

Item #7

SEMINAR IN LAW AND ECONOMICS
Professors Louis Kaplow & Steven Shavell

Tuesday, October 21, 2003

Pound 201, 4:30 p.m.

**CONCEPTUALIZING THE “FAT TAX”:
THE ROLE OF FOOD TAXES IN
DEVELOPED ECONOMIES**

Jeff Strnad

Reader's Guide to "Conceptualizing the 'Fat Tax'"

This paper was written in the fall of 2002. The goal was to identify potential rationales for a "fat tax," a levy targeting foods that tend to have adverse health consequences. I originally did not intend to publish it but to present it several places in order to test the soundness of the rationales before investing resources in more substantive work on the topic. Many individuals have urged me to publish a modified version, and I have decided to take that route.

The paper has a stream of consciousness type of quality, being more an extended story than the first draft of a law review article. Furthermore, the organization is arguably "backwards." Rather than presenting the strongest rationales for a fat tax up front, the paper leaves that task to last (Part III). It first discusses implementation problems (Part I) and some weaker rationales (Part II).

In the talk, I will concentrate mainly on Parts II and III. For the busy reader, reading in the following order would be a good strategy:

- (1) Read the introduction and conclusion (pages 1-3 and 83-84).
- (2) Read Part III (pages 47-82). This Part covers the strongest rationales.
- (3) Read Part II (pages 29-46), omitting the brief section on revenue goals (pages 32-33) entirely. Part II covers the weaker rationales. Some readers have expressed doubt as to whether the "internality" rationale is as weak as I claim, and the internality issues might be a topic of interest during the seminar.
- (4) In Part I, read section D on scientific uncertainty (pages 12-27). At a minimum, I will allude to the discussion in that section during the seminar. Depending on time and audience interest, it is possible that we will spend significant time on it.

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Conceptualizing the “Fat Tax”: The Role of Food Taxes in Developed Economies

*Jeff Strnad**

It has long been evident to public health experts that dietary factors have a major impact on mortality and morbidity in the United States.¹ In 1999, the three leading causes of mortality in the United States were heart disease, cancer, and cerebrovascular disease (“CVD”) with 30.3%, 23.0% and 7.0% of deaths respectively.² Three-quarters of the deaths from heart disease were due to ischemic heart disease (“IHD”), a category that includes most conditions culminating in “heart attacks.”³ As discussed below, there is strong existing evidence linking IHD to diet. On the morbidity side, 5% of Americans between 45-64 and 14% aged 65 and above report a chronic IHD condition.⁴ In addition, 21% and 36% of the same age groups report chronic high blood pressure,⁵ a condition strongly influenced by lifestyle and diet. Evidence of the impact of diet and physical activity on the incidence of malignant neoplasms varies by type of cancer, but the current “ballpark” figure is that at least 30-40% of malignant neoplasms would be prevented by following dietary guidelines and maintaining adequate physical activity.⁶ CVD includes most of the conditions described as “strokes” and also displays a strong connection to diet and

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1. For a brief history see MARION NESTLE, *FOOD POLITICS* 31-50.

2. CENTERS FOR DISEASE CONTROL AND PREVENTION (“CDC”), *Final Data for 1999*, National Vital Statistics Reports, Volume 49, Number 8 (September 21, 2001) at 8 (Table C)(hereinafter cited as “1999 CDC Death Report”). 1999 is the most recent year for which complete data is available from the CDC.

3. Out of 615,564 deaths from heart disease in the United States in 1999, 466,459 were due to IHD. 1999 CDC Death Report, at 95 (Table III).

4. CDC, *CURRENT ESTIMATES FROM THE NATIONAL HEALTH INTERVIEW SURVEY, 1996 (1999)* at 82 (Table 57) (hereinafter cited as “CDC NHIS 1996”).

5. *Id.*

6. *See* AMERICAN INSTITUTE FOR CANCER RESEARCH, *FOOD, NUTRITION AND THE PREVENTION OF CANCER: A GLOBAL PERSPECTIVE* (executive summary) (1997); Vay Liang W. Go, Debra A. Wong & Ritva Butrum, *Diet, Nutrition and Cancer Prevention: Where Are We Going from Here?*, 131 J. NUTRITION 3121S, 3121S (2001).

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physical activity. The morbidity rate for CVD in 1999 was 1.2% and 6.5% for those Americans aged 45-64 and above 65 respectively.

During the past two decades, the United States and many other countries in the world have experienced an “epidemic” of obesity.⁷ The percentage of obese individuals in the US was 13.3% in 1960-62, 14.6% in 1971-74, and 15.1% in 1976-80.⁸ This percentage increased sharply to 23.3% by 1988-94 and increased further to 26.0% in 1999.⁹ The increases occurred across all genders, age groups (beginning at 20 years), and major racial categories. Separate data for children (ages 6-11) and adolescents (12-19) indicate similar increases. The percentage of children 6-11 who are “overweight” increased from 4 % in 1965 to 13% in 1999, and the percentage of adolescents who are “overweight” increased from 5 percent in 1970 to 14% in 1999.¹⁰ Obesity is a risk factor for IHD and other major causes of mortality and morbidity.¹¹

The powerful morbidity and mortality effects of diet combined with growing concern about the obesity “epidemic” have led leading public health scholars and public interest advocates to call for taxes on food.¹² The proposals fall into two different categories. First, there are “junk food taxes” on less nutritious foods such as soft drinks, candy or snack foods. Second, there are more ambitious taxes that would

7. The characterization is from the U.S. Surgeon General who notes that “[o]verweight and obesity may not be infectious diseases, but they have reached epidemic proportions in the United States.” U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, *The Surgeon General’s Call to Action to Prevent and Decrease Overweight and Obesity*, at XIII. The visibility of the “epidemic” has increased to the point where it is being discussed in the popular press. See, e.g., *Obesity: A World-Wide Woe*, WALL STREET JOURNAL, JULY 1, 2002 AT B1.

8. CDC, HEALTH, UNITED STATES, 2001 at 256 (Table 69)(hereinafter, “CDC HEALTH 2001”). Obesity is defined as a body mass index (“BMI”) greater than 30 in units of kilograms of weight per meters of height squared.

9. OECD HEALTH DATA 2002 (Chart 5)

10. CDC HEALTH 2001, *supra* note 8, at 257 (Table 70). “Overweight” is defined as BMI “at or above the sex- and age-specific 95th percentile BMI cutoff points from the revised CDC Growth Charts: United States.” *Id.*

11. See, e.g., H. HUBERT, ET. AL., *Obesity as an Independent Risk Factor for Cardiovascular Disease: a 26-year Follow-up of Participants in the Framingham Heart Study*, 67 *Circulation* 968 (1983); Satish Kenchaiah, et. al., *Obesity and the Risk of Heart Failure*, 347 *NEW ENGLAND J. MEDICINE* 305 (2002).

12. See, e.g., E. Catherine Battle & Kelly D. Brownell, *Confronting a Rising Tide of Eating Disorders and Obesity: Treatment vs. Prevention and Policy*, 21 *ADDICTIVE BEHAVIORS* 755, 762 (1996); Tom Marshall, *Exploring a Fiscal Food Policy: the Case of Diet and Ischaemic Heart Disease*, 320 *BMJ* 301 (2000).

apply to a much broader range of foods and food components. Part I discusses both types of taxes and some obvious problems with employing food taxes: implementation, political economy, and scientific uncertainty. In Part II, I put aside these problems and, after discussing the inadequacy of public health rationales by themselves, consider potential roles that food taxes might play. I devote Part III to what I consider the most promising potential role: as an adjunct to health insurance systems. With this role in mind, Part IV closes with some concluding reflections and a brief reconsideration of the problems raised in Part I.

I. OVERVIEW: THE TAXES AND SOME PRELIMINARY OBSERVATIONS

A. Junk Food Taxes

As of the middle of 2000, seventeen states and two major cities imposed junk food taxes.¹³ Eight other states have imposed junk food taxes in the past but repealed them prior to 2000.¹⁴ In many cases, the soft drink industry or food and beverage industry played an active role in repeal.¹⁵

Many of the existing junk food taxes pre-dated the obesity epidemic. Advocates propose extending these taxes as a way to fund public health initiatives with respect to diet and exercise.¹⁶ The envisioned initiatives would counter what the advocates see as a “toxic environment” that “provides access to and encourages consumption of a diet that is high in fat, high in calories, delicious, widely available, and low in cost.”¹⁷ A significant part of the effort would be an informational campaign to offset the cumulative impact of advertising and promotion of unhealthy foods. The advocates emphasize that the taxes would not have to be very heavy, e.g., on the order of a penny per can of soda, in order to raise substantial revenues, and they note that surveys indicate

13. See Michael Jacobson and Kelly Brownell, *Small Taxes on Soft Drinks and Snack Foods to Promote Health*, 90 AM. J. PUBLIC HEALTH 854, 855 (2000).

14. *Id.* at 856.

15. *Id.* at 855-56. In some cases, there is even an explicit quid-pro-quo involving the industry. For example, in response to a Coca-Cola offer to build a bottling plant in Louisiana, the state passed a law in 1993 repealing its soft drink tax contingent on a bottling company contracting to build a bottling plant in the state worth \$50 million or more. Coca-Cola signed such a contract in 1997, putting an end to the tax.

16. See Michael Jacobson, *Tax Junk Foods*, NUTRITION ACTION, December 2000; Jacobson & Brownell, *supra* note 13, at 857.

17. Battle & Brownell, *supra* note 12, at 761. Professors Battle and Brownell provide several examples to back up the toxic environment characterization. For instance, they note that “[t]he average child sees 10,000 food commercials each year, with 95% of those being for candy, fast food, soft drinks, and sugared cereals” and note that it is hard to protect children against these messages since “the advertisements are so numerous and engaging, and the lines between program and advertisement are blurred (the same characters are often in each).”

substantial support for small taxes conditional on the revenues being spent to fund health education programs.¹⁸

The spread of “pouring-rights contracts” is a good example of the type of phenomenon that makes public health initiatives funded by junk food taxes politically appealing. Pouring-rights contracts are bargains between food or soft drink companies and school districts. In exchange for large lump-sum and annualized payments over a term of years, the school districts agree to exclusive sales of a single company’s products combined with exclusive use of company logos and advertising on vending machines, at all school events, on all school paraphernalia, and in all school brochures.¹⁹ By early 2000, 200 school districts in 33 states had pouring rights contracts. As an incentive for schools to encourage consumption of the company’s products, the contracts typically provide a bonus to the schools based on consumption levels exceeding certain quotas. Under the National School Lunch Act of 1946, the Child Nutrition Act of 1966, and other legislation, the federal government subsidizes certain school lunch and breakfast programs. In order to prevent junk foods sales at school from undermining the nutritional integrity of these programs, Congress has from time to time imposed various restrictions on such sales either directly or through rules promulgated by the US Department of Agriculture (“USDA”). The current federal restrictions are based on USDA rules promulgated in 1985. These rules ban sales of competitive foods of “minimal nutritional value” in schools, but the ban applies only during lunch period and only for sales in cafeterias. Certain states impose more onerous restrictions. New York State regulations, for example, follow an earlier version of the USDA rules which state: “From the beginning of the school day until the end of the last scheduled meal period, no sweetened soda water, no chewing gum, no candy including hard candy, jellies, gums, marshmallow candies, fondant, licorice, spun candy and candy coated popcorn, and no water ices except those which contain fruit or fruit juices, shall be sold in any public school within the state.”²⁰ Surveys and other evidence show widespread violations of both the USDA restrictions and other more severe restrictions imposed by states and cities.²¹

18. Jacobson & Brownell, *supra* note 13, at 856.

19. Most of the information about pouring rights and the relevant government regulations presented here comes from the cogent discussion in NESTLE, *supra* note 1, at 202-218.

20. *Id.* at 211-12.

21. *Id.* at 212. The problems exist even when states or cities have strict regulations that might seem to imply political will to address junk food sales in schools. For instance, New York City has a junk food regulation similar to the New York State regulation quoted in the text. Unfortunately, the city regulation was “universally ignored,” leading to an enforcement action by advocates against the board of education, the chancellor of education and five school principals. *Id.*

Tying junk food taxes to health initiative expenditures may create political appeal, but from a normative standpoint the connection between the tax and the expenditures is less obvious. If nutrition education or financial incentives to woo schools away from pouring-rights contracts have high public value, the government should be willing to fund these activities through revenues raised from the most efficient source. For a public finance economist, choice of source might turn on the amount of deadweight loss and distributional impact per dollar raised, taking into account any positive or negative externalities of the taxed activities. Soda consumption may involve negative externalities due to interactions with public or private insurance schemes that bundle soda-drinkers and non-soda-drinkers together. Part of the increase in premiums needed to cover ill-health from soda consumption will be paid by non-soda-drinkers. Soda drinkers might then consume a socially inefficient large amount of soda since part of the (health) cost of consumption is shifted to others. Soda tax advocates typically are not concerned with externalities or the behavioral impact of the taxes. Some even argue for soda taxes based on the belief that the taxes will be small enough that they will have no significant price or consumption impact, thereby making them politically much more acceptable.²²

In California, the problems with pouring rights contracts led Deborah Ortiz, a State Senator, to propose a 21 cent per gallon tax on soda pop (about 2 cents per can) with 30 percent of revenues earmarked for payment to middle schools and high schools willing to prohibit on-campus soda sales until after lunch hour. The bill was motivated in part by the fact that lack of adequate funding “has left schools to rely on soda contracts and the sale of soda and other unhealthy foods to fund vital after-school and extracurricular activities.” Richard Martin, *Soda Pop Tax won't Quench Lawmakers' Thirst for Levies on Sweet, Fatty Foods*, NATION'S RESTAURANT NEWS, April 29, 2002. Ortiz ultimately abandoned the tax bill, replacing it with a proposal for a total ban on soda sales at schools. See Katherine Corcoran, *Soda-tax Proposal Dropped; Ban in Schools Introduced*, SAN JOSE MERCURY NEWS, May 3, 2002 at 19A.

On August 27, 2002, Los Angeles County school officials voted unanimously to ban the sale of soft drinks to its 735,000 students, rejecting arguments that 677 campuses need the money they make from the drinks. Marlene Carter, one L.A. School Board member, said that “I find it appalling that we are discussing economics at the risk of our children's health.” The ban covers sales through vending machines on campus and school cafeterias. Schools must comply by January 2004. A spokesman for the National Soft Drink Association said that “sodas were being unfairly blamed for childhood obesity, which has a number of causes.” <http://www.ccn.com/2002/...ers.ednews/08/27/la.soda.reut/index.html>.

22. See Jacobson & Brownell, *supra* note 13, at 856..

B. Fat Taxes

A second set of tax proposals is much more ambitious. These proposals often fall under the moniker of “fat taxes” because many of the proposed taxes would apply to fatty foods or to the fat content of foods.²³ Some of the proposals are not limited to fat content. The most general simply call for taxing unhealthful foods and subsidizing healthy foods.²⁴ In contrast to junk food taxes, fat taxes explicitly attempt to influence behavior to meet public health goals. Therefore, scholars supporting such taxes are concerned about the impact of food taxes on consumption.²⁵ Fat tax proposals have drawn industry fire²⁶ and have been the subject of editorial treatment in prominent journals.²⁷

Advocates of fat taxes see them primarily as a public health initiatives, the goal being to improve people’s health. Focusing on this goal leads to the question of why the government should interfere with individual choice with respect to diet. Both the food industry and independent commentators have raised this issue,²⁸ an issue that is likely to be politically salient given the American public’s strong libertarian streak. Advocates and critics alike often analogize the fat tax proposals to cigarette taxation.²⁹ From the public health perspective, poor dietary choices results in about as much morbidity and mortality as cigarette consumption.³⁰ Critics, cynically or otherwise, predict a repeat

23. See, e.g., Nick Wilson & Osman Mansoor, *Getting the Fat Tax on the Table*, 113 NEW ZEALAND MEDICAL JOURNAL 451 (2000); Hanna Rosin *The Fat Tax: Is it Really Such a Crazy Idea?*, THE NEW REPUBLIC, May 18, 1998.

24. See, e.g., Battle & Brownell, *supra* note 12, at 762.

25. See, e.g., Marshall, *supra* note 12.

26. See, e.g., Milford Prewitt, *Feds Chew on U.S. Diet as NRA Wary of ‘Obesity Tax’*, NATION’S RESTAURANT NEWS, March 26, 2001; Pamela Parseghian, *Support High-calorie Food Tax Proposal? Fat Chance*, NATION’S RESTAURANT NEWS, April 30, 2001; Ralph Reiland, *What’s Next? A Fat Tax on Junk Food*, RESTAURANT HOSPITALITY, August 1998.

27. See, e.g., Rosin, *supra* note 23; Jacob Sullum, *Dining Fine*, REASON, December 31, 1997; Tim Byers, *Reflections on the Use of Food Policy for Waging War on Cancer*, 21 J. AM. COLLEGE NUTRITION 77 (2002).

28. See, e.g., Byers, *supra* note 27, at 78; Parseghian, *supra* note 26.

29. See, e.g., Reiland, *supra* note 26, at 78; Rosin, *supra* note 23.

30. See Rosin, *supra* note 23.

performance of the entire tobacco saga, including massive and costly litigation against sellers or producers of unhealthy foods, when there is much less justification to intervene or collect damages. Such litigation, in fact, has begun.³¹

Part II of this paper considers the critique of the public health perspective in greater depth and goes on to consider major public policy justifications that apply both to cigarette taxation and food taxation. The rest of this Part examines some of the obvious problems presented by food taxation.

C. Implementation and Political Economy

Considering food taxes, whether for public health purposes or otherwise, raises several obvious issues. One such issue is implementation. When particular classes of foods are taxed to the exclusion of others or at different rates, it becomes important to have a workable definition of each food class. This problem arises even with simple levies such as junk food taxes. California passed a tax on snack foods in 1991, but limited the tax to soda following 1992. Opponents of the tax argued successfully that it was too hard to determine which foods were subject to the tax.³² Even taxing “soft drinks” raises problems of definition. In particular, some drinks contain a proportion of fruit juice. It becomes necessary to choose a proportion at which the drink ceases being a “soft drink” subject to tax and to determine a method for computing the proportion. The later step may not be trivial. If one starts with fruit juice extracted in a way that results in lots of extra water and adds sugars and other flavorings in powder form that are only 10% by volume of the mix, is the mix 90% fruit juice?

Implementation becomes even more difficult when the target is particular food components. Consider, for example, a tax aimed at saturated fat. One approach would be tax each food item when it is purchased by the retail consumer. This method might not be hard for packaged foods. Manufacturers of those foods already are required to state how much saturated fat is present per serving. Restaurant consumption at the point of service is another matter. It would be administratively costly to require restaurants to compute taxes per menu item. Evasion might be fairly easy, and there is the problem that fat content may vary depending on the chef on duty. Clearly it would be better to tax food served in restaurants at an earlier stage in the chain of production. Taxing at earlier stages, however, involves other substantial difficulties. Consider cow’s milk.

31. In late July 2002, Caesar Barber, a New York City resident filed a class-action lawsuit against several major fast food companies (McDonald’s, Kentucky Fried Chicken, Burger King and Wendy’s). In his complaint, Barber alleges that these companies are legally responsible for his obesity and poor health. *See Oh, Temptation*, THE ECONOMIST, August 3, 2002 at 12.

32. *See* Jacobson & Brownell, *supra* note 13, at 856 (Table 2).

When it emerges from the udder, it is loaded with saturated fat. But milk is used to produce a multitude of products that contain little if any such fat. Skim milk is an obvious example. Less obvious, but nonetheless prevalent, is the use of milk proteins (stripped of any fat or lactose) in packaged foods. The milk fat that is removed to produce these products may reappear in other products, may be fed to animals, or may be discarded. Implementation of a saturated fat levy may be a trying exercise in second best taxation. E.g., an optimal approach for milk might be to tax it at the udder but at a rate that does not fully reflect the saturated fat content. The result would be that skim milk would suffer a tax that was too high, while the tax on whole milk might be inefficiently low.

The subject of milk suggests another set of hurdles facing any food tax. The political economy of food is very complex. The United States and most other developed countries have a set of agricultural subsidies that many believe have very little economic justification. As one prominent agricultural economist puts it, "the underlying motivation for these interventions [including price floors, trade barriers, production controls, etc.], generally viewed by the public as stabilization and by economists as substitution for a missing risk market, is more often redistribution to those who most enthusiastically and effectively support such measures."³³

The food industry appears to have considerable political influence. One particularly striking anecdote involving Monica Lewinsky and Bill Clinton is recounted by Professor Marion Nestle.³⁴ According to the Starr Report, on President's Day 1996 (a federal holiday) Clinton received a call during a conversation with Lewinsky about terminating their relationship, taking or returning the call just as she was leaving. Clinton spoke for 22 minutes. Boris Yeltsin, perhaps, calling to report an imminent possible attack on the United States with a lost Russian nuclear weapon? No, it was Alfonso Fanjul a prominent sugar grower calling from Palm Beach, Florida. Vice President Gore had just announced a proposed tax on Florida sugar growers to pay for damage to parts of the Everglades from sugarcane runoff. After noting that the tax was never passed, *Time's* account concluded, "That's access."³⁵

33. Brian Wright, *Storage and Price Stabilization*, in THE HANDBOOK OF AGRICULTURAL ECONOMICS, VOLUME 1B, 817, 844 (2001).

34. See NESTLE, *supra* note 1, at 109-110.

35. It is not just Bill. In 1998, Donna Shalala, at the time Secretary of Health and Human Services, was pictured (with milk moustache) in a milk marketing advertisement linking lack of dietary calcium to osteoporosis and stating that the best way to add dietary calcium is to drink milk. Both of these statements are controversial. See NESTLE, *supra* note 1, at 81-82; D. Mark Hegsted, *Fractures, Calcium, and the Modern Diet*, 74 AM. J. CLINICAL NUTRITION 571 (2001). As Professor Nestle notes, "although Secretary Shalala was not paid for her participation, the advertisement could easily be construed as federal endorsement of the milk industry's agenda." *Id.*

In addition to having the ear of politicians, the food industry seems to have a powerful influence over the administrative processes of the U.S. Department of Agriculture and the Food & Drug Administration. For example, Professor Nestle, a participant in various agency efforts to promulgate government nutrition guidelines, details the extensive history of food industry influence on such guidelines.³⁶ She believes that the widespread confusion about nutrition among the U.S. public that is apparent from surveys is partly due to the fact that the guidelines issued by the government are “ambiguous.”³⁷ She attributes this ambiguity to food company insistence on “permissive principles that encourage consumption of all foods regardless of nutritional value: ‘balance, variety, and moderation are the keys to healthful diets; there is no such thing as a good or bad food; all foods can be part of healthful diets; it’s the total diet that counts.’”³⁸ Fostering such beliefs is obviously in the interest of those who have a stake in producing foods with mixed or poor health characteristics.

Despite the idea that food may be the “next tobacco,” there are significant differences at the political level. There is a significant market for healthy foods, and producers and processors who might benefit from taxes on less healthy foods provide a counterweight to parties who would be put on the defensive by such taxes. An example comes from the history of regulation of health claims for food. Prior to 1984, the FDA viewed any food company claims about disease prevention for their products as an attempt to market foods as drugs without going through the formal (and often cumbersome) process of showing that the drugs are “safe and effective.” In that year, the Kellogg cereal company accomplished an end-run that forced the FDA to change its position.³⁹ Without informing the FDA, Kellogg developed language for its All-Bran cereal box in conjunction with the National Cancer Institute (a sister organization of the FDA with the same parent organization -- the Department of Health and Human Services) stating that “The National Cancer Institute believes eating the right foods may reduce your risk of cancer. Here are their recommendations: Eat high fiber foods. A growing body of evidence says high fiber foods are important to good health. That’s why a healthy diet includes high fiber foods like bran cereals.” The FDA campaign to block this advertisement failed, and the Federal Trade Commission (which regulates advertising claims more generally) “enthusiastically endorsed the Kellogg

at 81.

36. See NESTLE, *supra* note 1, at 51-92.

37. *Id.* at 91.

38. *Id.*

39. These events and the accompanying legal issues are recounted in NESTLE, *supra* note 1, at 239-44.

advertisements and recommended that other companies follow suit.”⁴⁰ All-Bran’s market share shot up 47% in the first six months of the marketing campaign. Health claims for food products proliferated. Some experts believe that the deluge of health-related advertising has promoted nutritional awareness among the public and shifted eating habits in a healthy direction.

An optimal comprehensive tax on foods for achieving public health or other goals probably would be very complex. However, it is not clear what (if anything) would emerge from the U.S. political process if faced with a proposal to impose such a tax. The end product might be a very distorted version of the optimal tax, or it may not be possible to pass such a tax at all. There also may be considerable second-best problems. If the tax were to emerge with a major piece missing (e.g., a component that imposes a stiff levy on saturated fat), eating patterns might be influenced for the worse. Political economy constraints and risks therefore might dictate a rather simple tax proposal that falls quite short of realizing the full potential for social benefit.

Both the politics and the implementation of a food tax are made more difficult by the prospect of technical change. For example, the way meat is produced has a major impact on its nutritional characteristics. In the United States, the final product typically has about seven times more fat and a much higher proportion of saturated fat to total fat compared to its wild game precursors.⁴¹ In addition, fat from wild game has significant amounts of some of the ω -3 fatty acids thought to be a significant factor in reducing the risk of IHD and atherosclerotic build-up. In contrast, U.S. beef has “undetectable amounts” of the same fatty acids.⁴² These results have led to speculation concerning the possibility of relying more heavily on grass-fed or free range animals for human consumption.⁴³ At present it appears that these approaches would reduce output and result in an end-product that many Americans would find too “gamey” for their taste. It is possible that the food industry could overcome these obstacles by developing new techniques for raising animals for human consumption. Alternatively, the industry eventually might develop synthetic meats (perhaps improvements on the soy-based synthetic meats currently on the market) that do not rely on use of animals at all but that are indistinguishable from actual meat. In either case, there may be a problem with how

40. *Id.* at 240

41. See Eaton & Connor, *Paleolithic Nutrition: A Consideration of Its Nature and Current Implications*, 312 *NEW ENGLAND J. MEDICINE* 283, 285 (1985).

42. *Id.*

43. See, e.g., John Robbins, *What About Grass-fed Beef*, www.foodrevolution.org (2002).

to classify the new product under an existing tax scheme.⁴⁴ If the tax system had a tendency to classify the new product in the same category as the older, nutritionally inferior product, the system might stifle technical change that would improve the health of consumers. In addition, the political stakes might be very high because of the impact of the product on the investments of existing producers. As a result, the political system might not accommodate innovation very easily. The situation becomes even more complicated in the case where an innovation may involve health risks as well as health benefits.⁴⁵ In that case, there may be sound reasons to delay the availability of the innovation to consumers until safety issues are resolved. These reasons may become overblown, distorted or obscured in the political arena as various parties compete to defend their interests.

D. Scientific Uncertainty and Complexity

This last point leads to two other major problems that would confront any food tax proposal: scientific uncertainty about the impact of diet on health and the complex nature of some relationships between diet and health even in the case of certainty. Scientific uncertainty and complexity obviously are relevant for taxes meant to influence behavior based on public health goals, but also would play a major role if a food tax is designed to meet other goals such as addressing externalities or making private or public health insurance systems more efficient and equitable.

That impact of diet on health is studied by a variety of different means, each with strengths and weaknesses. One is the “epidemiological study” (alternatively referred to as the “ecological study”) where one looks at the aggregate food consumption and health experience of a population. Some such studies, for example, compare consumption and outcomes in separate countries. Epidemiological studies suffer from certain characteristic difficulties. One is confounding factors. The populations compared may

44. The problem would be lessened if the food tax were based on components such as saturated fat or ω -3 fatty acids. Such a tax, however, might not be practical. It would entail taxing different cuts of beef differently depending on their fat content. As a result, the system may simply have a tax on “beef.”

45. An illustration is Olestra, Proctor & Gamble’s fat substitute. See NESTLE, *supra* note 1, at 338-57. Olestra is designed to add a taste identical to fat, but it cannot be broken down by normal digestive processes. As a result, it adds no calories. Since Olestra is a food additive that does not occur naturally in any food, P & G had to show it was “safe.” It took P & G thirty years to gain FDA approval of Olestra under that standard. A major reason is the possible side effects. Although the FDA approved Olestra as being “safe,” it requires food processors to add certain vitamins to products containing Olestra and to put a warning on the package stating that “Olestra may cause abdominal cramping and loose stools. Olestra inhibits the absorption of some vitamins and other nutrients. Vitamins A, D, E, and K have been added.” *Id.* at 338, 344.

differ in unobserved ways other than food consumption and these other differences may be responsible for the observed effects or may mask effects that otherwise occur. A second problem involves the timing of the food consumption and health outcomes. Food consumption long in the past may influence present health status. Studies that simply compare current consumption to current health outcomes may be flawed because food consumption has changed over time. Finally, the distribution of food consumption patterns may matter. If a particular food is healthy unless consumed to excess, the number or proportion of people who engage in excess consumption may be the relevant datum rather than average consumption.

One way to address this last point is to do a cross-sectional study, employing data from individuals rather than groups. One major problem with this type of study is that it typically relies on dietary surveys to determine what people are eating. However, such surveys tend to be subject to various inaccuracies, some of which may distort the results.

Another approach is prospective observational studies. One observes dietary pattern at the beginning of the study and then follows the morbidity and mortality outcomes of the subjects. The problems with this approach include the possibility that dietary intake patterns may have been different prior to the commencement of the study or may change during the study period. In addition, the dietary pattern observed at the start of the study may itself be influenced by health concerns, distorting causal inferences. If people more at risk for disease choose healthy diets, these diets may appear to be related to higher morbidity and mortality.

Using randomized trials is a methodology that tends to eliminate problems from confounding. Groups are selected at random conditional on some set of characteristics (e.g., a random group of non-smoking females). One then puts them on different diets and observes the results. The limitation of this type of study tends to be its length, often only a few weeks at most. Dietary effects on conditions such as IHD and various cancers may take a very long time to play out.

Animal experiments are another route. This approach allows more radical and longer term experiments that would violate moral or other constraints on human studies. The problem is that the results from animal studies often are only suggestive since it is not clear that they would carry over to humans.

In any particular area of inquiry (e.g., the effect of diet on a particular kind of cancer), researchers use all the various approaches to attempt to advance knowledge. In many instances there is strong evidence of an effect of diet (or diet combined with physical activity) but unpacking the independent dietary components ends up being hard.

Recent work on the connection between diet and osteoporosis provides a good example of the complexities that can make public policy (and individual dietary choice) difficult. A leading indicator of the rate of osteoporosis in a population is the observed incidence of hip fracture, especially in women over 50. Hip fracture is a major health problem for the elderly in the United States, affecting about 1.5 million Americans

annually. Reading the popular press and industry advertisements, one might get the impression that the best nutritional strategy for avoiding osteoporosis is to increase calcium intake to high levels. U.S. government regulators have raised recommended intakes so high that in the words of one expert, “it is difficult, if not impossible, to devise practical diets that meet these recommendations.”⁴⁶ Epidemiological studies call this conventional wisdom into question. Many countries with very low average calcium intakes (way below the U.S. RDA level) have much lower hip fracture rates than countries with high average calcium intakes.⁴⁷

One explanation for this phenomenon is that calcium balance rather than calcium intake may be critical. The kidneys excrete calcium in response to many different conditions, including excess protein in the diet,⁴⁸ net endogenous acid production,⁴⁹ and consumption of various foods such as coffee,⁵⁰ sodas containing phosphoric acid,⁵¹ and table salt.⁵² In addition, the body adapts to different levels of calcium intake to maintain balance, increasing (decreasing) the rate of absorption when intake decreases (increases).⁵³ Whether and to what extent factors such as excess protein consumption, net endogenous acid production, or consumption of particular foods cause actual bone loss is a matter of dispute.

A comprehensive discussion of the connection between diet and osteoporosis would be a paper in itself. We only scratch the surface here, identifying results and issues that present particular difficulty for using food taxation as a policy tool. Three problems are particularly salient. First, heterogeneity in health responses to diet may make the use of

46. D. Mark Hegsted, *Fractures, Calcium, and the Modern Diet*, 74 AM. J. CLINICAL NUTRITION 571 (2001).

47. *See id.* at 571-72.

48. *See* Linda Massey, *Does Excess Dietary Protein Adversely Affect Bone?* *Symposium Overview*, 128 J. NUTRITION 1048, 1048 (1998).

49. *See* Lynda Frassetto, Karen Todd, Curtis Morris & Anthony Sebastian, *Worldwide Incidence of Hip Fracture in Elderly Women: Relation to Consumption of Animal and Vegetable Foods*, 55A JOURNAL OF GERONTOLOGY: MEDICAL SCIENCES M585, M589 (2000).

50. *See* Linda Massey, *Is Caffeine a Risk Factor for Bone Loss in the Elderly?*, 74 AM. J. CLINICAL NUTRITION 569 (2001).

51. *See* Uriel Barzel & Linda K. Massey, *Excess Dietary Protein Can Adversely Affect Bone*, 128 J. NUTRITION 1051, 1051 (1998).

52. *Id.* at 1052-53.

53. *See* Hegsted, *supra* note 46, at 571. However, as Professor Hegsted notes “it may take considerable time -- weeks or months -- for the body to adapt to a new calcium intake.” *Id.*

general taxes ineffective or counterproductive. Second, the appropriate tax strategy with respect to individual foods may depend heavily on overall eating patterns. A good strategy conditional on one pattern may be a poor strategy under another pattern. In addition, the influence of the taxes on choice of patterns is an important issue. Third, research results often key off of factors that are proxies for the true causal factors. If taxation is aimed at the studied factors instead of the true factors, the results may be disastrous.

A good example of heterogeneity considerations flows from the most recent research on the impact of caffeine consumption on osteoporosis. It appears that caffeine consumption induces bone loss primarily in women with a certain vitamin D receptor genotype.⁵⁴ Heterogeneity of this sort creates difficulties for using general taxes as a policy tool to achieve goals such as promoting public health or requiring people to implicit insure their own risky behavior by paying taxes equal to the expected medical costs that flow from that behavior. One can imagine an even more difficult case where a particular food benefits some individuals and harms others. To make a tax or subsidy fully effective in the face this kind of heterogeneity, one would have to classify individuals into different impact groups and then tax or subsidize the consumption of the food differently for each group. Classifying the individuals may be costly -- e.g., involving expensive genetic tests that also might raise privacy issues. Even if classification is possible, differential taxes or subsidies for different groups may involve high administrative costs.

Illustrating the other two potential problems for taxation requires a somewhat lengthy foray into the impact of protein consumption and acid-base balance on bone loss and hip fractures. It is clear that excess protein consumption results in increased calcium excretion, but whether or not excess protein consumption necessarily results in bone loss is controversial.⁵⁵ Roughly one-third of bone mass is protein, and protein itself is important for the skeleton. As mentioned above, the body attempts to adjust to increased calcium excretion by increasing absorption. If calcium intake is sufficiently high, the higher rate of absorption will tend to cover the loss. It may be the case that there will be no problem with bone loss as long as the calcium to protein intake ratio is sufficiently high.⁵⁶ At the same time, it is clear that eating foods that create acid in the process of metabolism may result in enough calcium excretion to cause a negative

54. See Prema Rapuri, Christopher Gallagher, H Karimi Kinyamu & Kay Ryschon, *Caffeine Intake Increases the Rate of Bone Loss in Elderly Women and Interacts with Vitamin D receptor Genotypes*, 74 AM. J. CLINICAL NUTRITION 694, 699 (2001).

55. See, e.g., Uriel Barzel & Linda K. Massey, *supra* note 51; Robert P. Heaney, *Excess Dietary Protein May Not Adversely Affect Bone*, 128 J. NUTRITION 1054 (1998).

56. See Heaney, *supra* note 55, at 1056.

calcium balance and ensuing decalcification of bone.⁵⁷ A high protein diet and, in particular, large amounts of fish and meat protein tend to result in high renal acid load.⁵⁸ If one simply looks at *total* protein consumption, empirical work does not resolve the issue. Observational studies on the relationship between *total* protein intake and bone loss have mixed results. Some show a positive association, others a negative association, and still others no association.⁵⁹

One reasonable step is to study whether the type of protein matters. In fact, there is a strong relationship between the ratio of vegetable to animal protein and the incidence of hip fracture. In a recent study, this ratio explains 70% of the variation between fracture rates (adjusted for age) in the 33 countries for which good data sources both on fracture rates and food consumption are available.⁶⁰ The following table (reproduced directly from that study) shows the data for various countries.

Hip Fracture Incidence (HFI) and Dietary Protein Intake by Country (from Frassetto, et. al., <i>Worldwide Incidence of Hip Fracture in Elderly Women</i> , Table 1)					
Country	HFI per 100,000 person-years	Animal Protein Intake (AP) (g/day)	Vegetable Protein Intake (VP) (g/day)	VP/AP	Total Protein (TP) (g/day)
Nigeria	0.8	8.1	40.2	5.0	48.3
China	2.9	10.7	51.2	4.8	61.9
New Guinea	3.1	16.3	29.7	1.8	46.0
Thailand	5.0	14.7	34.3	2.3	49.0
South Africa	7.7	27.8	45.4	1.6	73.2
Korea	11.5	16.9	68.6	4.0	85.5
Singapore	21.6	24.5	30.2	1.2	54.7
Malaysia	26.6	24.3	32.7	1.3	57.0
Yugoslavia	33.5	26.1	67.8	2.6	93.9
Saudi Arabia	47.3	35.0	49.1	1.4	84.0

57. See Barzel & Massey, *supra* note 51, at 1052.

58. *Id.* at 1051

59. See Heaney, *supra* note 55, at 1054-55.

60. See Frassetto, et. al., *supra* note 49.

Chile	56.8	25.0	44.8	1.8	69.8
Italy	57.2	52.1	51.9	1.0	104.0
Holland	60.7	53.3	33.6	0.6	86.9
Spain	65.1	50.1	44.1	0.9	94.2
Japan	67.3	44.3	42.5	1.0	86.8
Hong Kong	69.2	44.0	36.7	0.9	80.7
Israel	75.5	39.7	51.0	1.3	90.7
Ireland	76.0	59.6	41.7	0.7	101.3
France	77.0	74.2	36.7	0.5	110.9
Finland	93.5	55.7	36.4	0.7	92.1
Canada	110.3	60.4	34.7	0.6	95.1
Crete	113.0	53.1	55.9	1.1	109.1
U. K.	116.5	54.4	36.3	0.7	90.7
Portugal	119.8	40.7	48.9	1.2	89.5
United States	120.3	70.1	32.9	0.5	103.1
Australia	124.8	64.7	33.3	0.5	98.0
Switzerland	129.4	62.6	35.2	0.6	97.8
New Zealand	139.0	70.6	34.3	0.5	104.9
Argentina	147.8	68.2	36.9	0.5	105.0
Denmark	165.1	55.6	30.5	0.5	86.1
Sweden	172.0	59.9	29.8	0.5	89.7
Norway	186.7	58.6	34.0	0.6	92.5
Germany	199.3	62.4	35.3	0.6	97.7

The large differences in hip fracture incidence (“HFI”) between countries is striking. For instance, HFI in China was only about one-fortieth HFI in the United States. Also noteworthy is the fact that countries with high dairy consumption generally had much

higher HFI than the countries with low dairy consumption.⁶¹ The study suggests that vegetable consumption plays a significant protective role that is independent of total protein consumption: vegetable protein intake was a significant negative predictor of hip fracture incidence (“HFI”) in a multiple regression of HFI on total protein and vegetable protein. The authors of the study express doubt that vegetable protein itself is the source of this role and hypothesize that the observed pattern stems from the fact that vegetable consumption reduces to alkali-ash, thereby lowering or offsetting endogenous acid production from the metabolism of proteins and other sources. This hypothesis receives support from animal studies and from prospective studies on humans. Acid and base forming substances result in decreases and increases respectively in bone formation in rats. Rats fed low calcium diets along with bicarbonate (a base forming source) “experience high bone formation and deposit about the same amount of bone content as rats fed a regular calcium diet.”⁶² It is clear, however, that other elements that occur in high concentrations in fruits and vegetables such as potassium and Vitamin K also may be a source of the protective effects.⁶³

The attempt to ascertain the true significance of the vegetable protein study illustrates the third policy challenge listed above. Using individual nutrients from epidemiological or prospective studies as independent variables may mask the true causal factors. It may be that other nutrients or nutrient combinations that occur in the same foods as the studied nutrient are responsible for the results. As one research group (“the Tucker group”) puts it, “associations seen with a single nutrient may, in fact, be caused by a more complex constellation of other nutrients consumed contemporaneously.”⁶⁴ This phenomenon led this group to examine the impact of food

61. The study did not examine dairy consumption as an independent factor. However, it is easy to extract dairy consumption data for all countries except Crete, Singapore, and Hong Kong from the food balance tables compiled by the United Nation’s Food and Agriculture Organization (“FAO”). Adding per capita consumption of milk and cheese protein and using the 1985 tables (to coincide with the time period examined in the study), the highest dairy consumption countries in the study were: Finland (20.3 g/day), Norway (20.8 g./day), U.S. (20.5 g/ day), Switzerland (21.8 g/day), France (23.9 g/day), and Ireland (25.3 g/day). All of these countries were in the top half of the study group in HFI. Lowest dairy consumption occurred in: Nigeria (04. g/day), Thailand (0.4 g/day), China (0.5 g/ day), New Guinea (0.6 g/day), Korea (0.9 g/day), and Malaysia (1.9 g/ day). With the exception of South Africa (6.1 g/day) and Singapore (no data), these countries make up the group with the lowest HFI.

62. See Barzel & Massey, *supra* note 51, at 1052.

63. See Bonnie Liebman & Jayne Hurley, *Vegetables: Vitamin K Weighs In*, 29 NUTRITION ACTION 55 (2002).

64. Katherine L. Tucker, Honglei Chen, Marian T. Hannan, L. Adrienne Cupples, Peter W.F. Wilson, David Felson, and Douglas P. Kiel, *Bone Mineral Density and Dietary Patterns in Older Adults: the Framingham Osteoporosis Study*, 76 AM. J. CLINICAL NUTRITION 245 (2002).

consumption patterns on bone mass density. They used one of the most successful and heavily studied epidemiological pools: a sample of residents of Framingham, Massachusetts chosen randomly in 1948 and followed continuously until the present. The original purpose for forming this sample was to study heart disease, but the massive collection of data since 1948 has made it a favorite to study other maladies as well. In 1988-89, researchers used a group of 1164 surviving subjects to begin the “Framingham Osteoporosis Study.” This Study generated bone mass density (“BMD”) data at four different body sites, and extensive food questionnaire data were available for most of the subjects. The Tucker group examined the food data, identifying six major patterns of consumption. They named these patterns based on foods with unusual high representation (as a percentage of total energy intake) in each pattern: (i) meat, dairy and bread; (ii) meat and sweet baked products; (iii) sweet baked products; (iv) alcohol; (v) candy; (vi) fruit, vegetables, and cereals. For men, the fruit, vegetables, and cereals group had significantly higher BMD than the other groups at all four sites examined. For women, the alcohol group and the fruit, vegetable, and cereals groups outperformed the others, but these results were only significant at one of the four sites. The weakest performer for both men and women was the candy group while the sweet baked products group was the second weakest.⁶⁵

The danger of focusing on individual nutrients in epidemiological or prospective studies is not just that the science will be obscured. There is a danger that individuals in countries like the United States where there is a culture of treatment by drugs and a low degree of regulation of supplements will take supplements of the individual nutrient.⁶⁶ These supplements, even if free from other side effects, may have a very different

65. In studying the impact of the food patterns, the Tucker group controlled for a large set of possible confounding variables: age, body mass index, height, physical activity, smoking status, total energy intake, use of calcium supplements, use of vitamin D supplements, season of BMD measurement, and (for women) estrogen use. *Id.* at 246.

66. For a good discussion of supplement regulation and its political history, see NESTLE, *supra* note 1, at 219-293. In the United States, especially following passage of the Dietary Supplement Health and Education Act (“DSHEA”) in 1994, supplements enjoy a lower degree of regulation than food additives or drugs. The definition of supplements in DSHEA includes amino acids, vitamins, minerals, herbs, botanicals, metabolites, and diet products. *Id.* at 235. Drugs must be shown to be safe and effective by the manufacturer before being sold to the public. Food additives must be shown to be safe by the manufacturer. In contrast, under DSHEA, supplement regulation is based on the principle that supplements are assumed to be safe until proven otherwise by the FDA. *Id.* at 219, 235. In addition, supplement marketers have more latitude to make health claims for their products than food marketers. In particular, supplement marketers can make “structure/function” claims (such as “helps maintain healthy cholesterol levels”) as long as they include a disclaimer (which can be in small print) that the claims have not been evaluated by the FDA and that the product is “not intended to diagnose, treat, cure or prevent any disease.” *Id.* at 235.

impact than eating the diets that generated the results in the studies. A famous example involves beta carotene. A series of studies linked low blood levels of beta carotene with increases in mortality from lung cancer. These results encouraged beta carotene supplementation of foods and sales of beta carotene supplements in pill or tablet form.⁶⁷ A few years later, however, it became clear that consuming beta carotene in the form of supplements led to significantly *higher* levels of lung cancer.⁶⁸

What explains the difference between the studies that focused on blood levels of beta carotene and those that examined the impact of supplements? High blood levels of beta carotene is a “biomarker” for high fruit and vegetable consumption. Evidence that fruit and vegetable consumption can reduce the risk of many cancers is strong, and the evidence is particularly numerous and consistent for lung cancer.⁶⁹ Fruits and vegetables contain a very large number of distinct phytochemicals, including many from the carotenoid family of which beta carotene is a member. It may be that the balance of phytochemicals is key rather than the action of individual compounds.⁷⁰ A leading expert on nutrition and cancer concludes that “[t]he identification of the specific protective constituents, or combination of constituents, is a daunting task and may never be completely possible.”⁷¹

What are the implications of the beta carotene saga for designing food taxes? Clearly, focusing taxes on individual food components may backfire. Consider, for example, the study suggesting that the ratio of vegetable to animal protein is a key indicator for the risk of hip fracture. Superficial examination of the study suggests that subsidizing foods containing vegetable protein and taxing those containing animal protein might be an appropriate policy. If, as seems to be the case, it is not the vegetable proteins themselves that are protective but some other components in fruits and vegetables, there is a danger that the tax will end up being misdirected. The food industry already markets products such as soy-based synthetic meats that substitute

67. Large number of people were taking beta carotene as a supplement in the belief that it would lower cancer risk. See ANDREW WEIL *EATING WELL FOR OPTIMUM HEALTH* 139 (2000).

68. See Heinonen, et. al., *Effect of Vitamin-E and Beta-carotene on the Incidence of Lung-cancer and Other Cancers in Male Smokers*, 330 *NEW ENGLAND J. MEDICINE* 1029 (1994); Pryor, et. al., *Beta Carotene: from Biochemistry to Clinical Trials*, 58 *NUTRITION REVIEWS* 39 (2000). One study was stopped 21 months earlier than planned because of the negative effects of the supplements. See Omenn, et. al., *Effects of a Combination of Beta Carotene and Vitamin A on Lung Cancer and Cardiovascular Disease*, 334(18) *NEW ENGLAND J. MEDICINE* 1150 (1996).

69. See Walter C. Willett, *Diet and Cancer*, 5 *THE ONCOLOGIST* 393, 395-96 (2000).

70. See Norman J. Temple & Audrey L. Balay-Karperien, *Nutrition in Cancer Prevention: An Integrated Approach*, 21 *J. AM. COLL. NUTR.* 79, 80 (2002).

71. Willett, *supra* note 69, at 396.

vegetable for animal protein and yet may not contain the protective factors in fruits and vegetables responsible for the positive results in the various osteoporosis studies. Since these synthetic meats would be very high in protein, they would receive a very heavy subsidy. Fruits, on the other hand, have very little protein (typically around 5% of total energy in fruit is from protein) and would receive very low subsidies. The net result might be an increase in osteoporosis incidence due to higher protein loads in the diet.

On the other hand, it is possible to imagine scenarios where taxes or subsidies on individual components might be wise. For example, suppose that the following story is true. Hip fractures are rare in countries with a high ratio of vegetable to animal protein because of the ensuing reduction in endogenous acid production. In some of these countries, calcium intake is very low -- way below the U.S. RDA, but it does not matter because the body is able to adapt to low intake as long as acid production is low. In countries with a low ratio of vegetable to animal protein, the average person faces considerable acid production, and protection against hip fracture depends critically on calcium intake. High intakes allow the body to compensate for the acid environment. In many of these countries, average intake is high due to high consumption of dairy products. However, we observe high hip fracture rates because there are segments of the population that have low calcium intake combined with the high acid production that characterizes the average person. Low calcium intake in these individuals may be because these individuals have difficulty assimilating dairy products or just don't like them.⁷² Subsidizing foods based on calcium content would encourage fortification of low-calcium foods and consumption of high-calcium foods (both dairy and non-dairy). Widespread fortification of non-dairy foods would alleviate the problem of individuals who cannot tolerate or do not prefer commonly available high-calcium foods.

The story just presented is quite plausible given the evidence we have examined so far. To illustrate how deep complexity and uncertainty can go, it is worth noting that the other evidence indicates that the story may be seriously incomplete and that the suggested policy approach may be deeply flawed. A recent prospective study on elderly women in the United States found that femoral neck bone loss and hip fractures increased with the ratio of animal to vegetable protein consumed, *even after* controlling for age, energy intake, total calcium intake (diet plus supplements), total protein intake,

72. The assimilation problem is very real because of the phenomenon of lactose intolerance. The ability to digest lactose (a milk sugar) after infancy is only present in humans with a mutant gene. This mutation is prevalent in certain groups such as people of northern European descent but is largely absent in other groups -- especially certain people of African or Asian descent. Since customary Western diets are short on high-calcium vegetables, dairy products provide the major source in many Western countries. The danger that certain groups and individuals will shun dairy products because of discomfort due to lactose intolerance therefore is a major concern for those who would address the hip fracture problem by increased dairy consumption. See, e.g., Karry A. Jackson & Dennis A. Savaiano, *Lactose Maldigestion, Calcium Intake and Osteoporosis in African-, Asian-, and Hispanic-Americans*, 20 J. AM. COLL. NUTR. 198S (2001).

current estrogen use, physical activity, smoking status and alcohol intake.⁷³ In addition, as indicated by the example of beta carotene above, in theory there is always the danger that promoting the consumption of a single nutrient will result in harm rather than benefit. There are dangers from excess calcium consumption. These dangers have prompted the U.S. Institute of Medicine to set tolerable upper intake levels and, in the face of significant uncertainty, to recommend further research on the interaction between calcium intake and the intake of other nutrients.⁷⁴ Although the dangers do not relate to bone health, it is worth noting that excess consumption of other essential minerals is a potential problem. For example, some have expressed concern about maintaining an appropriate ratio of calcium to phosphorous in the diet. In particular, there is some evidence that a high-phosphorous, low-calcium diet increases the risk of low bone density and bone fractures.⁷⁵ This evidence is particularly disturbing because of the jump in the consumption of soda beverages (typically phosphate rich) and the corresponding drop in (calcium-rich) milk consumption among children, teenagers and young adults in the United States.⁷⁶

The problems with focusing on nutrient components and the fact that the epidemiological and prospective study results with respect to hip fracture emphasize the impact of food pattern consumption suggests that tax/subsidy policy should address patterns. For example, the consistent positive evidence with respect to fruit and vegetable consumption might suggest subsidizing such consumption. However, there is an important caveat with respect to any policy (whether or not implemented through the use of taxes or subsidies) designed to induce major changes in dietary patterns. Epidemiological studies and many prospective studies usually involve populations with stable nutrition patterns. These patterns (including the use of supplements) usually are culturally ingrained, having emerged implicitly or explicitly by trial and error as successful overall nutritional strategies. Most patterns involve detailed features that emerge over time and are necessary for the pattern to be successful. An example in the United States is the mandated supplementation of table salt with iodine and milk with vitamin D. The vitamin D policy arose because significant numbers of people did not receive enough vitamin D from sun exposure. Adding the vitamin to milk, the main

73. See Deborah Sellmeyer, et.al. (The Study of Osteoporotic Fractures Research Group), *A High Ratio of Dietary Animal to Vegetable Protein Increases the Rate of Bone Loss and the Risk of Fracture in Postmenopausal Women*, 73 AM. J. CLINICAL NUTRITION 118, 120-21 (2001).

74. Institute of Medicine, *Dietary Reference Intakes for Calcium, Phosphorous, Magnesium, Vitamin D, and Fluoride*, at 134-145.

75. See Leonard Sax, *The Institute of Medicine's "Dietary Reference Intake for Phosphorous: A Critical Perspective*, 20 J. AM. COLL. NUTR. 271 (2001).

76. *Id.* at 276.

calcium source for much of the population made sense since vitamin D regulates the absorption and utilization of calcium (and phosphorous) and the mineralization of bone. At present, fortified milk is the main dietary source of vitamin D for Americans.⁷⁷

When eating patterns change in major ways for any reason, there is a danger of poor health results because of a failure to make subsidiary adjustments that are necessary. A good example is the adoption of vegan diets by Westerners for ideological or other reasons. These diets contain no food from animal sources. Most Western authorities would agree that a “well-planned” vegan diet will result in good health and probably will reduce the risk of many chronic diseases.⁷⁸ The “well-planned” aspect is important because Western food cultures are not adapted to this type of diet. Perhaps the most crucial item of planning is vitamin B-12. Deficiencies of vitamin B-12 can have very serious consequences such as permanent nervous system damage. This vitamin generally is not available from vegetable sources if food is carefully cleaned or cooked. The vitamin is produced by bacteria which are consumed by ruminants or other animals (who do not wash their food before consumption). As a result, meat and dairy products are good sources. Many vegetarian foods such as energy bars and soy milk are fortified with vitamin B-12, but this fortification is not systematic. If vegan diets become more

77. See WEIL, *supra* note 67, at 128. This supplementation does not prevent deficiency for all groups. A recent study using data from the third National Health and Nutrition Examination Survey, found that 42.4% of African-American women in the 15-49 age group had serum levels of a vitamin D biomarker below the cutoff indicating adequacy. See Nesby-O’Dell, et. al., *Hypovitaminosis D Prevalence and Determinants among African-American and White Women of Reproductive Age: Third National Health and Nutrition Examination Survey, 1988-1994*, 76 AM. J. CLINICAL NUTRITION 187 (2002). The equivalent deficiency percentage for white women was 4.2%. Maternal deficiency of vitamin D during pregnancy is a risk factor for poor vitamin D status during infancy. The study was motivated by recent reports of rickets (a disease caused by vitamin D deficiency) among African-American children. This disease “was nearly eradicated in the United States with the vitamin D fortification of milk in the 1930s.” *Id.* at 187. The prevalence of deficiency was particularly high (~ 51%) for African-American women who consumed milk less than three times per week and this group comprised about 60% of all such women. In contrast, only about 30% of the white women were in the low consumption group, and this group experienced deficiency prevalences of 3-4%. In the groups taking oral supplements of greater than or equal to 400 IU/d, the deficiency prevalence for African-American women was still 10.6% while the prevalence for white women was negligible (less than 0.1%). *Id.* at 191 (Table 2). These results suggest that African-American women have very high vitamin D needs. The strategy of supplementing milk may not work well for these women. 75% of the African-American population is lactose intolerant versus only 20% of the white population. See Jackson & Savaiano, *supra* note 72, at 202S (Table 3). See also note 72 *supra* (discussing lactose intolerance).

78. See, e.g., Walter C. Willett, *Convergence of Philosophy and Science: the Third International Congress on Vegetarian Nutrition*, 70 AM. J. CLINICAL NUTRITION 434S (1999); Colleen A. Venti & Carol S. Johnston, *Modified Food Guide Pyramid for Lactovegetarians and Vegans*, 132 J. NUTRITION 1050 (2002).

prevalent, the food culture may adapt by requiring systematic B-12 supplementation of foods as it did in the United States through the use of iodine supplementation of salt and vitamin D supplementation of milk. In the meantime, it appears that at least some Western vegans, especially the young and un-informed, are at risk for deficiencies of vitamin B-12.⁷⁹

Food pattern adjustment issues arise with respect to taxing foods that have undesirable health characteristics as well as with respect to subsidizing healthy foods. To motivate the discussion, it is worth considering the China-Oxford-Cornell study,⁸⁰ one of the most thorough and interesting epidemiological studies on diet. For the period 1973-75, the Chinese government comprehensively analyzed the cause of death for all mortalities in the country. The demographics and history of rural China presented a special opportunity for nutritional epidemiology because of the plausible assumption that “most individuals would exhibit stable residence patterns, would consume only locally produced food, and would consume mostly the same kinds of food over their lifetimes.”⁸¹ Another factor is that although China is a developing country, the medical system is sophisticated enough to have a high degree of confidence in the mortality statistics. In the early 1980s, the researchers picked random age-stratified random samples of individuals from two villages in each of 65 rural Chinese counties and did an exhaustive dietary and biomarker analysis of the individuals in the sample. The researchers were able to study incidence and associations for a very large number of diseases and conditions including virtually all of the major sources of mortality and morbidity in the West.

Dietary intakes in the 65 counties differed sharply on average from the United States. On average, the rural Chinese subjects consumed only 14.5% of energy from fat (versus 38.8% for the U.S.), the percentage of total protein from animal sources was 10.8% (versus 69% in the U.S.), and dietary fiber consumption was three times U.S. levels.⁸² Dietary intakes also differed substantially between counties. These characteristics provided an opportunity to supplement all of the studies from developed countries with a study of populations with a significantly different range of dietary characteristics. This

79. See, e.g., Christel L. Larsson & Gunnar K. Johansson, *Dietary Intake and Nutritional Status of Young Vegans and Omnivores in Sweden*, 76 AM. J. CLINICAL NUTRITION 100 (2002). Of course

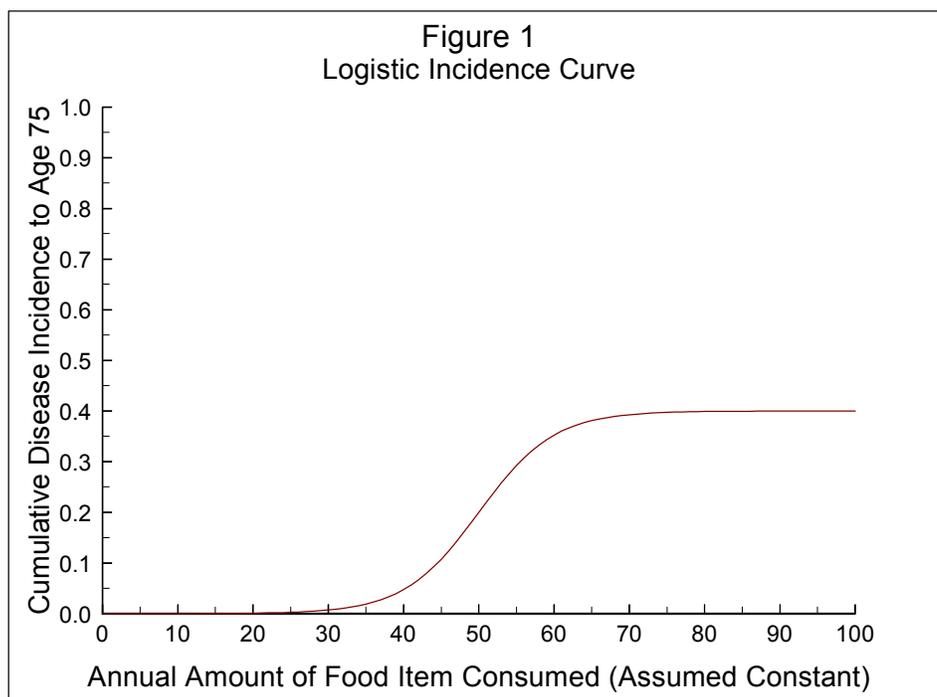
80. The study is described in detail and the data from the first phase is reported in CHEN JUNSHI, T. COLIN CAMPBELL, LI JUNYAO & RICHARD PETO, *DIET, LIFESTYLE AND MORTALITY IN CHINA -- A STUDY OF THE CHARACTERISTICS OF 65 CHINESE COUNTIES* (1990).

81. T. Colin Campbell & Chen Junshi, *Diet and Chronic Degenerative Diseases: Perspectives from China*, 59 AM. J. CLINICAL NUTRITION 1153S, 1154S (1994).

82. See *id.* at 1156S.

opportunity is valuable because many of the effects of diet on disease are likely to be non-linear -- very similar to the “dose-response” curve relationship between drug treatment and disease symptoms. I.e., small amounts of a food item in the diet may have little impact, at higher levels of consumption there will be a large marginal impact, then the marginal impact will fall again toward zero as consumption increases even further. One functional form that captures this pattern is the logistic distribution.⁸³

Consider the logistic incidence curve in the figure below. On the vertical axis is cumulative incidence of a disease up to age 75, i.e., the probability of incurring the



disease at or before that age. On the horizontal axis is the annual rate of consumption of a particular food item. We assume the annual rate is constant. At less than about 30 units per year, there is almost no incidence of the disease. Above about 70 units of annual consumption, the disease incidence is almost constant, at around 40% of the population.

If there is a population with a range of consumption between 70 and 100 annual units, there will be no empirical association between that consumption and disease incidence. Yet it may be true that all of the disease incidence in that population is

83. See MERRAN EVANS, NICHOLAS HASTINGS & BRIAN PEACOCK, *STATISTICAL DISTRIBUTIONS* 124 (3rd ed.2000).

caused by the food. This point illustrates why it is valuable to examine populations with very different ranges of consumption.

The China-Oxford-Cornell study presents such an opportunity. Consider IHD, the leading killer in the United States population. Based on U.S. data, it appears that about one-third of IHD incidence is due to diet and lifestyle factors. However, the incidence of IHD in China at comparable ages (cumulative up to 65) is only about 6% the U.S. incidence for men and 18% the U.S. incidence for women.⁸⁴ Not surprisingly, biomarkers that predict IHD also were very much lower on average in the China sample. For example, total serum cholesterol average about 144 mg/dL for the males in the China sample compared with a 211 mg/dL average for comparable males in the United States.⁸⁵ IHD mortality varies within rural China based on factors similar to those that have impact in the United States (fatty acid profile, meat consumption, etc.).⁸⁶ Perhaps most striking is that the mortality rates decline nearly to zero. One county had no incidence during 1973-75 among 181,000 females and another had no incidence among 246,000 males during the same period.⁸⁷ These results suggest (but do not prove) that virtually all (rather than merely one-third or so) of the IHD observed in the United States for persons 65 and under is due to dietary and lifestyle factors.⁸⁸

84. See T. Colin Campbell, Banoo Parpia & Junshi Chen, *Diet, Lifestyle, and the Etiology of Coronary Artery Disease: The Cornell China Study*, 82 AM. J. CARDIOLOGY 18T (1998). The 6% and 18% figures are based on the 1973-75 mortality data. Using 1986-88 mortality data, these figures would be about 20% and 34% respectively, significantly higher, but still very impressive. See ECOLOGICAL STUDY OF DIET, MORTALITY AND LIFESTYLE IN RURAL CHINA 117 (1989), <http://www.ctsu.ox.ac.uk/projects/cecology1989/>. The researchers also collected food intake information in 1986-88. This information showed a move toward United States levels for indicators like percent of energy from dietary fat and meat consumption. However, these levels remain substantially lower in rural China. It is possible that the different mortality results are partially or wholly due to the corresponding dietary changes.

85. See Campbell & Junshi, *supra* note 81, at 1156S-1157S. The mg/dL units are standard in the United States. Campbell & Junshi express their results in mmol/L, units used in the U.K. To convert from mmol/L to mg/dL, one multiplies by 38.6. A cholesterol reading of 144 mg/dL for a male in the United States would suggest negligible IHD risk. In some counties in China, the average total cholesterol value for males was as low as 100 mg/dL. *Id.*

86. See Campbell, et. al., *supra* note 84, at 20T.

87. See *id.*

88. The results are unlikely to be explained by genetic differences between the populations. Migration studies overwhelmingly indicate that when migrants adopt the dietary practices of their new locale their disease profile (including IHD incidence) shifts to that of the new locale. See, Campbell & Junshi, *supra* note 81, at 1155S; L. Jartti, et.al., *Population-Based Twin Study of the Effects of Migration from Finland to Sweden on Endothelial Function and Intima-Media Thickness*, 33 ARTERIOSCLER. THROMB. VASC. BIOL. 832 (2002) at 832 (discussing some IHD-related

Returning to the issue of food pattern adjustment in response to a tax on “unhealthy” foods, suppose that we attempted to push the U.S. diet in the direction of rural China circa 1980. One element might be a stiff tax on foods with saturated fats, including most meat and dairy products. Some significant potential food pattern adjustment problems emerge. Assuming that the substitution effect dominates, there would be a big drop in consumption of meat and dairy products. A key question is what Americans would substitute in place of these foods. They might increase consumption of synthetic fats, some of which (e.g., trans fatty acids) have worse health characteristics than saturated fat. Instead of substituting in the high quality vegetable protein foods eaten in China, Americans might eat more refined grain products, a food category almost universally disfavored by nutrition experts.⁸⁹ The substitution problem is particularly acute for low-income families and individuals who may rely on inexpensive milk and meat for protein and calcium needs. It may take time for producers to replace those products with equally inexpensive substitutes (e.g. fortified soy milk instead of fortified cow’s milk) that would meet the same nutritional needs. In addition, the food industry may respond to a tax on meat and milk by producing various synthetics. Some of these may have excellent nutritional qualities, but some may not. Even if the synthetics are fairly healthy, replacing meat and milk with these synthetics rather than with the actual foods consumed by the rural Chinese may not achieve the full benefits of the rural Chinese diet.

migration studies); KENNETH J. ROTHMAN & SANDER GREENLAND, MODERN EPIDEMIOLOGY 626 (1998)(discussing cancer-related studies).

In addition, the results for males are unlikely to be connected with differences in tobacco use between the United States and rural China. The incidence of current tobacco use in rural China among males was about 77% versus around 35% for U.S. males for the same year (1983). The proportions reporting ever smoking regularly were around 80% and 63% respectively. See CAMPBELL, ET. AL., *supra* note 80, at 662, 664; CDC, *Number (in millions) of adults 18 years and older who were current former or never smokers*, [http:// www.cdc.gov/ tobacco/ research_ data/ adults_prev/ tab_3.htm](http://www.cdc.gov/tobacco/research_data/adults_prev/tab_3.htm).

89. In February 2000, the U.S. Department of Agriculture held a “Symposium on the Great Nutrition Debate.” See UNITED STATES DEPARTMENT OF AGRICULTURE, In the matter of: Millenium Lecture Series Symposium on the Great Nutrition Debate (Verbatim Transcript). February 24, 2000 (hereinafter “Diet Gurus Debate”). The symposium was an actual debate and among the panelists were the five of the most prominent “diet gurus”: Dr. Robert C. Atkins, Dr. Barry Sears (the “Zone”), Dr. Morrison C. Bethea (Sugar-busters), Dr. John McDougall, and Dr. Dean Ornish. These doctors (and the other panelists) made very different overall dietary recommendations, creating a heated exchange. However, as noted by Dr. Bethea near the end of the symposium, everyone agreed that Americans are eating too much refined grain and sugar. *Id.* at 133. A public-health-motivated general tax scheme probably would impose a high tax on these products.

E. A Research Strategy

It is clear from the previous subsections that there are many factors that would make imposing a food tax difficult. At the same time, as illustrated by the outcomes in the China-Oxford-Cornell study, the stakes are very high. It is possible that a substantial portion of the leading causes of mortality and morbidity in the United States are associated with diet and physical activity.

Another consideration is that there are many other approaches besides taxing or subsidizing food that might achieve public health goals as or more effectively. In the United States, for example, the federal and state governments operate an extensive school lunch program and provide assistance to the needy in purchasing food through the “food stamp” program. Governments can (and sometimes do) restrict the foods served or subsidized in these programs. Various agencies also participate in public education campaigns, although arguably these have been severely under funded.⁹⁰

An important first step for evaluating the role of food taxes is to examine various purposes these taxes might serve from a normative perspective. That is the goal of the rest of this paper. Part II discusses various primarily non-insurance-related motivations for taxing food. Part III considers use of a food tax as a component of health insurance systems.

To make the normative discussion in Parts II and III manageable, we will assume away many of the problems discussed in this Part. In particular, we will assume throughout that implementation of the tax is possible and that there are no political constraints on the form (or existence) of the tax. At some points in the paper we also will assume that there is no scientific uncertainty about the impact of foods on disease, that individuals are homogeneous with respect to the dependence of disease risk on diet, and that the substitution effects of any tax are completely transparent. Finally, with a few exceptions, we do not attempt to take into account alternative approaches to taxation such as education or direct government provision of food.

90. See NESTLE, *supra* note 1, at 130-32; Jacobson & Brownell, *supra* note 13, at 854.

II. BEYOND THE PUBLIC HEALTH PERSPECTIVE: THE ROLE OF FOOD TAXES

There are many roles that food taxes might play. The discussion in Part I emphasized what can be termed the “public health perspective” as a motivation for taxing foods. This perspective assumes that it is socially valuable to make health outcomes better regardless of how individuals would trade off risky dietary behaviors with those outcomes. This perspective has dominated the literature concerning both fat taxes and junk food taxes, probably for the simple reason that public health professionals have authored much of that literature to date.

A very different approach would be to respect consumer sovereignty, in particular the right to risk future illness in order to consume foods that provide pleasure presently. This idea has a great deal of traction in Western societies. And it is no surprise that in the United States, the critique on fat taxes and junk food taxes has centered on the idea that people should be free to make their own health/lifestyle choices. The government should not interfere with these choices by using taxation to distort food prices or to punish certain choices.⁹¹

A sophisticated version of this alternative approach is implicit in a recent paper on obesity by Darius Lakdawalla and Tomas Philipson.⁹² The paper is motivated by the rapid growth of the incidence of obesity in the United States and worldwide.⁹³ Lakdawalla & Philipson construct a traditional economic model and use the model to attempt to explain the obesity epidemic. In their model, “people may rationally choose to be under- or over-weight in a medical sense, because weight results from personal tradeoffs and choices along such dimensions as occupation, leisure time activity or inactivity, residence, and, of course, food intake.”⁹⁴ Individuals therefore maximize utility that is a function of food intake, other consumption, and weight. Weight is a stock that falls over time without food input and that is influenced by the strenuousness

91. See *supra* note 28 (citing sources).

92. Darius Lakdawalla & Tomas Philipson, *The Growth of Obesity and Technological Change: A Theoretical and Empirical Examination*, NBER Working Paper #8946 (May 2002), <http://www.nber.org/papers/w8946>.

93. See text accompanying notes 7 -11 *supra*.

94. Lakdawalla & Philipson, *supra* note 92, at 1.

of work and home activities as well as by food intake. The model is elaborate, taking into account, for example, separate impacts of earned and unearned income. The basic argument that emerges from the model and the empirical analysis is that “technological change has led to weight growth by making home- and market-production more sedentary and by lowering food prices through agricultural innovation.”⁹⁵

Lakdawalla and Philipson dismiss alternative explanations for the rise of obesity by arguing that they are inconsistent with the time series price and quantity observations for the United States. Explanations such as “a change in the ‘culture’ of food consumption, growth in demand for fast food, ..., changing social norms, ..., a change in attitude toward obesity, or reduced parental oversight of children” all involve factors that would increase the demand for food, and “if demand were to grow in this fashion, weight would still grow, but price would *increase* rather than decrease, while food consumption would *unambiguously* rise.”⁹⁶ The authors note that there periods of time during which calorie intake, declining prices and growth in weight occurred simultaneously, factors that are “difficult to interpret as the result of demand growth alone.”⁹⁷

This argument does not logically preclude the alternative explanations, but merely suggests that they are not the whole story. The paper goes on to an empirical analysis that calculates weight growth due to population characteristics (e.g. the number of people engaged in strenuous jobs) and then attributes the rest of the growth to “technical change, in the tradition of economic growth-accounting.”⁹⁸ The authors then decompose this residual trend in weight growth into supply and demand components, estimating a 40% weight for the former and 60% for the later. An important lesson from the paper is that at least some of the growth of obesity and some of the persistence the concomitant chronic diseases that arise from rich Western diets may be a matter of rational, personal choice rather than the result of factors such as a “toxic” food environment.

On the other hand, it is easy to imagine that various informational and cognitive processing problems may result in a higher level of obesity and chronic disease than rational consumers would choose. Despite the availability of information about foods both due to labeling rules that require a nutritional breakdown and due to the ready availability of nutrition books and media programs, processing all of this information is costly. In addition, consumers, particularly the young, may underestimate the disease

95. Id. at 25. In developed countries “people must *pay* for undertaking, rather than be paid to undertake, physical activity.” Id. at 2. The payment is in terms of leisure time absorbed by exercise activities.

96. Id. at 3, 9.

97. Id. at 10.

98. Id. at 16.

risks that they are taking by establishing particular eating habits. It appears, however, that consumers do respond strongly to food prices.⁹⁹ As a result, one role of food taxes might be to provide signals to consumers about the true risks of consuming various products.¹⁰⁰ This role would emerge as a natural side benefit from the use of food taxes as part of the health insurance system, discussed below.

We now turn to various other roles that food taxes might play: raising revenue, addressing externalities, correcting “internalities,” adjusting for ex ante moral hazard in the face of a health insurance system, and operating as a key component of the health insurance system itself.¹⁰¹ In each case, as suggested by the discussion of the paper by Lakdawalla and Philipson, the goal is to discuss potential reasons for government intervention against a backdrop of free choice by consumers.

There are parallel literatures concerning tobacco and alcohol taxes that make this job much easier.¹⁰² Many of the issues involving cigarette and alcohol policy are similar to the issues for food policy and many of the policy alternatives, including taxation, are

99. See NESTLE, *supra* note 1, at 18.

100. At present the only information that consumers can infer from government action is that any food additives have been shown to be “safe” by the manufacturer according to FDA standards and that processors and retailers must meet certain standards of food preparation and storage or face penalties. The government also produces information such as dietary guidelines and the “food pyramid,” but these are somewhat compromised by the political nature of the process. See text accompanying notes 36-38 *supra*. In addition, government policy makers sometimes soft pedal advice based on what they believe the public will accept. See text accompanying note 148 *infra*.

101. We do not discuss *all* of the potential justifications for taxing food. For instance, there is a literature on using commodity taxes, including taxes on food, to counteract or adjust for imperfections in the production sector. These imperfections include oligopoly, differences in treatment between household and non-household production, increasing returns to scale, and monopolistic competition. For an interesting paper that also has a short literature review, see Aled Ab Iorweth & John Whalley, *Meals on Wheels: Restaurant and Home Meal Production and the Exemption of Food from Sales and Value-Added Taxes*, NBER WORKING PAPER #6653, July 1998, <http://www.nber.org/papers/w6653>.

102. For a good summaries of these literatures, see Frank J. Chaloupka & Kenneth E. Warner, *The Economics of Smoking*, in HANDBOOK OF HEALTH ECONOMICS, VOLUME 1 1539 (A.J. Culyer & J.P. Newhouse, eds. 2000); Philip J. Cook & Michael J. Moore, *Alcohol*, in HANDBOOK OF HEALTH ECONOMICS, VOLUME 1 1629 (A.J. Culyer & J.P. Newhouse, eds. 2000).

similar.¹⁰³ The literature on tobacco taxes is particularly well-developed, and we will draw liberally from it below.¹⁰⁴

A. Raising Revenue

A classic, and well-studied, reason to tax food is to raise revenue that can fund public goods or other government expenditures. In fact, many of the junk food taxes that currently exist or that existed in the past seem substantially or predominantly motivated by revenue goals.¹⁰⁵ In traditional commodity tax models, taxing food is attractive because demand is inelastic (eat or die!) thereby resulting in a lower excess burden and a more efficient tax. On the other hand, taxing food raises distributional concerns because low-income individuals spend more on food as a proportion of total expenditure than high-income individuals.¹⁰⁶ In countries that impose commodity taxes or value added taxes, food is often exempted or treated differently for this reason.¹⁰⁷

Since taxing food to raise revenue is intellectually well-plowed ground, we will not consider it further. However, there are two important aspects highlighted by the study of

103. For example, there is the potential use of “counter-advertising,” messages promulgated by the government or private parties to point out the risks of using cigarettes and alcohol. These messages include not only direct appeals in the media but also other approaches such as requiring warnings on cigarette packs. In the case of cigarettes these messages seem to have had quite powerful effects in reducing consumption. *See Chaloupka & Warner, supra* note 102, at 1593-96. In some cases governments have increased or instituted cigarette taxes to fund the counter-advertising. *Id.* at 1594-95. Food tax advocates often envision a similar approach in the case of food. In particular, using junk food taxes to fund public educational campaigns is a common theme. *See, e.g., Jacobson & Brownell, supra* note 13, at 856-57.

104. The alcohol and tobacco literatures are important for another reason. Some of the rationales for food taxation involve connections with the insurance system. In particular, the government can use food taxes as “premiums” levied on individuals who dietary risks. Dietary risk-taking is multifaceted. If one eats foods that greatly increase the risk of death from IHD at a young age, taking risks that increase the risk of cancer at older ages will be less costly to the insurer. Cigarette and alcohol consumption (as well as other risky behavior) interact with dietary risks in the same way. A scheme that includes food taxes might therefore include tobacco and alcohol as well.

105. *See Jacobson & Brownell, supra* note 13, at 854-56.

106. *See J.B. Davies, Manufacturers’ Sales Tax, Value-Added Tax and Effective Tax Incidence, in REPORT OF THE PROCEEDINGS OF THE THIRTY-SEVENTH TAX CONFERENCE, 1985 CONFERENCE REPORT, CANADIAN TAX FOUNDATION (TORONTO) 5:1-14 (1985).*

107. Exempting food from taxation arguably is a poor way to redistribute because well-off as well as poor individuals buy food. *Id.*

using food taxes to raise revenue. First, it is important to consider whether similar distributional issues may arise if food taxes are used for purposes such as correcting moral hazard or serving as implicit insurance premiums. In these situations, the substitution effects occur as consumers face social costs or insurance charges that otherwise would be charged separately or not at all. But there are also income effects, and it might be desirable to protect low income individuals from these effects via lump sum transfers or otherwise. On the other hand, there is an important difference between the impact of an across-the-board X% tax on food and the use of food taxes for insurance or public health purposes. In the later case, different foods will be subject to different taxes and subsidies. The net effect (especially if supplemented by transfers) may be to make healthy eating patterns more economically accessible to low-income individuals and families. In addition, substitution in favor of healthy eating among these groups may have a positive distributional effect since the distribution of health outcomes counts as well as the distribution of spending power.

Second, the attention to the excess burden of taxation in the commodity tax literature underscores the importance of considering that burden in assessing alternative tax and expenditure systems. For example, some countries, including the United States, fund part of their health insurance systems from general revenues. This approach may enhance or detract from the fairness and efficiency of the system. However, it is important to remember that general taxation typically involves excess burden at the margin, and that, as tax rates increase, the degree of excess burden tends to increase. The cost of raising an extra dollar through the U.S. income tax system is not simply one dollar, but one dollar plus the margin excess burden that results from increasing the tax. This excess burden may be substantial. For the U.S. income tax system estimates by reputable economists range as high as a \$1.65 loss due to excess burden per \$1.00 of additional revenue.¹⁰⁸

B. Addressing Externalities

A classic rationale for taxation is associated with Pigou.¹⁰⁹ Consumption of goods or other activities sometimes create social costs that are not a component of the price of the good. As a result, consumers and producers buy more of the good or do more of the activity that is socially optimal since they pay only part of the cost. An ideal Pigouvian tax would equal, for each unit of consumption, the added marginal social cost caused by consumption of that unit.

108. See Martin Feldstein, *How Big Should Government Be?*, NBER WORKING PAPER #5868, December 1996, at 25.

109. See A. C. PIGOU, *A STUDY IN PUBLIC FINANCE* (3rd rev. ed. 1962).

There is a well-developed literature analyzing cigarette taxation from the standpoint of externalities.¹¹⁰ The externality issues that arise with cigarettes are very similar (with some important differences discussed below) to the same set of issues with respect to food consumption. An important initial point is that smoking and eating involve both “external” and “internal” costs.¹¹¹ Most of the internal costs stem from the fact that bad choices in either domain will increase the risk of poor health or of a shorter life span. Although poor health or a shorter life span may affect others (such as family members), much of the impact will be on the individual taking the risks. Assuming people are fully informed and rational, it is not clear that there is a justification for intervention with respect to individuals who incur internal costs.

External costs are another story. For cigarettes, an obvious external cost is the harm caused by environmental tobacco smoke (“ETS”) often known as “second hand smoke.” In this case, the smoker’s consumption adversely impacts health outcomes for other people, and, absent government intervention, the smoker may not take these costs into account. If taxation were the only instrument to address ETS, it seems clear that a corrective tax on the order of several dollars per pack would be justified.¹¹²

Food consumption does not involve a feature that is an obvious parallel to ETS. However, there is another set of external costs for which very similar issues arise for both tobacco and food. In developed countries, various social and health insurance systems are in place, and a significant portion of these systems are operated by governments. Consider premature death due to smoking. Deaths due to smoking may result in higher or lower expected costs than other causes of death. Premature death means that costs will be incurred earlier and that the smoker will not be the source of health costs in subsequent years. If cutting off non-mortality related costs in these later years offsets the impact of accelerating health costs and any tendency for expected medical costs to be higher from smoking-related deaths, then, with respect to expected medical costs, smoking will provide a net *positive* externality to the health insurance system.¹¹³ Smokers and non-smokers will have paid the same premiums, but the average expected costs paid out on behalf of the smokers will be lower. Non-smokers will be subsidized by smokers. Of course, the externality may easily run in the other direction.

110. For a good summary of the literature and the issues, see Frank J. Chaloupka & Kenneth E. Warner, *supra* note 102, at 1579-1583.

111. Economists sometimes refer to these as social and private costs respectively. *See id.* at 1579. I use “external” and “internal” in what follows since “social cost” might be (and sometimes is) construed to mean the total costs to society including costs that are “internal” to the individual.

112. *Id.* at 1581.

113. *Id.* at 1580.

A similar phenomenon happens with respect to social insurance systems such as Social Security in the United States. Premature death from smoking results in a positive externality. Smokers and non-smokers will make the same contributions, but these contributions will fund larger benefits for non-smokers because they live longer.¹¹⁴

These externalities would not exist if premiums were conditional on smoking behavior. Rating based on smoking status is common in the case of life insurance. It appears that fraud (by claiming to be a non-smoker when one is not) is risky. Courts typically enforce draconian clauses in life insurance contracts that invalidate the policy if a smoker fails to disclose that status *even if* the cause of death is totally unrelated to smoking and would be otherwise covered by the policy.¹¹⁵ Health insurance and social insurance premiums are typically not adjusted for smoking status.

Parallel externality issues arise with respect to food. Risky eating behavior may impose positive or negative externalities on other participants in health or social insurance systems. If the risky behavior simply accelerates death, then the same considerations arise as with premature death from smoking. The impact on marginal expected medical costs paid out by health insurance systems from engaging in the behavior may be small or even negative. One would expect that risky dietary behaviors would have an interaction with social insurance (and private defined benefit pension) systems that is similar to the impact of smoking.

The similarities between externalities likely to arise from smoking and eating habits makes estimates of smoking externalities interesting. Leaving aside ETS-related externalities, most researchers find that the negative externality related to tobacco use is small but positive, justifying a tax on cigarettes on the order of 15 to 30 cents per pack. This amount is less than the present federal tax per pack.¹¹⁶ Nonetheless, the issue is as complex as it is important, causing leading scholars to call for much more research.¹¹⁷

It is interesting to note that these external cost estimates for smoking are much lower than estimates for internal cost. Following the literature on life valuation, Gruber and Koszegi start with a value of life of 6.8 million dollars, use estimates from the literature

114. See J.B. Shoven, J.O. Sundberg & J.P. Bunker, *The Social Security Cost of Smoking*, in THE ECONOMICS OF AGING (D.A. Wise, editor, 1989).

115. See David A. Winston, *Warning: A Misrepresentation on Smoking can be Hazardous to Your Life Insurance Policy*, LAN 150 (April 1993). Life insurance companies sometimes also require a physical examination prior to extending coverage. The blood sample portion of the examination typically includes a test for plasma markers of nicotine use.

116. Some prominent researchers even claim that smoking generates net positive externalities. See W. Kip Viscusi, *Cigarette Taxation and the Social Consequences of Smoking*, in TAX POLICY AND THE ECONOMY 51 (James Poterba, ed. 1995).

117. See Chaloupka & Warner, *supra* note 102, at 1579-83.

that smoking reduces life by six years on average, and consider typical lifetime cigarette consumption. They arrive at a cost of \$35.64 per pack. This estimate does not include costs from the reduction in quality of life prior to death but also does not take into account the possibility that smokers value their future lives less than others.¹¹⁸ Many dietary habits are likely to have a similar impact.

The distinction between internal and external cost distinguishes the typical “economic” approach from the public health perspective, both in the case of tobacco and the case of food.¹¹⁹ Under the later, public policy is concerned about internal costs in the form of shortened or lower quality lives even if the individual makes a rational choice with full information to take the risks that lead to the costs. Under the former, government intervention is justified only by external costs, not internal costs. Building on the discussion in this subsection, Part III will examine rationales for food taxation that are related to insurance systems. In the next section, we will consider situations where internal costs are relevant for public policy under an economic approach.

Before moving to that discussion, it is important to make one point about Pigouvian taxes. That tax mandates imposing a levy on each unit of externality-generating consumption equal to the marginal external costs generated by that unit of consumption. A Pigouvian tax schedule may be very complicated, however, if the relationship of external cost to consumption is nonlinear. It is likely, for example, that the relationship between disease risk and food consumption looks something like the logistic curve set out above.¹²⁰ At low and high levels of consumption, an additional unit of consumption generates very little increase in disease risk and, consequently, in the risk of generating external costs. In contrast, consumption units in the middle range result in a high marginal impact. An even more complex situation can occur, as in the case of alcohol, where experts believe that small amounts of consumption reduce disease risk, but high levels of consumption increase it.¹²¹ In all these situations, the ideal approach would be to monitor each individual’s actual consumption and impose the optimal tax schedule. If observation is too costly, the only alternative may be a linear food tax, with a flat rate

118. Jonathan Gruber & Botond Koszegi, *A Theory of Government Regulation of Addictive Bads: Optimal Tax Levels and Tax Incidence for Cigarette Excise Taxation*, NBER WORKING PAPER #8777, February 2002, <http://www.nber.org/papers/w8777>, at 24-26.

119. For a cogent discussion in the context of tobacco, see Chaloupka & Warner, *supra* note 102, at 1577, 1579.

120. See text accompanying note 83 *supra*.

121. See Cook & Moore, *supra* note 102, at 1651-52.

applying to each unit. This tax may fall considerably short of optimality.¹²² An alternative (or complementary) approach to taxing food would be to observe biomarkers (e.g., various cholesterol levels or obesity) that capture much of the impact of diet and that are related to morbidity and mortality. We discuss this approach in Part III.

C. Correcting “Internalities”

There are two aspects of tobacco use that have loomed large in the cigarette tax literature. One is that tobacco use is addictive. This aspect may change both the impact of cigarette taxes and their optimal level. The second issue involves information. Although the harmful health effects of tobacco are widely known, there is a danger that people in general, or specific groups such as youth, will have an unrealistic view of the dangers or of the addictive nature of tobacco. We discuss both of these issues in this subsection.

1. Addiction and Taxes

Cigarette use displays the classic characteristics of an addictive good, especially the habit formation (reinforcement) aspect: Current consumption is positively related to past consumption. There has been a great deal of intellectual activity in the past two decades both on the empirical and theoretical aspects of addiction.¹²³ A major development in the literature of addiction was a 1988 article by Gary Becker and Kevin Murphy.¹²⁴ Prior to Becker & Murphy’s work, the standard theoretical treatment presumed myopia: The addict does not contemplate the future implications of current consumption, but current consumption increases future consumption through habit formation. Becker and Murphy constructed a “rational addiction” model showing that many behaviors associated with myopic habit formation also are consistent with optimization under stable preferences. This optimization involves “adjacent complementarity” -- the addict understands that consumption in different time periods are complements. The main empirical prediction that would distinguish rational addiction from myopia is whether addicts respond to anticipated future prices. In the

122. See Louis Kaplow and Steven Shavell, *On the Superiority of Corrective Taxes to Quantity Regulation*, 4 AM. LAW & ECON. REV. 1, 4-5 (2002).

123. See Chaloupka & Warner, *supra* note 102, at 1556-64, Jonathan Gruber, *Tobacco at the Crossroads: The Past and Future of Smoking Regulation in the United States*, 15 J. ECON. PERSP. 193, 202-06 (2001). Much of the discussion here is drawn from these two articles.

124. Gary S. Becker & Kevin Murphy, *A Theory of Rational Addiction*, 96 J. POLIT. ECON. 675 (1988).

face of higher future prices, the rational addict will reduce consumption today, knowing that consumption in the future induced by today's consumption is now anticipated to be more costly. A myopic addict's present demand will not change since it depends only on current prices. Empirical papers have consistently found that anticipated higher future prices do impact current cigarette consumption,¹²⁵ strong evidence against the myopic model.

The normative implication of the rational addiction model is that only externalities justify government intervention. Ill-health or other adverse consequences for addicts is not relevant.

There are two major problems with the rational addiction model. One is that the model assumes that preferences are time-consistent. A time-consistent smoker who decides to smoke today but quit tomorrow actually will prefer to quit when tomorrow comes. As Gruber points out, time-inconsistency would explain the observed "inability to realize desired levels of future smoking."¹²⁶ He cites some strong evidence: 80% of smokers in the United States express a desire to quit; among high school seniors who smoke, 56% claim they will not be smoking in five years, but only 31% quit; among those who smoke more than one pack a day, the actual smoking rate five years later is higher among those who claimed they would quit (74%) than among those who made no such claim (72%).¹²⁷

Another evidence of time inconsistency is the use of "self-control devices" as well as "quitting aids" when people try to stop smoking. A quitting aid might be a nicotine patch or similar device that allows the individual to more easily transition to non-smoking status. In contrast, a self-control device imposes costs for additional smoking. An example is an agreement to tear up a dollar bill every time one smokes. Self-control devices do not make sense for individuals with time-consistent preferences. They will smoke up to a certain moment (up until the costs begin to exceed the benefits) and then will quit. It would not be rational to impose additional costs in the smoking state. For the person who has time-inconsistent preferences, however, self-control devices play a valuable role. They allow the current self to impose costs on future selves who smoke beyond the point that the current self judges as optimal.

A tax on cigarettes functions as a powerful self-control device. Instead of tearing up a dollar, the smoker gives it to the government. Gruber & Koszegi describe this

125. See Gruber, *supra* note 123, at 203.

126. *Id.* at 204.

127. *Id.* at 204.

situation as one involving “internalities.”¹²⁸ The internal costs of smoking are created and incurred by different “selves,” one for each different moment in time. Since the internal costs of cigarette smoking are so large (recall the \$35.64 per pack figure above), internalities may generate a much higher optimal tax than externalities. In fact, Gruber & Koszegi find that the optimal tax is at least \$1 per pack, much higher than the 15-30 cents that the bulk of the literature calculate as required to correct externalities.¹²⁹ It also is worth noting that adding time-inconsistent preferences to the rational addiction model does not change the prediction, observed in empirical studies, that anticipated future prices should lower present consumption. A time-inconsistent addict will respond in that way.

2. Information and Taxes

A second theoretical critique of the rational addiction model is that it is implausible that a person sits down at the initial opportunity to consume and rationally decides to be a smoker or an alcoholic. This problem stems from the assumption of perfect foresight in the model. If individuals differ in their capacity to be addicted and individuals have subjective beliefs about their capacity, it is possible to become addicted and regret that outcome. This point is particularly important for the situation of youthful experimentation. Youth appear to be particularly naive with respect to the addictive nature of smoking.¹³⁰

This critique identifies a more general category that may justify government intervention, including taxes: information failure. It is not just information about the addictive potential of smoking that is some times lacking. It also appears that youth and some classes of adults underestimate the health consequences of smoking. Heavy smokers, for instance, appear to understand the general risks for all smokers but do not personalize these risks. In addition, the public is aware of the impact of smoking on some major disease groups such as lung cancer, IHD, and chronic lung disease, but is not generally aware of the other potential health consequences of smoking.¹³¹

One way to address this information problem is to impose a tax equal to the present value of the internal costs of smoking. This tax would be very large, around \$30 per pack. If individuals information about health risks are imperfect rather than totally

128. Jonathan Gruber & Botond Koszegi, *Is Addiction ‘Rational’? Theory and Evidence*, NBER WORKING PAPER #7507, January 2000, <http://www.nber.org/papers/w7507> at 2.

129. *Id.* at 35.

130. *See* Chaloupka & Warner, *supra* note 102, at 1583-84.

131. *Id.* at 1595-96.

absent, a tax on the full value of internal costs might be quite excessive. Imposing such a tax means that the smoker will pay the same costs twice: once as a tax and the second time in the form of actual internal costs such as ill health. If the smoker only underestimates the actual internal costs by 20%, then imposing a tax equivalent to 100% of the costs will be inefficient.

This problem disappears if the tax revenues also serve as an insurance premium. The individual pays the tax, and the government pays any later “claims” concerning internal costs. In such a system the individual receives the correct signal about the future costs of present cigarette consumption. Ex ante, there is no problem of paying the same costs twice. The individual pays the expected cost and then is relieved of actual costs as they occur. This idea is pursued at length in Part III below.

3. Application to Food Taxes

So far we have used the vast and well-developed literature on tobacco taxation to identify and delineate key issues: “internalities” and information failure. Food consumption shares some relevant similarities with tobacco, but also some important differences. We already have mentioned the very real possibility of information failure with respect to the health aspects of food.¹³² These possibilities suggest the same potential role for taxation as in the case of cigarettes. An interesting question, however, is whether particular kinds of food may be considered “addictive” in the same way as tobacco. If so, there is the additional issue of whether the addictive qualities of food create a case for government intervention in the form of a tax.

There are various definitions of “addiction,” and the range of applications of the concept has spread from situations of drug or alcohol abuse to activities like playing video games and even certain relationship patterns. Not surprisingly, there is a literature on “food addiction.”¹³³ What is “addiction”? One typical approach would require the simultaneous presence of three indicia: tolerance, withdrawal, and reinforcement.¹³⁴ The reinforcement criterion is habit formation by another name. Empirical analysis

132. See text accompanying notes 98-100 *supra*.

133. See Peter J. Rodgers & Hendrik J. Smit, *Food Craving and Food “Addiction”: A Critical Review of the Evidence From a Biopsychosocial Perspective*, 66 PHARMACOLOGY BIOCHEMISTRY AND BEHAVIOR JOURNAL 3 (2000).

134. See *id.* at 1556.

demonstrates that habit formation is present for the consumption of most consumer non-durables, including food purchased for home use.¹³⁵

Does eating certain kinds of foods involve tolerance and withdrawal phenomena? “Tolerance” involves the body’s attempt to maintain homeostasis, a constant internal environment across a range of parameters such as body temperature and blood glucose levels.¹³⁶ After experiencing food, drugs, or other stimuli that upset homeostasis, the body learns to anticipate and offset the impact. This conditioning, Pavlovian or unconscious in nature, is “tolerance.” For example, eating typically results in elevated blood glucose levels. The body will respond directly to such higher levels by triggering a release of insulin from the pancreas or the liver. Although this feedback response would come too late to offset the impact of a large meal on blood glucose, there is another type of response: When the body receives cues that a meal is about to commence, it triggers the release of insulin in advance. This pre-meal insulin is called “cephalic insulin” because it is triggered by the brain directly in response to sensory cues rather than from feedback based on increased levels of glucose in the bloodstream.¹³⁷ This learned response is “tolerance.” The impact of eating the food is blunted. To achieve a hyper-glycemic effect it would be necessary to “surprise” the system by eating more than usual or by eating foods that are very glycemic.¹³⁸ The same phenomenon

135. See Chaloupka & Warner, *supra* note 102, at 1558; H.S. HOUTHAKKER & LESTER D. TAYLOR, CONSUMER DEMAND IN THE UNITED STATES: ANALYSES AND PROJECTIONS 62-63, 164 (2nd ed., 1970). Houthakker and Taylor find that food consumed in home “is seen to be subject to some habit formation ... although the habit wears off quite rapidly.” *Id.* at 62. In contrast, for purchased meals “consumers (figuratively) treat eating-out as a durable good.” *Id.* at 63. This result makes sense. The experience of going out to a restaurant “depreciates,” and some time passes before one is eager to do it again. It is important to note that Houthakker & Taylor’s estimates are for aggregate consumption. *Id.* at 57. That fact limits their applicability to many addiction issues that relate to specific foods or specific food components.

136. Many of the points made here concerning tolerance come directly from the excellent summary article by Stephen Woods and Douglas Ramsay. Stephen C. Woods & Douglas S. Ramsay, *Pavlovian Influences over Food and Drug Intake*, 110 BEHAVIOURAL BRAIN RESEARCH 175 (2000).

137. *Id.* at 177.

138. Carbohydrates in foods elevate blood glucose, but eating different foods results in different blood glucose responses per gram of carbohydrate consumed. Food scientists have constructed a “glycemic index” to measure this phenomenon. This index is based on a reference food, typically white bread or glucose itself. The reference food will trigger an increase in blood glucose, and the body will respond with the release of insulin. Blood glucose still will be elevated for a period of time. If one plots blood glucose versus time after ingestion, the curve will initially increase above the baseline level and then fall back to that level. The area under the curve (above the baseline level) is a measure of how glycemic the food is. The reference food is defined to have a glycemic

happens with drugs such as heroin or ethanol. After one or several experiences with the drug, the body learns to anticipate the impact of the drug and triggers offsetting adjustments when faced with each additional round of use. For some drugs, this dulls the “high” and requires a higher dose to achieve the same effects.

What about withdrawal? A simple response follows from the discussion of tolerance. If the tolerant individual is presented with stimuli associated with ingestion of the tolerated substance but the substance is not provided, the individual will experience “withdrawal.” The body will make adjustments that would tend to restore homeostasis in the presence of the substance. Not surprisingly, in the absence of the substance, many of the adjustments will result in effects opposite to those arising from the substance. If the individual is used to highly glycemic meals, the body may typically trigger a very powerful cephalic insulin response in anticipation of each meal. If the individual receives a meal with little or no carbohydrate instead, insulin levels may be unusually high, resulting in lethargy and in a “craving” for sugars or sweets to restore homeostasis.

Although there is a strong connection between drug and food related behavior, addiction analogies do not always fit. An interesting example is “chocolate addiction.” Despite the large number of papers finding elements of “addiction” with respect to chocolate, a recent review by Peter Rogers and Hendrik Smit argues persuasively that no true addictive phenomenon is present in most cases.¹³⁹ As a starting point, the review makes the point that none of the known psychoactive ingredients of chocolate are present in sufficient quantities to play any substantial role in mood alteration. Although it is possible that the combination of known ingredients or some as yet unidentified ingredient has such effects, cocoa powder itself appears to have only small effects, and some studies indicate that only chocolate itself (as opposed to cocoa powder) relieves chocolate “cravings.”¹⁴⁰ After rejecting other biologically-based explanations, the review argues that the key factors are “the psychological processes of restraint, ambivalence, and attribution, operating together with the normal mechanisms of appetite

index of one. The relative area under the curve for each other food per gram of carbohydrate is the glycemic index for that food. A typical example of the formal definition of glycemic index in a research paper is: “the area under the glycemic response curve after consumption of 50 g of carbohydrate from a test food divided by the area under the curve after consumption of 50 g of carbohydrate from a control substance, either white bread or glucose.” David S. Ludwig, et. al., *High Glycemic Index foods, Overeating, and Obesity*, 103(3) PEDIATRICS 26 (1999). Glycemic index values are available for hundreds of foods and supplements. See Kaye Foster-Powell, Susanna H.A. Holt & Janette C. Brand-Miller, *International Table of Glycemic Index and Glycemic Load Values: 2002*, 76 AM. J. CLINICAL NUTRITION 5 (2002).

139. See Rogers & Smit, *supra* note 133. The authors of the review acknowledge support from the Biscuit, Cake, Chocolate, and Confectionary Alliance, London. Id. at 12.

140. Id. at 5.

control, the hedonic effects of certain foods, and socially determined perceptions of the appropriate intakes and uses of those foods.”¹⁴¹ The idea is that chocolate is perceived as a “treat” to be eaten with restraint. This creates “ambivalence.” The amount of chocolate considered acceptable falls far short of what will satiate. Satiation is a race between the positive feedback created by the sensory experience of eating and negative feedback in the form of signals the stomach and intestine send after ingestion. “Attributions” are “commonsense explanations made in an attempt to understand and sometimes to excuse personal behavior.”¹⁴² Here it is easier (socially and/or personally) to attribute excess consumption of chocolate to the loss of control accompanying “addiction” than to assume personal responsibility in the face of ambivalence. Rogers & Smit contrast chocolate addiction with the binge eating associated with bulimia which they believe can reasonably be “labeled as ‘food addiction.’”¹⁴³ They reason that bulimia is “a severe psychopathological state in which control over eating is lost” that “causes harm to the individual who typically attempts unsuccessfully to refrain from the behavior.”¹⁴⁴

Defining addiction is not simple, and, despite the chocolate example, it is hard to exclude many eating phenomena from the purview of the term.¹⁴⁵ Although “addiction” may have important social and personal meanings, whether or not the foods meet some definition of being “addictive” is not critical. What is important is whether the same public policy interventions that flow from the addictive nature of cigarettes would apply to foods. In particular, would taxes be justified to correct “internalities” for certain foods as well as cigarettes? The most relevant aspect of the addiction definitions discussed above for the internality issue is the idea that addiction results in loss of self-

141. Id. at 12.

142. Id. at 10.

143. Id. at 7, 11.

144. Id. at 7.

145. Another way to try to distinguish the case of food from items such as heroin is to include “dependence” as a necessary part of “addiction.” Dependence is the state of needing a substance in order to function within normal limits. J. Altman, et.al., *The Biological, Social and Clinical Bases of Drug Addiction: Commentary and Debate*, 125 *PSYCHOPHARMACOLOGY* 285 , 287 (1996). This definition is tailored to drugs -- e.g., the “addict” who needs a fix in order to perform routine tasks. Even for most admitted “chocoholics,” removing chocolate from the diet will not result in a collapse of the ability to function. Nonetheless, food is a necessity for life, and the ability to function is preserved only by substituting other foods for the “addictive” food. Unfortunately for the attempt to distinguish food phenomena logically from classic addictive drugs, the same situation exists for many of the drugs. Heroin is almost universally considered to be “addictive,” but methadone will restore functionality for most heroin addicts.

control to such a degree that the individual wishes to stop the behavior, but is no longer able to do so. But loss of self-control by itself is not dispositive. A “rational” addict may understand and accept that indulging now will reduce self-control in the future. The internality aspect arises if the addict wants to refrain from the behavior in the future, but plans to quit are frustrated when the future arrives. This phenomenon means that it makes sense for the “present” self to impose costs on indulgence by “future” selves. A tax is one vehicle for imposing such costs.

Short of cases involving serious eating disorders, it is easy to be skeptical of an internalities-based tax approach. This approach is incremental, providing a little push away from existing habits. The problem is what Carl Phillips calls “the paradox of dietary change.”¹⁴⁶ Many individuals make major, permanent changes in diet and express no desire to change back. Even those who make imposed dietary changes (e.g., to address a chronic disease condition) report satisfaction with the changes. On the other hand, most individuals believe that changing their diet “would be a painful and a permanent burden” while health professionals “often believe it is hopeless to try to encourage changes.”¹⁴⁷ Following this pattern, in revising U.S. food guidelines, the U.S. government and major U.S. non-governmental organizations chose to recommend only a modest reduction in fat intake (30% of total calories from fat as a maximum versus actual levels of 38%) not based on science but on “estimates of what consumers might be willing to accept.”¹⁴⁸ A drop from 38% to 30% appears to be too modest to cause any significant reduction in risk.¹⁴⁹

To see how such a result might emerge, Phillips creates a complex systems model based on four elements of individual preference: health, taste, habit, and availability (including price). The model has multiple suppliers as well as multiple consumers. Suppliers maximize profit by seeking to supply food types in high demand that are served by a low number of competing suppliers. The model results in a “quasi-equilibrium” in the space of food attributes consisting of multiple persistent clusters, each encompassing a network of consumers and suppliers. The clusters arise in response to supply economies of scale and network externalities. Consumers habituate to their cluster location. Incremental change tends to be ineffective since utility reaches

146. Carl V. Phillips, *Complex Systems Model of Dietary Choice with Implications for Improving Diets and Promoting Vegetarianism*, 70 AM. J. CLINICAL NUTRITION 608S, 609S (1999).

147. Id.

148. See Campbell & Junshi, *supra* note 81, at 1153S.

149. Id. The response of health risk to food or drug items tends to be nonlinear. Recall the logistic risk curve discussion above. See text accompanying notes 83-84 *supra*. Small changes have almost no effect if current levels of consumption correspond to a relatively flat region of the risk response curve.

a local maximum at the location of each cluster. Thus, modest taxes on a particular food pattern will not dissipate the cluster eating in that pattern and may not cause any individuals to shift clusters. Only what appear to be more radical changes, such as trying the diet of a friend located (foodwise) in another cluster will tend to work. Shifting clusters turns out (ex post) not to be as hard as supposed based on multiplying the pain involved in incremental changes from the old cluster position. The new cluster is at a local maximum. Habituation sets in and reinforces the change.

Even if one is not skeptical about whether taxes would be effective in solving externalities from food consumption, there is another problem. The whole idea of using a tax to address externalities is to provide individuals who wish to terminate a particular behavior with a self-control device. This self-control device permits the individual to discipline “future selves” who might tend to deviate from the plan to quit or reduce consumption. Leaving aside the administrative costs of taxing individuals differently on consumption of the same good, one can imagine an externality system where individuals make a binding commitment to the state to pay tax on each unit of future consumption. Since an unrelated party enforces the agreement, this self-control plan might work better than an internally-enforced one, such as a resolution to tear up a dollar every time one consumes a cigarette.

Gruber & Koszegi’s work on externalities, however, is about the appropriate level of a general tax on tobacco, not about individual deals with the state. Working in favor of a general tax to address externalities is the high degree of proportion of smokers in the U.S. (e.g., 80% of adults, as mentioned above) who express a desire to quit. It is possible that the value of the externality levy for these individuals would outweigh the distortion in prices for smokers who have no desire or intention to quit.¹⁵⁰ The possibility of such a result with food items such as chocolate or saturated fat is likely to be considerably lower because the population is likely to be much more heterogeneous

150. Assessing the trade-off might be very complicated. One issue is whether the private sector is able to provide low-cost self-control devices that have a similar degree of effectiveness. If so, using a tax to address externalities may be inefficient. On the other hand, the costs of the private sector approach include the time and resources spent signing people up. For some people, the conflicts that lead to significant externalities also might cause them to delay or defer signing up if the scheme were voluntary and private.

In a recent working paper, Gruber & Mullainathan find strong evidence for the proposition that predicted smokers are better off as a class when cigarette excise taxes are higher. Jonathan Gruber & Sendhil Mullainathan, *Do Cigarette Taxes Make Smokers Happier?*, NBER WORKING PAPER #8872, April 2002, <http://www.nber.org/papers/w8872>. They find large effects. For instance, the impact of a 50 cent per pack increase in the United States would be equivalent (in terms of happiness) to moving a predicted smoker from the bottom to the top income quintile, and raising the tax enough to reduce smoking by 60% in the U.S. would remove the (relative) unhappiness among smokers. *Id.* at 19-20. Their results are robust against a very extensive set of specification checks and tests of alternative interpretations. *Id.* at 21-27.

with respect to foods than with respect to cigarettes. Some foods or eating patterns may be an “addiction” for some individuals, but, for other individuals, they may be a pleasant, occasional indulgence. The proportion of the population that would favor or benefit from taxes on chocolate, saturated fat or other items may be very low compared to the large proportion of smokers who claim they want to quit. Having a lower proportion of beneficiaries raises the efficiency cost of any tax imposed to correct externalities. As a result, the optimal level of the tax will be lower, resulting in a sacrifice of potential gains with respect to the individuals for whom the tax would be a valuable self-control device.

In summary, the case for using food taxes to address externalities seems much weaker than the corresponding case for cigarettes. It is unclear that foods raise the same kind of “addiction” pattern as tobacco use. Even if food addiction turns out to be a present and identifiable problem, in light of the paradox of dietary choice, it is not clear that the incremental approach implicit in using a tax will help. Finally, even if taxes might be effective for some individuals, heterogeneity may make general taxes on foods an inefficient way to address externalities.

III. FOOD TAXES AS A COMPONENT IN HEALTH INSURANCE SYSTEMS

Part II discussed three possible roles for food taxes in a developed economy: raising revenue, addressing externalities and correcting internalities. We put the goal of raising revenue aside since use of food taxes in that context has been well studied. Externalities in the case of food consumption arise primarily from interaction with the health insurance and social insurance systems. In the case of cigarettes, the total externality from these sources is quite small. The same type of insurance impacts are likely to apply in the case of unhealthy food habits. Thus, it is plausible that externalities would justify only a small tax in the case of food also. Finally, the case for taxing food to correct for internalities appears to be weak both from a biological perspective and due to heterogeneity in the population.

In this Part, we consider the role that food taxes might play as a component of health insurance systems. The normative arguments for use of food taxes in conjunction with health insurance are quite strong. We begin in section A with a description of some relevant positive and normative elements of health insurance systems in developed countries. Sections B through D discuss several major problems in these systems that might be alleviated or solved by using food taxes. Section E summarizes the role that food taxes might play as a component of health insurance systems. Throughout the Part we will use an insurance markets model developed by Eric Bond and Keith Crocker to illustrate various points and arguments.¹⁵¹

A. *Some Features of Health Insurance Systems*

Developed countries have extensive public and private systems of health insurance.¹⁵² Even in countries such as the United States where formal coverage is

151. Eric W. Bond & Keith J. Crocker, *Smoking, Skydiving, and Knitting: The Endogenous Categorization of Risks in Insurance Markets with Asymmetric Information*, 99 J. POLIT. ECON. 177 (1991). The model is applicable for our purposes because it incorporates insurance charges based on risk generated by consumption of a good X to examine moral hazard and adverse selection problems simultaneously. In addition, several of the results in the article are very relevant to the discussion here.

152. For good surveys on health insurance and health systems, see David M. Cutler & Richard J. Zeckhauser, *The Anatomy of Health Insurance*, in HANDBOOK OF HEALTH ECONOMICS, VOLUME 1 564 (A.J. Culyer & J.P. Newhouse, eds. 2000); Ulf-G. Gerdtham & Bengt Jonsson,

incomplete, access to emergency medical services is not denied on the basis of lack of insurance. As a result, there is at least implicit catastrophic coverage for almost everyone.¹⁵³ In all other OECD countries, health insurance is universal.¹⁵⁴

The tendency toward universal coverage suggests a basic normative decision evident even in countries such as the United States or Switzerland that emphasize private choice in health insurance matters.¹⁵⁵ Treatment for at least a basic package of medical services will be available for all, even those individuals who would not insure against potential medical costs beyond their means if given a choice. One can think of many appealing reasons for this approach, including physician-based principles of rescue and the idea that individuals who desire treatment should not be denied based on foolish lifestyle or economic planning choices that they made in the past. The approach may even have a welfarist justification if one admits sociotropic preferences: Although certain individuals would not choose to be insured, the idea that they might be denied treatment later may be troubling to others, making these others willing to fund the premiums for individuals who otherwise would go without insurance. Without discussing justifications further, we take this “treatment principle” as a given in what follows.

The treatment principle changes the terms of the analysis. In particular, the existence of “compulsory” health insurance means that activities such as unhealthy eating that increase the risk of poor health outcomes impose an externality. The individual who engages in such activities will be relieved of some of the future costs. Unless the insurer can observe these activities and charge higher premiums or allow

International Comparisons of Health Expenditure: Theory, Data and Econometric Analysis, in HANDBOOK OF HEALTH ECONOMICS, VOLUME 1 21 (A.J. Culyer & J.P. Newhouse, eds. 2000).

153. See Cutler & Zeckhauser, *supra* note 152, at 570.

154. *Id.* at 569. Although the United States lags in insurance coverage, its per capita health expenditures are far greater than other OECD countries, around twice as large as expenditure in other high spending countries such as Germany, Canada, France, Australia, Japan, Switzerland, and the U.K. The comparison is even more dramatic for the elderly where US per capita spending ranges from twice to almost four times as large as in these other countries. See Uwe E. Reinhardt, *Health Care for the Aging Baby Boom: Lessons from Abroad*, 14 J. ECON. PERSPECTIVES 71, 73 (2000); Gerdtham & Jonsson, *supra* note 152, at 14. Some scholars question, however, whether higher U.S. spending achieves significantly superior results. See David M. Cutler, *Walking the Tightrope on Medicare Reform*, 14 J. ECON. PERSPECTIVES 45, 51-52 (2000).

155. The United States and Switzerland rely much more on private sector insurance than other OECD countries. See Adam Wagstaff & Eddy Van Doorslaer, *Equity in Health Care Finance and Delivery*, in HANDBOOK OF HEALTH ECONOMICS, VOLUME 1 1803, 1820-22 (A.J. Culyer & J.P. Newhouse, eds. 2000). Private insurance systems typically allow greater choice among plans and coverage than public systems. Switzerland required health insurance coverage in 1996. Prior to that year, however, it subsidized insurance so heavily that virtually everyone purchased it. See Cutler & Zeckhauser, *supra* note 152, at 569 n.4.

lower benefits, other individuals will have to pay higher premiums or will have a lower benefits as a result. This externality is the same type as discussed in section II B above with respect to tobacco consumption.

It is important to point out an important feature of health insurance in developed countries. This insurance covers medical expenses but not any of the other costs of ill health. Although there are markets for disability insurance and life insurance, it is generally difficult or impossible for individuals to insure health status.¹⁵⁶ As a result, individuals are only partially insured against health risks. This fact will play an important role in the discussion of “moral hazard” below.

Using a food tax as part of a health insurance system raises the question of what to do with the revenues. An obvious idea would be to pump these revenues back into the health system. One variant of this idea that we will examine in detail is the use of such taxes as “implicit premiums” in an “implicit insurance system.” Suppose for instance that all of the incidence of a particular disease is due to eating a certain food. The government could impose a tax equal to the discounted expected future medical expenses arising from each unit of consumption and then commit to paying all such future medical expenses. In a public health insurance system, the government would cover these expenses directly. In a private system, the government would reimburse the expected or actual expenses when the disease struck. We discuss the use of taxes as part of an implicit insurance system extensively in section E.

In most cases, it will not be true that *all* of the disease incidence will be attributable to diet or to other behaviors that are a matter of choice. Suppose for instance that the expected medical costs conditional on incurring a disease total to L and that $\pi(x)$, the probability of incurring the disease depends on x , the level of consumption of some food, X .¹⁵⁷ Then the expected damage from consuming level x will be $\pi(x)L$, and this expected damage is equal to the actuarially fair premium to insure against the illness.

There are two aspects of the probability function that bear emphasis. First, in most cases it will be true that $\pi(0) > 0$. I.e., there will be a probability of the disease occurring in the absence of any risky behavior. This represents an “inherent” tendency to be a victim of the disease. This tendency may include “genetic susceptibility,” but it is not limited to that cause. Factors beyond the individual’s control such as the fetal

156. See Cutler & Zeckhauser, *supra* note 152, at 577.

157. For simplicity, we ignore the intertemporal aspects of the situation. The disease may occur much later than the consumption of the food, and that consumption may occur over many time periods. Most diseases depend on many behavior factors other than the consumption of one food. A more general approach would be to write $\pi(x,r)$ where x is a vector of consumption levels and activities that affect the probability of incurring the disease, and r is a vector of inherent characteristics that are not the subject to choice by the individual. It is convenient to begin, however, with the simple version in the text.

environment or exposure to toxins may play a role. In addition, this “inherent” element may include behavioral variables that influence disease incidence but that have not yet been identified as causal agents by researchers.

Potential “inherent” elements raise the issue of whether it is “fair” to compel individuals to pay premiums with respect to risks that are out of their control. Putting aside “moral hazard” (discussed below), the point of insuring is to protect against risks that an individual or entity cannot otherwise avoid. Nonetheless, under the treatment principle, insurance coverage is *mandatory*. Although that principle may dictate that everyone should be covered, it does not determine who should pay the premiums. In fact, countries differ greatly in how they fund health insurance.¹⁵⁸ The OECD countries divide into three major groups. Countries such as Denmark, Spain, Sweden, Portugal, Finland, Ireland, and the U.K. fund health care primarily from general taxes. Some of these countries rely primarily on income taxes while others rely more on VAT or other consumption-based taxes. A second group which includes Germany, France, and the Netherlands relies primarily on “social insurance” as a funding source. Social insurance consists of payroll taxes similar to the 2.9% tax that funds Medicare, Part A in the United States. A third group, including the United States and Switzerland, relies significantly on premiums paid to private insurers as well as on general taxes and social insurance.¹⁵⁹

If all individuals faced the same level of $\pi(0)$, the probability of contracting the disease in the absence of risky behavior, then, *ceteris paribus*, it would seem fair to charge each individual the same premium ($= \pi(0)L$) with respect to the “inherent” risk captured by $\pi(0)$. Fairness issues arise when different individuals face different levels of $\pi(0)$. In that case there is a social contract type of argument for ignoring individual differences in $\pi(0)$ when assessing premiums.¹⁶⁰ The idea is that if individuals could

158. See Wagstaff & Van Doorslaer, *supra* note 155, at 1820-22.

159. In addition to meeting health care expenditures through private and public insurance, individuals from countries in all three groups make “direct payments” (not covered by insurance) to providers. Direct payments typically constitute 10-20% of total health expenditures. *Id.* at 1821. Often these payments are “co-payments” required by insurance policies that deliberately leave the insured responsible for paying part of the medical expenses. This feature gives the insured incentives not to over-consume medical treatment. In addition, policies often include “deductibles” leaving the insured completely responsible for some level of initial expenditures during a time period or for particular condition. For individual indemnity insurance coverage in the United States in 1991, a typical deductible was \$205 while the coinsurance rate was 20%. See Cutler & Zeckhauser, *supra* note 152, at 585.

160. See Cutler & Zeckhauser, *supra* note 152, at 626; Louis Kaplow, *The Income Tax as Insurance: The Casualty Loss and Medical Expense Deductions and the Exclusion of Medical Insurance Premiums*, 73 CALIFORNIA L. REV. 1485, 1507-08 (1991); Louis Kaplow, *A Note on Taxation as Social Insurance for Uncertain Labor Income*, 49 PUBLIC FINANCE 244, 252 (1994).

buy insurance prior to learning their particular $\pi(0)$, they would insure against the risk of ending up with a particularly high $\pi(0)$. Complete insurance would entail each individual paying a premium equal to the average $\pi(0)$ across the population times L ($= \text{avg}(\pi(0))L$) in addition to paying for the expected additional damage caused by that individual's consumption of the food. I.e. individual i would pay a premium equal to $\text{avg}(\pi(0))L + [\pi_i(x_i) - \pi_i(0)]L$ where $\pi_i(x_i)$ is individual i 's probability of incurring the disease if individual i consumes x_i units of the food. This approach would remove any influence of $\pi_i(0)$, the individual's particular inherent risk, on the individual's premium by essentially replacing $\pi_i(0)$ with $\text{avg}(\pi(0))$, the average inherent risk for the population. Alternatively, the government could fund $\text{avg}(\pi(0))$ through the income tax, consumption tax, or other systems designed to achieve distributional goals.

Differences in $\pi(0)$ across individuals is not the only aspect that raises fairness issues. It might be the case that individuals vary greatly in the impact of consuming the food on their probability of becoming ill -- the level of $\pi'(x)$ and how this level varies with x may vary significantly across individuals.¹⁶¹ One might argue that this "inherent" difference also calls for a compensating adjustment. Aside from this "differential marginal damage" argument, there also are fairness arguments based on "preferences." People will vary in their taste for the food. Individuals with a particular liking for the food may claim that this liking is "inherent" and that they should not be held responsible for their consumption of the food. This claim is reminiscent of the food "addiction" issues addressed above.

These two aspects illustrate that there may be no sharp line between behavior that is a matter of "free choice" that implies personal responsibility for the consequences and behavior or outcomes that are due to "inherent" qualities over which the individual has no control. Nonetheless, the fairness arguments with respect to differential marginal damage and preferences seem much less appealing than the claim that individuals should not suffer because of behavior independent risks.

An important issue for policy purposes is how much information that the government has about the consumption of X , the damage function, and individual preferences. The most informationally rich situation is where the government knows how much X each individual consumes, each individual's $\pi(x)$ schedule, and each individual's preferences. In this case, the government can design a tax/premium schedule for each individual that achieves both distributional and insurance goals.¹⁶² It

161. An example result discussed above suggesting that caffeine tends to promote osteoporosis only for individuals with certain genetic characteristics. See text accompanying note 54 *supra*.

162. We assume that the amount of loss, L , is the same across all individuals and does not depend on factors such as the individual's income. This assumption is unrealistic. For instance, a shorter life or disability will mean a greater financial loss for those who have higher incomes. In addition, the amount of loss after disease strikes may depend on the individual's behavior,

also is worth noting that if the government has this type of information, it is likely that private insurers also would have it. If private insurers do, then there is a question of whether government provision of insurance or government intervention in the insurance market is necessary or desirable. In particular, Louis Kaplow has pointed out several situations where provision of government insurance through the tax system may result in levels of coverage or other features that are not optimal due to the interaction between the insurance role played by the tax system and private insurance.¹⁶³ In addition, using private rather than public providers or insurers results in competition that may lead to efficiencies or degrees of consumer choice not present if the government serves as provider as well as funding sponsor of the insurance system.¹⁶⁴ In the United States, for example, about 87% of Medicare beneficiaries buy private “Medigap” insurance policies that wrap around Medicare provision. In addition, 17% of beneficiaries are enrolled in private Medicare managed care plans rather than the government-operated traditional Medicare indemnity system.¹⁶⁵ Policy analysts from across the academic and political spectrum have proposed reforms that introduce more competition into the system while trying to avoid some of the problems (discussed below in section C) that might arise from such competition.¹⁶⁶

including diet. A more complete model would include the post-incidence stage separately. Any taxes levied on food items would affect the outcome of this stage as well as whether or not the disease will strike the individual in the first place. We leave modeling these aspects to later work, focusing on more elementary policy contours in this paper.

163. In two articles, Kaplow studies government allowance of personal losses (including losses due to uninsured medical expenses) as deductions and also the exclusion of some employer-paid medical insurance premiums from taxable income for covered employees. See Kaplow, *supra* note 160; Louis Kaplow, *Income Tax Deductions for Losses as Insurance*, 82 *AM. ECON. REV.* 1013 (1992). Kaplow shows that these tax provisions can interact with the private insurance system in many ways, often lowering welfare. One such interaction involves medical or casualty loss deductions. These deductions cover only uninsured losses. As a consequence, purchasing private insurance (up to the amount “covered” through the tax deductions) means giving up free government insurance, and individuals will underinsure compared to the optimum. Repealing the deductions, lowering tax rates to compensate, and allowing the private insurance market to operate without distortion is Pareto superior to the current policy of allowing the deductions.

164. Competition in health insurance and provision markets is not a panacea. Because consumer identity (e.g., those highly susceptible to disease versus those who are not) is crucial to costs and profitability, unregulated private markets are prone to serious adverse selection problems. These problems are discussed in section C below.

165. See Mark McClellan, *Medicare Reform: Fundamental Problems, Incremental Steps*, 14 *J. ECON. PERSP.* 21, 26 (2000).

166. See, e.g., Cutler, *supra* note 154, at 54-55; McClellan, *supra* note 165, at 28-32,

There are many other informational scenarios that one might imagine. The government may not have individualized information about $\pi(0)$, about the rest of the $\pi(x)$ schedule, or about the level of x or preferences for individuals. In some cases, lack of information or inability to use it may be deliberate and may apply to insurers also. For instance, many states have privacy provisions that bar insurers from denying coverage or setting higher rates based on genetic information.¹⁶⁷ For many diseases and foods, genetic information is an important factor in ascertaining $\pi(0)$ or the shape of the $\pi(x)$ schedule.¹⁶⁸ Some information deficits will tend to make food taxes a useful complement to public and private insurance systems. For example, the government may not know each individual’s consumption of a food but, unlike private insurers, may be able to tax that consumption on a per unit basis. This ability would allow the government to charge individuals “premiums” based on their consumption even though the government cannot observe each individual’s consumption at low cost.

In the rest of this Part, we will be sensitive to various information scenarios and their bearing on the use of food taxes. We begin, in the next three sections (B through D), by considering three major problems (moral hazard, adverse selection, and incomplete markets) faced by current health insurance systems and the role that taxes might play in addressing those problems. In section E we examine the use of food taxes more generally as part of an implicit insurance system. That section relies heavily on the prior discussion of moral hazard, adverse selection, and incomplete insurance markets.

B. Adjusting for Ex Ante Moral Hazard

Long before any proposal for a fat tax circulated in the public health community, Richard Arnott and Joseph Stiglitz wrote an article on the use of taxes to address moral hazard problems in which they listed food taxes as an example.¹⁶⁹ Moral hazard problems arise when an insured individual is able to take actions that affect the

167. See, e.g., Matt E. Thatcher & Eric K. Clemons, *Managing the Costs of Informational Privacy: Bundling as a Strategy in the Individual Health Insurance Market*, 17 J. MGMT. INFO. SYSTEMS 29 (2000).

168. There are numerous examples. One we have already mentioned is that the connection between caffeine consumption and osteoporosis appears to exist only for persons with certain gene patterns. See *supra* note 54 and accompanying text. Genetic information also bears on expected loss conditional on having the disease. For example, genes partially predict the efficacy of treatment for breast cancer. See N. Seppa, *Ominous Signals: Genes May Identify the Worst Breast Cancers*, 161 SCIENCE NEWS 68 (2002).

169. Richard Arnott & Joseph E. Stiglitz, *Moral Hazard and Optimal Commodity Taxation*, 29 J. PUB. ECON. 1, 15 (1986).

probability or severity of the insured event. If the insurance completely covers any such event, the insured lacks any incentive to engage in accident-avoidance. In some instances accident-avoidance costs for the insured will be less than the present value of the damage avoided. As a result, moral hazard may lead to an inefficiently low level of accident avoidance activity.

Moral hazard will not be a problem if the insurer can observe the insured's accident avoidance activities (or lack thereof) and verify this observation to a third party (such as a court) at little or no cost. In that case, the insurer may propose a contract that makes claims awards contingent on the pattern of accident avoidance activity and thereby internalizes the costs and benefits of such activity for the insured party. The accident avoidance clauses in the contract will be enforceable under the assumption of verifiability: The insurer can prove the extent of accident avoidance activity to the satisfaction of a judge, jury, or other third party who enforces the contract.

The existence of extensive public and private health insurance systems in developed countries raises two potential moral hazard issues. The first involves treatment costs once a covered event occurs. If coverage includes the full costs of treatment, the insured (and the insured's physicians) have no incentive to control costs. This problem is sometimes termed "ex-post moral hazard" since it arises after the covered event occurs. A huge and growing scholarly literature attempts to analyze this problem, to study various proposed solutions, and to generate optimal solutions.¹⁷⁰ A common approach is to provide only partial coverage, requiring the insured to make up the rest via a coinsurance payment.¹⁷¹ Since the insured is paying part of the cost of treatment, the incentive to engage in "wasteful" treatment (treatment that the insured would not pay for out of the insured's own funds) is reduced.

Diet also may interact with treatment costs. An appropriate diet may shorten or even eliminate the underlying condition, reducing or obviating additional medical expenses. However, if treatment is completely effective and the insured does not bear any of the costs, the insured has no incentive to engage in treatment-cost-avoidance behavior such as an appropriate diet. Food taxes, whether aimed at this type of moral hazard or imposed for some other reason, might have an impact on post-event dietary incentives. Despite the possible existence of diet-based moral hazard and the potential relevance of food taxes during the post-incidence phase of disease, for simplicity I will ignore that phase in what follows. Enough complexity arises from considering the impact of dietary behavior on the initial incidence of disease.¹⁷²

170. For a good survey, see Cutler & Zeckhauser, *supra* note 152, at 576-590..

171. For an abstract discussion of the use of partial coverage to address moral hazard problems, see Steven Shavell, *On Moral Hazard and Insurance*, 93 Q. J. ECON. 541 (1979).

172. See *supra* note 162.

Taxes considered as part of an insurance system by nature are on the *funding* side of the system. Leaving aside possible post-incidence effects of taxes, ex post moral hazard primarily affects the *payment* aspect of the system. In the discussion below, we will typically treat the payment side as a “black box.” For instance, the government might use food taxes to raise premiums that cover part or all of the expected disease cost for a particular condition, but how the government then reimburses the afflicted (either directly or through payments to private insurers) involves the black box. Simply covering any costs that might arise generally would not be desirable because of ex post moral hazard problems. The government (or private insurers reimbursed by the government) might want to use coinsurance or some other scheme to generate optimal incentives. What happens in the black box may cause a mismatch between funding and payment. For instance, the food tax “premiums” may cover the entire expected cost of the disease but insurers may provide only partial coverage. The government might use the surplus revenues to reduce distorting taxes, thereby creating a side benefit from the food tax policy. We will ignore such side benefits or detriments in order to concentrate on the impact of the funding side.

The other moral hazard problem is of more direct concern. An individual’s diet may strongly influence the probability, magnitude and cost of various covered health events. This fact creates potential “ex-ante moral hazard,” the possibility that the individual will be more careless about health risks knowing that all the medical costs will be covered in any event.

As noted by many scholars, the problem of ex-ante moral hazard may not be very serious because in existing health insurance systems the individual is only partially insured with respect to the adverse consequences of disease events.¹⁷³ Health insurance coverage is limited to medical costs and does not include many other costs such as loss of time spent in treatment, restrictions on leisure activities due to chronic conditions, and any reduction in life span that reduces the retirement period. These other costs may be considerable, dwarfing the direct medical costs in magnitude. In effect, the current system provides partial coverage for loss of health status.

It is not clear, however, whether the extent of partial coverage is optimal. As Steven Shavell demonstrates the optimal degree of coverage is a U shaped function of the costs of accident-avoidance.¹⁷⁴ When these costs are high, then the cost-benefit ratio of

173. See, e.g., Cutler & Zeckhauser, *supra* note 152, at 577.

174. See Shavell, *supra* note 171, at 544-550. These results assume that it would be optimal for the insured to fully insure in the absence of moral hazard. Full insurance is optimal when utility (as a function of wealth) is not state contingent. In that case, assuming a concave utility function, individuals will want to fully insure in order to equalize wealth in all states. However, full insurance is not necessarily optimal in the case of health insurance since utility as a function of health may be state contingent. Suppose, for example, that a particular disease will result in death

engaging in avoidance activities is not favorable, there is little danger of loss from moral hazard, and nearly full coverage is optimal. When accident-avoidance costs are very low, only a small drop from full coverage will induce a great deal of accident avoidance activity and will eliminate most of the costs of moral hazard. When accident avoidance costs are moderate, the gains from reducing coverage in order to mitigate moral hazard become significant, and the optimal reduction in coverage may be large.

As Shavell shows, the need to reduce coverage to address moral hazard occurs only in the absence of the ability to observe accident avoidance at low cost. If the insurer can observe avoidance activities perfectly (and if these observations are verifiable), then full coverage is optimal.¹⁷⁵ If observation is imperfect, partial coverage again may be desirable.¹⁷⁶

Returning to our model, the marginal expected cost of consuming an additional unit of food when consumption is at level x is $\pi'(x)L$. Subjecting the individual to a total tax equal to $\pi(x)L$ would create the correct incentives at the margin and would eliminate any moral hazard problem. Future medical costs due to consuming the food would be internalized due to the tax. Other costs (such as the loss of time spent in treatment) are already internalized since the individual is not insured against these costs.

Imposing this tax requires that the government knows the level of X consumed by each individual and the function $\pi(x)$ for that individual. If this level of information is available to private insurers also, there is the question of whether insurance should be funded via taxation or left to the private sector. With the information in hand, private insurers could charge a premium equal to $\pi(x)L$ for each individual. There may be administrative reasons for choosing the government route, but it is not obvious that the government has an administrative cost advantage or that this advantage would outweigh other possible disadvantages of government provision.¹⁷⁷

if not treated. An expensive course of treatment will have no impact on life span but will render the individuals comatose for the rest of his or her life. Whether or not intervention should be forced on the individual raises significant moral and spiritual questions. But it would not be crazy for an individual to choose not to insure against this state, choosing instead to have higher wealth should any other state occur and to die (rather than live in a coma) if the disease strikes. The story becomes morally more interesting if the individual dedicates the extra wealth to enhance the life prospects (including health prospects) of needy individuals or groups -- preferring that resources be spent on them rather than prolonging the insured's life in a coma.

175. Id. at 553.

176. Id. at 554-555.

177. See Kaplow, *supra* note 163, at 1015-16. Kaplow considers the case where the government system involves a fixed cost α and a variable cost equal to a proportion β of the expected payout from insurance. The private sector is similar but the parameters are "a" and "b" instead of α and

The case for taxation becomes much stronger when neither the government nor private insurers can observe individual consumption.¹⁷⁸ Insurers cannot individually or collectively impose general taxes that address the moral hazard associated with consumption of the food, but the government can. This point is the basis for Arnott & Stiglitz’s article mentioned above.¹⁷⁹ The framework of their article is that there are a group of “commodities” that the government may tax and a group of “activities” that are beyond the scope of taxation. Some of the activities reduce the chance of an accident that is covered by insurance. Some of the goods are purchased before accidents might occur and some after. Arnott & Stiglitz show that in this situation, with one caveat, pre-accident commodities that are substitutes for accident avoidance activities should be taxed and those that are complements should be subsidized.¹⁸⁰ The optimal taxes and subsidies balance the welfare loss from pricing away from marginal cost for the taxed or subsidized goods against the welfare gain from reducing the costs of moral hazard that arise from the inability to observe accident avoidance activity at the individual level.¹⁸¹ The caveat is that the consumption of accident avoidance goods may reduce accident

β . In the scheme of Kaplow’s paper, government insurance is through a tax deduction that covers only the portion of loss that is not insured by the private sector. As a result, government insurance involves a welfare loss because individuals end up with suboptimal coverage. Kaplow analyzes both the case where individuals continue to buy private insurance as well as receiving insurance through a tax deduction and the case where individuals do not buy any private insurance. Consider the situation where individuals continue to purchase private insurance. In order for government insurance to be preferred on administrative grounds, Kaplow argues that it must be true that “ b ” > β , and that resulting savings in variable costs exceeds the fixed cost α plus the welfare loss due to use of a tax deduction limited to uninsured losses. (Since private insurance will exist in any event, there is no opportunity to save the fixed cost “ a .”) *Id.* at 1015.

The situation in this paper does not necessarily involve a similar welfare loss, but there may be advantages of private insurance (due to competition) that would be lost under government provision. In addition, if the food tax covers only particular diseases or provides only partial coverage, private sector health insurance most likely will continue to exist

178. When we say that these parties “cannot” observe individual consumption, we mean both directly and through observable individual traits such as blood chemistry, weight, urine chemistry, etc. If these “biomarkers” collectively indicate the level of consumption and measuring the biomarkers is cheap, then the government and private insurers effectively *can* learn what each individual’s level of consumption is.

There also is the possibility that the biomarkers themselves are superior indicators of the risk of disease so that the insurance system might key off of them instead of food consumption. This possibility is discussed further in section E. 2. below.

179. See Arnott & Stiglitz, *supra* note 169.

180. *Id.* at 2, 10-12.

181. *Id.* at 7.

avoidance activities which are a cheaper way (in utility terms) to avoid an accident. To understand this caveat, consider unhealthy food and exercise and assume that the unhealthy food will cause disease but that the disease is completely avoidable through exercise. Taxing the food heavily may drive consumption down to zero but with a very large welfare loss due to intense enjoyment of the food. At the same time, it might be true that individuals would experience very little welfare loss from increasing their exercise to a level that would immunize them against the disease.

Our framework is somewhat different than the one in Arnott & Stiglitz. Consuming the food is the activity that directly causes (or increases) the probability of disease. Rather than being constrained to tax or subsidize substitutes or complements for that consumption, with the ensuing distortions in consumption of the substitutes or complements, the government is able to tax or subsidize the problematic activity directly. That activity creates an externality given that the treatment principle demands insurance coverage. The tax that covers the ensuing social costs is a Pigouvian tax, and the optimal level for the tax is the magnitude of the harm caused by the externality -- in this case, the costs imposed on the insurer.¹⁸² No adjustment is necessary for the loss in consumer or producer surplus from the price distortion induced by the tax. Another way to look at this situation is that the taxes are implicit premiums for the coverage offered by the government. Setting the tax equal to the level of expected claims simply means that the insured will pay the correct premium for the insurance.¹⁸³

Although the inability to observe individual levels of unhealthy food consumption creates a strong potential case for taxation of the food, it makes computation of the appropriate tax harder. The added difficulty comes from two sources of heterogeneity: Individuals will have different preferences for the unhealthy food and individuals will face different probability curves, $\pi(x)$.¹⁸⁴ If everyone had the same preferences and the same damage function, consumption of the unhealthy good would be the same for all

182. For a cogent discussion of Pigouvian taxes, see Kaplow & Shavell, *supra* note 122.

183. From a welfarist perspective, there is a potential problem with this argument. The government is providing *compulsory* insurance. If an individual has state dependent utility, it is possible that the individual would not choose purchase actuarially fair coverage. See *supra* note 174. The provision of insurance in that case is for the benefit of others, not the insured. With state dependent utility, it may be optimal for an individual to remain uninsured and to consume the unhealthy food even in a perfect insurance market where the individual would face higher insurance premiums based on that consumption. In such a case, it is not clear from a welfarist perspective whether charging the individual for the expected health costs of the food consumption would be appropriate.

184. We assume away two other sources of heterogeneity that are likely to be present and significant in real world populations: heterogeneity in income and heterogeneity in L , the expected loss conditional on impact of the disease.

individuals and so would the level of additional expected costs, $\pi(x)L$. Assuming that $\pi(x)$, the probability curve, and L , the level of costs conditional on incurring the disease, are known but preferences and production costs for the food are not,¹⁸⁵ there are a variety of approaches that would permit the government to impose an optimal tax immediately or through a sequential process.¹⁸⁶ For instance, the government might set a tax level and then observe aggregate consumption. (Assuming no tax evasion, aggregate

185. It is reasonable to assume that the government has knowledge about $\pi(x)$ and L . It is knowing that the food increases the risk of disease that motivates considering taxation or other public policy responses in the first place. Epidemiological and medical studies of the impact of food consumption typically state their results in terms of relative risk ratios with confidence intervals. For example, after adjusting simultaneously for age, sex, smoking, exercise, high blood pressure, and consumption of other foods such as fruits, legumes, bread, cheese, fish, meat and coffee, a major study of Seventh Day Adventists found that relative risk for myocardial infarction and fatal IHD was about .50 with 95% confidence intervals of (.3, .9) and (.35, .75) respectively for those who consumed nuts five or more times per week compared with those who consumed one time or less per week. See Joan Sabate, *Nut Consumption, Vegetarian Diets, Ischemic Heart Disease Risk, and All-cause Mortality: Evidence from Epidemiologic Studies*, 70 AM. J. CLINICAL NUTRITION 500S, 501S-502S (1999). If the estimate is correct and all of the confounding factors have been identified, then regular consumption of nuts will reduce the probability of heart attacks and IHD fatalities by 50%. Of course, nut consumption may be a stand in for other unidentified confounding factors, and the wide confidence intervals mean that the 50% figure may be significantly low or high compared to the “actual” value.

In addition to evidence about the impact of diet on the probability of disease incidence, considerable information is available about the *current* value of L . There are a multitude of studies that examine medical costs associated with mortality and morbidity for most major diseases. There is major uncertainty, however, about *future* costs, and some of the costs that result from current consumption may occur decades later. Some conditions such as IHD that lead to very high medical expenses today cost very little to treat several decades ago, largely because treatments such as bypass surgery and angioplasty were not available. There was no expectation at the time that such treatments would develop or that they would turn out to be so expensive. See Cutler & Zeckhauser, *supra* note 152, at 628. Real Medicare spending per person increased at a 4.7% annual *real* rate between 1980 and 1999, and one leading scholar summarizes a group of projections from various actuaries and others by stating that “most experts expect that future growth rates will be similar as a result of continuing cost-increasing changes in medical technology.” McClellan, *supra* note 165, at 21. Arguably, Medicare benefits are a proxy for minimal coverage in the United States under the “treatment principle.” Other scholars and experts come up with sharply different projections. For instance, the Health Care Finance Administration assumes that the high real growth rate of per capita medical expenditures under Medicare experienced over the last two decades will drop to 0.9% by 2022. See Thomas R. Saving, *Making the Transition to Prepaid Medicare*, 14 J. ECON. PERSP. 85,90 (2000). The difficulty of making projections stems not only from uncertainty about new technology. Coverage and the forces that influence technological development are endogenous. The pressure to control Medicare spending may result in lower coverage and entrepreneurial development of technologies that reduce costs.

186. For an excellent and concise discussion of some of these approaches, see Kaplow & Shavell, *supra* note 122.

consumption will be apparent through tax receipts.) Since individuals are identical, aggregate consumption translates immediately into a level, x_{avg} , of individual consumption. If the tax is not equal to the marginal harm, $\pi'(x_{avg})L$, the tax can be increased or decreased. Assuming a reasonably regular probability function and that preferences and the probability function are stable over time, it should be possible for the government to come close to the optimal tax after only few iterations.

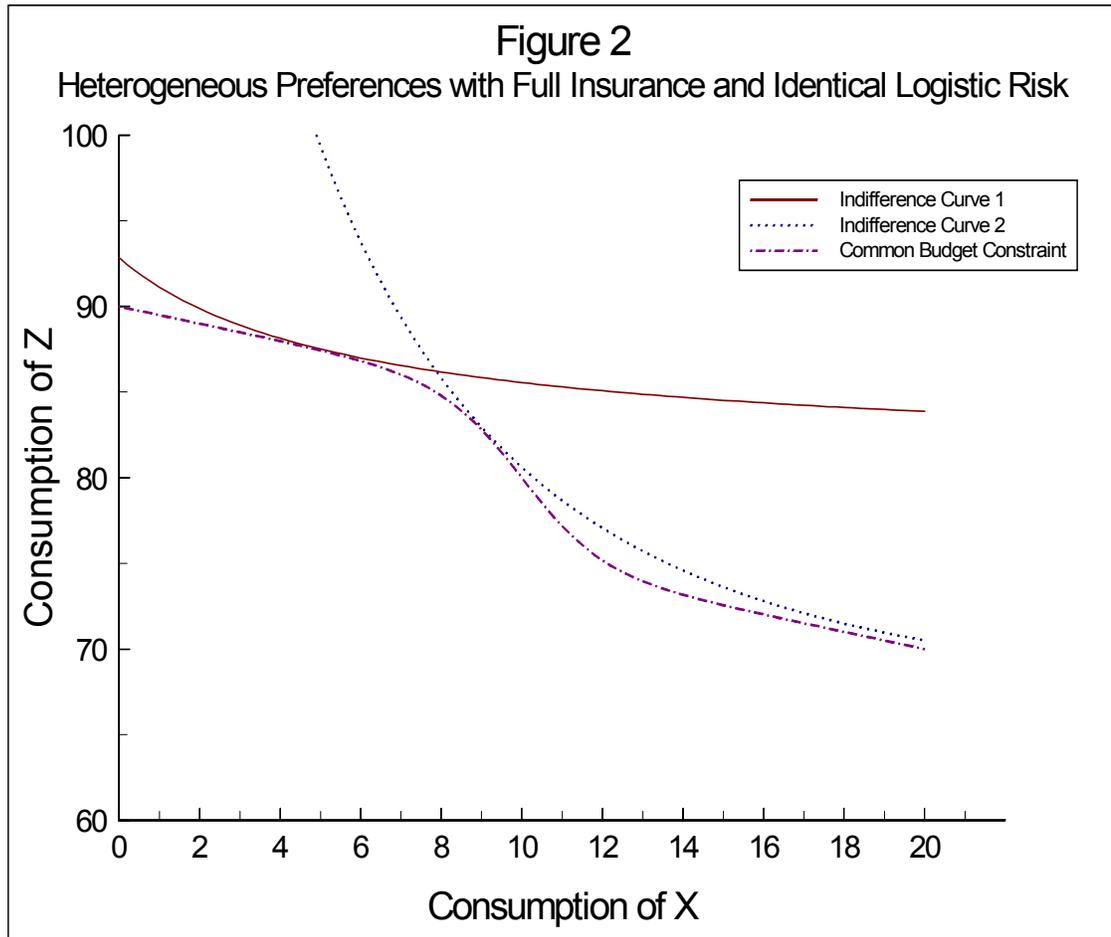
Heterogeneity of preferences makes the situation much more difficult even if the probability schedule, $\pi(x)$, is known and is identical for all individuals. There are two problems. First, the marginal impact $\pi'(x)L$ of consuming an additional unit of x typically may differ among individuals. Second, the individuals may differ in how price elastic their consumption is.

Consider the figure below based on the Bond & Crocker model. In that model, individuals have identical income at level Y , consume some quantity x of the good X that creates risk, pay insurance premiums that may be (if observable) a function of x , and use the rest of their resources to consume all other goods (represented by Z). Actuarially fair insurance will cost $\pi(x)L$, and the individual's consumption of Z will equal $Y - \pi(x)L - cx$ where c is the production cost of X per unit and the production cost of Z is normalized at 1. $z = Y - \pi(x)L - cx$ is the individual's budget constraint.

In the figure, the budget constraint is represented by the line with dots and dashes. The shape of this curve reflects the logistic incidence of disease as a function of consumption of X . At levels of consumption below five units and above fourteen units, the curve is nearly linear, reflecting the relative cost, c , of producing X versus Z . In these ranges of consumption, there is little impact of each unit consumed on the probability of contracting the disease. These ranges correspond to the flat portions of the logistic incidence curve.¹⁸⁷ Between five and fourteen units of consumption most of the damage

187. See Figure 1, text accompanying notes 83-84 *supra*.

with respect to future health occurs. At around nine units of consumption, the marginal



impact of consuming an extra unit reaches a maximum. The budget curve is steep here because the individual's insurance premiums are increasing sharply with extra consumption, reflecting the increase in expected medical costs.

There are two indifference curves in the diagram, describing different preferences. Individuals of type 1 do not value X very highly versus Z. Their consumption of X is low and they are on the initial flat part of the logistic curve (and the budget constraint) where the marginal expected future medical costs from consuming an additional unit of X are low. In contrast, individuals of type 2 have a strong taste for X versus Z, and their consumption levels are on the steep part of the logistic curve (and the budget constraint).

Consuming an extra unit of X increases future medical costs significantly for these individuals.

What should the tax rate be? The tangency points in the diagram represent a first best allocation. Each individual bears the full social cost of consuming X (production cost c plus expected future medical costs, $\pi(x)L$, and chooses x and z accordingly. It would be optimal to set the tax on marginal consumption for each type i at the Pigouvian rate $\pi'(x_i^*)L$ where x_i^* is type i 's optimal consumption of X . But the government does not know which type each individual is and must use a single tax rate. This tax rate will apply to all units, not just marginal units of consumption. Bond & Crocker show that in this situation “the efficient tax is a compromise between the two [Pigouvian taxes on marginal units]” and that “the social planner uses distortions from full insurance at the margin to mitigate overconsumption.”¹⁸⁸ The tax rate will result in too little or too much consumption of X by one or both of the types, and typically it will be optimal to offer at least one type less than full insurance. The outcome is a second best allocation. The first best is unattainable. The compensated price elasticity of demand for X of the two types comes into play since deviations from the optimal tax rate will tend to result in a bigger welfare loss for the more elastic type. Constraining the government to provide full insurance to both parties under the treatment principle would result in a similar “compromise tax.”

It is likely that the government will operate with sparser information. In particular, the government may not know the distribution of preferences by types, individuals may be subject to different $\pi(x)$ schedules, and the government may not have much individualized information about these schedules. Presumably, however, there is some scientific evidence about the impact of consuming X on disease incidence. Assume that the government has population-wide estimates of the relative risk due to consuming food at various levels x , but these estimates are *average* estimates consistent with many different possible sets of $\pi(x)$ curves across the population. For instance, epidemiological evidence might demonstrate that consuming ten units of X results in a ten percentage point increase in incidence of a certain medical condition while there is no chance of the condition occurring if no units of X are consumed (i.e., $\pi(0) = 0$ for everyone). But this ten percentage point increase in incidence may occur because 10% of the population (with very steep $\pi(x)$ schedules) will incur the disease for certain after consuming ten units ($\pi(10) = .1$ versus $\pi(0) = 0$) while the rest of the population is unaffected ($\pi(10) = \pi(0) = 0$), or it may occur because everyone's chance of getting the disease goes up by 10% ($\pi(10) = .1$ versus $\pi(0) = 0$). Assuming that preferences are fairly similar, a uniform tax will have better welfare properties in the case where individuals all face the same $\pi(x)$ schedule. Adding more sources of heterogeneity

188. Bond & Crocker, *supra* note 151, at 196.

makes choosing the “compromise tax” more difficult and increases uncertainty about the welfare effects of the final rate that is chosen.

Another feature of the “compromise” Pigouvian tax is worth noting. The tax is, speaking very roughly, something like a weighted average of the marginal expected medical costs of consuming an extra unit of X across the population. But, as mentioned above, for each individual the tax applies to *all* units of consumption not just to the last unit. As a result, the total taxes collected may greatly exceed or be much less than the appropriate total “implicit premium” that would cover total expected medical costs generated by consumption of X across the population. For example, if many individuals consume X at levels that are on the steep part of the logistic curve, total taxes will greatly exceed the *total* expected increase in medical costs due to consumption of X. In contrast, if the population has very high per capita consumption of X, most individuals may be on the flat portion of the curve where consumption levels are high. In that case, the optimal tax on marginal units of consumption will be very low, and total taxes will fall far short of the expected medical costs generated by consumption of X despite the fact that these expected medical costs will be (relatively high) since individuals have consumed to the point where almost all of the health damage is incurred. In the case where the government knows each individual’s consumption of X and $\pi(x)$ schedule, it was possible to impose a charge equal to $\pi(x)L$. This amount is exactly equal to the total increase in expected medical costs from consumption of X, and the “tax” on marginal consumption will be $\pi'(x)$ in accord with Pigouvian principles. Heterogeneity and lack of individualized information makes it impossible to collect the appropriate insurance premium using only a tax that is constrained to meet Pigouvian goals for charges on marginal consumption. In order to fund the insurance system at the appropriate rate, the government would have to levy charges or subsidies in addition to the tax.

Despite the difficulties of specifying the optimal tax in the face of heterogeneity and information deficits, it is clear that food taxation has a significant potential role to play in mitigating *ex ante* moral hazard. If the government is constrained to offer full insurance under the treatment principle, taxation becomes even more important because the government cannot address *ex ante* moral hazard by offering only partial coverage.¹⁸⁹

189. Of course, the government or the health plans responsible for providing the medical services funded by the revenues collected by the government may use partial coverage (e.g., by requiring coinsurance payments) to address the *ex post* moral hazard arising from the incentive for fully insured parties to overconsume medical services. Partial coverage at this stage also would impact *ex ante* moral hazard.

C. Adverse Selection and Taxes

Competition in insurance markets lowers costs, promotes variety and creates an inducement for introducing new products to meet consumer needs. Nonetheless, the fact that the identity of the customer affects costs and profits means that competitive markets are prone to “adverse selection” problems that may result in substantial welfare losses.¹⁹⁰ These problems also arise in markets where a sponsor, typically a government or private employer, desires to offer plans with different terms in order to satisfy different tastes for insurance.

A classic way to describe adverse selection problems is to consider a situation where the sponsor (or the private market) offers two plans, one with generous benefits and one with lower premiums but less generous benefits. Assume that there are two types of individuals where the “unhealthy” type is much more likely to be ill than the “healthy type.” If the sponsor is able to distinguish among the types *ex ante* (before illness events occur), the sponsor can charge higher premiums (equal to expected health benefits under the plan) to the unhealthy type under both of the plans. In this case, the market will efficiently sort people. Each type will pay a premium equal to expected benefits under either plan. Since both plans will be actuarially fair to all individuals, individuals will be able to choose between plans without penalty based on preferences, and the outcome will be efficient.

Very different results will occur if the sponsor cannot distinguish between healthy and unhealthy individuals *ex ante* or if the sponsor is not able to discriminate between types by offering different premiums or otherwise. If both plans are priced with the average individual in mind, the generous plan will be more attractive to the unhealthy individual. If individuals have freedom to choose plans, the unhealthy will gravitate toward the more generous plan. This plan will experience higher costs, necessitating higher premiums. These high premiums will drive out healthy types who, for reasons of high risk aversion or otherwise, would prefer to enroll in the more generous plan. This situation is not amenable to simple fixes. For example, heavily subsidizing premiums for the generous plan will induce individuals to gravitate to this plan who would otherwise be happier with the less generous plan. Costs will balloon for the sponsor, and, ultimately, some individuals will pay for the subsidy that results in inefficiently generous benefits for other individuals.

190. For good surveys of the conceptual issues and empirical evidence concerning adverse selection in health insurance markets, see Cutler & Zeckhauser, *supra* note 152, at 606-625; Wynand P.M.M. van de Ven & Randall P. Ellis, *Risk Adjustment in Competitive Health Plan Markets*, in HANDBOOK OF HEALTH ECONOMICS, VOLUME 1 755, 771-778 (A.J. Culyer & J.P. Newhouse, eds. 2000).

Both in theory and in real world outcomes, adverse selection can impact either high or low risk types adversely. In a separating equilibrium where types gravitate into particular plans, it is typical that either the high-risk or low-risk types will not be able to receive as much coverage as they would like. In other situations, there may be no equilibrium that sustains a set of plans, and certain plans will face a “death spiral” of rising costs, culminating in termination of the plan. In this situation, the final state may be an inefficient pooling equilibrium (where only a few, and possibly only one plan, are left as options) preceded by bankruptcy and other costs associated with the death spiral.

Which outcome will occur in theory depends upon demographics and various assumptions that affect the dynamic nature of the adjustment. To make things concrete, it is worth recounting a real world example of a death spiral that occurred in the health insurance system sponsored by Harvard University.¹⁹¹ In the early 1990s, employees had a choice between a generous PPO (preferred provider organization) plan and a variety of HMOs (health maintenance organizations). Harvard paid 90% of the premium cost for all plans. The premium contribution from individuals enrolled in the PPO was around \$500 per year. In 1995, in order to reduce costs, Harvard moved to a more competitive health insurance system where it paid a flat benefit equal to a percentage of the premium for the lowest cost plan and where it required employees to pay all of the excess. About 25% of the PPO enrollees left the plan in the first year, and these individuals were predominantly healthier and younger than those who remained. Accelerating per capita costs for the PPO required a \$1000 increase in premium for the PPO in 1996, causing 50% of the remaining enrollees to leave in that year, again a healthier and younger group than those remaining in the plan. Huge losses from the PPO in 1997 meant that there would be a gigantic premium increase in 1998. This increase would be much too large for most individuals to pay and neither the university nor the insurance company was willing to provide the large subsidy necessary to keep the plan going. Harvard disbanded the PPO.

Was Harvard’s policy foolish? It is not clear. Professors David Cutler and Richard Zeckhauser point out that the Harvard case illustrates the fact that increased competition results in a tradeoff in which “losses from adverse selection must be balanced against the gains, if any, from lower premiums that competition induces.”¹⁹² At the same time that the PPO fell into a death spiral, HMO premium costs fell about \$1000 per family even in the face of absorbing former PPO enrollees. On the one hand, “[t]he disappearance of the PPO [was] a welfare loss to employees who would have chosen it at their individual-specific cost,” and economists estimated the size of this welfare loss at 2-4% of baseline

191. The description that follows is a simplified version of the much more detailed history set forth in Cutler & Zeckhauser, *supra* note 152, at 616, 622-23.

192. *Id.* at 624.

premiums.¹⁹³ On the other hand, the same economists estimated the savings to Harvard from the lower HMO premiums at 5-8% of baseline spending.¹⁹⁴ Cutler and Zeckhauser conclude that “the net effect of competition in the Harvard circumstance appears to be beneficial, although the adverse selection losses were quite large.”¹⁹⁵ Aside from anecdotal evidence, empirical studies show that the impact of adverse selection on consumer choice is quantitatively quite large on at least three margins: the choice between fee-for-service and managed care plans; the choice between being insured versus not being insured; and the choice between high-option and low-option plans.¹⁹⁶

Aside from the impact of adverse selection on the variety and quality of health plans available to individuals, there is a second, but perhaps equally salient set of costs, referred to by phrases such as “plan manipulation” or “cream skimming.” In the absence of an ability to identify enrollees based on health status or to charge differential premiums, health plans have an incentive to attract and retain healthy enrollees and to discourage those who are unhealthy. The incentive is particularly strong where the plan sponsor pays the plan a fixed premium or subsidy per enrollee. Any reduction in costs will increase profits for the plan.

Some devices that plans may use to encourage low-risk enrollees involve the terms of the plan -- for example, setting up a low-option, high deductible plan, denying prescription drug benefits, or limiting the choice of providers. Other devices may be much more damaging to efficiency: deliberately choosing providers that have a poor reputation for dealing with high cost ailments (such as AIDS) or foregoing innovations for particular diseases that result in large benefits at little or no extra cost because the innovations might attract the sick. More problems arise after a plan is able to identify that certain enrollees are high cost customers. Plans may provide poor care or poor service or even offer a golden handshake hoping that these enrollees will move elsewhere. J.P. Newhouse suggests the subtle tools available to plans in his “famous ‘mother with an asthmatic child’ example,” including “keeping the patient in uncertainty about the correct diagnosis, making the patient wait for an appointment, making the patient wait in the office, being discourteous to the patient, or advising chronically ill patients to consult another physician who is ‘more specialized in treating their disease.’”¹⁹⁷

193. Id. at 623.

194. Id. at 624.

195. Id.

196. Id. at 616-21.

197. van de Ven & Ellis, *supra* note 190, at 775.

There are several ways to address adverse selection problems. One is for the sponsor to share costs with the plans. This “risk sharing” approach weakens the plan’s incentives to select against and discriminate against the unhealthy but also reduces the plan’s incentive to control costs. Despite the trade-off some degree of risk sharing often is desirable.¹⁹⁸

Another approach, of more interest in the context of using food taxes as a component in health insurance systems, is “risk adjustment.” Under this approach, the sponsor subsidizes plans that take on high-risk individuals and taxes plans in which below-average-risk individuals predominate. It is useful to use some nomenclature describing payment flows developed by Wynand van de Ven & Randall Ellis in their extensive survey article on risk adjustment.¹⁹⁹ Individuals pay a “premium contribution” in order to receive benefits under a health insurance plan. The plan also may receive a “premium subsidy” with respect to that individual. The “premium” that the plan collects in total is the sum of the premium contribution and the premium subsidy. Finally, enrollees may pay the sponsor a “solidarity contribution,” an amount paid “toward the health needs of everyone covered by the sponsor, not payments made for a consumer’s own health care.” For example, in the United States, the government is the sponsor for the Medicare system. The system includes certain private HMO plans as well as traditional Medicare coverage. Workers pay a 2.9% tax on their wages (half directly and half paid by the employer) which funds Medicare, Part A (mostly inpatient care). This payment is a solidarity contribution because it is not made for the consumer’s own health care but is paid to the sponsor for the benefit of everyone who is covered by Medicare. The HMO plans currently receive as a premium subsidy 90% of the risk-adjusted predicted per capita costs of those enrolled in the plan. The percentage was 95% prior to the Balanced Budget Act of 1997 but was decreased to 90% because favorable selection into these plans meant that enrollees in the plans would have incurred a 10% lower level of costs in the traditional system than the average enrollee in that system.²⁰⁰ The plans are permitted to charge a community-rated (i.e., the same for all enrollees) premium contribution to make up for any shortfall. In 1996, prior to the new legislation, 63% of HMO enrollees paid no premium, and the remaining 37% paid premiums averaging \$162 per year.²⁰¹

198. For a good discussion of risk sharing, see van de Ven & Ellis, *supra* note 190, at 817-28.

199. *Id.* at 764-66.

200. See Cutler & Zeckhauser, *supra* note 152, at 623.

201. van de Ven & Ellis, *supra* note 190, at 766.

Adding restrictions on risk-rating or on the premium charges that plans may use is a common feature of systems where a government sponsor risk adjusts.²⁰² These restrictions ensure that the government's preferred normative breakdown of the premium into a premium contribution and a premium subsidy is implemented.

Given this description of payment flows, it is apparent that risk adjustment involves a decision as to what payment (the premium contribution) should be made by the insured and what amount should come from other sources (premium subsidies funded by solidarity contributions). This decision may involve strong normative or political elements. In addition, it is worth noting that risk adjustment applies most naturally to situations where insurance is compulsory and where the sponsor is an entity like a national government able to impose uniform normative outcomes. If insurance is not compulsory, the taxes on the plans with low-risk individuals may drive these individuals out of the insurance system. If the system contains many sponsors and the insured can choose among them, low-risk individuals may seek sponsors who do not risk adjust. The result may be selection problems between sponsors that impose different risk adjustment formulae.

Risk adjustment uses factors that are predictive of the level of claims that the insured will generate during the period of coverage. Some typical factors include demographic variables such as gender and age, the existence of medical conditions, and past spending history. If the sponsor were able to include all the risk factors observable by the plans, the sponsor could set the premium subsidy or tax for each individual to equalize expected cost across individuals thereby greatly reducing or eliminating adverse selection problems.²⁰³

One problem with fully risk-adjusted premiums is that plans would have no incentive to institute programs to improve the health of enrollees. Such improvement would lower medical costs but would result in exactly offsetting lower premium subsidies. If there were a lag between the improvement and the reassignment of

202. *Id.* at 769-71.

203. If risk adjustment is done on an individual basis and the premium subsidy is passed on to the individual, adverse selection may be totally eliminated. This approach creates a situation where each individual pays a premium equal to expected benefits under each particular plan. As mentioned in the text, efficient sorting would occur. Individuals would receive insurance priced at social cost from enrolling in every plan and would choose the coverage pattern that maximized individual welfare net of social cost.

Risk adjustment is more often based on the average characteristics of individuals in a plan. If each individual receives a premium subsidy based on this average, the person who would be at the margin between two plans at the social optimum will not face prices that reflect social costs and may choose the wrong plan. The optimal price difference between plans would reflect the cost difference for that marginal person not the cost difference between the average person in each plan. *See* Cutler & Zeckhauser, *supra* note 152, at 624-25.

subsidies, the plans might make extra profit in the meantime. Nonetheless, there would still be a problem since the plans would bear the full cost of health improvement but would be barred from receiving some of the future returns.²⁰⁴

There is another reason to stop short of complete risk-adjustment. Not all factors that affect expected health costs are appropriate for adjustment. For example, different plans may involve different practice styles that affect medical costs. Some of these practice styles may include services that (in the opinion of most physicians) are not medically necessary or cost-effective. It is not clear why a person who prefers such services should receive them on a subsidized basis funded by the solidarity contributions of others.²⁰⁵

A similar issue of particular interest for considering food taxes is the whether or not to risk adjust for lifestyle. In their survey, van de Ven and Ellis present the two sides of the argument.²⁰⁶ On one side is the idea that health care expenditures related to lifestyle factors such as risky sexual behavior, smoking, or eating unhealthy food “should not be subsidized because these expenses can be influenced by the individual.” On the other hand, “it is unfair if people with lung cancer or AIDS cannot receive appropriate medical treatment.” This latter problem is particularly acute because, as discussed in the next section, health insurance is typically available only on an annualized basis. Without risk adjustment, smokers or individuals with AIDS may face prohibitively large premiums, effectively shutting them out of the health care system.

The dilemma here is due to the fact that requiring (necessarily) very high ex post payments for access to medical care when the consequences of poor lifestyle choices come home to roost violates the treatment principle, the idea that no one should be denied at least basic care even if their own foolish decisions led to their health problems. A food tax as “premium contribution” is a nice response since it operates on an ex ante basis. If the tax for each food is set equal to the expected future medical costs that result from indulgence, the individual can engage in risky dietary activities but must pay the full cost of insuring against the medical costs associated with unfortunate outcomes. Others will be insulated (on an expected value basis) from the consequences of the individual’s choices, and their solidarity contributions will not be spent on medical costs that result from voluntarily assumed risks. It is clear that a food tax, functioning as an implicit insurance premium, might play a very valuable role in a risk adjustment system.

204. See van de Ven & Ellis, *supra* note 190, at 781-82. van de Ven & Ellis discuss various proposals in the literature that address this problem, including giving plans bonuses for “health improvement.”

205. *Id.* at 767-68.

206. *Id.* at 783

Bond & Crocker demonstrate that a food tax also may directly impact adverse selection by relaxing the incentive compatibility constraint even in the absence of any moral hazard.²⁰⁷ If moral hazard is absent, individuals may differ in the level of $\pi(0)$, but for each individual $\pi'(x) = 0$ for all $x \geq 0$. Assuming that the government cannot observe consumption of X or $\pi(0)$ for each individual, the only tool the government has to combat adverse selection is to offer distinct insurance contracts, $C = \{q, D\}$ where q is the premium and $D = L - I$ is the deductible (where L is the loss and I is the payout if the disease strikes). If there are two types (based on $\pi(0)$ and preferences), the government typically will offer two different contracts, each involving different terms $\{q, D\}$. Each type will prefer one of the contracts to the other. In most cases at least one of these contracts will deviate from the first best for the type that chooses it. The government will adjust that contract but must stop at the point where one of the types becomes indifferent between the two contracts. At this point, adverse selection threatens to eviscerate one of the plans, causing a welfare loss. The incentive compatibility constraint “binds” for the party that is indifferent between the two contracts. In some cases, the government can gain some more room to adjust if it taxes or subsidizes consumption of X . That will change the slope of the budget constraint for both parties and may relax the incentive compatibility constraint, allowing a different set of contracts that result in an efficiency gain.

Bond & Crocker prove that “the optimal tax is nonzero as long as an incentive compatibility constraint binds and agents of different types consume differential amounts of the hazardous good.”²⁰⁸ In particular, if the incentive compatibility constraint binds for type 1, then the tax will be positive (negative) if type 2 individuals would consume more (less) of good X than type 1 individuals conditional on both having the insurance contract suitable for type 2. Whether a tax or subsidy is appropriate and the magnitude of each depends on the preferences and $\pi(0)$ of the different types.

This result from Bond & Crocker has implications beyond the technical attempt to compute the optimal tax in a pure adverse selection economy. Employing a food tax for reasons unrelated to adverse selection may affect the extent to which incentive compatibility constraints limit the contracts that the government may offer and thereby either reduce or increase problems of adverse selection. A similar problem may arise with using a food tax as part of a risk adjustment scheme as discussed above. In the case where x and $\pi(x)$ are known for individuals, imposing a food tax equal to expected future medical costs from an extra unit of consumption made risk adjustment easier by removing the need to adjust for a normatively questionable factor. In that case, risk adjustment is perfect in the sense that insurers have no selection incentives. When x and

207. See Bond & Crocker, *supra* note 151, at 196-97.

208. *Id.* at 196.

$\pi(x)$ are not known at the individual level, risk adjustment using a food tax would be imperfect, and it is possible that the overall impact of the food tax may be to worsen the adverse selection problem because of the impact of the tax on the incentive compatibility constraints.

D. Incomplete Markets and Taxes

We have already discussed one way that health insurance markets are incomplete. One can insure against incurring future medical costs but not against other future costs associated with a decline in health status. Costs such as time lost due to treatment are not insurable.

There is another way in which health insurance markets are incomplete, sometimes called the “problem of renewable insurance” or the “problem of intertemporal insurance.”²⁰⁹ Health insurance is generally provided only on an annual basis. Individuals cannot insure against the risk that they will become sick and then be forced to pay higher premiums. This problem becomes more severe the more information that is available to insurers who can use this information to set premiums. In a sense, there is a recontracting problem. Risk averse individuals would prefer to insure against lifetime risks with a single premium paid before any information on present or future health status emerges. But the system essentially allows the insurer to recontract annually. This ability subverts the original optimal contract.

There are many reasons we do not see “whole health insurance” or “premium insurance” that protect against future premium increases due to a change in health status.²¹⁰ In many countries insurance is bundled with provision and is provided by employers, regions, or national governments. Individuals switching employers, regions, or countries may find that the new employer, region or nation is unwilling to continue the old contract at the agreed upon rate. Insurers writing long-term contracts also face “aggregate risks” that medical costs will accelerate more than expected due to new treatments. Some medical conditions (“diseases”) currently may lie undiscovered by science and may engender costly treatments after they are identified. Finally, there are moral hazard and adverse selection issues that would attend premium insurance.

These problems make it difficult for a private insurance system on its own to provide long-term insurance. In a competitive market, each private insurer has an incentive to risk-rate to the extent possible. With no premium regulation, scholars have shown that the premium for full health coverage can be expected to range from ten times the

209. See Cutler & Zeckhauser, *supra* note 152, at 627.

210. *Id.* at 627-28.

average to one-tenth the average as firms risk-rate using factors such as health status, tobacco use, age, gender, and family size.²¹¹ A large portion of this range is due to variations in health status, a factor that would not result in variation if long-term insurance were available.

It is possible for governments to address this situation even if the insurance function resides primarily in the private sector. Unlike private firms, the government can implement cross-subsidies between insured parties without fear of losing the business of the parties who are “taxed” under the scheme. These cross-subsidies are an *ex post* way of achieving the level premiums (despite different health status outcomes) that would have been the result under long-term insurance. The risk adjustment approach described in the previous section is a way to cross-subsidize. The government selects certain risk factors (such as health status) and provides private insurers with a premium subsidy based on these factors. At the same time, the government prohibits risk-rating based on the factors. The government would choose a method of funding the premium subsidies via “solidarity contributions” that would achieve the desired result. For example, in a country where income and wealth are distributed fairly equally, the government might charge a solidarity contribution equal to the average value of $\pi(0)L$ across the population, thereby equalizing the charges for expected health costs that are independent of individual behavior. It would then use the proceeds to pay premium subsidies to plans based on the best estimate of $\pi(0)L$ of individuals in the plans and would prohibit the plans from risk-rating based on information about each individual’s $\pi(0)$.

A food tax would play a similar role in such a system as described in the previous section. Setting this tax at the level $(\pi(x) - \pi(0))L$ would result in each individual paying an implicit premium contribution equal to the expected additional medical costs generated by consuming unhealthy foods. The result would be to separate out “inherent” factors that should be the subject of long-term insurance from “moral hazard” factors that are under each individual’s control.²¹² As discussed above, if individual information about x and $\pi(x) - \pi(0)$ is known, insurers may be able to levy these implicit premiums as well or better than the government. The interesting case is where individual consumption levels, x , are not known. In that case, the government can use general taxation to get at x , a tool that private insurers do not possess. The bad news is that in this case the government will have to set the tax based on average or marginal levels of $(\pi(x) - \pi(0))L$. The implicit premiums will no longer be individualized, deviating from the correct marginal or average values for most individuals.

211. See van de Ven & Ellis, *supra* note 190, at 770.

212. As mentioned above, see text accompanying notes 161-162 *supra*, this picture may be too simple. Individuals might argue that an unfavorable damage schedule $\pi(x)$ or unfavorable preferences are “inherent” traits that should be subject to long-term insurance.

E. Food Taxes As a Component of the Health Insurance System

Previous sections have discussed various considerations that are relevant to the role of food taxes as a component of the health insurance system: moral hazard, adverse selection, and incomplete markets. This section considers that role in light of all the considerations simultaneously. After elucidating the basic case for a food tax as an adjunct to the health insurance system and the shape it might take in subsection 1, subsection 2 considers the food tax as part of a broader set of taxes and insurance devices. Subsection 3 briefly examines the alternative of employing ex post damages via litigation.

1. The Basic Case -- Food Taxes as Implicit Premiums

Consider first the case where the government knows the consumption level x_i of the hazardous food X and the function $\pi_i(x_i)$ for each individual i and knows L , the expected medical costs conditional on contracting the disease. The following would serve as an efficient and (arguably) fair insurance system. First, under the treatment principle, the government requires that each individual carry health insurance covering the loss L . Private insurers or the government as public insurer will need total premiums equal to the sum of $\pi_i(x_i)L$ across all individuals i to cover the anticipated total loss of $\sum_i \pi_i(x_i)L$. Second, the government charges each individual i an implicit premium, $[\pi_i(x_i) - \pi_i(0)]L$, equal to the expected medical costs from that individual’s consumption of X . Third, since individuals have no control over $\pi(0)$, the government would fund the rest of the required premiums, $\sum_i \pi_i(0)L$, through “solidarity contributions.” If every individual of the N total has equal income Y , the government might charge each individual $\frac{1}{N} \sum_1^N \pi_i(0)L$, the average expected medical costs arising from “inherent” risk that is beyond individual control. This system would replicate complete insurance that risk averse individuals might choose behind a veil of ignorance where it is equally likely that each individual would end up with any particular individual i ’s actual inherent risk, $\pi_i(0)$. Finally, the government would pay plans (public or private) risk-adjusted premium subsidies equal to the expected medical cost, $\pi_i(x_i)L$, for each individual in the plan, and would bar the plans from varying premiums based on $\pi(0)$, $\pi(x)$, or x .²¹³

213. One problem is that the optimal way for plans to control ex post moral hazard might be provide only partial coverage by requiring co-payments. In this case, the government might fund the partial coverage by reducing the premium subsidy proportionately and then transferring an amount equal to the required co-payment unconditionally to the afflicted individual.

This system would eliminate any moral hazard associated with consumption of X because each individual i would pay $\pi_i'(x_i)L$ for consuming an additional unit of X . This amount is equal to the covered expected medical costs generated by that additional consumption. As a result, individuals would internalize the cost to the insurance system of consumption of X . There would be no adverse selection problem with respect to the disease associated with X since health plans would receive perfectly risk-adjusted premium subsidies. They would not have an incentive to favor or disfavor individuals on the basis of $\pi(0)$, $\pi(x)$, or x . Finally, individuals effectively would receive long-term insurance since insurance is mandatory and since the government will have funded the inherent expected costs, $\pi_i(0)L$, for each individual i through solidarity contributions, fairly distributing the risk of drawing a bad (high) value of $\pi_i(0)$ by accident of birth.

This case of complete individualized information is subject to the points made earlier. In particular, there may be no need for the government to charge the implicit premium $[\pi_i(x_i) - \pi_i(0)]L$. Given that same information (x and $\pi(x)$ for each individual), private insurers or health plans could impose the charges. However, these parties would not be able to operate the transfer part of the system since these parties do not have plenary power to impose solidarity contributions across the whole population.²¹⁴ In addition, it still would be necessary for the government to restrict risk-rating by health plans and private insurers in order to maintain the integrity of the risk-adjustment system.

As mentioned above, the case for taxation becomes stronger if individual levels of consumption of X are not observable. In that case, the government's power to tax is an

“Unconditionally” means that the individual is not obligated to spend the transfer on the co-payment or on medical care. This approach does not violate the treatment principle. That principle only dictates that each individual may choose to be treated when the disease strikes, not that the individual will be treated against his or her will.

It is easy to explain the ex post moral hazard problem in terms of L . L is the (ex ante) expected medical cost of the particular disease, but “appropriate” (ex post) realized levels will vary because individuals will require different levels of treatment based on biological and medical factors. “Appropriate” means what the individual would spend out of his or her own funds. Because the insurer is paying the costs, there is a moral hazard problem since the individual does not bear the cost of services that go beyond the “appropriate” level. If the appropriate levels were known with certainty, there would be no such problem. Instead of requiring co-payments, the insurer could fund 100% of the appropriate level of care and then require the patient to pay 100% of any excess. Difficulties arise, and co-payments become desirable, when the insurer cannot distinguish between appropriate costs and costs that go beyond what is appropriate.

214. Sponsors could impose solidarity contributions and transfers among the plans they sponsor, but the transfer system would be incomplete if there are plans outside of their sponsorship. In addition, if individuals have a choice between sponsors, movement between sponsored groups might constrain the degree of transfers that are possible.

important tool that is not available to the private insurance system. Since the potential health damage from foods motivates taxation in the first place, we assume that the government has some information about damage schedules, $\pi(x)$. In particular, suppose that the government and insurers know each individual i 's damage schedule $\pi_i(x)$, but the government and insurers do not know each individual's preferences and are unable to observe levels of consumption of X on an individual basis.²¹⁵

In this situation designing a tax is much less straightforward. An appropriate tax to address moral hazard will not necessarily be optimal with respect to adverse selection problems or with respect to addressing the absence of long-run health insurance. Since $\pi_i(0)$ is known for each individual and does not depend on x_i , the government will be able to use solidarity contributions to redistribute the "inherent" risk as before. The problem comes in deciding how to tax X . For purposes of risk adjustment, the selection danger is that in the absence of being able to observe x , plans may discriminate against individuals who have particularly steep $\pi(x)$ schedules -- i.e., high values of $\pi'(x)$. The government might counter this tendency by paying premium subsidies equal to $\pi_i(x_i^*)L$, where x_i^* is the "best estimate" of person i 's consumption of X .²¹⁶ Since risk adjustment is the goal, the "best estimate" might be what the government thinks that health plans would use as an estimate. Funding these premium subsidies would require charging individual i the amount $\pi_i(x_i^*)L$ or imposing a general linear tax on X that raises total

revenue equal to $\sum_{i=1}^N \pi_i(x_i^*)L$, the required amount of revenue to fund the premium

subsidy payments. In some rough sense, either form of the tax will be based on the average expected medical costs induced by consuming X . In contrast, a Pigouvian tax aimed at moral hazard would be based on the expected *marginal* medical costs per additional unit of consumption, $\pi_i'(x_i^*)L$, across individuals. As discussed above, this marginal amount may be much larger or much smaller than the average amount if people are on the steep or flat portions of the logistic curve respectively. Finally, given that risk

215. The assumption that the government and insurers know the damage schedule for each individual contrasts with the more limited assumption in the discussion above about moral hazard that all the government (and insurers) knew was some information about the population average disease incidence response to various consumption levels of X . See text accompanying notes 188-189 *supra*. The assumption here creates a richer situation on the adverse selection front since insurers may discriminate more easily given their knowledge of individual damage schedules. Assuming less information in the moral hazard discussion was appropriate because the goal was to illustrate the difficulties of Pigouvian taxation in an information-poor environment.

216. In the absence of knowledge about preferences or about how they might correlate with the shape of $\pi(x)$, it might seem reasonable to attribute average consumption of X to each individual. However, if individuals know their own $\pi(x)$ schedules, those with steeper schedules will tend to consume less X given that health insurance is incomplete, covering only the medical cost consequences of disease.

adjustment is imperfect when there is no information about consumption patterns of X, the impact of any food tax on incentive compatibility constraints may improve or worsen adverse selection problems.

In choosing a tax, consumer behavior that generates the “paradox of dietary change” may favor taxes that, at a minimum, approximate the average expected medical costs from consuming hazardous foods. Recall Phillips’ model where consumers locate on “utility hills” around eating patterns that are low cost. The low cost arises because each such pattern attracts a number of consumers sufficiently large to allow producers to realize economies of scale in production of the foods that fit into the pattern.²¹⁷ Consumers habituate to the pattern that characterizes the hill they are on and overestimate the cost of moving to another hill because they incorrectly extrapolate the high marginal pain from incremental moves (“down” the utility hill) to be equal to the average pain per unit involved in the big move to another hill. Imposing a tax equal to the expected health costs of remaining on the unhealthy hill may spur consumers to at least experiment with switching hills. In addition, since the tax simply internalizes the cost of insurance being provided to the consumer, it would seem unobjectionable from a welfarist perspective at least in the case where the consumer would have wished to purchase the insurance anyway. Habituation and misestimation of the utility effects of switching hills might justify a larger tax, but the argument for this position and the determination of the appropriate level of tax would be a complicated exercise whether or not one adopts a welfarist perspective.

It is clear that when individual preferences and individual levels of consumption of X are unknown, choosing the appropriate food tax schedule as an implicit part of a health insurance system may be a very complex enterprise. Nonetheless, the motivations for taxation are particularly strong in this instance because taxation provides a powerful tool to address moral hazard, adverse selection, and incomplete insurance markets in ways that the private market cannot duplicate.

2. Use of Biomarkers and a Broader Set of Taxes

Taxation is particularly useful as part of an insurance system when the government and private insurers are unable to observe individual levels of consumption of foods that elevate the risk of mortality or morbidity. It is important to consider, however, that these parties may be able to observe a large number of individual biomarkers such as weight, cholesterol levels, blood levels of various phytochemicals, or blood glucose levels. These biomarkers contain information that is a combination of “inherent” factors and indicators of individual behavior. Some of the biomarkers are very predictive of the future incidence of disease. Although it is relatively rare for health insurance to be

217. See text accompanying notes 146-149 *supra*.

conditioned on a physical examination, at least in group coverage settings, life insurance companies often require blood and urinalysis work prior to issuing a policy or prior to extending coverage beyond normal group rates. These examinations include collecting biomarkers that indicate tobacco or drug use as well as biomarkers such as total cholesterol, triglyceride levels, HDL and LDL levels that are correlated with risk of disease.

The onset of genetic testing raises whole new possibilities for biomarkers. Genetic tests may be able to provide information about baseline risk (the $\pi(x)$ schedules discussed above, including the level of “inherent” risk, $\pi(0)$). In conjunction with other biomarkers, this information may be helpful in distinguishing inherent from behavioral risks at the individual level.

The availability of biomarkers presents two new issues. First, the biomarkers may provide information about consumption of hazardous foods by individuals even though the government and private insurers are unable to observe individual consumption levels directly. Second, the biomarkers may present an alternative or complementary basis for taxation or the creation of an implicit insurance system. This possibility raises a more general point. If the goal is to produce the best possible insurance system, one would not limit the tax targets to foods and potentially would want to include all sources of information, including biomarkers, to construct the system. We consider these two issues in turn.²¹⁸

The first issue is straightforward. If food consumption by individuals is not observable, but the consumption information is fully available from biomarkers, then the government (or the government in tandem with private insurers) can impose the “full information” combination of taxes and insurance premiums set forth above.²¹⁹ In many instances, biomarkers provide only partial information about past dietary behavior.²²⁰ In

218. In doing so, we ignore possible constitutional or moral constraints on the ability of the government to collect biomarker information. For example, in the United States, it is questionable whether the federal government or state governments would have the power to force individuals to undergo blood tests or genetic tests in order to charge proper premiums under a system of compulsory health insurance. *See generally*, LAURENCE H. TRIBE, AMERICAN CONSTITUTIONAL LAW 1329-35 (2nd ed. 1988).

219. There is considerable evidence that biomarkers are useful indicators of dietary patterns. *See, e.g.*, Clayton S. Hann, et. al., *Validation of the Healthy Eating Index with Use of Plasma Biomarkers in a Clinical Sample of Women*, 74 AM. J. CLINICAL NUTRITION 479 (2002).

220. *See, e.g.*, Ahmed El-Soheemy, et. al., *Individual Carotenoid Concentrations in Adipose Tissue and Plasma as Biomarkers of Dietary Intake*, 76 AM. J. CLINICAL NUTRITION 172 (2002). Carotenoids are components in many vegetables. The El-Soheemy group compared intake to plasma and adipose tissue (fat) levels. The hypothesis was that short-term intake would affect plasma levels and long-term intake would be apparent from levels in adipose tissue. The hypothesized

the situation where the insurer has only imperfect information about the hazardous activities of the insured it is generally still optimal to vary premiums in response to the information, but full coverage is no longer optimal since partial coverage can reduce the residual moral hazard problem stemming from the failure of premium adjustment to fully address the problem.²²¹ Under the treatment principle, however, partial coverage is not an option. The government therefore must either relax that principle or accept a larger welfare loss from the presence of moral hazard.²²²

Many biomarkers are strong predictors of disease and may in fact be stronger predictors than dietary patterns. This fact raises the question of whether it would be better to ignore food consumption and simply levy taxes or base insurance premiums on the biomarkers. (Instead of a tax on fatty foods, tax people who are fat!²²³) A significant problem with this approach is that biomarkers include information about both behavioral and inherent risk.²²⁴ From a normative perspective it is useful to distinguish factors that are under individual control from factors that are not. The desire to draw these distinctions makes taxing food or charging premiums based on food consumption attractive under the presumption that food consumption is a matter of choice. In contrast, there is a strong argument that individuals should not pay higher premiums based on higher inherent risk.

There are other problems with using biomarkers. Some biomarkers are subject to short-term manipulation. Changing one's diet over a period of a few days or weeks prior

effects were present, but the correlations between intake and the observed levels were low, ranging from close to zero to .55. A .55 correlation means that observed levels reflect only about 30% of the variation in intake.

221. See Shavell, *supra* note 171, at 554-55.

222. A welfarist approach probably would involve some relaxation of the treatment principle since the welfare gain from enforcing the principle through complete coverage is not infinite.

223. A recent study argues that obesity is an independent risk factor for heart failure (one kind of IHD). See Kenchaiah, et. al., *supra* note 11. The other factors considered included age, smoking status, alcohol consumption, total serum cholesterol, hypertension, diabetes mellitus, and several more technical indicators. After adjusting for these other factors, the increase in risk from obesity was modest, about 5% for men and 7% for women. Clearly obesity would be only one of several biomarkers in any scheme to set premiums or taxes based on the risk of heart failure.

224. See, e.g., Cheryl L. Rock, et. al. *Diet and Lifestyle Correlates of Lutein in the Blood and Diet*, 132 J. NUTRITION 525S (2002). Lutein is a carotenoid that appears to be inversely associated with age-related macular degeneration and cataracts. The Rock group found that serum lutein concentration was related to intake but that other factors including demographic characteristics explain much of the variance in that indicator. Race/ethnicity, education level and smoking status had the strongest associations with serum levels.

to testing can have a significant impact on some indicators.²²⁵ In addition, drugs affect biomarkers. Cholesterol lowering drugs are an obvious example. If individuals know their test date and know that their insurance premiums or tax liability depends on the results, there will be an incentive to manipulate the results. The government either would have to respond by making the test more complicated (e.g., extracting adipose tissue to pick up long-run biomarker evidence or testing for residues of cholesterol lowering drugs) or would have to test citizens on a random, unannounced basis.

Despite the difficulties associated with using biomarkers, it is clear that they provide potentially useful information even given that the goal may be to measure behavior-induced risk of disease rather than overall risk. The possibility of using biomarkers along with other information leads to the second subject of this subsection. Up to this point the focus has been on potential roles for food taxes. The strongest case is for using these taxes as an adjunct to health insurance systems. But the argument with respect to food taxes applies much more broadly. Many behaviors other than diet affect the risk of disease. This fact embeds the discussion of food taxes and insurance in what is in many ways a more natural public policy question: What role should behavioral information play in health insurance systems?

A general approach would be to consider all behaviors known or suspected to affect disease risk (as well as biomarkers that reveal information about those behaviors) and ask what the optimal approach to insurance might be if the government can use tax strategies related to the behaviors or if insurers (including private firms as well as the government) might be able to make premiums conditional on particular behaviors. This approach would call into play some classic tax approaches. For example, the government might not be able to observe exercise, a major disease-avoidance activity for several conditions, but, using the Arnott & Stiglitz approach discussed above, it might be desirable for the government to tax substitutes for exercise and to subsidize complements. Some behavior that affects disease risk has independent normative significance beyond the welfare of the person choosing the behavior. For example, a meta-analysis recently published in a prominent medical journal based on data from 147,275 women participating in 47 studies in 30 countries found that “a woman’s risk of developing breast cancer dropped by 7 percent for each child she had and decreased by 4.3 percent for every year of breastfeeding.”²²⁶ Should women who have children and

225. See, e.g., K.J. Yeum, et. al., *Human Plasma Carotenoid Response to the Ingestion of Controlled Diets High in Fruits and Vegetables*, 64 AM. J. CLINICAL NUTRITION 594 (1996). The Yeum group concluded that “most of the measurable carotenoids of human plasma can be increased by moderate alterations in diet within a short time.”

226. *Breast-feeding Has Protective Bonus*, 162 SCIENCE NEWS 93 (2002). The meta-analysis is published as, Collaborative Group on Hormonal Factors in Breast Cancer, *Breast Cancer and Breastfeeding: Collaborative Reanalysis of Individual Data from 47 Epidemiological Studies in 30 Countries, Including 50,302 Women with Breast Cancer and 96,973 Women without the Disease*,

women who breast feed be charged reduced premiums with the difference made up by women (at higher risk) who do not, or should all women pay the same premium, one reflective of average risk? At different periods in history, countries have had policies to encourage or discourage child-bearing. In addition, the breast feeding decision may have career implications for women, and countries may have a policy of encouraging or discouraging female labor participation. The optimal premium approach from an insurance standpoint may result in subsidiary beneficial or negative consequences for demographic or labor force participation policies.

Although I do not pursue the general approach much further here, there is an important point that follows from it. Under the general approach, the government is considering a wide range of tax targets, behavioral parameters, and data such as biomarkers. Optimal tax or insurance premium conclusions about particular food items may be very different under this general approach than if one constrains the government to set premiums or taxes only for that particular food item. For instance, both saturated fat consumption and smoking are risk factors for IHD. If these factors are positively correlated, then under an implicit premium approach it is likely that a tax based on the saturated fat content of foods will be at a much higher rate if the government cannot tax cigarettes under the same scheme. It also may be the case that certain biomarkers are better tax or premium targets when individual food consumption is not observable. It is obvious that optimal tax or implicit premium conclusions about food items may be very sensitive to the range of instruments and information available to the government and private insurers.

3. An Alternative: Ex Post Damages through Litigation

It is clear from the discussion so far that, even putting aside political economy, using food taxes as part of an insurance scheme may involve the government in a very difficult process of information gathering and analysis. The government would have to estimate expected medical costs, and a substantial fraction of these costs may occur far in the future, subject to considerable uncertainty in the face of technological change and other factors. The government would have to determine the impact of food on disease incidence in the face of scientific uncertainty. Even with information about loss and the causal nature of food consumption, it would be necessary either to observe food consumption at the individual level or, in the absence of individual information, to engage in the potentially very complex process of computing optimal tax rates that reflect heterogeneity and trade-offs between various insurance-related goals.

An alternative for the government is to shift at least part of the job to the private sector. In particular, instead of the ex ante approach of levying food taxes, there is the

ex post approach of making food producers and processors strictly liable for the health costs caused by particular foods. Under standard economic analysis, these producers and processors would increase prices to reflect the expected future health costs per unit of consumption, in effect levying a “tax.” In addition, these parties would have significant incentives to conduct research on the health consequences of their products and to make foods safer and healthier given that they are on the line for any food-induced health costs.

There are some serious problems with this approach. First, standard economic analysis does not take into account the impact of limited liability and bankruptcy rules. It probably is not an equilibrium for food companies to play the “responsible strategy” of carefully considering the health consequences of their products, raising prices accordingly, and accumulating reserves in light of future health cost liabilities. If all companies choose the “responsible strategy,” any one food company has a strong incentive to deviate in the following manner. The company would reduce prices slightly to gain market share, pay out the monies that would have been accumulated as reserves as dividends, pay out the normal returns to capital and (to the extent possible) the capital itself as dividends, and then declare bankruptcy when the liabilities come due. In a competitive environment, a situation where most companies engage in the “responsible strategy” might quickly unravel to the point where no companies use that strategy. One way to overcome this problem would be for the government to require the companies to set prices and accumulate reserves in an appropriate manner. However, that solution essentially puts the government back into the tax business since it must decide the appropriate “tax” to add to prices.

The history of litigation with respect to health costs associated with smoking is not encouraging.²²⁷ Beginning in the mid-1990s states and other parties began winning class action lawsuits against tobacco companies to recover medical costs, and in 1996 the largest “fringe” manufacturer broke ranks with the rest of the industry and provided substantial evidence of past industry knowledge of the dangers of smoking. Faced with massive potential liabilities, the major tobacco industry players attempted to reach a settlement with the states and private parties filing lawsuits. The “Master Settlement Agreement” that emerged in late 1998 obligated the major tobacco companies to pay the equivalent of a 45 cent per pack tax over the next twenty-five years in exchange for relief from future class action suits brought by the settling states and private parties. A separate provision of the settlement requires the settling states to impose equivalent taxes on other brands not parties to the settlement on sales in excess of 125% of each brand’s 1997 market share. The litigation and settlement involved massive legal costs, by one estimate forty times the amount that would have followed from actual damage

227. The discussion here is largely a distillation of the more detailed treatment in Gruber, *supra* note 123, at 198-202.

awards. The nature and costs of the settlement led Jonathan Gruber, a leading scholar of tobacco policy, to state that “it is unambiguously true that a 45 cent per pack tax on cigarettes would have been better social policy, avoiding disparate treatment of producers and huge lawyers fees.”²²⁸

Differences between the food industry and the tobacco industry make litigation in the food area a less promising vehicle. The tobacco industry is very concentrated. For example, four firms produce over 98% of the cigarettes consumed in the United States.²²⁹ The industry is highly profitable, and there are good reasons to believe that there are significant barriers to entry.²³⁰ Although this industry structure may be bad news for consumers, it makes litigation and settlement relatively easy since there are only a few major players on the production side. In the case of food, the situation is much messier. For example, some produce is sold directly by farmers to consumers or to small grocery chains. Would we expect these parties to raise prices in the face of expected future medical costs and to accumulate appropriate reserves? The grocery industry itself is a fragmented low-margin industry, with plenty of turnover due to business failures and entry. There are some big players such as major fast food companies and some major food processing and production companies, but these even these companies do not share the profitability and tight oligopoly structure that is present in the tobacco industry. It is likely that the outcome of litigation to recover health costs from the food industry would be much more haphazard and deficient from a public policy perspective than similar outcomes for the tobacco industry.

In sum, it appears that relying on ex post litigation may be a very poor substitute for an ex ante taxation approach.²³¹

228. *Id.* at 201.

229. *Id.* at 197.

230. *Id.* at 196-97.

231. As Jonathan Gruber notes, litigation may be socially valuable, especially if there are steep political barriers to raising taxes to the socially optimal level. In discussing the 1998 Master Settlement Agreement, he notes that “the likely alternative to such a settlement was not a 45 cent per pack tax, but rather no federal action to raise the price of cigarettes” and that “the payments to lawyers and excess profits to small producers, while inequitable, can be viewed as the political economy costs that must be paid to impose cigarette taxes.” *Id.* at 201.

IV. CONCLUSIONS, REFLECTIONS, AND NEXT STEPS

This paper examines the case for food taxes at a conceptual, qualitative level. There are no formal models, empirical analyses or simulations. Before spending resources on work of that kind, it is important to determine whether there are any areas where food taxes may play a salient role and, if so, what areas are most promising.

Current food tax proposals rest on one of two bases. Some propose modest taxes on junk food to raise funds for public health initiatives with respect to diet. This type of tax may be politically appealing, but a normative basis for linking the tax provision with the expenditure side is lacking. Other proposals, including various “fat tax” schemes, are more ambitious, hoping to use the impact of taxes on prices to achieve public health goals. The problem with these proposals is the “public health perspective,” a view that better health is desirable regardless of the cost or of other objectives (such as enjoying eating) that must be sacrificed.

Going beyond the public health perspective, there is the classic externality justification for taxation and the newer “internality” rationale that views taxation as a self-control device for addicts with time-inconsistent preferences. With respect to externalities, the outcome is likely to be similar to the case of tobacco taxation. Despite very large health costs, positive and negative external effects tend to cancel out so that externalities justify only a very small tax, if any. The internality rationale is very strong in the case of cigarettes largely because most users express a desire to quit and exhibit behavior that strongly suggests time-inconsistent preferences. For food, the rationale is much weaker. Leaving aside eating disorders, it is doubtful that food involves the same addiction and preference pathology as cigarettes. In addition, only a small proportion of consumers may benefit from self-control devices making a general tax a poor vehicle.

The strongest case for food taxes is an adjunct to health insurance systems. Food taxes may play a major role in addressing ex ante moral hazard and adverse selection problems. The taxes also provide a way for distinguishing between behavior-induced risk and “inherent” risk, and it may be normatively desirable to treat these risks very differently.

Implementing food taxes may not be easy, and there are substantial political minefields that may make taxation impossible or result in a very distorted tax of dubious value from a public policy perspective. Nonetheless, the insurance-based rationale is very powerful, and it is possible to overestimate the political and implementation difficulties in light of the potential gains. In Part I, for instance, we considered political economy difficulties without thinking about food taxes as an adjunct to the existing

health insurance system. One of the gravest political concerns in the United States at present is the fate of Medicare and Medicaid, the major public components of the health insurance system. It seems clear that continuing the Medicare program in anything like its current form will require a significant reductions in benefits for future recipients, a much larger (and, almost certainly, politically infeasible) tax burden on young workers, or a program of forced saving combined with delayed retirement.²³² Given these unpleasant alternatives, the idea of significantly relieving the funding pressure on Medicare by making those who take health risks pay for the ensuing expected medical costs may have very strong appeal, perhaps strong enough to easily override any opposition from some sectors of the food industry and other interested parties.

Part I made the point that scientific uncertainty and complexity may be a major obstacle to designing food taxes that make sense with respect to certain medical conditions. Osteoporosis may be one such condition, as indicated in that Part. Nonetheless, taxation may be a very viable approach for several very important conditions. For example, as mentioned in the introduction, IHD is a leading cause of mortality and morbidity in the United States. The risk factors for IHD have been widely studied, and it is possible to identify a strong and fairly clear role of diet.

Excited about the possibilities for the insurance rationale, my current intention is to follow up this paper with several more detailed studies, at least one of which will examine the IHD case in detail. It is easy to say a food tax might be desirable to combat moral hazard or adverse selection. It is another task entirely to show how the tax might apply for specific diseases or in a general system that addresses many diseases simultaneously.

232. See Victor R. Fuchs, *Medicare Reform: The Larger Picture*, 14 J. ECON. PERSP. 57 (2000) (general discussion); Saving, *supra* note 185 (proposing mandatory prepaid accounts for young workers).