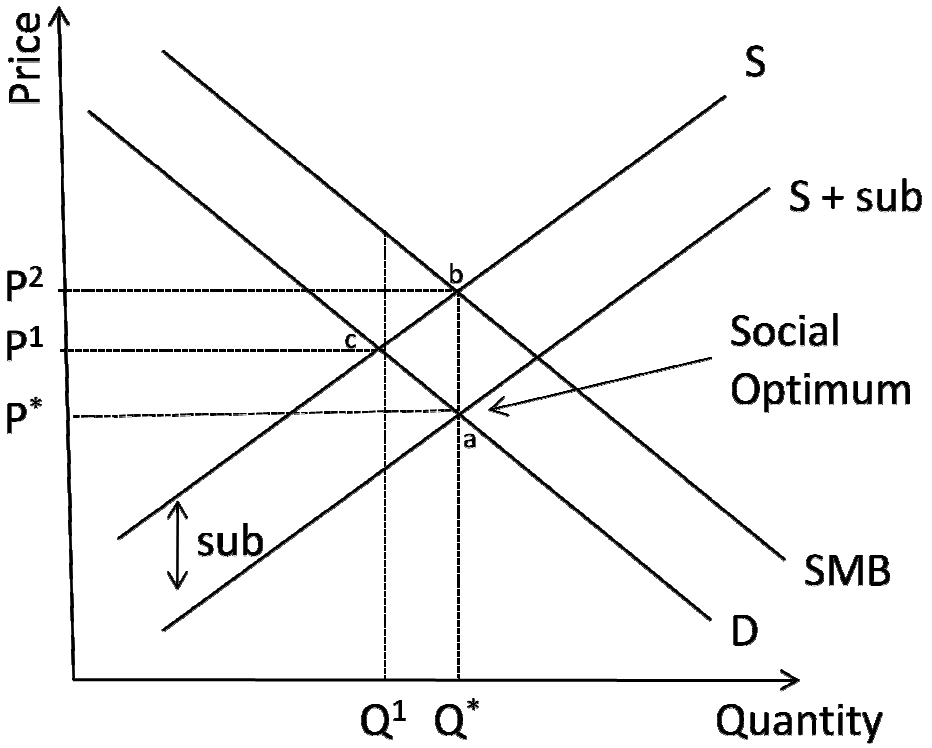

Figure 2: Impact of a Thin Subsidy

Elasticity of Demand Curve and Breadth of Substitutes

The percent change in quantity demand divided by the percent change in price is known as the price elasticity of the demand curve. It is a summary statistic that represents how much consumers are willing to substitute one product for another. An "elastic" demand means that there are many close substitutes while an "inelastic" curve implies few substitutes. Knowing the elasticity of demand enables policy-makers to predict the change in consumption and amount of revenue generated by a fat tax policy. A small tax with an elastic demand curve will lead to a large change in a product's level of consumption. However, if consumers have an inelastic demand for an unhealthy product, consumers will not change their consumption levels even with a sizeable fat tax; yet, while the impact on quantity demanded may be small (with an inelastic demand curve), the revenue generated by the tax could be significant.

When a tax or subsidy is indiscriminately applied, the issue of substitutability creates the potential for unintended consequences. As an example, consider the implications of a fat tax levied on a particular unhealthy product group, soft drinks, versus a tax levied on an unhealthy ingredient, salt. The problem with the tax on carbonated soft drinks compared with one on salt is akin to that of a narrow- versus broad-based initiative. A soda-tax may have large effect on the soft drinks, yet not have a significant impact on the underlying health issue. There are many substitution possibilities on both the demand side and the supply side of the market for soft drinks – for instance, uncarbonated lemonade or sweetened fruit juices. A salt-tax however influences many products as salt has fewer obvious substitutes. Consequently an appropriately applied ingredient tax may have a much larger impact for both improving health outcomes and generating revenues than does a tax on a given product class.

Empirical Evidence on Basic Fat Taxes and Thin Subsidies

The empirical evidence on the effectiveness of fat taxes and thin subsidies is mixed. Schroeter et al. (2008) found that a tax on soft drinks would lead to a decrease in consumption and therefore a decrease in weight. Similarly, Gustavsen (2005) presents evidence that a fat tax on soft drinks does lead to lower consumption. Kuchler et al. (2005), on the other hand, determined that even a reasonably large tax on salty foods would not have a major effect on the diet of consumers. Cash et al. (2005) focused on thin subsidies for fruits and vegetables and determined that a thin subsidy could be a potent method for altering consumer behaviour, particularly for low income households.

The state of Maine introduced a snack tax that lasted from 1991 to 2001. Oaks (2005) analyzed data from this policy and found that the tax did not significantly impact obesity outcomes. However, he notes that revenues collected could have been more effectively targeted at obesity reduction programs (Cash and Lacanilao, 2007).

The general conclusion from these studies is that both the health goals and the policy instruments must be well-conceived to be successful. Fat taxes and thin subsidies may be useful tools under the right circumstances. Yet, even the simplest policies are more challenging to enact than the textbook formulation suggests. The next two sections illustrate several complications that may develop with fat taxes and thin subsidies.

SHAPE OF SOCIAL MARGINAL COST AND BENEFIT CURVES

Food is distinct from products such as tobacco or pollution. For example, smoking no cigarettes is beneficial to health even if it does not maximize utility. If an individual consumed zero calories however,

it would be severely detrimental to their health. People do not need to smoke cigarettes, whereas people do need to eat.

The categories of healthy and unhealthy foods are local classifiers. The term local classifier means that outside a given range foods that are otherwise healthy or unhealthy may be detrimental or beneficial, respectively, to people's health outcomes. For example, over-consumption of red wine, even though at low levels it may reduce heart disease, is harmful to well-being. Similarly, even unhealthy fast foods such as potato chips can improve the health of malnourished individuals. Figures 3 and 4 demonstrate some of these implications.

Figure 3 illustrates a situation where the government introduces a thin subsidy on a healthy product. The goal is to promote consumption of this food, perhaps because it contains particular healthful properties. Complications may develop however. At point Q^2 the social marginal benefit curve crosses the private marginal benefits curve (D) and a social benefit actually becomes a social cost – i.e., there is over-consumption of an otherwise healthy promoting food. The over-consumption of healthy products can occur under a number of scenarios. For example, individuals with addiction related mental health issues often focus on health and well-being to the point where they cause themselves harm. Similarly, as recent experience with trans-fats has illustrated, the science on health and nutrition is not mature.

Knowing the shape of the social marginal benefit curve is necessary when considering price-based policies. A little excess-consumption can turn health benefits into health costs. Figure 3 highlights a key issue with all fat taxes and thin subsidies – namely, the information required to calculate an optimal policy is substantial. It is important to remember that correcting externalities should only be undertaken if the benefits of the policy are greater than the costs.

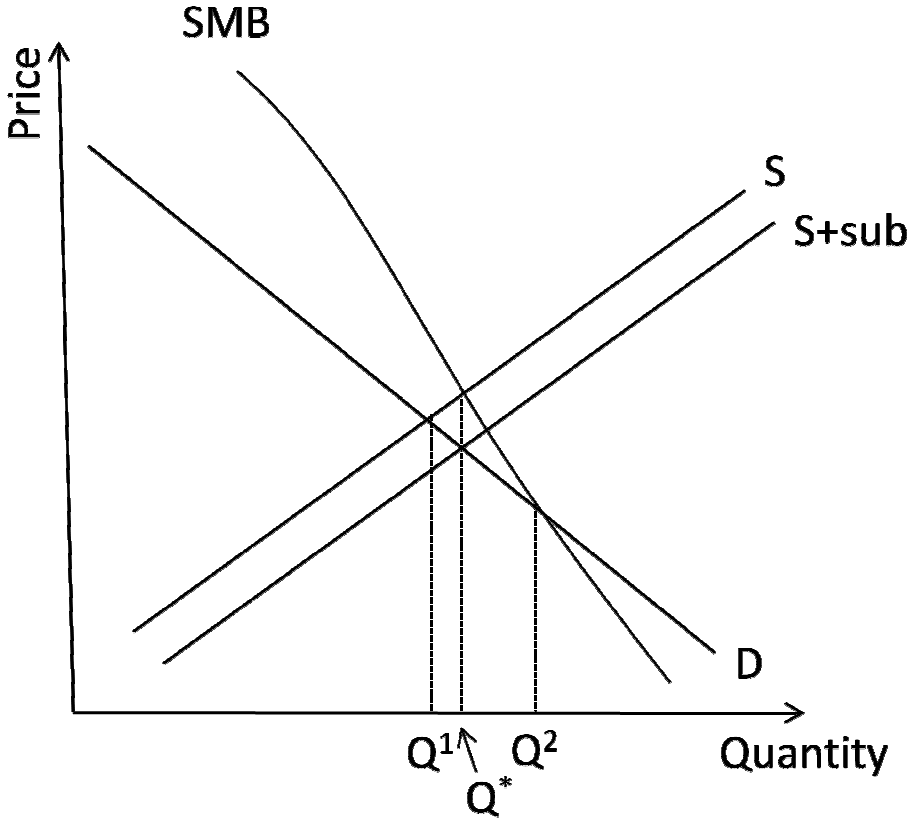

Figure 3: Over-consumption of a Healthy Product

Figures 3 and 4 tell a similar story. In Figure 4, the social marginal cost curve crosses demand curve at Q^2. To the left of this point, consumption of the otherwise unhealthy food is beneficial to well-being. Low income and malnourished individuals often have greater access to foods which under alternative circumstances would be classified as unhealthy. Taxing these products may harm some of the most vulnerable people in society. This regressivity of fat taxes is further discussed below.

The potential of for the under- and over-consumption of unhealthy and healthy foods underscores an additional factor. Individuals have the ability to take action to alter their health states. People make food choices based on taste, convenience, family structure and traditions, age and knowledge. As a consequence, changing the price and income incentives on individuals' diets will only affect some of the determinants of lifestyle (Kuchler et al., 2005). The key message is: food plays a unique role in most people's lives and therefore unforeseen difficulties may emerge when attempting to control food and health choices through policy.

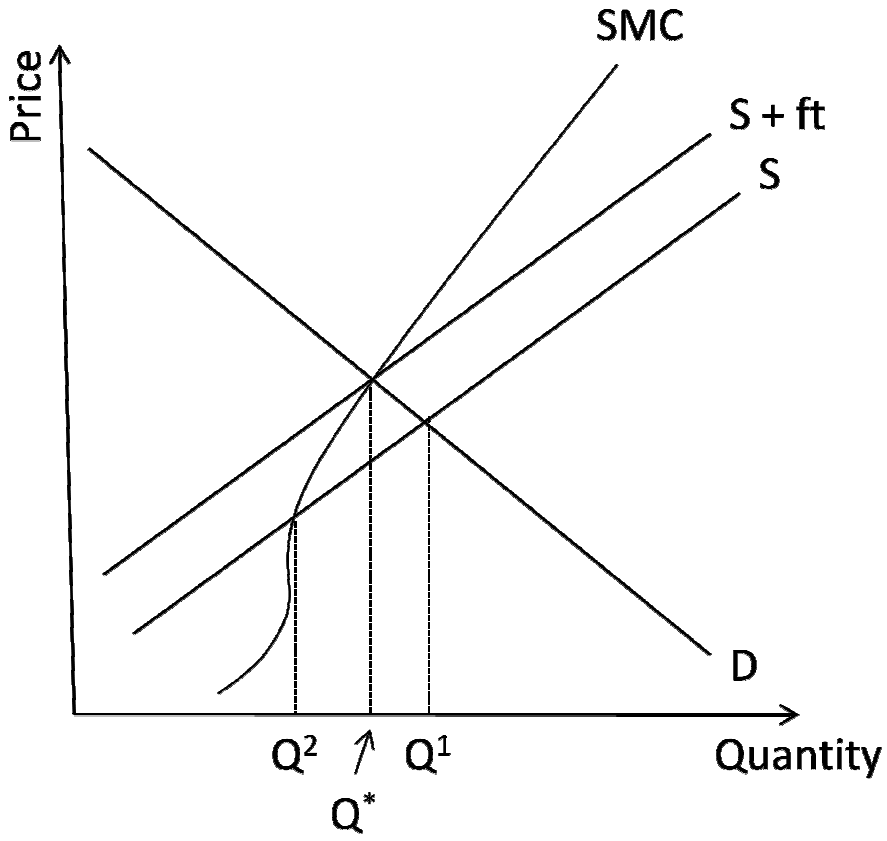

Figure 4: Potential Under-consumption of Total Calories

OPTIMAL FAT TAXES WITH CONSUMER HETEROGEITY

Consumer heterogeneity generates an additional complication for fat tax design. Not all consumers generate externalities via their consumption. Some individuals can consume large volumes of unhealthy foods and still not impose costs on society. Genetic qualities or other lifestyle decisions such as allocation of time to physical exercise may enable a portion of the population to avoid problems associated with unhealthy products. In this case, two "types" of consumers can be considered, healthy and unhealthy. Consumer heterogeneity implies that a fat tax may reduce the costs of market failure for unhealthy people but would impose a deadweight loss on healthy consumers.

Consider a food that is contributor to obesity for the unhealthy consumer type. Figure 5 demonstrates a market outcome for the two types of consumers. Both consumer types have a positive demand for the product. Healthy people can freely eat any quantity without imposing costs on society. The unhealthy group however imposes an externality via their consumption. The market demand curve (D) for the product is the horizontal sum of the healthy (d^H) and unhealthy (d^U) demand functions in Panel B.

Markets cannot distinguish between healthy and unhealthy individuals and consumers may not even be fully cognizant of their type. This means that the price paid by both groups is the same. The competitive equilibrium without a fat tax is at the point (Q^*, P^*), where the quantities demanded by healthy and unhealthy groups correspond to q_H^* and q_U^*. If a fat tax is imposed to equate social marginal cost to marginal benefits, equilibrium is given by the point (Q^{ft}, P^{ft}).

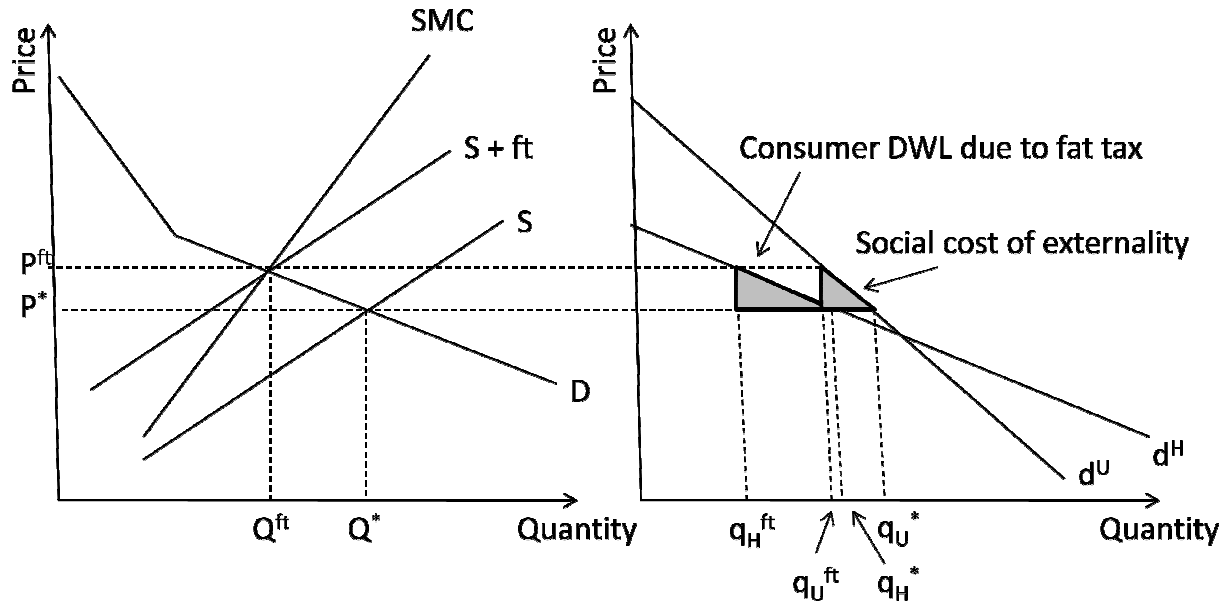

Figure 5: Effect of a Fat Tax with Healthy and Unhealthy Consumers

At the fat tax equilibrium, healthy consumers pay a higher price and consume less than at the competitive equilibrium. Therefore the tax generates a deadweight loss to these consumers. Even though only unhealthy individuals imposed the social cost from their consumption decisions, all consumers must bear a share of the costs from obesity, which implies that attempts to internalize the externality causes a loss of economic welfare for healthy individuals.

An optimal fat tax then must weigh externality costs against deadweight losses. Figure 6 illustrates the total social costs curve, which is the sum of deadweight loss and externality costs at different tax levels. Without a fat tax, the social costs due to the externality are represented by point *a*. A tax policy when there is consumer heterogeneity trades-off reductions in externality costs from the unhealthy group against increases in the deadweight losses imposed on the healthy consumers. The optimal fat tax occurs at the point t^* where total social costs are at a minimum.

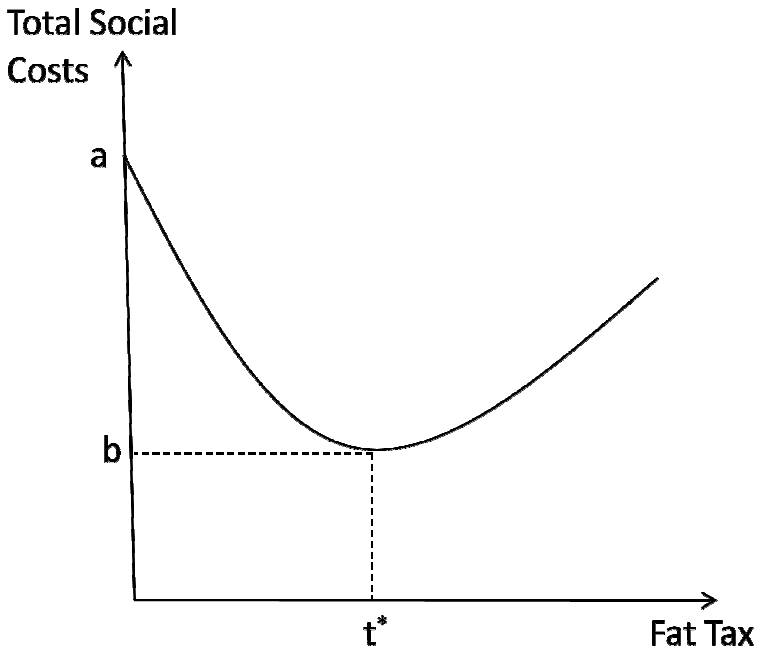

Figure 6: Total Social Costs of a Fat Tax with Healthy and Unhealthy Consumers

The scenario depicted in Figure 6 is known as a "second best" policy. Second best policies occur whenever policy-makers have imperfect information, usually about preferences or technology (Gravelle and Rees, 2004). In this case, it is impossible to distinguish between healthy and unhealthy consumers. Consumer heterogeneity underscores the difficulty of designing food and health policy even in a situation where there are only two consumer types. In reality, many consumer types exist, preferences are unknown, information is imperfect and optimal taxes and subsidies are even more demanding to calculate.

TAX REGRESSIVITY AND ALTERNATIVE POLICIES

There are two additional features of fat taxes and thin subsidies that should be discussed. Both the regressivity of fat taxes and alternative food and health policy suggestions are relevant to this primer.

Regressivity

There is substantial evidence that fat taxes are regressive, adversely affecting low income households compared to wealthier families. In general, higher income households allocate a smaller share of household expenditures to food, while still spending a larger amount in total. It follows that a food tax would have a smaller proportional impact on wealthier families than less fortunate households. Similarly a greater total subsidy dollar value would likely accrue to higher income households, even if their share were smaller.

Leicester and Windmeijer (2004) found that in the UK a fat tax targeting fat, sodium and cholesterol would yield effective tax rates of 0.7%, 0.25% and 0.1% for poor, median and wealthy income levels respectively. These results highlight the fact that policy-makers must be cognizant of the distributional impacts of proposed mechanisms before implementation. The corollary of this is that a thin subsidy should provide disproportionately larger benefits to poorer consumers, creating both health and income redistribution effects.

Non-Price Policies

Food and health policies can be divided into demand- and supply-side policies (Audretsch and DiOrio, 2007).

Fat taxes and thin subsidies are categorized as demand-side together with labelling, information dissemination and education. Subsidization of gym memberships is another demand-side policy applied to the exertion-side of the caloric identity (i.e., calorie intake = calorie use + weight gain/loss). Demand-side policies have the advantage of directly influencing consumer choices. Yet the empirical validity of many of these proposals is still unknown.

Supply-side policies, rather than attempting to influence consumer choices, place restrictions on the availability of choices in the market. Restrictions and regulations prevent the supply of certain products. In general, product bans and strict regulation are considered policies of last resort as these approaches often lead to greater total economic costs than price-based policies.

The elimination of subsidies to primary agriculture is another supply-side policy suggestion. The logic is that agricultural subsidies keep food prices artificially low, enabling over-consumption by consumers. This argument may not be empirically sound however. Canada's food processing sector has a high degree of concentration (Agriculture and Agri-Food Canada, 2009), so lower commodity prices do not necessarily imply that consumers pay lower prices for processed food. Any subsidies that are provided to primary producers likely do not have a large impact on consumer behaviour (Alston et al., 2007).

CONCLUSIONS

Fat taxes and thin subsidies are proposals that if enacted correctly could contribute to improving the health outcomes of Canadians. This primer presents some the basic features of these policies in a fashion that is comprehensible to those with a basic understanding of economics. The benefits and challenges of fat taxes and thin subsidies were emphasized. One theme that was stressed throughout the paper is that practical matters of economic policy are more challenging than shifting curves in a two-dimensional diagram. Policies are often layered on regulations and other rules. If there is one core message, it is that the consequences of economic policies should be well-reasoned and skilfully executed.

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