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

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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 2002, the three leading causes of mortality in the United States were heart disease, cancer, and cerebrovascular disease ("CVD"), which accounted for 28.5%, 22.8%, and 6.7% of deaths, respectively.[2] Roughly 71% 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, strong existing evidence links IHD to diet. On the morbidity side, 7.1% of Americans between ages forty-five and sixty-four, 18.7% between sixty-five and seventy-four, and 24.5% aged seventy-five and above reported a previous or continuing serious coronary condition in 2002.[4] In addition, 29.0%, 49.6%, and 51.8% of the same age groups, respectively, reported 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 by

1. For a brief history see MARION NESTLE, FOOD POLITICS 31–50 (2002).

2. CENTERS FOR DISEASE CONTROL & PREVENTION, HEALTH, UNITED STATES, 2004 154 tbl.31 (2004); CENTERS FOR DISEASE CONTROL & PREVENTION, 53 NATIONAL VITAL STATISTICS REPORTS, NO. 17, at 13 tbl.1 (2005). The most recent year for which complete data is available from the Centers for Disease Control and Prevention ("CDC") is 2002.

3. Out of 696,947 deaths from heart disease in the United States in 2002, 494,382 were due to IHD. CENTERS FOR DISEASE CONTROL & PREVENTION, *Deaths: Final Data for 2002*, 53 NATIONAL VITAL STATISTICS REPORTS, NO. 5, at 30 tbl.10 (2004).

4. CENTERS FOR DISEASE CONTROL & PREVENTION, SUMMARY HEALTH STATISTICS FOR U.S. ADULTS: NATIONAL HEALTH INTERVIEW SURVEY, 2002, VITAL AND HEALTH STATISTICS, SERIES 10, NO. 222 110 app.2, at tbl.IV (2004) [hereinafter NHIS 2002]. These individuals had been told by a doctor at some time before the survey that they had "coronary heart disease, angina pectoris, or heart attack." *Id.* at 111 nn.1, 3.

5. *Id.* at 110 app. 2, at tbl.IV.

maintaining adequate physical activity.[6] CVD includes most of the conditions described as "strokes" and also displays a strong connection to diet and physical activity. The morbidity rate for strokes in 2002 was 2.5%, 6.4%, and 11.1% for those Americans aged forty-five to sixty-four, sixty-five to seventy-four, and over seventy-five, respectively.[7]

During the past two decades, the United States and many other countries in the world have experienced an "epidemic" of obesity.[8] The percentage of obese individuals twenty to seventy-four years of age in the United States was 13.3% during 1960–62, 14.6% during 1971–74, and 15.1% during 1976–80.[9] This percentage increased sharply to 23.3% during 1988–94 and increased further to 31.1% during 1999–2000.[10] The increases occurred across both genders, all age groups (beginning at twenty years), and all major racial categories. Separate data for children (ages six to eleven) and adolescents (ages twelve to nineteen) indicate similar increases. The percentage of children aged six to eleven who are "overweight" increased from approximately 4% in the 1960s and early 1970s to 15.8% in 1999–2002, and the percentage of adolescents who are "overweight" increased from roughly 5% in the 1960s and early 1970s to 16.1% in 1999–2002.[11] Obesity is a risk factor for IHD and other major causes of mortality and morbidity.[12]

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6. *See* AM. INST. FOR CANCER RESEARCH, FOOD, NUTRITION AND THE PREVENTION OF CANCER: A GLOBAL PERSPECTIVE (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).

7. NHIS 2002, *supra* note 4, at 110 app.2, at tbl.IV.

8. The characterization is from the United States Surgeon General, who notes that, "[o]verweight and obesity may not be infectious diseases, but they have reached epidemic proportions in the United States." Tommy G. Thompson, *Message from the Secretary* in U.S. DEP'T OF HEALTH & HUMAN SERVS., THE SURGEON GENERAL'S CALL TO ACTION TO PREVENT AND DECREASE OVERWEIGHT AND OBESITY 2001 XIII. The visibility of the "epidemic" has increased to the point where it is being discussed in the popular press. *See, e.g.*, Michael D. Lemonick et al., *America's Obesity Crisis*, TIME, June 7, 2004, at 57–13; Ron Winslow, *Obesity: A World-wide Woe*, WALL ST. J., July 1, 2002, at B1.

9. HEALTH, UNITED STATES, 2004, *supra* note 2, at 242 tbl.69. Obesity is defined as a hody mass index ("BMI") greater than thirty in units of kilograms of weight per meter of height squared. *Id.* at 244 n.7.

10. *Id.* at 242 tbl.69.

11. *Id.* at 245 tbl.70. "Overweight" is defined as BMI "at or above the sex- and age-specific 95th percentile BMI cutoff points from the 2000 CDC Growth Charts: United States." *Id.* at 245 tbl.70 notes.

12. *See, e.g.*, Helen B. 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 ENG. J. MED. 305 (2002). A sharp increase in the incidence of type II diabetes has mirrored the increase in obesity. CENTERS FOR DISEASE CONTROL & PREVENTION, HEALTH, UNITED STATES, 2003 58–59 (2004).

The powerful morbidity and mortality effects of diet combined with growing concern about the obesity "epidemic" have led public health scholars and public interest advocates to call for taxes on food.[13] 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 apply to a much broader range of foods and food components.

This Article concentrates on the second set of taxes.[14] Part I discusses both types of taxes, surveys some work indicating that the public health stakes associated with dietary choice are potentially very large, and considers in a preliminary fashion some of the potential rationales for the more ambitious taxes. Parts II and III carry out the central task of the Article by exploring and assessing these rationales and others in a more detailed manner. Armed with potential rationales, Part IV considers the challenges to tax design that arise from scientific uncertainty, causal complexity, tax implementation, and politics. Part V offers some concluding thoughts.

I. THE TAX LANDSCAPE AND THE PUBLIC HEALTH PERSPECTIVE

A. JUNK FOOD TAXES

As of the middle of 2000, seventeen states and two major cities imposed junk food taxes.[15] Six other states have imposed junk food taxes in

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Obesity is associated with an increased risk of type II diabetes in both adults and children. Rita P. Raman, *Obesity and Health Risks*, 21 AM. C. NUTRITION. 134S, 135S (2002).

13. *See, e.g.*, E. Katherine Battle & Kelly D. Brownell, *Confronting a Rising Tide of Eating Disorders and Obesity: Treatment vs. Prevention and Policy*, 21 ADDICTIVE BEHAV. 755, 762 (1996); Tom Marshall, *Exploring a Fiscal Food Policy: The Case of Diet and Ischaemic Heart Disease*, 320 BRIT. MED. J. 301, 301 (2000).

14. The aim is to assess the strengths and weaknesses of broad tax approaches, not to arrive at a general package of suggested public policy measures. There are many non-tax approaches that might enhance or provide a superior substitute to such taxes in meeting the relevant normative goals. 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 underfunded. *See* NESTLE, *supra* note 1, at 130–32; Michael F. Jacobson & Kelly D. Brownell, *Small Taxes on Soft Drinks and Snack Foods to Promote Health*, 90 AM. J. PUB. HEALTH 854 (2000).

15. *See* Jacobson & Brownell, *supra* note 14, at 855 tbl.1.

the past but repealed them prior to 2000.[16] In many cases, the soft drink industry or food and beverage industry played an active role in repeal.[17]

Many of the existing junk food taxes pre-dated the obesity epidemic and were enacted when there was much less concern about the health impact of such foods.[18] Advocates now propose extending these taxes as a way to fund public health initiatives with respect to diet and exercise.[19] 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."[20] A significant part of the effort would be an informational campaign to offset the cumulative impact of advertising and promotion of unhealthful foods. The advocates emphasize that the taxes would not have to be very heavy—for example, on the order of a penny per can of soda—in order to raise substantial revenue. Advocates note that surveys indicate a body of support for such small taxes, and they suggest that committing the revenue to fund health education programs would greatly increase the amount of support.[21]

Tying junk food taxes to health-initiative expenditures may create political appeal, but from a normative standpoint the justification for connecting the tax and the expenditures is not clear. If nutrition education has high public value, the government should be willing to fund these activities through revenues raised from the most efficient source. In addition, junk food taxes are not well designed to achieve other social goals. For instance, soda consumption may involve negative externalities due to interactions with public or private insurance schemes that bundle

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16. *Id.* at 856.

17. *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. *Id.*

18. It appears that most of these provisions were viewed simply as good sources of tax revenue. *Id.* at 854–56.

19. *See* Michael F. Jacobson, *Tax Junk Foods*, NUTRITION ACTION, December 2000, *at* http://www.cspinet.org/nah/12_00/cspinews.html; Jacobson & Brownell, *supra* note 14, at 857.

20. Battle & Brownell, *supra* note 13, at 761. 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)." *Id.*

21. KELLY D. BROWNELL & KATHERINE BATTLE HORGEN, FOOD FIGHT 222–24 (2004); Jacobson & Brownell, *supra* note 14, at 856.

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 amount of soda since part of the health cost of consumption is shifted to others. But advocates typically do not favor junk food taxes based on a concern for externalities or based on the behavioral impact of the taxes. Indeed, some even argue in favor of such 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 much more politically acceptable.[22]

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 proposals 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.[25] Therefore, scholars supporting such taxes are concerned about the impact of food taxes on

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22. *See* Jacobson & Brownell, *supra* note 14, at 856. Of course, ultimately the junk food tax advocates care very much about influencing diet, including consumption of such foods. Their practical point has a Trojan horse flavor. The junk food taxes may be politically innocuous because they have no direct impact on consumption, but they provide seed money for counteradvertising that can begin to turn the tide. Some of the same individuals who favor this Trojan horse strategy also favor broader taxes that would have a direct influence on eating behavior. *See* Battle & Brownell, *supra* note 13, at 762 and accompanying text.

23. *See, e.g.*, JIM SINNER & SKY DAVIES, REPORT TO DIABETES NEW ZEALAND AND FIGHT THE OBESITY EPIDEMIC, INC., CUTTING THE FAT: HOW A FAT TAX CAN HELP FIGHT OBESITY (2004); Nick Wilson & Osman Mansoor, *Getting the Fat Tax on the Table*, 113 NEW ZEALAND MED. J. 451 (2000); Hanna Rosin, *The Fat Tax: Is It Really Such a Crazy Idea?*, NEW REPUBLIC, May 18, 1998; *British Doctors Urge "Fat Tax,"* CNN, June 10, 2003, *at* http://www.cnn.com/2003/HEALTH/diet.fitness/06/10/ (reporting that British and Australian doctors have proposed fat taxes); Reuters, *Ireland Mulls 'Fat Tax' to Curb Obesity Levels*, BOSTON.COM, Aug. 26, 2003, *at* http://www.Boston.com/YourLife/Health&Fitness/Fitness&Nutrition; BBC News, *Government Unit 'Urges Fat Tax'*, Feb. 19, 2004, *at* http://news.bbc.co.uk/go/pr/fr/-/1/hi/health/3502053.stm (detailing the fat tax considered by the Prime Minister's Strategy Unit in the United Kingdom).

24. *See, e.g.*, Battle & Brownell, *supra* note 13, at 762.

25. It is important to note one limitation of the terminology here. A tax aimed at behavior with public health goals in mind may target what are thought of as junk foods. *See infra* text accompanying notes 272–94 (describing taxes on energy-dense, nutritionally poor foods as a potential approach, if obesity and the costs ensuing therefrom are the targets of the reform).

consumption.[26] Fat tax proposals have drawn industry fire[27] and have been the subject of editorial treatment in prominent journals.[28]

Advocates of fat taxes see them primarily as public health initiatives, the goal being to improve people's health. Focusing on this goal raises the question of why the government should interfere with individual choices with respect to diet. Both the food industry and independent commentators have raised this issue[29]—one 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.[30] Some researchers have suggested that poor dietary choices combined with physical inactivity result in nearly as much morbidity and mortality as cigarette consumption.[31] Critics, cynically or otherwise, predict a repeat performance of the entire tobacco saga, including massive and costly litigation against sellers or producers of unhealthful foods, when there is much less justification to intervene or collect damages. In fact, such litigation already has begun,[32] and legislation to limit it has been proposed in Congress.[33]

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26. *See, e.g.*, Marshall, *supra* note 13.

27. *See, e.g.*, Pamela Parseghian, *Support High-Calorie Food Tax Proposal? Fat Chance*, NATION'S RESTAURANT NEWS, Apr. 30, 2001; Milford Prewitt, *Feds Chew Fat on U.S. Diet as NRA Wary of 'Obesity Tax'*, NATION'S RESTAURANT NEWS, Mar. 26, 2001; Ralph Reiland, *What's Next? A Fat Tax on Junk Food*, RESTAURANT HOSPITALITY, Aug., 1998.

28. *See, e.g.*, Tim Byers, *Reflections on the Use of Food Policy for Waging War on Cancer*, 21 J. AM. C. NUTRITION 77 (2002); Rosin, *supra* note 23; Jacob Sullum, *Dining Fine*, REASON, Dec. 31, 1997, *at* http://www.reason.com/sullum/123197.shtml.

29. *See, e.g.*, BROWNELL & HORGEN, *supra* note 21, at 228; Byers, *supra* note 28, at 78; Parseghian, *supra* note 27.

30. *See, e.g.*, Reiland, *supra* note 27, at 78; Rosin, *supra* note 23.

31. *See, e.g.*, Ali H. Mokdad et al., *Actual Causes of Death in the United States, 2000*, 291 J. AM. MED. ASS'N 1238, 1239–40 (2004); Ali H. Mokdad et al., *Correction: Actual Causes of Death in the United States, 2000*, 293 J. AM. MED. ASS'N 293 (2005); Rosin, *supra* note 23.

32. 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 alleged that these companies were legally responsible for his obesity and poor health. *See Oh, Temptation*, ECONOMIST, Aug. 1, 2002, at 12. Barber's claims were dismissed, but soon there were several subsequent suits alleging misleading claims or the absence of warnings on the part of fast-food companies with respect to their fare. In mid-2004, a news column reported that "there have been eight 'fat' lawsuits," five of which were "at least partially successful" in that plaintiffs received settlement monies or defendants changed their mode of operation. Laura Parker, *Legal Experts Predict New Rounds in Food Fight*, USA TODAY, May 7, 2004, at 3A.

33. *See infra* note 207.

C. THE PUBLIC HEALTH STAKES

Public health concerns about diet and obesity are certainly justified. To see how deep the overall impact of food choices on health might be, it is worth considering the China-Oxford-Cornell study,[34] one of the most thorough and interesting epidemiological studies on diet. For the period from 1973 to 1975, 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."[35] Another factor is that, although China was a developing country in the 1970s, the medical system was sophisticated enough to have a high degree of confidence in the mortality statistics. In 1983, the researchers picked age-stratified random samples of individuals from two villages in each of sixty-five 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.

Average dietary intakes in the sixty-five counties differed sharply from those in the United States. On average, the rural Chinese subjects consumed only 14.5% of their energy from fat versus 38.8% in the United States. In addition, the percentage of total protein from animal sources was 10.8% for the Chinese subjects versus 69% in the United States, and dietary-fiber consumption was three times United States levels.[36] Dietary intake also differed substantially among 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 opportunity is valuable because it is likely that

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34. The study is described in detail and the data from the first phase is reported in CHEN JUNSHI ET AL., DIET, LIFE-STYLE, AND MORTALITY IN CHINA: A STUDY OF THE CHARACTERISTICS OF 65 CHINESE COUNTIES (1990). The first phase involved Chinese government mortality data for 1973–75 combined with surveys of biochemistry, diet, and lifestyle done in 1983. The second phase included mortality data collected for 1986–88 and surveys done in 1989 and 1993. For the results of the second phase, see OXFORD UNIVERSITY, CLINICAL TRIAL SERVICE UNIT, GEOGRAPHIC STUDY OF MORTALITY, BIOCHEMISTRY, DIET AND LIFESTYLE IN RURAL CHINA, *at* http://www.ctsu.ox.ac.uk/~china/monograph/ (last visited July 24, 2005) [hereinafter COC STUDY, SECOND PHASE].

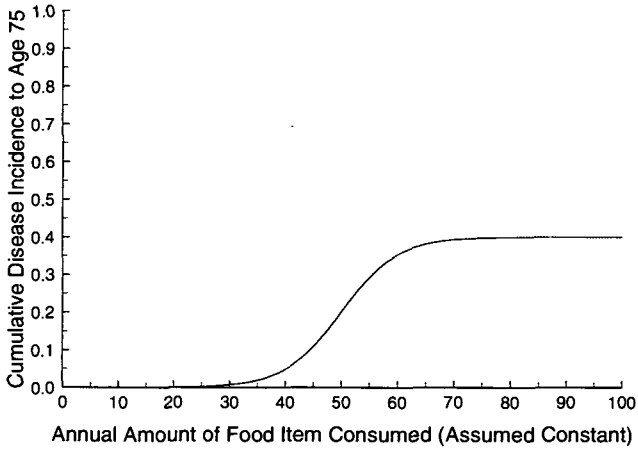
35. T. Colin Campbell & Chen Junshi, *Diet and Chronic Degenerative Diseases: Perspectives from China*, 59 AM. J. CLINICAL NUTRITION 1153S suppl., at 1154S (1994).

36. *See id.* at 1156S.

many of the effects of diet on disease are nonlinear—very similar to the "dose-response" curve relationship between drug treatment and disease symptoms; that is, small amounts of a particular food in the diet may have little impact, higher levels of consumption will have a large marginal impact, and then, as consumption increases even further, the marginal impact will fall toward zero.

Consider the logistic incidence curve in the figure below.[37] On the vertical axis is the cumulative incidence of a disease up to age seventy-five—that is, 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. I assume the annual rate is constant. At less than about thirty units per year, there is almost no incidence of the disease. Above about seventy units of annual consumption, the disease incidence is almost constant at around 40% of the population.

FIGURE 1. Logistic incidence curve



If there is a population with a range of consumption between seventy and one hundred 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 caused by the food. This point

37. This curve is based on the logistic distribution, a functional form that is useful for measuring hazard or growth phenomena. *See* MERRAN EVANS, NICHOLAS HASTINGS & BRIAN PEACOCK, STATISTICAL DISTRIBUTIONS 124–25 (3d ed. 2000). I use this functional form in some of the examples in Part III.

illustrates why it is valuable to examine populations with very different ranges of consumption.[38]

The China-Oxford-Cornell study presents such an opportunity. Consider IHD, a leading killer in the United States population. Based on United States data, about one-third of IHD incidence appears to be due to diet and lifestyle factors. However, the incidence of IHD in China at comparable ages, cumulative up to age sixty-five, as of 1973–75 was only about 6% of the United States IHD incidence for men and 18% of the United States IHD incidence for women.[39] Not surprisingly, biomarkers that predict IHD were much lower on average in the China sample. For example, total serum cholesterol averaged about 144 mg/dL for the males in the China sample compared to a 211 mg/dL average for males in the United States.[40] IHD mortality varies within rural China based on factors similar to those that have an impact in the United States, such as fatty acid profile and meat consumption.[41] Perhaps most striking is that the mortality rates of the Chinese studied decline nearly to zero. Between 1973 and 1975, one county had no mortality incidence among 181,000 females, and another county had no incidence among 246,000 males.[42] These results suggest (but do not prove) that a lot more than one-third of the IHD

38. Other scholars have noted the need to consider nonlinearities in disease response when interpreting empirical evidence. *See, e.g.*, WILLIAM HARRIS, THE SCIENTIFIC BASIS OF VEGETARIANISM 56 (1995).

39. *See* T. Colin Campbell, Banoo Parpia & Chen Junshi, *Diet, Lifestyle, and the Etiology of Coronary Artery Disease: The Cornell China Study*, 82 AM. J. CARDIOLOGY 18T, 20T (1998). The incidence of IHD for the same rural counties in 1986–1988 was quite a bit higher, mean rates being about two and one-half times as large for males and two times as large for females. The rates were still quite low compared to United States rates—approximately 22% and 40% of the United States rates for males and females, respectively. COC STUDY, SECOND PHASE, *supra* note 34, at 119.

40. *See* Campbell & Junshi, *supra* note 35, at 1156S–1157S (discussing the first phase results). The mg/dL units stated here are standard in the United States. Campbell and Chen express their results in mmol/L units used in the United Kingdom. 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.* In the second phase biochemical surveys, average total serum cholesterol for males was 148 mg/dL. COC STUDY, SECOND PHASE, *supra* note 34, at xiii fig.3.

41. *See* Campbell et al., *supra* note 39, at 20T.

42. *See id.*

observed in the United States for persons aged sixty-five years or less is due to dietary and lifestyle factors.[43]

D. THE ROLE OF FOOD TAXES: INTRODUCTORY THOUGHTS

The public health impact of diet may be immense, possibly accounting for much of the incidence of maladies such as IHD that are major sources of mortality, morbidity, and medical system costs in developed countries. Unfortunately, the connection between diet and chronic or acute disease may be very complicated,[44] and there are some serious implementation issues with respect to addressing dietary choice through taxes. Part IV discusses the impact of causal complexity, scientific uncertainty, tax-implementation issues, and political constraints on the feasibility of using tax instruments. Before beginning that discussion, it is important to determine the precise purposes that such taxes would serve. That is the main task of this Article, and I begin with a preliminary discussion in this section.

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43. 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* KENNETH J. ROTHMAN & SANDER GREENLAND, MODERN EPIDEMIOLOGY 626 (2d ed. 1998) (discussing cancer-related studies); Campbell & Junshi, *supra* note 35, 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 ARTERIOSCLEROSIS, THROMBOSIS, & VASCULAR BIOLOGY 832, 832 (2002) (discussing certain IHD-related migration 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 males in the United States for the same year, 1983. The proportions of males reporting ever smoking regularly were around 80% and 63%, respectively. *See* JUNSHI ET AL., *supra* note 34, at 662, 664; Centers for Disease Control & Prevention, Tobacco Information and Prevention Source, *Number (in Millions) of Adults 18 Years and Older Who Were Current, Former, or Never Smokers, Overall and by Sex, Race, Hispanic Origin, Age, and Education*, *at* http://www.cdc.gov/tobacco/research_data/adults_prev/ tab_3.htm (last visited July 25, 2005).

44. For example, even the striking IHD results from the China-Oxford-Cornell study are suggestive rather than definitive. The study is "ecologic" since it compares group rather than individual outcomes. Causal inferences from this type of study are risky since using group comparison creates several significant sources of bias and confounding that do not exist in studies based on individuals. *See* ROTHMAN & GREENLAND, *supra* note 43, at 459–80. The authors of the China-Oxford-Cornell study are aware of these difficulties and state that although "[a] few of the geographic correlations . . . do yield good evidence of causality, . . . the main value of the study is descriptive." COC STUDY, SECOND PHASE, *supra* note 34, at x. They are carefully tentative about the IHD results, stating only that "[d]ietary factors might well account for much of [the striking difference between rural Chinese IHD rates and those in the U.K]." *Id.* at xiii.

1. Limitations of the Public Health Perspective

Food taxes might play many different roles. The discussion so far has presumed what can be termed the "public health perspective" as a motivation for taxing foods. This perspective assumes that it is socially valuable to improve health outcomes, 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 presently provide pleasure. This idea has a great deal of traction in Western societies. It is no surprise that in the United States, the critique of fat taxes and junk food taxes has centered on the idea that people should be free to make their own health and lifestyle choices. The government should not interfere with these choices by using taxation to distort food prices or to punish certain choices.[45]

A sophisticated version of this alternative approach is implicit in a recent working paper on obesity by Darius Lakdawalla and Tomas Philipson.[46] The paper is motivated by the rapid growth of the incidence of obesity in the United States and worldwide.[47] Lakdawalla and Philipson construct a traditional economic model and use the model to attempt to explain the obesity epidemic. In their model, "people may rationally prefer 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."[48] Individuals therefore maximize utility, which is a function of food intake, other consumption, and weight. Weight is a stock that falls over time without food input. Weight is influenced by the strenuousness 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

45. *See supra* note 29.

46. DARIUS LAKDAWALLA & TOMAS PHILIPSON, THE GROWTH OF OBESITY AND TECHNOLOGICAL CHANGE: A THEORETICAL AND EMPIRICAL EXAMINATION (Nat'l Bureau of Econ. Research, Working Paper No. 8946, 2002). *See also* Tomas J. Philipson & Richard A. Posner, *The Long-Run Growth in Obesity as a Function of Technological Change*, 46 PERSP. BIOLOGY & MED. S87 suppl. (2003).

47. *See supra* text accompanying note 46.

48. LAKDAWALLA & PHILIPSON, *supra* note 46, at 1.

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."[49]

Lakdawalla and Philipson dismiss alternative explanations for the rise of obesity by arguing that they are inconsistent with the time-series observations of price and quantity for the United States. Explanations such as "a change in the 'culture' of food consumption, growth in the demand for fast food, or changing social norms," and "a change in attitude toward obesity, or reduced parental oversight of children" all involve factors that would increase the demand for food.[50] "[I]f demand were to grow in this fashion, weight would still grow, but price would *increase* rather than decrease, while food consumption would *unambiguously* rise."[51] The authors note that there have been periods of time during which increased calorie intake, declining prices, and growth in weight occurred simultaneously—factors that are "difficult to interpret as the result of demand growth alone."[52]

This argument does not logically preclude the alternative explanations, but merely suggests that they are not the whole story. For example, cultural factors may have been very significant, causing the observed price decrease to be much less than it would have been in the absence of such factors. Regardless of how one comes out on this empirical issue, an important lesson from Lakdawalla and Philipson's paper is that at least some of the growth of obesity and some of the persistence of 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.

Parts II and III consider some of the roles that food taxes might play: addressing externalities; correcting "internalities" (defects in individual self-control); correcting for any inability of consumers to access accurate health information about food choices at reasonable cost; correcting the tendency of individuals to make various cognitive or behavioral errors; adjusting for ex ante moral hazard associated with a health insurance system; and operating as a key component of the health insurance system

49. *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.

50. *Id.* at 3, 9.

51. *Id.* at 9.

52. *Id.* at 10.

itself.[53] In each case, the goal is to discuss potential reasons for government intervention against a backdrop of free choice by consumers.

For two reasons, this approach should be valuable even if one is not motivated by a desire to study food taxes based on a normative preference for consumer sovereignty. First, in developed countries featuring broad political participation, overriding or influencing consumer choice is likely to be politically viable only if it is possible to convince a broad segment of the public that restrictions are desirable. Developing a strong public policy argument is one way to approach that task. Second, I attempt to include in my analysis many of the factors that would motivate rejection of consumer sovereignty in its unalloyed form: self-control problems, information deficits, and behavioral/cognitive errors. Some of these factors play a key role in preventing consumers from avoiding the poisons of the "toxic environment" described by public health advocates.[54]

2. Food Taxes as Implicit Insurance Premiums

Before turning to detailed consideration of various food-tax roles in Parts II and III, I will preview two of the strongest potential rationales for such a tax in this section. In constructing this preview, I also will develop a simple analytic framework that will be useful throughout the Article. Perhaps the best case for a food tax is as a component of a health insurance system. To state this case, I begin by discussing some basic features of health insurance systems.

Developed countries have extensive public and private health insurance systems.[55] Even in countries such as the United States where

53. I do not discuss *all* of the potential justifications for taxing food. Consonant with the recent fat tax proposals, the focus is on rationales that interact with individual health or disease.

There are major literatures that examine the role of food taxes as part of a commodity tax scheme directed at raising revenues efficiently or at correcting non-health related imperfections in the economy, especially 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 article in this area that also has a short literature review, see Aled ab Iorwerth & John Whalley, *Efficiency Considerations and the Exemption of Food from Sales and Value Added Taxes*, 35 CANADIAN J. ECON. 166 (2002).

54. It is important to reiterate that the focus here is limited to the role that *broad taxes on food* might play in mitigating or correcting the effects of some of these factors. Even if such taxes are not very effective at that task, there are other approaches—such as, counteradvertising to help with consumer information deficits—that may be effective. *See supra* note 14; *infra* note 66.

55. For good surveys on health insurance and health systems see David M. Cutler & Richard J. Zeckhauser, *The Anatomy of Health Insurance*, *in* 1A HANDBOOK OF HEALTH ECON. 563 (Anthony J. Culyer & Joseph P. Newhouse eds., 2000); Ulf-G. Gerdtham & Bengt Jönsson, *International Comparisons of Health Expenditure: Theory, Data and Econometric Analysis*, *in* 1A HANDBOOK OF HEALTH ECON., 11 (Anthony J. Culyer & Joseph P. Newhouse eds., 2000).

formal coverage is 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.[56] In all other OECD (Organization for Economic Cooperation and Development) countries, health insurance is universal.[57]

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.[58] A minimal package of medical services will be available for all, even for 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 choose not 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, I 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 unhealthful 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

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56. *See* Cutler & Zeckhauser, *supra* note 55, at 570.

57. *Id.* at 569. Although the United States lags in insurance coverage, its per capita health expenditures are far greater than those in other OECD countries, around twice as large as expenditures in other high spending countries such as Germany, Canada, France, Australia, Japan, Switzerland, and the United Kingdom. The comparison is even more dramatic for the elderly, where per capita spending in the United States ranges from twice to almost four times as large as in these other countries. *See* Gerdtham & Jönsson, *supra* note 55, at 14; Uwe E. Reinhardt, *Health Care for the Aging Baby Boom: Lessons from Abroad*, 14 J. ECON. PERSP. 71, 73 (2000). Some scholars question, however, whether higher spending in the United States achieves significantly superior results. *See* David M. Cutler, *Walking the Tightrope on Medicare Reform*, 14 J. ECON. PERSP. 45, 51–52 (2000).

58. 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* 1B HANDBOOK OF HEALTH ECON., 1803, 1820–22 (Anthony J. Culyer & Joseph 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 55, at 569 n.4.

observe these activities and charge higher premiums or allow lower benefits, other individuals will have to pay higher premiums or will have lower benefits as a result. "Moral hazard" generates this externality: a fully insured individual has no incentive to expend costs to avoid the damage inherent in the insured event. If the expected value of that damage exceeds the avoidance costs, the failure to avoid the damage will be inefficient.

One way to address this externality is to use food 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 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.

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 cost conditional on incurring a disease equals L and that $\pi(x)$, the probability of incurring the disease, depends on x where x is the level of consumption of some food, X.[59] 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 $\pi(0) > 0$. That is, 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 environment or involuntary 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.

59. For simplicity, I 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 behavioral 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 subject to choice by the individual. It is convenient to begin, however, with the simple version in the text.

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 problems, the point of insuring is to protect against risks that an individual or entity cannot otherwise avoid. 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, mixing general taxes, social insurance, private insurance payments, and direct "copayments" at the time of service in different proportions.[60]

If all individuals faced the same probability, $\pi(0)$, of contracting the disease in the absence of risky behavior, then it would seem fair to charge each individual the same premium ($= \pi(0)L$) with respect to the associated "inherent" risk. When different individuals face different levels of $\pi(0)$, there is a social-contract type of argument for ignoring individual differences in $\pi(0)$ when assessing premiums.[61] The idea is that if individuals could 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. That is, individual *i* would pay a

60. The OECD countries divide into three major groups. Countries such as Denmark, Spain, Sweden, Portugal, Finland, Ireland, and the United Kingdom fund health care primarily from general taxes. Some of these countries rely primarily on income taxes while others rely more on consumption-based taxes such as value added 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.

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. Wagstaff & Van Doorslaer, *supra* note 58, at 1821. Often these payments are "copayments" 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 overconsume 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 conditions. For individual indemnity insurance coverage in the United States in 1991, typical deductible and co-insurance rates were $205 and 20%, respectively. *See* Cutler & Zeckhauser, *supra* note 55, at 585; Wagstaff & Van Doorslaer, *supra* note 58, at 1820–22.

61. *See* Cutler & Zeckhauser, *supra* note 55, at 626; Louis Kaplow, *A Note on Taxation as Social Insurance for Uncertain Labor Income*, 49 PUB. FIN. 244, 252 (1994); Louis Kaplow, *The Income Tax as Insurance: The Casualty Loss and Medical Expense Deductions and the Exclusion of Medical Insurance Premiums*, 73 CAL. L. REV. 1485, 1507–08 (1991) [hereinafter Kaplow, *Casualty Loss*].

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 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 income taxes, consumption taxes, or other systems designed to achieve distributional goals.

This simple "implicit insurance scheme" eliminates any externalities arising from moral hazard. Individual i pays a "food tax" equal to $[\pi_i(x_i) - \pi_i(0)]L$, the second component of the "premium" above. As a result, the individual contemplating eating an extra unit of food X must pay $\pi_i'(x_i)L$, the full marginal expected medical cost due to consuming that extra unit. That individual, and no one else, will bear the full ex ante cost of engaging in risky behavior. At the same time, by paying $\text{avg}(\pi(0))L$, the first component of the premium, the individual will be able to insure against behavior-independent risks.

Unfortunately, additional normative considerations, imperfect information on the part of the government, and various interactions with other aspects of the insurance system make this story much too simple. On the normative front, the difference in $\pi(0)$ across individuals is not the only aspect that raises fairness issues. It might be the case that individuals vary greatly with respect to the impact of consuming the food on the probability of their becoming ill; $\pi'(x)$, the marginal increase in disease probability from consuming one additional unit of the food, may vary significantly across individuals.[62] One might argue that this "inherent" difference also calls for a compensating adjustment. Aside from this "differential marginal damage" argument, there are also fairness arguments based on "preferences." Individuals with a particular liking for unhealthful foods may claim that this liking is "inherent" and that they should not be held responsible for their consumption of such foods. This claim is echoed in various "food addiction" arguments discussed below.[63]

These two aspects illustrate that there may be no sharp line between behavior that is a matter of "free choice," which implies personal responsibility for the consequences, and behavior that is due to "inherent" qualities over which the individual has no control. Nonetheless, the fairness arguments with respect to differential marginal damage and preferences

62. For example, recent research suggests that caffeine tends to promote osteoporosis only for individuals with certain genetic characteristics. *See infra* note 228 and accompanying text.

63. *See infra* text accompanying notes 85–114.

seem much less appealing than the claim that individuals should not suffer because of behavior-independent risks. I will leave further consideration of these two aspects to future work.

The implicit insurance scheme discussed above assumes that the government has full information at an individual level—that is, the government knows how much X each individual consumes, each individual's $\pi(x)$ schedule, and each individual's preferences. The ability to design an individualized tax/premium schedule that eliminates the moral-hazard externality and achieves both distributional and insurance goals relies critically on this assumption. Part III includes an extensive discussion of more realistic scenarios in which the government (and private insurers) have more limited information, and also considers complications that would arise from interactions with other imperfections in current health insurance systems.[64]

Engaging in risky dietary behavior creates externalities above and beyond the moral-hazard externality that follows from mandatory insurance coverage. In addition, food taxes may serve a role as self-control devices, aiding individuals in facing the "addictive" nature of particular unhealthful foods. I discuss both of these aspects in Part II.

There are parallel literatures concerning tobacco and alcohol taxes that make all of these tasks much easier.[65] 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 similar.[66] The

64. An additional assumption implicit in the discussion above is that the amount of expected 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 a 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, 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. I leave modeling these aspects to later work, focusing on more elementary policy contours in this Article.

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

66. For example, there is the potential use of "counteradvertising" 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 65, at 1593–96. In some cases governments have increased or instituted cigarette taxes to fund the counteradvertising. *Id.* at 1594–95. Some food tax advocates envision similar approaches, for example, using junk food taxes to fund public

literature on tobacco taxes is particularly well-developed, and I will draw liberally from it below.[67]

II. EXTERNALITIES, INFORMATION FAILURE, AND "INTERNALITIES"

A. ADDRESSING EXTERNALITIES

A classic rationale for taxation is associated with Pigou: addressing externalities.[68] Consumption of a good, or engaging in activities relating to the good, sometimes creates 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 than is socially optimal because 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. I already have discussed one form of externality: the moral hazard arising from mandatory health insurance.

There is well-developed literature analyzing cigarette taxation from the standpoint of externalities.[69] Many of the externality issues that exist with respect to food consumption are similar to the issues that stem from smoking. Smoking and eating involve both "external" and "internal" costs.[70] Most of the internal costs stem from the fact that bad choices in either domain will increase the risk of either poor health or 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 hard to find an

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educational campaigns with respect to dietary choices. *See, e.g.*, BROWNELL & HORGEN, *supra* note 21, at 218, 226–28, 231; Jacobson & Brownell, *supra* note 14, at 856–57.

67. 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 take dietary risks. Dietary risk-taking is multifaceted. If one eats foods that greatly increase the risk of death from IHD at a young age, engaging in behavior that increases the risk of cancer at older ages will be less costly to the insurer. Cigarette and alcohol consumption, as well as other risky behavior, interacts with dietary risks in the same way. It is important to consider these interactions when setting food taxes. The government will be able to achieve better results if it can set taxes jointly on foods, tobacco, and alcohol, versus being constrained to take alcohol and tobacco taxes as given when setting food taxes.

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

69. For a good summary of the literature and the issues, see Chaloupka & Warner, *supra* note 65, at 1579–83.

70. Economists sometimes refer to these as "social" and "private" costs, respectively. *See id.* at 1579. I use the terms "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 "interual" to the individual.

obvious justification for intervention when individuals incur internal costs. There are some cogent arguments for such intervention, but they are distinct from the externality arguments, and I deal with them in separate sections below.

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.[71]

Food consumption does not involve a feature that obviously parallels ETS. There is, however, 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 exist, 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 covered costs than deaths due to other causes. Premature death means that covered costs will be incurred earlier and that the smoker will not be the source of such costs in subsequent years. If cutting off nonmortality-related costs in these later years offsets both the impact of accelerated health costs due to premature death 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.[72] 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. Nonsmokers will be subsidized by smokers. Of course, the externality may easily run in the other direction.

There is less ambiguity in the case of social insurance systems, such as Social Security in the United States. Within such systems, premature death from smoking typically results in a positive externality. Smokers and nonsmokers make the same contributions to the system, but these contributions will fund larger benefits for nonsmokers because they live longer.[73]

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71. *Id.* at 1580–81.

72. *Id.* at 1580.

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

Externalities related to health insurance and social insurance systems would not exist if premiums were conditional on smoking behavior. Setting premiums based on smoking status is common and appears to be effective in the case of life insurance,[74] but health insurance and social insurance premiums typically are 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 cost 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 the externalities likely to arise from smoking and those likely to arise from eating habits make estimates of smoking externalities interesting. Leaving aside ETS-related externalities, most researchers find that the negative externality related to tobacco use is small, justifying a tax on cigarettes on the order of fifteen to thirty cents per pack. This amount is less than the present federal tax per pack.[75] Computing the net externality from smoking is not simple. Many of the elements in the computation are individually complex. In addition, the outcome is sensitive to the choice of discount rates and other assumptions. The following table from an article by Kip Viscusi gives a sense of the computation. It is not surprising that leading scholars have called for further research.[76]

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74. It appears that fraud—claiming to be a nonsmoker 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 otherwise would be covered by the policy. *See* David A. Winston, *Warning: A Misrepresentation on Smoking Can Be Hazardous to Your Life Insurance Policy*, LIFE ASS'N NEWS, Apr. 1993, at 150. 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.

75. One prominent researcher claims 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, 75 (James Poterba ed., 1995).

76. *See* Chaloupka & Warner, *supra* note 65, at 1579–83.

TABLE 1. External cost per pack of cigarettes, 1993[77]

Category	Discount Rate	
	0 percent	5 percent
Medical care	$0.72	$0.51
Group life insurance	0.24	0.09
Sick leave	0.00	0.02
Fires	0.01	0.02
Nursing home care	-0.60	-0.08
Retirement pension	-2.89	-0.37
Lost payroll taxes	0.88	0.12
Total net cost per pack	**-1.64**	**0.31**

It is interesting to note that the typical external cost estimates of fifteen to thirty cents per pack for smoking are much lower than internal cost estimates. Following the literature on life valuation, Jonathan Gruber and Botond Köszegi start with a value-of-life of 6.8 million, use estimates from the literature that smoking reduces life by six years on average, and consider typical lifetime cigarette consumption.[78] They arrive at a cost of $35.64 per pack.[79] 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.[80] The patterns of external costs and internal costs for many dietary habits are likely to be similar to the pattern for smoking.

Both in the case of tobacco and in the case of food, the internal versus external cost distinction plays a critical role in distinguishing the typical "economic" approach from the public health perspective.[81] Under the latter, public policy is concerned about internal costs of shortened or lower-

77. *See* Viscusi, *supra* note 75, at 74 tbl.4. The totals in Table 1 differ slightly from the sum of the entries due to rounding.

78. Jonathan Gruber & Botond Köszegi, *Tax Incidence when Individuals Are Time-Inconsistent: The Case of Cigarette Excise Taxes*, 88 J. PUB. ECON. 1959, 1974 (2004).

79. *Id.* at 1980.

80. *See id.*

81. For a cogent discussion in the context of tobacco, see Chaloupka & Warner, *supra* note 65, at 1577, 1579.

quality lives; these concerns exist even if each individual faces no problems of self-control and makes a rational, fully informed choice to take risks that lead to these costs. Under the former, external costs justify government intervention, but internal costs do so only if there are informational, cognitive, or behavioral failures amenable to correction via government policies. In the next section, I consider the potential role of food taxes in addressing such failures.

Before moving to that discussion, it is important to make one point about Pigouvian taxes. These taxes mandate 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 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.[82] 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, in which some experts believe that small amounts of consumption reduce disease risk, but high levels of consumption increase it.[83] In all of 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 feasible tax schedule may be linear, with a flat rate applying to each unit. This tax may fall considerably short of optimality.[84]

B. CORRECTING INFORMATIONAL, COGNITIVE, AND BEHAVIORAL FAILURE

A separate set of rationales for food taxation arises from various behavioral and informational problems. These problems are divided somewhat artificially into three sets. First, individuals may have full information about the health consequences of dietary choices and complete insight into their own future and present tastes, but suffer from self-control problems. This scenario includes many of the phenomena associated with the term "addiction." Second, there is the case of bounded rationality: individuals are rational, know their own present and future tastes, and have

82. *See supra* note 37 and accompanying text.

83. *See* Cook & Moore, *supra* note 65, at 1651–52.

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

complete self-control, but are subject to information limitations or costs. These limitations prevent them from making optimal dietary choices. Third, individuals may have complete information and full self-control but suffer from various behavioral or cognitive deficits, including systematically failing to anticipate their own future preferences accurately.

I discuss each of these problems in turn. The large volume of work on tobacco taxation is relevant to all three problems. I draw heavily from the tobacco literature and assess the applicability of the cigarette tax analogy to food taxation in what follows.

1. Addiction and Self-control

The most comprehensive literature on tax approaches to addiction and self-control involves tobacco use.[85] Cigarettes display the classic characteristics of an addictive good, especially the habit formation (reinforcement) aspect: current consumption is positively related to past consumption. I begin by reviewing some results from the cigarette tax literature as well as some of the more general literature on addiction.

A major development in the general literature on addiction was a 1988 article by Gary Becker and Kevin Murphy.[86] Prior to Becker and 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.[87] This optimization involves "adjacent complementarity"—the addict understands that consumption is complementary in different time periods.[88] The main empirical prediction that would distinguish rational addiction from myopia is whether addicts respond to anticipated future prices. In the face of higher future prices, the rational addict will reduce consumption today, knowing that consumption in the future, which is induced by today's consumption, is anticipated to be more costly. A myopic addict's present demand will not change because it

85. There has been a great deal of scholarship during the past two decades both on the empirical and theoretical aspects of tobacco use. *See* Chaloupka & Warner, *supra* note 65, 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 in this subsection is drawn from these two articles.

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

87. *Id.* at 676–78.

88. *Id.* at 680–85.

depends only on current prices. With respect to tobacco use, empirical papers have consistently found that anticipated higher future prices do impact current cigarette consumption,[89] which is strong evidence against the myopic model.

The normative implication of the rational addiction model is that only externalities justify government intervention. Poor health or other adverse consequences for addicts are not relevant. Smokers will quit if and when it is optimal as dictated by their own preferences.

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 and quit tomorrow actually will prefer to quit when tomorrow comes. As Gruber points out, time-inconsistency would explain the observed "inability to realize desired future levels of smoking."[90] He and Köszegi cite 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%).[91]

As Gruber and Köszegi point out, another indication of time-inconsistency is the use of "self-control devices" as well as "quitting aids" when people try to stop smoking.[92] A quitting aid might be a nicotine patch or similar device that allows the individual to make an easier transition to nonsmoking 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 the future self who smokes beyond the point that the current self judges as optimal.

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89. *See* Gruber, *supra* note 85, at 203.

90. *Id.* at 204. Jonathan Gruber developed this point in more formal work with Botond Köszegi. Jonathan Gruber & Botond Köszegi, *Is Addiction 'Rational'? Theory and Evidence*, 116 Q. J. ECON. 1261, 1279 (2001).

91. Gruber, *supra* note 85, at 204; Gruber & Köszegi, *supra* note 90, at 1279.

92. Gruber, *supra* note 85, at 204–05; Gruber & Köszegi, *supra* note 90, at 1278.

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 and Köszegi describe this situation as one involving "internalities."[93] 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 and Köszegi find that the optimal tax is at least $1 per pack, much higher than the fifteen to thirty cents that the bulk of the literature estimates as required to correct externalities.[94] 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.

Food consumption displays some strong similarities with tobacco, but also some important differences. One important dimension of comparison is whether particular kinds of food may be considered "addictive" in the same way as tobacco. If so, there is the further issue of whether the addictive qualities of food create the same case for government intervention in the form of a tax as exists for cigarettes.

There are various definitions of "addiction," and the everyday 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 literature on "food addiction."[95]

What is "addiction"? One typical approach would require the simultaneous presence of three indicia: tolerance, withdrawal, and reinforcement.[96] The reinforcement criterion is habit formation by another name. Empirical analysis demonstrates that habit formation is present for the consumption of most consumer nondurables, including food purchased for home use.[97]

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93. Gruber & Köszegi, *supra* note 90, at 1263.

94. *Id.* at 1292.

95. *See* Peter J. Rogers & Hendrik J. Smit, *Food Craving and Food "Addiction": A Critical Review of the Evidence from a Biopsychosocial Perspective*, 66 PHARMACOLOGY BIOCHEMISTRY & BEHAV. 3 (2000).

96. *See* Chaloupka & Warner, *supra* note 65, at 1556.

97. *See id.* at 1558; H.S. HOUTHAKKER & LESTER D. TAYLOR, CONSUMER DEMAND IN THE UNITED STATES: ANALYSES AND PROJECTIONS 62–63, 164 (2d ed. 1970). Houthakker and Taylor find that food consumed at 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

Does eating certain kinds of foods involve tolerance and withdrawal phenomena? "Tolerance" arises from the body's attempt to maintain homeostasis, a constant internal environment across a range of parameters such as body temperature and blood glucose levels.[98] 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 premeal 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.[99] This learned response is "tolerance." The blood sugar impact of eating is blunted. To achieve a hyperglycemic effect it would be necessary to "surprise" the system by eating more than usual or by eating foods that are very glycemic.[100]

The same phenomenon happens with drugs such as heroin or ethanol. After one or several experiences with the drug, the body learns to anticipate

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"depreciates," and some time passes before one is eager to do it again. It is important to note that Houthakker and 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.

98. 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 BEHAV. BRAIN RES. 175 (2000).

99. *Id.* at 177.

100. 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 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 PEDIATRICS e26 (1999), *available at* http://pediatrics.aappublications.org/cgi/content/full/103/3/e26. 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).

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.

Withdrawal is related to 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 a "craving" for sugars or sweets to restore homeostasis.

Although there is a strong connection between drug and food related behavior,[101] 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.[102] 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 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."[103] 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 control, the hedonic effects of certain foods, and

101. As one review article puts it, "[a]ddictive drugs act on brain reward systems, although the brain evolved to respond not to drugs but to natural rewards, such as food and sex." Ann E. Kelley & Kent C. Berridge, *The Neuroscience of Natural Rewards: Relevance to Addictive Drugs*, 22 J. NEUROSCIENCE 3306, 3306 (2002). Although there has been a great deal of research progress, neuroscientists are still trying to determine the exact neural systems or processes that are involved in addiction. Major questions—such as whether aversive (withdrawal) phenomena are generated by the same systems as pleasure/reward hooks for addiction—remain unanswered. *Id.*

102. *See* Rogers & Smit, *supra* note 95. The authors of the review acknowledge support from the Biscuit, Cake, Chocolate, and Confectionary Alliance, London. *Id.* at 12.

103. *Id.* at 5.

socially and culturally determined perceptions of the appropriate intakes and uses of those foods."[104] The idea is that chocolate is perceived as a "treat" to be eaten with restraint. This creates "ambivalence." The amount of chocolate that is considered acceptable falls far short of the amount that will satiate. Satiation is a race between 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."[105] 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 and Smit contrast chocolate addiction with the binge eating associated with bulimia, which they believe can reasonably be labeled as "food addiction."[106] 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."[107]

Defining "addiction" is not simple and, despite the chocolate example, it may be hard to exclude many eating phenomena from the purview of the term.[108] The term clearly has important social and personal meanings. It also may play an important formal or rhetorical role in any litigation involving the health consequences of various foods. Nonetheless, from a public policy perspective, whether or not particular foods meet some definition of being "addictive" is not critical. What is important is whether government intervention is appropriate, including the kinds of interventions that scholars have argued are justified with respect to cigarettes or certain recreational drugs because of their addictive nature. Particularly apposite

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104. *Id.* at 12.

105. *Id.* at 10.

106. *Id.* at 7.

107. *Id.*

108. 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—for example, 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. Food is a necessity for life, but the ability to function may be preserved 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 such drugs. Heroin is almost universally considered to be "addictive," but methadone will restore functionality for most heroin addicts.

for the inquiry in this Article is whether taxes would 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-control to such a degree that the individual wishes to stop the behavior, but is no longer able to do so. 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 knows that any plans to quit will tend to be frustrated when the future arrives.[109] 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.

Ideally, such a tax would be individualized. Individuals would make a binding commitment to the state to pay a 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 or eats an ounce of a particular food.[110]

When one shifts the focus from individualized taxes to general taxes, it is likely that the internality-based case for tobacco taxes is stronger than the case for food taxes. The high proportion of smokers in the United States who express a desire to quit—for example, 80% of adults, as mentioned above—works in favor of a general tax to address the internalities of smoking. It is possible that the value of the internality levy for these individuals would outweigh the distortion in prices for smokers who have no desire or intention to quit.[111] The possibility of such a result with food

109. A different situation would arise if the individual does not anticipate a loss of self-control or the reversal of intentions to quit. This type of situation is discussed in Section II.B.3.

110. *See* Gruber & Köszegi, *supra* note 90, at 1286 (presenting a similar argument with respect to smoking).

111. 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 internalities 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 internalities also might cause them to delay or defer signing up if the scheme were voluntary and private.

In a recent working paper, Gruber and Sendhil 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? (Nat'l Bureau of Econ. Research, Workng Paper No. 8872, 2002). They find large effects. For instance, the impact of a fifty cents 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. Raising the tax

items, such as chocolate or saturated fat, probably is considerably more remote because the population is likely to be much more heterogeneous with respect to foods than with respect to cigarettes. Particular foods or eating patterns may be an unwanted "addiction" for some individuals, but a pleasant, occasional indulgence for others. The proportion of the population that would favor or benefit from taxes on chocolate, saturated fat, or other items on self-control grounds probably is much lower than the large proportion of smokers who claim they want to quit. Having a low proportion of beneficiaries raises the efficiency cost of any tax imposed to correct internalities. 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 solely to address internalities seems significantly weaker than the corresponding case for cigarette taxes. It is unclear that foods induce the same kind of "addiction" pattern as tobacco. In addition, heterogeneity in demand for self-control instruments may make general taxes on foods an inefficient way to address internalities.

Even if this heterogeneity problem means that a food tax is not justifiable on internality grounds alone, it is important to note that internality motivations may bolster the case for imposing a food tax for other reasons. Of particular interest is use of the tax as part of an implicit insurance scheme. In the ideal version of such a scheme, the food tax would be equal to an actuarially fair premium representing the increase in discounted expected medical cost from eating an additional unit of food. As discussed above, this tax would remove the moral-hazard externality associated with mandatory insurance coverage. If the tax is fully or partially passed on in the form of a retail price increase, the tax also would serve as a self-control instrument for those individuals desiring such a device.

Despite aiding some individuals in their quest for self-control, such a tax and the resulting after-tax price would tend to be too low from a social perspective. The tax corrects the ex ante moral-hazard externality and, as a result, the after-tax price would be equal to the social cost of the good, production plus externality cost, *absent* consideration of any self-control

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enough to reduce smoking by 60% in the United States 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.

problems.[112] Individuals with time-inconsistent preferences would prefer an *additional* internality-controlling charge as a self-control aid even though the externality-correcting tax, if passed on in the form of a price increase, already would have lowered levels of present and future consumption. Although the externality tax would induce forbearance, the socially optimal level of forbearance would be even larger. In other words, the tax helps on the self-control front but a larger tax would be required to reach optimality.[113]

In this subsection I have been implicitly considering the situation where an individual is aware of the addictive nature of foods and therefore would favor a tax as an aid to self-control. A more complex situation arises if the individual is not aware of or underestimates the addictive properties of particular dietary patterns. I consider that situation in Section II.B.3 below. The outcomes probably would be very different with respect to the optimal level of tax.[114] In addition, if the populace is not fully aware of self-control problems that will arise from particular foods, it will be much harder to build political support for a tax addressing those problems.

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112. In the context of smoking, Gruber and Közsegi show that the optimal level of "internality" tax is less than the discounted expected loss per cigarette. *See* Gruber & Köszegi, *supra* note 90, at 1290. That discounted expected loss equals the Pigouvian level in the implicit insurance scheme discussed in the text. Gruber and Közsegi's tax, however, is set in a framework that explicitly ignores externalities, including externalities that would stem from mandatory insurance coverage. *Id.* at 1286. Ignoring externalities is consistent with one of their goals—showing that correcting internalities by itself suggests a substantial per pack tax on cigarettes. After adding an externality correcting tax, the resulting post-tax price plays exactly the same role as the pretax price in their model. It represents the production cost and externality cost of the cigarette.

113. This conclusion becomes less certain when I introduce some subtleties present in more realistic settings. In particular, insurance coverage is mandatory, and some individuals may value it much less than the amount of the tax. As a result, the tax may exceed the insurance and self-control benefits that such individuals realize. It is likely that individuals are heterogeneous with respect to the discounted expected costs of the insured events, and also with respect to risk preferences. As a result, some will be overtaxed and others undertaxed by a linear tax because that tax will generate the same insurance premium for all individuals. In addition, it is a reasonable assumption that there would be a positive correlation between the demand for self-control and the correct premium at the individual level. Individuals at greater risk of damaging their health would tend to value self-control more highly. This skewing would reduce the overall optimality of a flat rate tax even more.

114. In the context of smoking, Gruber and Köszegi consider two different extreme cases: "naive" smokers who are completely unaware of any future self-control problem, and "sophisticated" smokers who anticipate their self-control problems perfectly. For sophisticated smokers, they estimate an optimal "internality" tax rate with a lower bound of one dollar per pack and an upper bound of as high as three dollars per pack. These amounts compare to a cost in life-years lost per pack of about thirty dollars. They go on to say that the optimal tax for naive smokers would be higher and possibly "much higher." Gruber & Közsegi, *supra*, note 90, at 1291–93.

2. Bounded Rationality

An additional, even stronger side benefit to charging implicit insurance premiums through food or cigarette taxes emerges from another possible market imperfection. Even if individuals are rational, do not suffer from self-control problems, and are able to forecast their future preferences perfectly, individuals may face serious "bounded rationality" constraints: it may be too costly or difficult to unravel the relationship between various eating patterns and disease. Lacking full information, individuals will be unable to choose an optimal diet.

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. At any given time, there are widely publicized diet approaches that appear healthy but later turn out to be defective. In addition, individuals, especially the young, may underestimate the disease risks that result from establishing particular eating habits. It appears, however, that consumers do respond strongly to food prices.[115] As a result, one role of food taxes might be to provide signals to consumers about the true risks of consuming various products.[116]

It might seem that a tax equal to the expected internal cost of consuming the food would provide exactly the right signal, but using such a tax raises serious problems. Imposing a tax in that amount means that the consumer will pay the same costs twice: the first time as a tax and the second time in the form of actual internal costs such as ill health. The situation is even worse for individuals whose information about health risks is imperfect rather than totally absent. These individuals pay twice the cost

115. *See* NESTLE, *supra* note 1, at 18; sources cited *infra* note 310 (detailing works postdating Marion Nestle's book).

116. At present, the only information that consumers can infer from government regulation is that (1) any food additives have been shown to be "safe" by the manufacturer under United States Food and Drug Administration ("FDA") standards, and (2) 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 infra* text accompanying notes 214–15. In addition, government policymakers sometimes soft-pedal advice based on what they believe the public will accept. *See infra* text accompanying note 128.

Fred Kuchler and Elise Golan express skepticism about the view that consumers generally lack, or are confused about, health information. Fred Kuchler & Elise Golan, *Is There a Role for Government in Reducing the Prevalence of Overweight and Obesity?*, CHOICES, Fall 2004, at 41, 42–43. They go on to say, however, that there may be a lack of information about restaurant food that will not be cured by the market. *Id.* at 44.

of the health damage, even though the information problem may not be very serious for them.

This "double-cost" 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. Ex ante, there is no problem of paying the same costs twice since the individual pays the expected cost and then is relieved of actual costs as they occur. At the same time, the information benefits are present: in such a system, the individual receives the correct signal about the future costs of present consumption.

3. Correcting Behavioral or Cognitive Errors

In Section II.B.1 1 discussed one theoretical critique of the rational addiction model: individuals may understand the addiction process, but may struggle with self-control. Realizing that self-control will be difficult in the future, these individuals will be willing to pay for self-control devices. An "internality"-based tax is one such device. But there is a deeper problem with rational addiction. It seems 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 have subjective, but incorrect, beliefs about their capacity for addiction, it is possible to become addicted and regret that outcome. This point is especially relevant to the situation of youthful experimentation. For instance, youth appear to be particularly naive with respect to the addictive nature of smoking.[117]

In part, lack of perfect foresight may involve a type of information failure associated with bounded rationality. Individuals may not understand the connection between smoking cigarettes or eating unhealthful food and subsequent health outcomes at the time they initially consume. There is some evidence that this type of information failure exists with respect to 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.[118]

There is an additional, different kind of information failure that might occur. Individuals may understand the health consequences of smoking or consuming unhealthful food, but may not properly anticipate their own

117. *See* Chaloupka & Warner, *supra* note 65, at 1583–84.
118. *Id.* at 1595–96.

future preferences or behaviors. Youthful naiveté about the addictive nature of smoking is one example. Youth may understand that cigarettes are not healthy but believe that it will be easy to quit in the future. As a result, peer approbation or other short-run benefits of smoking a few cigarettes will appear to outweigh any costs.

The psychological concept of projection bias encompasses this kind of behavioral error. Projection bias occurs when individuals overestimate how closely their future preferences will resemble their current preferences.[119] There is direct evidence that projection bias impacts dietary choice. In a study by Daniel Read and Barbara van Leeuwen,[120] subjects were divided into groups: those who were *presently* hungry and those who were *presently* satiated. The two groups were asked to choose between a healthy snack and an unhealthful snack a week in advance, conditional on their being either hungry or satiated *at the time of the snack.* Those who expected to be hungry at the time of the snack chose the unhealthful snack in greater proportions, whether or not they were presently hungry. *Present* hunger resulted in an increased tendency to pick the unhealthful snack *regardless* of whether the individual anticipated being hungry or satiated at the time the snack would be delivered. This last result suggests projection bias—individuals project present preferences into the future, biasing their assessment of how they actually will feel when the future arrives.[121]

Projection bias has multiple intersections with dietary behavior, some of which appear in the nutrition literature under different names. As prominent scholars have noted, projection bias leads to exactly the kind of information failure, mentioned above, regarding the tendency to become addicted. In one of the leading works on projection bias, George Loewenstein, Ted O'Donoghue, and Matthew Rabin give two reasons why individuals with that bias might be particularly vulnerable to developing harmful addictions.[122] First, projection bias may lead individuals to underestimate the degree to which current consumption increases future

119. George Loewenstein, Ted O'Donoghue & Matthew Rabin, *Projection Bias in Predicting Future Utility*, 118 Q. J. ECON. 1209, 1210 (2003).

120. Daniel Read & Barbara van Leeuwen, *Predicting Hunger: The Effects of Appetite and Delay on Choice*, 76 ORGANIZATIONAL BEHAV. & HUMAN DECISION PROCESSES 189 (1998). The text tracks the excellent discussion of the Read and van Leeuwen results detailed in Loewenstein et al., *supra* note 119, at 1215–16.

121. As noted by George Loewenstein, Ted O'Donoghue and Matthew Rabin, the fact that projection bias seems to exist with respect to hunger—a state that individuals encounter repeatedly—suggests that it does not necessarily disappear with experience. Lowenstein et al., *supra* note 119, at 1238.

122. *See id.* at 1232–33.

desire for the addictive good. In economic terms, these individuals do not understand that the *marginal utility* of consuming the good will be higher in the future due to current consumption. Second, individuals may fail to appreciate the degree to which current consumption will lower *total utility* in the future. In the context of diet, the danger is that individuals will not understand the magnitude of the damage to future health and well-being that may result from poor eating habits in the present.

Projection bias is not the only cognitive theory that potentially explains the overconsumption of harmful addictive goods. An alternative explanation is captured by "hyperbolic-discounting" models. In these models, individuals do not apply a constant annualized discount rate to each future year. Instead, they have a very high annualized discount rate for early years and lower annualized discount rates for future years. For example, the discount rate for the first year might be 10% versus a discount rate of 5% for all future years. Yet at the beginning of each future year, the discount rate for that year goes up to 10%. The result may be that the individual continually puts off giving up the addictive good, anticipating that it will be easier to do so when the discount rate drops in future years when, in fact, no such drop in the short-run discount rate will occur. This phenomenon is exactly the basis for the internality tax analysis of Gruber and Köszegi described in Section II.B.1 above.[123] As Gruber and Köszegi point out, a crucial factor is the degree to which individuals anticipate their own tendency to behave as hyperbolic discounters. A low degree of anticipation justifies a larger corrective tax but also reduces the potential political support for such a tax.[124]

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123. *See* Gruber & Köszegi, *supra* note 90, at 1279–80. *See also* Shane Frederick, George Loewenstein & Ted O'Donoghue, *Time Discounting and Time Preference: A Critical Review*, XL J. ECON. LITERATURE 351, 366–67 (2002) (discussing hyperbolic discounting).

George Loewenstein has developed a third way—in addition to projection bias and hyperbolic discounting—to explain distortions in intertemporal choice that is more directly related to "self-control." George Loewenstein, *Emotions in Economic Theory and Economic Behavior*, 90 AM. ECON. REV. 426, 430 (2000). This explanation is based on "visceral factors," which Loewenstein defines as "refer[ring] to a wide range of negative emotions (e.g., anger, fear), drive states (e.g., hunger, thirst, sexual desire), and feeling states (e.g., pain), that grab people's attention and motivate them to engage in specific behaviors." *Id.* at 426. Loewenstein postulates that these factors cause two problems. First, they cause short-term behavior to deviate from what individuals would perceive as their long-term self-interest. Second, and apropos to the present discussion, people tend to underestimate the potential impact of visceral factors on present and future behavior. *Id.* at 428. The result can be behavior that "give[s] the appearance of extreme discounting of the future." *Id.* at 430. Loewenstein specifically mentions the case in which people fail to adhere to a healthful diet in the face of significant consequenees. *Id.*

124. *See supra* note 90 and accompanying text.

The projection-bias literature identifies a phenomenon that is highly relevant to dietary choice: the tendency of individuals to overestimate the impact of major changes, such as a deterioration in health or job loss. There is substantial evidence that individuals fail to anticipate the degree to which they will adapt to new circumstances. In fact, evidence shows that individuals suffer much less of a change in the overall level of contentment than expected.[125] The same tendency exists with respect to eating habits, but under a different name. It is what Carl Phillips calls "the paradox of dietary change."[126] Many individuals make major, permanent changes in diet and express no desire to change back. Even when the dietary changes are "imposed"—for example, by an urgent need to address a chronic disease condition—individuals report satisfaction with the changes. On the other hand, most individuals believe that changing their diet "would be a painful and permanent burden," while health professionals "often believe it is hopeless to try to encourage changes."[127]

Respect for the paradox of dietary change has impacted public policy. For example, in revising United States food guidelines, the United States government and major United States nongovernmental 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."[128] A drop from 38% to 30% appears to be too modest to cause any significant reduction in risk.[129]

To see how the paradox might emerge, Phillips creates a complex systems model based on four elements: health, taste, habit, and availability (including price). The model has multiple suppliers as well as multiple consumers. Suppliers seek to maximize profit by supplying foods in high demand that are not being provided by competing suppliers. The model results in a "quasi-equilibrium" in the space of food attributes. The quasi-equilibrium consists of multiple persistent clusters, each encompassing a network of consumers and suppliers. The clusters arise in response to consumer habituation, supplier economies of scale, and network externalities. Consumers habituate to the diet characterizing their cluster

125. *See* Loewenstein et al., *supra* note 119, at 1212–13.

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

127. *Id.*

128. *See* Campbell & Junshi, *supra* note 35, at 1153S.

129. *Id.* The response of health risk to food or drug items tends to be nonlinear. Recall the logistic risk curve discussion above. *See supra* text accompanying note 35. Small changes have almost no effect if current levels of consumption correspond to a relatively flat region of the risk-response curve.

location, and producers achieve economies in producing the foods associated with that location, thereby lowering the price of that dietary pattern. Incremental change tends to be ineffective since utility reaches a local maximum and cost achieves a local minimum at the location of each cluster. Thus, modest taxes on a particular food pattern will not dissipate the cluster adopting that food pattern, and may not cause any individuals to shift clusters. Only more radical changes—such as trying the diet of a friend located (food-wise) in another cluster—will tend to work. Shifting clusters turns out (ex post) not to be as hard as supposed. Instead of involving some high multiple of the pain involved in incremental changes from the old cluster position, consumers find that they do not feel as bad as they anticipated. The food bundle that characterizes the new cluster is affordable because the new cluster is located at a local cost minimum. Habituation sets in and reinforces the change, and there is no desire to return to the previous cluster. The paradox of a dietary change phenomenon suggests high levels of tax. Small incremental taxes will not be effective at motivating individuals to shift from unhealthy clusters to healthy ones.

A common theme emerges from the discussion of imposing taxes in situations where individuals fail to anticipate the future utility gains of healthy eating, the addictive nature of bad eating habits, or the negative health consequences of such habits. These situations call for placing high taxes on the associated habits or foods. Coincident with this need for high taxes is a serious problem of political economy. People who are unaware of their tendency toward addiction, who underestimate the consequences of poor eating habits, and who believe (counterfactually) that healthy eating will be unpleasant will be much less likely to support corrective taxes than those who are self-aware.

I have considered behavioral and cognitive phenomena at a high level of generality so far. There are some important ways in which these phenomena affect dietary behavior and health outcomes at a more detailed level, especially with respect to obesity. I discuss some of these more specific effects when I consider tax implementation and scientific complexity issues in Part IV.

III. FOOD TAXES AS A COMPONENT IN HEALTH INSURANCE SYSTEMS

As discussed in the previous part, food taxes may be useful for addressing externalities, bounded rationality, and various behavioral or cognitive errors. Externalities in the case of food consumption arise

primarily from interaction with health insurance and social insurance systems. In the case of cigarettes, the total externality from these sources is quite small. Insurance effects most likely are of the same magnitude in the case of unhealthful food habits; thus, it is plausible that externalities would justify only a small tax on unhealthful foods as is the case for cigarettes. Turning to bounded rationality, food taxes might serve as an aggregated signal with respect to the health impact of particular foods. Setting a proper level of tax, however, requires an understanding of the degree of information-failure and creates a "double charges" problem. For consumers with foresight but subject to addiction, the taxes potentially serve as a self-control device. Unlike the case of cigarettes, however, consumer heterogeneity with respect to demand for such devices is likely to make such taxes inefficient. Correcting for behavioral or cognitive deficits generally may involve imposing high taxes on a populace which will not appreciate the need for such levies. Finally, as in the case of taxes as self-control devices, heterogeneity may mean that a general, nonindividualized tax will be an inefficient way to address bounded-rationality problems or defects arising from behavioral or cognitive failure.

Part I set forth another possible use for food taxes: as a component in the health insurance system. In addition, as indicated in Part II, use of taxes as implicit insurance premiums has potentially large beneficial side effects in the form of alleviating bounded rationality problems and in aiding those in need of self-control. The treatment in Part I, however, considered taxes as insurance premiums in an idealized setting. In particular, I assumed that the government imposed the taxes with full knowledge of food consumption, food preferences, and the damage function at the individual level.

In this part, I will consider food taxes as an insurance system component in more realistic scenarios where this "full information" assumption does not apply. I begin by considering three major problems—moral hazard, adverse selection, and incomplete markets—that affect current health insurance systems. I then address the role that taxes might play in addressing those problems. In Section III.D I examine the use of food taxes more generally as an implicit component in health insurance systems.[130]

130. Throughout Part III, I use an insurance market model developed by Eric Bond and Keith Crocker to illustrate various points and arguments. Eric W. Bond & Keith J. Crocker, *Smoking, Skydiving, and Knitting: The Endogenous Categorization of Risks in Insurance Markets with Asymmetric Information*, 99 J. POL. ECON. 177 (1991). In addition to providing a good framework, several of the results in the article are directly relevant to the discussion here.

Before beginning the discussion, it is important to make several points. First, dropping the "full information" assumption actually strengthens the case for using food taxes as a component in health insurance systems. In the case of full information, private insurance markets may work perfectly well, and adding government provision of any kind may create serious inefficiencies. On the other hand, when information is imperfect, the ability to impose a general tax on certain foods becomes a valuable instrument, and it is an instrument that is the exclusive province of the government. It is worth explaining these two points in more detail.

If the government has full information, it is likely that private insurers also would have it. If private insurers do, then a serious question arises as to 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 in which provision of government insurance through the tax system may result in levels of coverage or other features that are not optimal. This result is due to the interaction between the tax system and private insurance.[131] In addition, using private rather than public insurers results in competition. Such competition may lead to efficiencies or degrees of consumer choice that are not present when the government serves as both insurance provider and funding sponsor of the insurance system. In the United States, for example, about 87% of Medicare beneficiaries buy private "Medigap" insurance policies that wrap around Medicare provision.[132] In addition, 17% of beneficiaries are enrolled in private Medicare managed care plans rather than the government-operated traditional Medicare indemnity-based system.[133] Policy analysts from across the academic and political spectrum have proposed reforms that introduce more competition into the system,

131. In two articles, Louis Kaplow studies government allowance of personal losses—including losses due to uninsured medical expenses—as tax deductions. Kaplow also examines the exclusion of some employer-paid medical insurance premiums from taxable income for covered employees. *See* Kaplow, *Casualty Loss*, *supra* note 61; 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.

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

133. *Id.*

while trying to avoid some of the adverse selection problems (discussed below in Section III.B) that might arise from such competition.[134]

There are many different possible scenarios involving less than full information. The government may lack several different items of individualized information: the base level of disease absent poor dietary habits ($\pi(0)$ in the analysis in Part I); the impact of such habits (the $\pi(x)$ schedule in the analysis in Part I); individual levels of food consumption; and individual preferences. In some cases, the lack of information or the inability to use it may be deliberate and may apply to private insurers also. For instance, many states have privacy provisions that bar insurers from denying coverage or setting higher rates based on genetic information.[135] For many diseases and foods, genetic information is an important factor in ascertaining $\pi(0)$ and/or the shape of the $\pi(x)$ schedule.[136] As will be discussed in more detail below, some information deficits will tend to make food taxes a useful complement to public and private insurance systems. If neither the government nor private insurers are able to observe each individual's food consumption, the government's ability to tax that consumption on a per unit basis would allow the government to charge individuals implicit "premiums" based on their consumption. Private insurers do not have the power to impose such a tax.

Another feature of health insurance in developed countries is important. This insurance covers medical expenses, but it does not cover 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.[137] As a result, individuals are only partially insured against health risks. This fact will play an important role in the discussion of "moral hazard" in the next section.

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134. *See, e.g.*, Cutler, *supra* note 57, at 54–55; McClellan, *supra* note 133, at 28–32.

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

136. There are numerous examples. One, which is discussed in Part IV, is that the connection between caffeine consumption and osteoporosis appears to exist only for persons with certain gene patterns. *See infra* note 228 and accompanying text. Genetic information also bears on expected loss conditional on having a 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*, SCI. NEWS 68, Feb. 2, 2002, at 68.

137. *See* Cutler & Zeckhauser, *supra* note 55, at 577.

A. 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, and they listed food taxes as an example.[138] Moral-hazard problems arise when an insured individual is able to take actions that affect the probability or severity of the insured event. If the insurance completely covers all damages from the event, the insured has no 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 accidence-avoidance.

Moral hazard will not be a problem if the insurer can observe the insured's accident-avoidance, 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. This type of contract internalizes the costs and benefits of accident-avoidance 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 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 that ensue 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 body of scholarly literature attempts to analyze this problem, to study various proposed solutions, and to generate optimal solutions.[139] A common approach is to provide only partial coverage, requiring the insured to make up the rest via a co-insurance payment.[140] Since the insured is paying part of the cost of treatment, the incentive to engage in "wasteful" treatment—that is, treatment that the insured would not pay for out-of-pocket—is reduced.

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

139. For a good survey, see Cutler & Zeckhauser, *supra* note 55, at 576–90.

140. 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).

The second moral-hazard problem arises because 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" in the form of the danger that the individual will be more careless about health risks knowing that all the medical costs will be covered if the risks materialize.

Although the main focus here is on ex ante moral hazard, measures addressing ex post moral hazard also may affect ex ante moral hazard. Taxes considered as part of an insurance system are on the *funding* side of the system. Both the origin of and the policy responses to ex post moral hazard primarily involve the *payment* aspect of the system. Devices such as copayments reduce ex post moral hazard by putting the insured in a situation where coverage is only partial. But partial coverage on the payment side also will tend to alleviate ex ante moral hazard. In what follows, I typically treat the payment side as fixed—set optimally to address ex post moral hazard. I do not vary the payment side along with the tax side. As a result, it is necessary to face the problem of an imbalance between funding and payments. Food tax "premiums" may cover the entire expected cost of the disease, but insurers may provide only partial coverage in order to mitigate ex post moral hazard.

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 ex post 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.[141]

As noted by many scholars, the problem of ex ante moral hazard may not be very serious because in existing health insurance systems, even in the absence of payment-side devices such as requiring copayments, the individual is only partially insured with respect to the adverse consequences of disease.[142] Health insurance coverage is limited to medical

141. *See supra* note 64.

142. *See, e.g.*, Cutler & Zeckhauser, *supra* note 55, at 577.

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 shortens 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 accidence-avoidance.[143] When these costs are high, the cost-benefit ratio of engaging in avoidance activities is not favorable—there is little danger of loss from moral hazard, and nearly full coverage is optimal. When accidence-avoidance costs are very low, only a small drop from full coverage will induce a great deal of accident-avoidance 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 are 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.[144] If observation is imperfect, partial coverage again may be desirable.[145]

Returning to the notation used in Section I.D.2 above, I assume that the expected medical cost conditional on incurring a disease equals L and that $\pi(x)$, the probability of incurring the disease depends on x, the level of consumption of some food, X. The expected damage from consuming level

143. *See* Shavell, *supra* note 140, at 544–50. These results assume that it would be optimal to fully insure in the absence of moral hazard. Assuming a concave utility function, full insurance is optimal when utility (as a function of wealth) is not state-contingent because individuals will want to equalize wealth in all states. However, full health insurance is not necessarily optimal since utility as a function of health may be state-contingent. Suppose, for example, that a particular disease will result in death if not treated. An expensive course of treatment will avert death but will render the treated individual comatose for the rest of that individual's life. Whether or not intervention should be forced on the individual raises significant moral and spiritual questions. It would not be crazy for an individual to decide not to insure against this disease, choosing instead to have higher wealth if it does not occur and to die (rather than live in a coma) if it does. The story becomes morally more interesting if the individual dedicates the extra wealth to enhance the life and health prospects of needy individuals or groups—preferring that resources be spent on them rather than prolonging the insured's own life in a coma.

144. *Id.* at 553.

145. *Id.* at 554–55.

x will be $\pi(x)L$, and this expected damage is equal to the actuarially fair premium to insure against the illness. 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 know 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.[146]

The case for taxation becomes much stronger when neither the government nor private insurers can observe individual consumption.[147] 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 and Stiglitz's article

146. *See* Kaplow, *supra* note 131, 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 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. *See supra* note 131. Kaplow analyzes both the case in which individuals continue to buy private insurance and the case in which they do not. 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 the resulting savings in variable costs exceeds the total of 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 of insurance. 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.

147. When I say that these parties "cannot" observe individual consumption, I mean both directly and through observable individual traits such as blood chemistry, weight, and urine chemistry. If these "biomarkers" collectively indicate the level of consumption—and measuring the biomarkers is cheap—then the government and private insurers effectively *can* learn the levels of each individual's consumption. There also is the possibility that the biomarkers themselves are superior indicators of the risk of disease; thus, the insurance system might key off of them instead of food consumption. This possibility is discussed further in Section III.D.2, *infra*.

mentioned above.[148] 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 that an accident covered by insurance will occur. Some of the commodities are purchased before accidents occur and some are purchased after. Arnott and Stiglitz show that in this situation, with one caveat, preaccident commodities that act as substitutes for accident-avoidance activities should be taxed, while those commodities that are complements should be subsidized.[149] The optimal taxes and subsidies balance the welfare loss, which results from pricing the goods away from marginal cost, against the welfare gain associated with reducing the costs of moral hazard.[150]

The one caveat is that the consumption of accident-avoidance goods may reduce certain accident-avoidance activities, which may be a cheaper way (in utility terms) to avoid an accident. To understand this caveat, consider the situation where an unhealthful food will cause disease, but the disease is completely avoidable through exercise. Heavily taxing the food may drive consumption down to zero; but it will create a very large welfare loss because individuals will deprive themselves of the 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.

The present framework is somewhat different than the one in Arnott and Stiglitz. Consuming the food is the activity that directly causes, or increases the probability of, disease. Rather than simply taxing or subsidizing the substitutes or complements for that food, 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.[151] 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

148. *See* Arnott & Stiglitz, *supra* note 138.
149. *Id.* at 2, 10–12.
150. *Id.* at 7.
151. For a cogent discussion of Pigouvian taxes, see Kaplow & Shavell, *supra* note 84.

government. Setting the tax equal to the level of expected claims simply means that the insured will pay the correct premium for the insurance.[152]

Although the inability to observe individual levels of unhealthful food consumption creates a strong potential case for taxation of the unhealthful food itself, it also makes computation of the appropriate tax harder. The added difficulty comes from two sources of heterogeneity: First, individuals will have different preferences for the unhealthful food. Second, individuals will face different probability curves, $\pi(x)$.[153] If everyone had the same preferences and the same damage function, consumption of the unhealthful good would be the same for all individuals and so would the level of additional expected cost, $\pi(x)L$. Assuming that $\pi(x)$, the probability curve, and L, the level of costs conditional on incurring the disease, are known but that preferences and production costs for the food are not,[154] there are a variety of approaches that would permit

152. 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 to purchase actuarially fair coverage. *See supra* note 143.

153. I assume away two other sources of heterogeneity that are likely to be present and significant in real world populations: (1) heterogeneity in income, and (2) heterogeneity in L, the expected loss conditional on incurring the disease.

154. It is reasonable to assume that the government has knowledge about $\pi(x)$ and L. Knowing that the food increases the risk of disease motivates consideration of taxation or other public policy responses in the first place. Epidemiologic 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 nuts one time or less per week. *See* Joan Sabaté, *Nut Consumption, Vegetarian Diets, Ischemic Heart Disease Risk, and All-cause Mortality: Evidence from Epidemiologic Studies*, 70 AM. J. CLINICAL NUTRITION 500S suppl., at 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 medical costs *currently* 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 arise decades later. Computing L requires being able to estimate those future costs with some degree of precision. 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 55, 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 133, at 21.

the government to impose an optimal tax immediately or through a sequential process.[155] For instance, the government might set a tax level and then observe aggregate consumption. (Assuming no tax evasion, aggregate 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 assuming 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.

Even if the probability schedule, $\pi(x)$, is known and is identical for all individuals, heterogeneity of preferences makes the situation much more difficult. 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 the degree of price-elasticity of their consumption. Consider the figure below based on the model developed by Eric Bond and Keith Crocker. In that model, individuals have identical income at level Y, they consume some risk-creating quantity x of the good X, they pay insurance premiums that may be (if observable) a function of x, and they 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. The individual's budget constraint is $Z = Y - \pi(x)L - cx$.

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

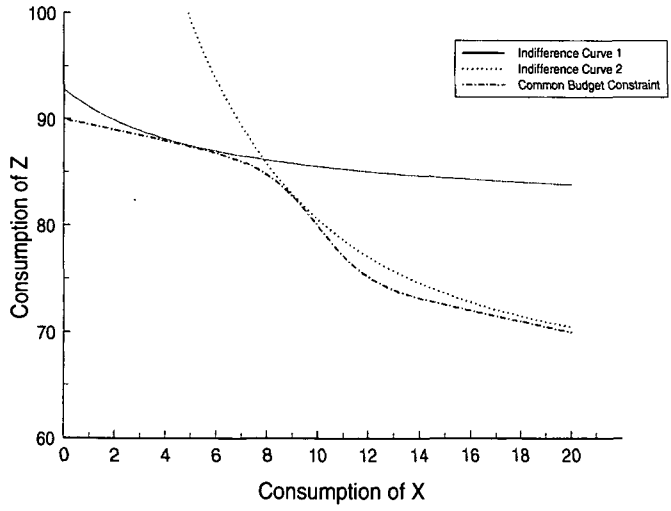
Arguably, Medicare benefits are a proxy for minimal coverage in the United States under the "treatment principle." Other scholars and experts have come up with sharply different projections. For instance, the Health Care Finance Administration assumes that the high real growth rate of per capita medical expenditures under Medicare experienced over the last two decades will drop to 0.9% by 2022. Thomas R. Saving, *Making the Transition to Prepaid Medicare*, 14 J. ECON. PERSP. 85, 90 (2000). The difficulty of making projections does not stem only from uncertainty about new technology—both 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.

155. For an excellent and concise discussion of some of these approaches, see Kaplow & Shavell, *supra* note 84.

contracting the disease. These ranges correspond to the flat portions of the logistic incidence curve.[156] Between five and fourteen units of consumption, most of the damage 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 cost.

There are two indifference curves in the diagram, describing different preferences. Individuals of type 1 do not value X very highly, as compared to their valuation of 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 cost from consuming an additional unit of X is low. In contrast, individuals of type 2 have a strong taste for X, when compared to 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 expected future medical cost significantly for these individuals.

FIGURE 2. Heterogeneous preferences with full insurance and identical logistic risk



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 cost, $\pi(x)L$)

156. *See supra* Figure 1 and text accompanying notes 37–38.

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 and Crocker show that in a general setting where the government can vary the amount of insurance coverage, "the efficient tax is a compromise between the two [Pigouvian taxes on marginal units]" and "the social planner uses distortions from full insurance at the margin to mitigate overconsumption incentives."[157] 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 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 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 the incidence of a certain medical condition while there is no chance of the condition occurring when no units of X are consumed—that is, $\pi(0) = 0$ for everyone. But this ten percentage point increase in incidence may occur because 10% of the population (with very steep $\pi(x)$ schedules) will undoubtedly incur the disease 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 makes choosing

157. Bond & Crocker, *supra* note 130, at 196.

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 cost 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 cost 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 cost 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 cost generated by consumption of X—despite the fact that this expected medical cost 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 each individual's $\pi(x)$ 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 cost 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 make 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 with respect to future medical costs.[158]

158. 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 (for example, by requiring co-insurance payments) to address ex post moral hazard arising from the incentive for fully

A by-product of using food taxes to reduce or eliminate ex ante moral hazard associated with risky eating behaviors is that the net externality calculation would change. If the food taxes worked perfectly, earlier or more expensive medical care for those with poor eating habits would no longer be cross-subsidized by others in the insurance system. The "premiums" collected through food taxes would fund all of the extra costs of such care. Assuming effects similar to the case of cigarettes, the result might be to transform a small net negative externality into a small net positive one.[159]

B. ADVERSE SELECTION AND TAXES

Competition in insurance markets lowers costs, promotes variety, and induces the introduction of 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.[160] 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 between the types ex ante (before illness occurs), the sponsor can charge higher premiums to the unhealthy type under both of the plans. The premiums would be equal to the expected health benefits under each plan. In this case, the market will efficiently sort

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insured parties to overconsume medical services. Partial coverage at this stage also would reduce ex ante moral hazard. In addition, the fact that elements of health status other than medical treatment are not insurable means that individuals already face partial coverage with respect to risky eating behavior.

159. Under Kip Viscusi's 1994 computation, for instance, the present value of the extra medical costs due to smoking amounts to about fifty-one cents per pack, assuming a 5% discount rate. Using the same discount rate, Viscusi computed the total (negative) externality to be about thirty-two cents per pack. *See supra* note 75 and accompanying text. Assuming that the cases of food and cigarettes are coextensive and that the entire extra medical cost from risky eating habits was covered by food taxes, the result for food taxes would be equivalent to a shift from a thirty-two cents per pack negative externality to a nineteen cents per pack positive externality in the case of cigarettes.

160. For good surveys of the conceptual issues and empirical evidence concerning adverse selection in health insurance markets, see Cutler & Zeckhauser, *supra* note 55, at 606–25; Wynand P.M.M. van de Ven & Randall P. Ellis, *Risk Adjustment in Competitive Health Plan Markets*, *in* 1A HANDBOOK OF HEALTH ECON., 755, 771–78 (Anthony J. Culyer & Joseph P. Newhouse eds., 2000).

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.

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 higher 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 who would otherwise be happier with the less generous plan to gravitate towards the more generous plan. Costs will balloon for the sponsor, and, ultimately, some individuals will pay for a subsidy that results in inefficiently generous benefits for other individuals.

Both in theory and in real world outcomes, adverse selection can harm either high-risk or low-risk individuals. In a separating equilibrium where two types differentiated by risk preferences gravitate into particular plans, it is typical that either the high-risk or low-risk type will not be able to receive as much coverage as desired. 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. 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. Prior to reaching this final state, the death spiral will be accompanied by plan bankruptcies and various non-bankruptcy costs.

Whether a particular outcome will occur 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 Harvard University's health insurance system.[161] 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

161. The description that follows is a simplified version of the much more detailed history set forth in Cutler & Zeckhauser, *supra* note 55, at 616, 622–23.

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 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, and, again, those leaving were a healthier and younger group than those remaining in the plan. Huge losses from the PPO in 1997 meant that there would have been a gigantic premium increase in 1998. This increase would have been much too large for most individuals to pay, and neither the university nor the insurance company was willing to provide a large enough subsidy to keep the plan going. Harvard disbanded the PPO.

Was Harvard's policy foolish? It is not clear. 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."[162] 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.[163] 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 premiums.[164] On the other hand, the same economists estimated the savings to Harvard from the lower HMO premiums at 5%–8% of baseline spending.[165] 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."[166] 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.[167]

162. *Id.* at 624.
163. *Id.*
164. *Id.* at 623.
165. *Id.* at 624.
166. *Id.*
167. *Id.* at 616–21.

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 beneficial, low-cost innovations for particular diseases because such 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. Joseph 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.'"[168]

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 tradeoff, some degree of risk sharing often is desirable.[169]

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. Some nomenclature developed by Wynand van de Ven and Randall Ellis to describe payment flows is useful.[170] Individuals pay a "premium

168. van de Ven & Ellis, *supra* note 160, at 775.
169. For a good discussion of risk sharing, see *id.* at 817–28.
170. *Id.* at 764–66.

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."[171]

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 paid by each worker, and half paid by the employer—which funds Medicare, Part A (mostly inpatient care).[172] This payment is a solidarity contribution because it is not earmarked for the consumer's own health care, but rather is paid to the sponsor for the benefit of everyone who is covered by Medicare. The HMO plans currently receive a premium subsidy of 90% of the risk-adjusted predicted per capita costs of those enrolled in the plan.[173] The plans are permitted to charge a community-rated premium contribution, which is the same for all enrollees, 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.[174]

Adding restrictions on risk-rating or on premium charges is a common feature of systems in which a government sponsor engages in risk adjustment.[175] 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 should be made by the insured (the premium contribution) 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, risk adjustment applies most naturally to situations in which insurance is

171. *Id.* at 765.

172. McClellan, *supra* note 132, at 23.

173. 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 10% lower costs in the traditional system than the average enrollee in that system. *See* Cutler & Zeckhauser, *supra* note 55, at 623; McClellan, *supra* note 132, at 23–28.

174. van de Ven & Ellis, *supra* note 160, at 766.

175. *Id.* at 769–71.

compulsory and in which the sponsor is an entity, such as a national government, that is able to impose uniform 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 of 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. This subsidy or tax would greatly reduce or eliminate adverse selection problems.[176]

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 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.[177]

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

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176. 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 in which each individual pays a premium equal to the expected benefits under each particular plan. As mentioned in the text, efficient sorting would occur. Individuals enrolling in every plan would receive insurance priced at social cost; thus, they 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 55, at 624–25.

177. *See* van de Ven & Ellis, *supra* note 160, at 781–82. Van de Ven and Ellis discuss various proposals in the literature that address this problem, including giving plans bonuses for "health improvement." *Id.* at 781–83.

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.[178]

Another issue relevant to food taxes is whether one should risk adjust for lifestyle. In their survey, van de Ven and Ellis present the two sides of the argument.[179] On one side is the idea that health care expenditures related to lifestyle factors—such as risky sexual behavior, smoking, or eating unhealthful food—"should not be subsidized because these expenses can be influenced by the individual."[180] On the other hand, "it is unfair if people with lung cancer or AIDS cannot receive appropriate medical treatment."[181] This later problem is particularly acute because, as discussed in Section III.C, 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 that requiring very high ex post payments for access to medical care once the consequences of poor lifestyle choices materialize violates the treatment principle—the idea that all individuals should receive basic care, even those whose own foolish decisions led to their health problems. A food tax as "premium contribution" is a nice response because it operates on an ex ante basis. If the tax for each food is set equal to the expected future medical cost that results 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.

Bond and Crocker demonstrate that a food tax also may directly impact adverse selection even in the absence of any moral hazard.[182] It is worth explaining in some detail how this happens. Suppose that moral hazard is absent. That is, 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

178. *Id.* at 767–68.
179. *Id.* at 783.
180. *Id.*
181. *Id.*
182. *See* Bond & Crocker, *supra* note 130, at 196–97.

cannot observe consumption of X or $\pi(0)$ on an individual basis, the only tool the government has to combat adverse selection is to offer distinct insurance contracts, $C = \{q, D\}$, consisting of a premium, q, and a deductible, $D = L - I$, 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 $\{q, D\}$. Assuming a separating equilibrium, 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. In technical language, 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 and broader set of contracts that result in an efficiency gain.

Bond and 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."[183] In particular, if the incentive compatibility constraint binds for type 1, then the tax will be positive if type 2 individuals consume more of good X and negative if type 2 individuals consume less, when compared with type I individuals, conditional on both types having the insurance contract suitable for type 2. The magnitude of a tax or subsidy, as well as whether such tax or subsidy is appropriate, depends on the preferences and $\pi(0)$ of the different types.

This result from Bond and 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 exacerbate 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 the expected future medical cost from an extra unit of consumption facilitates risk adjustment by removing the need to adjust for a normatively questionable factor. In that case, risk adjustment is perfect in

183. *Id.* at 196.

the sense that insurers have no selection incentives. When x and $\pi(x)$ are not known at the individual level, risk adjustment using a food tax would be imperfect, and given the impact of the tax on the relevant incentive-compatibility constraints, it is possible that the food tax would worsen the adverse selection problem.

C. INCOMPLETE MARKETS AND TAXES

I 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."[184] 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. The more information that is available to insurers when they set premiums, the more severe this problem becomes. 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 concerning 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 one does not see "whole health insurance" or "premium insurance," which protects against future premium increases resulting from a change in health status.[185] In many countries insurance 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" associated with the fact that medical costs may accelerate more than expected due to new treatments or newly discovered medical conditions ("diseases") that engender costly treatments after they are identified. Finally, there are moral hazard and adverse selection effects that would be associated with premium insurance.

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184. *See* Cutler & Zeckhauser, *supra* note 55, at 627.
185. *Id.* at 627–28.

These problems make it difficult for a private insurance system 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 average to one-tenth the average as firms rate risks using factors such as health status, tobacco use, age, gender, and family size.[186] 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 among 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 emulating the level premiums (despite different health status outcomes) that would result under long-term insurance. The risk adjustment approach described in the previous section is a way to provide such a cross-subsidy. 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 then chooses a method for funding the premium subsidies via "solidarity contributions" that would achieve the desired "level premium" 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 $\pi(0)L$ for 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 complementary role in such a system. 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 cost generated by consuming unhealthful 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.[187] As

186. *See* van de Ven & Ellis, *supra* note 160, at 770.

187. As mentioned above, this picture may be too simple. *See supra* notes 62–64 and accompanying text. Individuals might argue that an unfavorable damage schedule $\pi(x)$ or unfavorable preferences are "inherent" traits that should be subject to long-term insurance.

discussed above, if individual information about x and $\pi(x) - \pi(0)$ is known, private insurers also may be able to levy these implicit premiums, and may be able to do so more efficiently 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 applying a general tax, the implicit premiums will no longer be individualized, deviating from the correct marginal or average values for most individuals.

D. 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 examines 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 discussing the shape it might take in Section III.D.1, Section III.D.2 considers the food tax as part of a broader set of taxes and insurance devices. Section III.D.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's information includes: the consumption level x_i of the hazardous food X for each individual *i*; the disease probability function $\pi_i(x_i)$ for each individual *i*; and the value of L, the expected medical cost 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 that covers the loss L. Private insurers, or the government as public insurer, will need total premiums that are equal to the sum of $\pi_i(x_i)L$ across all individuals *i* to cover the anticipated total claims of $\sum_{i=1}\pi_i(x_i)L$. Second, the government charges each individual *i* an implicit premium, $[\pi_i(x_i) - \pi_i(0)]L$, equal to the expected medical cost 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 $\frac{1}{N}\sum_{i=1}^{N}\pi_i(0)L$, the average expected medical cost arising from "inherent" risk that is beyond individual control. This system would replicate the complete insurance for inherent risks as a category 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.[188]

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 expected medical cost 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 because 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, thereby 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, $[\pi_i(x_i) - \pi_i(0)]L$, because private insurers or health plans could impose the charges as long as they are given that same information (x and $\pi(x)$ for each individual). Private parties, however, would not be able to operate the transfer part of the system effectively since these parties do not have plenary power to impose solidarity contributions

188. One problem is that the optimal way for plans to control ex post moral hazard might be to provide only partial coverage by requiring copayments. 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 copayment unconditionally to the afflicted individual. "Unconditionally" means that the individual is not obligated to spend the transfer on the copayment or on medical care. This approach does not violate the treatment principle. That principle only dictates that individuals may choose to be treated when the disease strikes, not that individuals will be treated against their 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 individuals would spend out of their own funds. Because the insurer is paying the costs, there is a moral hazard problem since individuals do 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 copayments, 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 copayments become desirable, when the insurer cannot distinguish between appropriate costs and costs that go beyond what is appropriate.

across the whole population.[189] 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 important tool that is not available to the private insurance system. Since the potential health damage from foods motivates taxation in the first place, it is assumed that the government has some information about damage schedules, $\pi_i(x)$. In particular, suppose that both the government and insurers know each individual's damage schedule, $\pi_i(x)$, but that 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.[190]

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 adverse 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—that is, 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.[191] Since risk adjustment is the goal, the "best estimate" might be what the government thinks that health plans would use as an estimate. Funding

189. 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 the sponsored group. In addition, if individuals have a choice between sponsors, movement between sponsored groups might constrain the degree of transfers that are possible.

190. The assumption that the government and private insurers know the damage schedule for each individual contrasts with a similar discussion about moral hazard in which it was assumed that the only information the government (and private insurers) knew was the population's average disease-incidence response to various consumption levels of X. *See supra* text accompanying notes 157–58. The assumption that the extra information is available here creates a richer situation on the adverse selection front since insurers may discriminate more easily given their knowledge of individual damage schedules. It was appropriate to assume less information in the moral hazard discussion because the goal was to illustrate the difficulties of Pigouvian taxation in an information-poor environment.

191. 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 of disease.

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 cost induced by consuming X.

In contrast, a Pigouvian tax aimed at moral hazard would be based on the expected *marginal* medical cost per additional unit of consumption, $\pi_i'(x_i^*)L$, across individuals. As discussed above, this marginal amount will be much larger than the average amount if people are on the steep portion of the logistic curve or much smaller than average if people are on the flat portions of the curve. Finally, given that risk 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 cost from consuming hazardous foods. Recall Phillips's model in which consumers tend to cluster 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.[192] Consumers habituate to the pattern characteristic of their hill location 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 one big move to another hill. Imposing a tax equal to the expected health costs of remaining on an unhealthful 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 faulty estimation of the utility effects of switching hills might justify a larger tax, but determining 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

192. *See supra* text accompanying notes 126–29.

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 individuals' 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 conditioned on a physical examination, it is not unusual for life insurance companies to require blood and urinalysis work prior to issuing a policy or, in group coverage settings, 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 (high-density lipoprotein) levels, and LDL (low-density lipoprotein) levels, which 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, which is measured by 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 risks from behavioral risks at the individual level.

The availability of biomarkers presents two new issues. First, the biomarkers may provide information about an individual's consumption of hazardous foods, 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 for 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, but would want to

include all sources of information, including biomarkers, to construct the system. I consider these two issues in turn.[193]

The first issue is straightforward. If food consumption by individuals cannot be observed, 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.[194] In many instances, biomarkers provide only partial information about past dietary behavior.[195] In the situation in which the insurer has only imperfect information about the hazardous activities of the insured, it is still optimal to vary premiums in response to the information. Full coverage, however, is no longer optimal in this situation because partial coverage can reduce the residual moral-hazard problem stemming from the failure of premium-adjustment to completely address the problem.[196] Under the treatment principle, however, partial coverage is not an option. The government therefore must either relax the treatment principle or accept a larger welfare loss from the presence of moral hazard.[197]

Many biomarkers are strong predictors of disease and may in fact be stronger predictors than dietary patterns. This raises the question of whether it would be better to ignore food consumption and simply levy taxes or set insurance premiums on the basis of biomarkers. (Instead of a tax on fatty foods, tax people who are fat!)[198] A significant problem with

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193. In doing so, I 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 either 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 (2d ed. 1988).

194. 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).

195. *See, e.g.*, Ahmed El-Sohemy 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-Sohemy group compared intake to plasma and adipose tissue (fat) levels. *Id.* at 172. The hypothesis was that short-term intake would affect plasma levels and long-term intake would be apparent from levels in adipose tissue. *Id.* The hypothesized effects were present, but the correlations between intake and the observed levels were low, ranging from almost zero to .55. *Id.* at 175. A correlation of .55 means that observed levels reflect only about 30% of the variation in intake. *Id.*

196. *See* Shavell, *supra* note 140, at 554–55.

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

198. A recent study argues that obesity is an independent risk factor for heart failure (one kind of IHD). *See* Kenchaiah et al., *supra* note 12. The other factors considered included age, smoking status,

this approach is that biomarkers include information about both behavioral and inherent risk.[199] 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, as long as we presume 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 to testing can have a significant impact on some indicators.[200] 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—for example, by extracting adipose tissue to pick up long-run biomarker evidence—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 for that role applies much more broadly. Many behaviors other than diet affect the risk of disease. This point suggests consideration of a more encompassing

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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.

199. *See, e.g.*, Cheryl L. Rock et al., *Diet and Lifestyle Correlates of Lutein in the Blood and Diet*, 132 J. NUTRITION 525S suppl. (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.

200. *See, e.g.*, Kyung-Jin 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 "[m]ost of the measurable carotenoids of human plasma can be increased by moderate alterations in diet within a short time." *Id.* at 594.

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, to examine all biomarkers that reveal information about those behaviors, and then to select the optimal insurance scheme from among those in which the government can use tax strategies related to the behaviors, and in which insurers—including private firms as well as the government—can make premiums conditional on particular behaviors. This approach would call into play some classic tax policy strategies. For example, the government might not be able to observe exercise, a major disease-avoidance activity for several conditions, but, using the Arnott and 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 from thirty countries participating in forty-seven studies 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."[201] Should women who have children and women who breast feed be charged reduced premiums, with the difference made up by women who do not, or should all women pay a premium that is 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 create subsidiary consequences for demographic or labor-force-participation policies.

Although I do not pursue the general approach further, 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. Conclusions about optimal taxes or insurance premiums relating to particular food items may be very different under this general approach than if one constrains the government

201. *Breast-feeding Has Protective Bonus*, SCI. NEWS, Aug. 10, 2002, at 93. 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*, 360 LANCET 187 (2002).

to set premiums or taxes only for those particular food items. 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. Optimal taxes or implicit premiums for 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, including substantial costs occurring far in the future that may be subject to considerable uncertainty in the face of technological change and other factors. Even with information about loss and the causal nature of food consumption, it would be necessary either to observe each individual's food consumption or, in the absence of individual information, to engage in the potentially very complex process of computing optimal tax rates that reflect heterogeneity and tradeoffs 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 healthier and safer.

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 is probably not an equilibrium for all food companies to adopt 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 chose the "responsible strategy," any one food company would have a strong incentive to deviate in the following manner: (1) reduce

prices slightly to gain market share; (2) pay out as dividends the reserve monies that would have been accumulated, the normal returns to capital, and to the extent possible, the capital itself; and then (3) declare bankruptcy when the liabilities come due. In a competitive environment, a situation in which 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. That solution, however, 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.[202] Beginning in the mid-1990s states and other parties began winning class action lawsuits against tobacco companies to recover medical costs. 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 players attempted to reach a settlement with the states and private plaintiffs. The "Master Settlement Agreement" that emerged in late 1998 obligated the major tobacco companies to pay the equivalent of a forty-five 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 sales exceeding 125% of the 1997 market share by other brands that were not parties to the settlement. The litigation and settlement involved massive legal costs—by one estimate, forty times the amount that would have followed from actual damage 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 forty-five cent per pack tax on cigarettes would have been better social policy, avoiding disparate treatment of producers and huge lawyer fees."[203]

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.[204] The industry is highly profitable, and there are good reasons to believe that there are significant

202. The discussion here is largely a distillation of the more detailed treatment in Gruber, *supra* note 85, at 198–202.

203. *Id.* at 201.

204. *Id.* at 197.

barriers to entry.[205] Although this industry structure may be bad news for consumers, it makes litigation and settlement relatively easy because 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 these parties be expected 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 even these companies do not share the profitability and oligopoly structure of 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.[206] In addition, such litigation may face substantial political hurdles. Currently, pending legislation in Congress would curtail some causes of action that rely on claims of adverse health consequences from food.[207]

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205. *Id.* at 196–97.

206. As Gruber notes, such litigation may be socially valuable despite its faults 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 forty-five cents per pack federal 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.

207. H.R. 339, a bill to "prevent legislative and regulatory functions from being usurped by civil liability actions brought or continued against food manufacturers, marketers, distributors, advertisers, sellers, and trade associations for claims of injury relating to a person's weight gain, obesity, or any health condition associated with weight gain or obesity" was introduced on January 27, 2003 in the House of Representatives. H.R. 339, 108th Cong. (2004) (enacted). A similar Senate bill, S. 1428, 108th Cong. (2003), was introduced on July 17, 2003. The House bill passed on March 10, 2004, but the Senate version languished in committee. H.R. 339 was reintroduced in the House as H.R. 554 on Febrnary 2, 2005. H.R. 554, 108th Cong. (2005). As noted in press coverage, one impact of the bill would be to "ban lawsuits by obese customers who say they became overweight by eating at fast-food restaurants." Ted Barrett, *House Bans Fast-food Lawsuits*, CNN.COM, Mar. 10, 2004, *at* http://www.cnn.com/2004/LAW/03/10/fat.lawsuits/ index.html.

IV. IMPLEMENTATION, POLITICS, AND SCIENTIFIC UNCERTAINTY

A. IMPLEMENTATION AND POLITICAL ECONOMY

There are many practical issues that would arise with respect to actually imposing food taxes, whether for public health purposes, as implicit insurance premiums, or otherwise. 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.[208] Opponents of the tax argued successfully that it was too hard to determine which foods were subject to the tax.[209] 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" 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 a lot of extra water, and then 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 to tax each food item when it is purchased by the retail consumer. This method might not be hard for packaged foods. Manufacturers of packaged foods already are required to state how much saturated fat is present per serving. Taxing restaurant consumption at the point of sale 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. 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,

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208. BROWNELL & HORGEN, *supra* note 21, at 220–21; Jacobson & Brownell, *supra* note 14, at 856 tbl.2.

209. *See* BROWNELL & HORGEN, *supra* note 21, at 220–21; Jacobson & Brownell, *supra* note 14, at 856.

such fat. Skim milk is an obvious example. Less obvious, but nonetheless prevalent, is the use of milk proteins that are stripped of any fat or lactose in packaged foods. The milk fat that is removed to produce these products may reappear in other products, or it may be fed to animals, or it may be discarded. Implementation of a saturated fat levy would be an exercise in second-best taxation. For example, 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 a tax on skim milk that was too high, while the tax on whole milk would be inefficiently low.[210]

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, and production controls], 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."[211]

The food industry appears to have considerable political influence. One particularly striking anecdote involving Monica Lewinsky and Bill Clinton is recounted by Marion Nestle.[212] According to the Starr Report, on President's Day, 1996, a federal holiday, Clinton received a call while talking with Lewinsky about terminating their relationship, taking or returning the call just as she was leaving. Clinton spoke for twenty-two 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, an account in *Time* magazine concluded, "That's access."[213]

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210. For a very thoughtful discussion of the best place in the distribution chain to impose a real-world "fat tax," see SINNER & DAVIES, *supra* note 23, at 18, 22–23, 33–35.

211. Brian Wright, *Storage and Price Stabilization*, *in* 1B THE HANDBOOK OF AGRICULTURAL ECONOMICS 817, 844 (B. Gardner & G. Rausser eds., 2001).

212. *See* NESTLE, *supra* note 1, at 109–10.

213. *Id.* at 110. It is not just President Clinton. In 1998, Donna Shalala, the Secretary of Health and Human Services at the time, was pictured (with a 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

In addition to having the ear of politicians, the food industry seems to have a powerful influence over the administrative processes of the United States Department of Agriculture and the Food and Drug Administration ("FDA"). For example, Nestle, a participant in various agency efforts to promulgate government nutrition guidelines, details the extensive history of food industry influence on such guidelines.[214] She believes that the widespread confusion about nutrition among the American public, which is apparent from surveys, is partly due to the fact that the government guidelines are "ambiguous."[215] 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.'"[216] 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 substantial market for healthful foods, and producers and processors who might benefit from taxes on less healthful foods provide a counterweight to parties who would oppose such taxes. An example comes from the history of regulation of health claims for food. Prior to 1984, the FDA viewed any food-company claim about the relationship between its products and disease prevention 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.[217] 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

571 (2001). As 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." NESTLE, *supra* note 1, at 81.

214. *See* NESTLE, *supra* note 1, at 51–92.

215. *Id.* at 91.

216. *Id.*

217. *Id.* at 239–44 (setting forth these events and the accompanying legal issues).

includes high fiber foods like bran cereals."[218] The FDA campaign to block this advertisement failed, and the Federal Trade Commission, which regulates advertising claims more generally "enthusiastically endorsed the Kellogg advertisements and recommended that other companies follow suit."[219] All-Bran's market share shot up 47% in the first six months of the marketing campaign. Health claims related to food products proliferated. Some experts believe that the deluge of health-related advertising has promoted nutritional awareness among the public and has shifted eating habits in a healthy direction.

An optimal comprehensive tax on foods to achieve public health or other goals probably would be very complex. It is not clear, however, what, if anything, would emerge from the United States political process if it were faced with a proposal to impose such a tax. The end product might be a distorted version of the optimal tax, or it may be impossible 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—for example, a component that imposes a stiff levy on saturated fat—eating patterns might be influenced for the worse. Political economy constraints and risks might dictate a rather simple tax proposal that falls quite short of realizing the full potential for social benefit. Nonetheless, the potential benefits may be large enough that capturing even a relatively small part of them would be worthwhile.[220]

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.[221] In addition, fat from wild game has significant amounts of some of the omega-3 fatty acids thought to be a significant factor in reducing the risk of IHD and atherosclerotic build-up. In contrast, United States beef has "undetectable amounts" of the same fatty acids.[222] These results have led to speculation concerning the possibility of relying more

218. *Id.* at 240.

219. *Id.* at 241.

220. For an interesting discussion of how food taxes affecting or aimed at health have fared politically across the world, see CORINNA HAWKES & TIM LANG, THE FOOD TAX WARS: IMPLICATIONS FOR PUBLIC HEALTH POLICY (Working Paper, 2004).

221. *See* S. Boyd Eaton & Melvin Konner, *Paleolithic Nutrition: A Consideration of Its Nature and Current Implications*, 312 NEW ENG. J. MED. 283, 285 (1985).

222. *Id.*

heavily on grass-fed or free range animals for human consumption.[223] 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.

The food industry possibly 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 the use of animals at all, but that are indistinguishable from actual meat.[224] In either case, there may be a problem with how to classify the new product under an existing tax scheme.[225] 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 changes 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.[226] 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.

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223. *See, e.g.*, John Robbins, *What About Grass-fed Beef?*, FOOD REVOLUTION, *at* http://www.foodrevolution.org/htm (last visited July 27, 2005).

224. A recent review concludes that laboratory-cultured meat is "technically feasible" but that "significant challenges remain before it could be produced economically." P.D. Edelman et al., In Vitro-*Cultured Meat Production*, 11 TISSUE ENGINEERING 659, 661 (2005). The review also notes that the benefits of laboratory-cultured meat would include manipulating its characteristics to make it a healthful alternative to conventional meat. For example, "the ratio of saturated to polyunsaturated fatty acids could be . . . controlled." *Id.*

225. The problem would be lessened if the food tax were based on components such as saturated fat or omega-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 might simply have a tax on "beef."

226. 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 an additive that does not occur naturally in any food, Proctor & Gamble had to show it was "safe." It took Proctor & Gamble 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.

B. SCIENTIFIC UNCERTAINTY AND COMPLEXITY

I now turn to two other major issues 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. Scientific uncertainty and complexity are relevant issues not only for taxes meant to influence behavior based on public health goals, but also for taxes designed to meet other goals, such as addressing externalities or making private or public health insurance systems more efficient and equitable.

I address scientific complexity and uncertainty by considering an example: the connection between diet and osteoporosis. This connection turns out to be particularly complex and counterintuitive.[227] The example brings out three general points that are critical to the efficacy of any tax approach. First, heterogeneity in health responses to diet may make the use of 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, and the influence of the taxes on the choice of patterns may be crucial. 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.

The relationship between diet and health is complex not only because the health impact of various foods or eating patterns is uncertain, but also because some detrimental outcomes may result from behavioral or cognitive phenomena rather than from food content. If these phenomena play a big role, effective tax solutions will look very different. Exploring the implications of the impact of various behavioral and cognitive factors on eating behavior requires considerable elaboration, and the key points do not flow in a complete or satisfying way from the osteoporosis example. As a result, those implications are discussed in a separate subsection.

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227. A comprehensive discussion of the connection between diet and osteoporosis would be an article in itself. Due to the rapid accumulation of knowledge, some of which simply expands the domain of uncertainty, modal beliefs about major aspects of the connection have been in flux. I only scratch the surface here, identifying some results and issues that illustrate the potential difficulties for using food taxation as a policy tool. The difficulties I identify are general and are likely to persist independent of developments on the diet-based etiologies of particular diseases.

Some of the results discussed in the text are controversial. No attempt at summarizing the current state of knowledge is intended here. For readers interested in such a summary, I would suggest starting with my own favorite recent survey: Ann Prentice, *Diet, Nutrition and the Prevention of Osteoporosis*, 7 PUB. HEALTH NUTRITION 227 (2004). This survey discusses some of the methodological issues in studying diet and osteoporosis, and also canvasses the results.

For most major diseases, there is considerable heterogeneity throughout the population with respect to the impact of the consumption of particular foods or food components on the disease. A good example flows from 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.[228] Heterogeneity of this sort makes it difficult to use general taxes as a policy tool to achieve goals such as promoting public health or requiring people to implicitly insure their own risky behavior by paying taxes equal to the expected medical cost flowing from that behavior. To make a tax fully effective when a particular food benefits some individuals and harms others, it would be necessary to classify individuals into different impact groups and then tax or subsidize the consumption of the food differently for each group. Both the classification process—for example, using genetic or other tests—and administering a system of differential taxes or subsidies for different groups would be difficult and costly.

The second and third points, the crucial role of patterns, and the serious errors that may arise from taxing proxies, emerge from a more general discussion of the connection between osteoporosis and diet. A leading indicator of the rate of osteoporosis in a population is the observed incidence of hip fracture, especially in women over fifty years old. Hip fracture is a major health problem for the elderly in the United States, affecting about 1.5 million Americans annually.[229] 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. United States 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."[230] Epidemiological studies call this conventional wisdom into question. Many countries with very low average calcium intakes—for example, significantly below the United States recommended daily allowance level—have much lower hip-fracture rates than countries with high average calcium intakes, including the United States.[231]

228. *See* Prema B. Rapuri et al., *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).

229. Hegsted, *supra* note 213, at 571.

230. *Id.*

231. *See id.* at 571–72.

One possible 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;[232] net endogenous acid production;[233] and consumption of various foods such as coffee,[234] sodas containing phosphoric acid,[235] and table salt.[236] In addition, the body adapts to different levels of calcium intake to maintain balance, increasing or decreasing the rate of absorption when intake decreases or increases.[237] 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 considerable dispute.

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.[238] 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 from excretion. It may be the case that there will be no problem with bone loss as long as the ratio of calcium to protein intake is sufficiently high.[239] 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 calcium balance and decalcification of bones.[240] A high protein diet and, in particular, large amounts of fish and meat protein tend to result in high renal acid load.[241] If one simply looks at *total* protein consumption, empirical work does not resolve the issue. Observational studies on the relationship between *total*

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

233. *See* Lynda A. Frassetto et al., *Worldwide Incidence of Hip Fracture in Elderly Women: Relation to Consumption of Animal and Vegetable Foods*, 55A J. OF GERONTOLOGY MED. SCI., M585, M589 (2000).

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

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

236. *Id.* at 1052–53.

237. *See* Hegsted, *supra* note 213, at 571. As Hegsted notes, however, "it may take considerable time—weeks or months—for the body to adapt to a new calcium intake." *Id.*

238. *See, e.g.*, Barzel & Massey, *supra* note 235; Robert P. Heaney, *Excess Dietary Protein May Not Adversely Affect Bone*, 128 J. NUTRITION 1054 (1998).

239. *See* Heaney, *supra* note 238, at 1056.

240. *See* Barzel & Massey, *supra* note 235, at 1052.

241. *Id.* at 1051.

protein intake and bone loss have mixed results. Some show a positive association, others a negative association, and still others no association.[242]

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, at least at the epidemiological level. In a recent study, this ratio explains 70% of the variation between age-adjusted fracture rates in the thirty-three countries for which good data sources both on fracture rates and food consumption are available.[243] The following table, reproduced directly from that study, shows the data for various countries.

242. *See* Heaney, *supra* note 238, at 1054–55.
243. *See* Frassetto et al., *supra* note 233, at M586.

TABLE 2. Hip-fracture incidence (HFI) and dietary protein intake by country[244]

Country	HFI per 100,000 person-years	Animal Protein Intake (AP) (g/day)	Vegetable Protein Intake (VP) (g/day)	VP/AP	Total Protein (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
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
United Kingdom	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

244. The source of this data is Frassetto et al., *supra* note 233, at M586 tbl.1.

The large differences in hip-fracture incidence ("HFI") between countries is striking. For instance, HFl in China was only about one-fortieth of 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.[245] The study suggests that vegetable consumption plays a significant protective role, which is independent of total protein consumption: vegetable protein intake was a significant negative predictor of 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 protective role. They 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 some support from animal studies and from prospective studies on humans. Acid-forming 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 deposited about the same amount of bone content as rats fed a regular calcium diet."[246] 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.[247]

The attempt to ascertain the true significance of the vegetable protein study illustrates the second and third general points mentioned above. Using individual nutrients as independent variables in population studies or prospective studies may mask the true causal factors. It may be that other nutrients or nutrient combinations occurring in the same foods as the studied nutrient are responsible for the results. As one research group, the

245. The study did not examine dairy consumption as an independent factor. It is easy, however, 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), United States (20.5 g/day), Norway (20.8 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. The lowest levels of dairy consumption occurred in: Nigeria (0.4 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.I g/day) and Singapore (no data), these countries make up the group with the lowest HFI. *Id.*

246. *See* Barzel & Massey, *supra* note 235, at 1052.

247. *See* Bonnie Liebman & Jayne Hurley, *Vegetables: Vitamin K Weighs In*, 29 NUTRITION ACTION HEALTH LETTER 6, 55 (2002).

Tucker group, observed, "associations seen with a single nutrient may, in fact, be caused by a more complex constellation of other nutrients consumed contemporaneously."[248] This phenomenon led the Tucker group to examine the impact of food 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.[249] 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."[250] This study generated bone mass density ("BMD") data at four different body sites. 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 unusually high representation (calculated 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; and (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 significant only at one of the four sites.[251] The weakest performer for both men and women was the candy group, while the sweet baked products group was the second weakest.[252]

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248. Katherine L. Tucker et al., *Bone Mineral Density and Dietary Patterns in Older Adults: The Framingham Osteoporosis Study*, 76 AM. J. CLINICAL NUTRITION 245, 245 (2002).

249. *Id.*

250. *Id.* at 245–46.

251. *Id.* at 246–48.

252. *Id.* In studying the impact of the food patterns, the Tucker group controlled for a large set of possible confounding variables: age, BMI, height, physical activity, smoking status, total energy intake, use of calcium supplements, use of vitamin D supplements, season of bone mass density measurement, and (for women) estrogen use. *Id.* at 246. Other studies have suggested a beneficial role for fruits and vegetables. *See* Helen M. Macdonald et al., *Nutritional Associations with Bone Loss During the Menopausal Transition: Evidence of a Beneficial Effect of Calcium, Alcohol, and Fruit and Vegetable Nutrients and of a Detrimental Effect of Fatty Acids*, 79 AM. J. CLINICAL NUTRITION 155, 163 (2004); Frances A. Tylavsky et al., *Fruit and Vegetable Intakes Are an Independent Predictor of Bone Size in Early Pubertal Children*, 79 AM. J. CLINICAL NUTRITION 311, 311 (2004) (surveying the literature on this issue).

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 people in countries like the United States, where there is a culture of drug treatment and little regulation of supplements, will take supplements of the individual nutrient.[253] These supplements, even if free from other side effects, may have a very different impact than eating the foods that generated the results in the studies. A famous example involves beta-carotene. A series of studies linked low levels of beta-carotene in the blood with increases in mortality from lung cancer. These results encouraged supplementation of foods with beta-carotene, and encouraged the sale of beta-carotene supplements in pill or tablet form.[254] A few years later, however, it became clear that consuming beta-carotene in the form of supplements leads to significantly *higher* levels of lung cancer.[255]

What explains the difference between the studies that focused on blood levels of beta-carotene and those that examined the impact of supplements? A high blood level of beta-carotene is a "biomarker" for high fruit and vegetable consumption. There is strong evidence that fruit and vegetable consumption can reduce the risk of many cancers, and the evidence is particularly numerous and consistent for lung cancer.[256] Fruits and vegetables contain a very large number of distinct phytochemicals, including many from the carotenoid family of which beta-carotene is a

253. For a good discussion of supplement regulation and its political history, see NESTLE, *supra* note 1, at 219–93. 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. *See* Dietary Supplement Health and Education Act of 1994, Pub. L. No. 103-417, 108 Stat. 4325. The definition of supplements in DSHEA includes: amino acids, vitamins, minerals, herbs, botanicals, metabolites and diet products. NESTLE, *supra* note 1, at 235. Drugs must be shown to be both 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 do 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.

254. Large numbers 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).

255. *See* Olli P. Heinonen & Demetrius Albanse, The Alpha-Tocopheral, Beta Carotene Cancer Prevention Group, *The Effect of Vitamin E and Beta-carotene on the Incidence of Lung Cancer and Other Cancers in Male Smokers*, 330 NEW ENG. J. MED. 1029 (1994); William A. Pryor, Wilhelm Stahl & Cheryl L. Rock, *Beta Carotene: From Biochemistry to Clinical Trials*, 58 NUTRITION REVS. 39 (2000). One study was stopped twenty-one months earlier than planned because of the negative effects of the supplements. *See* Gilbert S. Omenn et al., *Effects of a Combination of Beta Carotene and Vitamin A on Lung Cancer and Cardiovascular Disease*, 334 NEW ENG. J. MED. 1150 (1996).

256. *See* Walter C. Willett, *Diet and Cancer*, 5 ONCOLOGIST 393, 395–96 (2000).

member. It may be that the balance of phytochemicals, rather than the action of individual components is key.[257] 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."[258]

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, which substitute vegetable for animal protein and yet may not contain the protective factors in fruits and vegetables that are 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. This possibility is enhanced by recent findings that purified proteins, whether of animal or plant origin, increase urinary calcium, while high protein in the form of meat or milk may not adversely affect calcium balance.[259] Meats, as well as vegetables, have protective factors, in particular, high phosphorus content, that tend to offset the deleterious effects of the protein by itself.[260] Synthetic meats that lack the protective components of fruits,

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

258. Willett, *supra* note 256, at 396.

259. *See* Linda K. Massey, *Dietary Animal and Plant Protein and Human Bone Health: A Whole Foods Approach*, 133 J. NUTRITION 862S suppl., at 864S (2003). Linda Massey also notes that some plant foods such as wheat have a *greater* proportion of sulfur-containing amino acids per gram of protein—and therefore a higher tendency to increase potential renal acid load—than fish, milk, beef, or chicken. *Id.* at 863S. Her general claim is that "[a]nimal and plant foods may have different effects on bone health, although these effects are mainly attributable to other constituents of the food and diet, not protein." *Id.* at 865S.

260. *See* Ann Prentice, *supra* note 227, at 234–35. Indirect support for this point comes from the Tucker group study discussed above. *See supra* text accompanying notes 248–52. Although the high

vegetables, or "real" meats may be the worst possible protein source with respect to the risk of osteoporosis.

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 and the protective factors present in plant foods. In some of these countries, calcium intake is very low—way below the United States recommended daily allowance—but it does not matter because the body is able to adapt to low intake as long as acid production is low and/or the protective factors are present. In countries with a low ratio of vegetable to animal protein, the average person faces considerable net acid production, and avoiding a high risk of hip fracture depends critically on calcium intake and on whether the individual is consuming animal or plant foods sufficient in protective factors. High calcium intake allows the body to compensate for the acid environment and/or lack of protective factors. In many of these countries, average calcium intake is high due to high consumption of dairy products. High hip-fracture rates, however, are observed because there are segments of the population that have low calcium intake combined with high net acid production and diets that lack protective factors.[261] Low calcium intake in these individuals may be

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fruit and vegetable groups did best with respect to bone health, the high meat groups were by no means the worst performers. Rather, the worst performers were groups who consumed large amounts of sugars and refined carbohydrates.

The impact of particular foods depends critically on the foods that they replace or the foods with which they are replaced. This point is illustrated by an interesting recent exchange in the literature. A recently published study found that high meat diets do not have much effect on calcium retention. Zamzam K. (Fariba) Roughead et al., *Controlled High Meat Diets Do Not Affect Calcium Retention or Indices of Bone Status in Healthy Postmenopausal Women*, 133 J. NUTRITION 1020 (2003). A letter-writer pointed out that the increase in meat in the diets studied came at the expense of the intake of cereal grain products. Anthony Sebastian, Letter to the Editor, *Low Versus High Meat Diets: Effects on Calcium Metabolism*, 133 J. NUTRITION 3237, 3237–38 (2003). In fact, most of the cereal grain products appear to have been in refined form. Sebastian argued that the real result from the Roughead study was that "adding meat to the diet and isoenergetically subtracting foods comprising predominantly cereal grain products does not adversely affect calcium retention and bone metabolism in postmenopausal women." *Id.* at 3238. In their reply to the letter, two of the authors of the original study agreed that "one cannot make a 'generic' comparison of high versus low meat diets" but that "conclusions . . . should be based upon practical comparisons using meat and common isoenergetic substitutions." Zamzam K. (Fariba) Roughead & Janet R. Hunt, Letter to the Editor, *Reply to Sebastian and Remer and Manz*, 133 J. NUTRITION 3240, 3240 (2003). In response to Sebastian's suggestion that the result would be very different if the extra meat had been substituted for fruits and vegetables, Roughead and Hunt questioned whether that substitution would be "practical" given the much higher volume of the fruits and vegetables that would be required. *Id.*

261. Based on the evidence surveyed above, it is likely that the groups most at risk will be those who consume many of their calories in the form of refined grains rather than those with large amounts

because these individuals have difficulty assimilating dairy products or because they just do not like dairy products.[262] Subsidizing foods based on calcium content would encourage fortification of low-calcium foods and consumption of high-calcium foods, both dairy and non-diary. Widespread fortification of non-dairy foods would alleviate the problem of individuals who cannot tolerate or do not prefer commonly available high-calcium foods.[263]

The story just presented is quite plausible given the evidence examined so far. But other evidence suggests that the story may be seriously incomplete and that the proposed policy approach may be 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 (including supplements), total protein intake, current estrogen use, physical activity, smoking status, and alcohol

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of meat in their diets. In the Tucker group study, high meat diets occupied an intermediate position with respect to bone health between high fruit and vegetable diets (most protective) and high refined carbohydrate diets (least protective). See *supra* text accompanying notes 248–52. Prospective studies on the impact of animal versus plant protein sources on bone losses show mixed results. *See* Massey, *supra* note 259, at 862S–863S (discussing six such studies). Since the consumption of refined grain products is highly correlated with increased animal protein consumption at the national level, it is possible that the epidemiological link between animal protein sources and hip fracture is picking up population subgroups that derive much of their energy from consuming refined carbohydrates. It is also possible that this type of diet is the true cause of the high hip fracture rates observed in developed countries.

262. 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 among 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 is a major concern for those who would otherwise address the hip-fracture problem by increasing 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. C. NUTRITION 198S (2001).

263. Ann Prentice, in her survey concerning nutrition and osteoporosis, notes that calcium supplementation appears to be effective primarily for those individuals who: (1) live in countries with high hip fracture rates; and (2) consume relatively low amounts of calcium (less than 400–500 milligrams per day), as compared to others in the same countries. In many countries with low fracture rates, calcium consumption is very low, but it does not seem to matter. The potential impact of supplementation in such countries is not known. In high fracture rate countries, supplementation beyond currently recommended intake levels appears to confer no benefits. *See* Ann Prentice, *supra* note 227, at 231–33.

This pattern suggests that the optimal policy is targeted, providing calcium (and vitamin D) supplements only to individuals living in high fracture rate countries who have low intakes of calcium (or vitamin D). Population-wide supplementation would be wasteful and unnecessary. *Id.* at 236–37. General measures might be good policy, however, if it were costly or impossible to identify low intake individuals.

intake.[264] In addition, as indicated by the example of beta-carotene above, 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 United States 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.[265]

The problems with focusing on nutrient components, and the emphasis on food pattern consumption in the epidemiological and prospective hip-fracture studies, suggest that tax and subsidy policies should address food patterns. For example, the consistent positive evidence with respect to fruit and vegetable consumption might suggest subsidizing such consumption. There is, however, 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. Many epidemiological studies and prospective studies involve populations with stable nutrition patterns. These patterns, including the use of supplements, often 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, which are necessary for the pattern to be successful. Two examples from the United States are the mandated supplementation of table salt with iodine, and the supplementation of 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 calcium source for much of the population, made

264. *See* Deborah E. Sellmeyer et al., *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). As previously discussed, animal protein consumption itself may not be the culprit but may be correlated with other dietary factors that are. *See supra* note 259. Regardless of the cause, the Sellmeyer study indicates that high calcium supplementation by itself is insufficient to overcome the dietary factors that are generating high hip-fracture rates in the United States and other developed countries. At the same time, calcium may be protective for some subgroups in the United States population. *See infra* note 265 (discussing the need to balance diets with excess phosphorus).

265. INST. OF MED. STAFF, DIETARY REFERENCE INTAKES FOR CALCIUM, PHOSPHOROUS, MAGNESIUM, VITAMIN D, AND FLUORIDE 134–45 (1999). 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. *See* Leonard Sax, *The Institute of Medicine's "Dietary Reference Intake" for Phosphorous: A Critical Perspective*, 20 J. AM. C. NUTRITION 271 (2001). This evidence is particularly disturbing because of the jump in the consumption of soda beverages, which are typically phosphate-rich, and the corresponding drop in calcium-rich milk consumption among children, teenagers, and young adults in the United States. *Id.* at 276.

sense because vitamin D regulates the absorption and utilization of calcium and phosphorous and regulates the mineralization of bone. At present, fortified milk is the main dietary source of vitamin D for Americans.[266]

When eating patterns change in major ways for any reason, there is a danger of poor health results because of a failure to make necessary subsidiary adjustments. 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.[267] 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. Vitamin B-12 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 prevalent, the food culture may adapt by

266. *See* WEIL, *supra* note 254, 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 inadequacy cutoff. *See* Shanna 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, 187 (2002). The equivalent deficiency percentage for white women was 4.2%. *Id.* 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.* The prevalence of deficiency was particularly high—approximately 51% for African-American women who consumed milk less than three times per week, and this group comprised about 60% of all such women. *Id.* at 189. In contrast, only about 30% of the white women were in the low-consumption group, and this group experienced deficiency prevalences of 3%–4%. *Id.* 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 tbl.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 since 75% of the African-American population is lactose intolerant—versus only 20% of the white population. *See* Jackson & Savaiano, *supra* note 262, at 202S tbl.3. *See also supra* note 262 (discussing lactose intolerance).

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

requiring systematic B-12 supplementation of foods, similar to the mandated supplementation of iodine in salt and vitamin D in milk. In the meantime, it appears that at least some Western vegans, especially the young and uninformed, are at risk for vitamin B-12 deficiency.[268]

Food pattern adjustment issues arise both with respect to taxing foods that have undesirable health characteristics and with respect to subsidizing healthy foods. Suppose, for example, that we attempt to push the United States diet in the direction of rural China circa 1980. One element of such an attempt might be a stiff tax on foods high in saturated fats, including most meat and diary products. Some significant food pattern adjustment problems might accompany this strategy. Assuming that the substitution effect dominates, there would be a big drop in consumption of meat and dairy products. A key issue is what Americans would substitute in place of these foods. They might increase consumption of synthetic fats, some of which—for example, 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.[269] The substitution problem is particularly acute for low-income families and individuals who rely on inexpensive milk and meat for protein and calcium needs.[270] It may take time for producers to replace those products with equally inexpensive substitutes—for example, 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

268. *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).

269. In February 2000, the United States Department of Agriculture held a "Symposium on the Great Nutrition Debate." *See* U.S. Dep't of Agric., Debate at the Millennium Lecture Series Symposium on the Great Nutrition Debate (Feb. 24, 2000) (transcript on file with author). The symposium was an actual debate and among the panelists were 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. As noted, however, 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. *See infra* note 294 and text accompanying notes 287–91.

270. The danger that low-income families would substitute foods high in added sugars and fats is particularly acute. These foods tend to be the cheapest per unit of energy, and there is evidence that low-income individuals consume such foods disproportionately. *See* Adam Drewnowski, *Fat and Sugar: An Economic Analysis*, 133 J. NUTRITION 838S (2003). The implications of the lower relative cost of added fats and sugars for food taxes are explored later in this Article. *See infra* text accompanying notes 287–91.

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.[271]

C. BEHAVIORAL AND COGNITIVE FACTORS

Scientific relationships have a strong bearing on the optimal form for a food tax. Some scientific relationships involve behavioral or cognitive factors, in addition to the disease-inducing tendencies of foods and food components discussed in the previous section. If the target is obesity, for example, it seems clear that the macronutrient composition of foods may matter much less than qualities such as "energy density," which is equal to the energy content of the food, usually measured in calories, divided by the weight of the food. The change in tax strategy that might follow if behavioral or cognitive factors play a key role raises implementation issues that differ in kind or extent from the ones examined in Section IV.A above.

Turning to obesity, one consistent finding is that fat and carbohydrate content have little independent effect on satiety (the timing and amount of subsequent intake) if meals or snacks have the same energy density and palatability.[272] In addition, fat content seems to have no effect on satiation (the amount eaten at a meal) if energy density is held constant. People tend to consume a constant weight of food at each sitting regardless of its composition.[273] A food-based tax aimed at reducing population levels of obesity or at covering the ensuing health costs on an ex ante basis might be based in large part on the energy density of each food.[274] If energy density is the crucial link in the chain,[275] then using it as a basis for taxation

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271. Two United States government economists have made similar points about the potential substitution problems that might flow from a food tax scheme. *See* Elizabeth Frazao & Jane Allshouse, *Strategies for Intervention: Commentary and Debate*, 133 J. NUTRITION 844S, 846S (2003).

272. *See* Megan A. McCrory et al., *Dietary Determinants of Energy Intake and Weight Regulation in Healthy Adults*, 130 J. NUTRITION 276S, 277S (2000); Barbara J. Rolls, *The Role of Energy Density in the Overconsumption of Fat*, 130 J. NUTRITION 268S, 268S–269S (2000).

273. *See* Rolls, *supra* note 272, at 269S–270S.

274. One of the most detailed "fat tax" proposals relies heavily on this approach. SINNER & DAVIES, *supra* note 23, at 29–31.

275. An important caution is that the link between energy-dense foods and obesity is not completely clear. Two recent studies found no association between energy density and BMI in children and adults, respectively. John M. de Castro, *Dietary Energy Density Is Associated with Increased Intake in Free-Living Humans*, 134 J. NUTRITION 335, 338–40 (2004); Terry T-K Huang et al., *Energy Intake and Meal Portions: Associations with BMI Percentile in U.S. Children*, 12 OBESITY RES. 1875, 1883 (2004). These studies, however, are cross-sectional in nature, comparing energy density of meals over a short period of time—one day and one week, respectively—to observed BMI. The de Castro study finds

circumvents many problems. For instance, taxing particular food components raises the possibility that food manufacturers will "invent around" the tax, using new synthetic components or new combinations of existing components that face little or no tax. These new components or combinations might be as unhealthful as the heavily-taxed ones. No such circumvention would be possible if energy density is crucial and is the primary or sole object of the tax.

Since energy density is simply equal to a measure of energy—for example, calories—divided by weight, it might seem that implementing any such tax would be relatively easy. Nonetheless, there are some complex facets. Adding water to prepared meals reduces the energy density and increases both satiety and satiation.[276] However, there is evidence that consumption in liquid form, especially of high energy-containing beverages such as sodas, may result in substantially lower satiety than consumption in solid form.[277] To be effective, a tax based largely on energy density might need to differentiate among categories such as solid versus liquid. The required differentiation would greatly complicate the administrability and transparency of the tax.

Some additional potential implementation difficulties follow from the fact that certain foods—such as nuts and avocados—are energy-dense but also involve substantial, and possibly unique, health benefits, while other foods are energy-dense but bereft of nutrition.[278] Some researchers have identified a category of foods that they designate as energy-dense, nutrient poor ("EDNP").[279] Recent data suggest that these foods not only promote fatness because of the extra total energy intake, but also tend to replace nutritionally rich foods, resulting in a risk of micronutrient shortfalls.[280] The same data indicate that about 27% of the total energy in the United States diet comes from EDNP foods and that one-third of the United States population averages 45% or more of its energy intake from such foods.[281]

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a short-term impact of energy density on energy intake, but de Castro suggests that the increased intake may be compensated for by later reductions. de Castro, *supra* note 275.

276. *See* Rolls, *supra* note 272, at 269S.

277. For a brief survey, see Megan A. McCrory, Vivian M.M. Suen & Susan B. Roberts, *Biobehavioral Influences on Energy Intake and Adult Weight Gain*, 132 J. NUTRITION 3830S, 3831S (2002).

278. *See supra* note 154 (discussing nuts).

279. *See* Ashima K. Kant, *Consumption of Energy-Dense, Nutrient-Poor Foods by Adult Americans: Nutritional and Health Implications. The Third National Health and Nutrition Examination Survey, 1988–1994*, 72 AM. J. CLINICAL NUTRITION 929 (2000).

280. *Id.* at 934.

281. *Id.* at 932.

A tax that distinguishes between "healthful" and "unhealthful" energy-dense foods might target EDNP foods exclusively or impose particularly high rates on these foods versus foods that are energy-dense but have significant nutritional value.[282] Exempting nutritious, high-energy foods or applying lower rates to these foods might make sense from an instrumental perspective, but would complicate the tax. One casualty is the difficulty of "inventing around" a pure energy-density tax through the use of tax-exempt synthetics or by combining exempt items with each other or with other items. Some of the ensuing problems are obvious. "Junk food" manufacturers might add vitamins or "good fats"—for example, omega-3-rich fish oils—to energy-dense snack foods in order to avoid taxation or to lower the rate of tax. Government regulators would have to engage in a very complex line-drawing exercise to determine which foods fell in exclusion or lower rate categories. In addition, because food manufacturers would have a very wide variety of additives or combinations at their disposal, the government would have to be prepared to assess the entire spectrum of nutrition claims with all of the attendant scientific complexity.

For instance, the government would have to determine whether adding calcium or vitamin A "counts" toward a food reaching the "nutritious" category. The task is made much more difficult by the fact that the decisions in particular cases would not be independent. If a wide variety of foods reach exempt status through added calcium or vitamin A, the food supply will be saturated with these nutrients.[283] More ominously, some nutrients are toxic or result in negative side effects when consumed in large quantities. For example, retinol-based versions of vitamin A are toxic at high levels, and even plant-based substitutes such as beta-carotene, which the body converts to vitamin A, may have a deleterious effect when consumed as a supplement.[284] Similarly, there are dangers associated with consuming too much calcium.[285] As if the instrumental difficulties with

282. It is tempting to see an EDNP-based tax as a "junk food" tax with broader goals. Instead of aiming at raising a modest amount of revenue to engage in counteradvertising, the goals might be to promote public health by influencing behavior or to create an implicit insurance scheme by charging consumers with the expected medical cost of consuming the foods. Some EDNP foods, however, will not correspond to those traditionally considered to be "junk food." Foods such as cheese and many kinds of bread might fall into the EDNP category due to their low ratio of nutrition to calories.

283. "Saturation episodes," in which a particular nutrient is added to many foods might well arise from the dynamics of the regulatory process. If company *A* succeeds in shifting junk food to tax-exempt status by adding a particular supplement, a clear strategy for other companies would be to add the same supplement and then claim exempt status based on the precedent established by company *A*.

284. *See supra* note 255 and accompanying text (discussing higher lung cancer rates associated with beta-carotene supplementation).

285. *See supra* note 265 and accompanying text.

implementing different categories were not enough, there also is the dark cloud of political economy. Differential treatment might lead to a political free-for-all as various food constituencies clamor for favorable treatment of their products.

An energy-density-based tax faces the same conundrum of choosing the proper stage of production or distribution to impose the tax that was examined in Section IV.A. An early stage tax might focus on additives such as fats or sugars. The problem with such a tax is that foods sold at the retail level containing these additives are not necessarily energy-dense. For example, such foods might contain a great deal of fiber or water which sharply lowers the energy density. On the other hand, it will be infeasible to tax some foods based on energy density at the point of consumption. Imposing such a tax on home consumption almost surely would be impossible, and even taxing restaurant food would be very difficult because the energy density of restaurant food will be impacted heavily by the mode of preparation.

There also are heterogeneity problems with taxing energy-dense foods. Important subsegments of the population need or benefit greatly from consuming such foods. These groups include older individuals who have trouble consuming enough energy due to the toll of age on digestive efficiency, and individuals recovering from eating disorders who need to maintain or gain weight.[286] Excluding these groups from the tax would be an administrative nightmare. But, without the exclusion, the net benefits of the tax are lower since these groups are harmed. In theory these heterogeneity problems might be avoidable if the energy-density tax targeted only nutritionally poor foods. Groups who need to gain or maintain weight would be able to do so by consuming healthy, energy-dense foods such as nuts or avocados. As discussed above, however, sizable taxes may have an unexpected impact on individual eating patterns and also on food cultures that develop a complex and health-sustaining nutritional "balance" only over time. An EDNP-based tax might result in those individuals who are energy-intake challenged dropping the EDNP foods they consume presently without substituting nutritious energy-dense foods.

Any tax on energy-dense foods, even one targeted at EDNP foods, involves another possibly very serious complication suggested by Adam

286. *See, e.g.*, Rolls, *supra* note 272, at 270S (discussing the clinical implications of the energy density of food).

Drewnowski and S.E. Specter.[287] Drewnowski and Specter show that energy-dense foods, and especially those with added sugars and fats, tend to be the least expensive per calorie. At the same time, obesity and poor dietary quality are much more frequent among individuals with the lowest incomes and educational levels. Although education has a stronger effect on diet-quality than income, income does have an effect. There is the danger that "healthier diets cost more and are beyond the reach of many low-income families."[288] Survey evidence suggests that low-income individuals spent "their limited food dollars on energy-dense foods that were largely composed of added sugars and fat."[289] This outcome would make sense under the hypothesis that "consuming energy-dense foods . . . is an important strategy used by low-income consumers to stretch the food budget."[290]

A tax on energy-dense foods, if passed on in the form of higher prices, would promote the public health goal of pushing consumers away from foods most likely to promote obesity. Regardless of the incidence of the tax, it could be designed to function as an implicit insurance premium. If the tax were passed on, an important consideration in any such scheme would be the impact on the poorest individuals. Unless the price increases were offset by additional income assistance, these individuals' nutritional status might deteriorate. On the other hand, since these individuals presently appear to have the most to gain from healthier eating, combining special assistance with a stiff energy-density-based tax might result in especially large welfare gains for them. At the same time, such special assistance certainly would make the scheme more complicated both administratively and politically, even assuming that the government might be able to provide that assistance largely through increasing benefits under present programs.[291] Finally, there is added intertemporal complexity. The

287. Adam Drewnowski & S.E. Specter, *Poverty and Obesity: The Role of Energy Density and Energy Costs*, 79 AM. J. CLINICAL NUTRITION 6 (2004).

288. *Id.* at 10.

289. *Id.* at 13.

290. *Id.* at 11. Drewnowski and Specter are appropriately tentative about asserting whether this hypothesis is true. Their general observation about the connection between diet quality and cost is that "[a]s yet, there are no data that would allow us to link all of the dietary and economic variables into a causal chain." *Id.* at 11. Despite the survey results mentioned in the text, the evidence on low-income individuals and on the impact of assistance programs such as food stamps is quite sparse. *Id.* at 12–13.

291. The political and moral salience of the impact of "fat taxes" on the poor is already apparent from the history of particular proposals. The British Medical Association rejected calls by some of its members for a fat tax because "to put a tax on any food would hit the poorest and most vulnerable people in society." Paul Kelbie, *Obesity Puts as Much Strain on NHS in Scotland as Smoking, Says Survey*, INDEPENDENT, June 12, 2003, at 7. A major proposal for a fat tax in New Zealand calls for the return of revenues to low-income individuals. SINNER & DAVIES, *supra* note 23, at 35–36.

short-run and long-run impact of an energy-based tax on low-income individuals may differ sharply, especially if EDNP foods are the target of the tax. In the face of the price effects of an EDNP-based tax, the food industry would have strong incentives to develop and produce low-cost, energy-dense foods that are nutritious and highly palatable with the low-income market in mind. In the long run, it is likely that such foods would reach the market, and that low-income individuals would habituate to consuming the foods.

Complexities such as heterogeneity, the fact that the poor may rely on energy-dense foods, and the need to distinguish between taxed foods and those exempt from tax, might not be very serious if energy-based taxes were low compared to the current prices of the target foods. But the opposite is almost certainly the case if the energy-based tax is designed either to create implicit insurance premiums covering the medical and social costs of obesity, or to shift eating patterns to achieve public health goals. Although there appear to be no systematic computations of the appropriate level of tax under these two goals, it is possible to engage in very rough estimates that give significant information about the likely magnitudes. Based on the previous discussion, it is assumed that the tax would take the form of a levy on EDNP foods. If shifting eating patterns requires raising the cost per calorie of these foods to the same level as the cost for "healthy" foods, then, at a minimum, the taxes may need to be around five times the current prices of EDNP foods such as cookies, chips, and soda.[292] If the tax is used as an implicit insurance premium, a back-of-the-envelope calculation reveals somewhat lower, but still significant magnitudes.[293] For cookies, chips, and soda, the tax might be between one and two times the current prices of the foods.[294]

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292. *See* Drewnowski, *supra* note 270, at 838S; Drewnowski & Specter, *supra* note 287, at 9. These articles include estimates of cost per calorie for various foods. For example, the cost per calorie of chips and cookies is about one-fifth the corresponding cost for fresh carrots. Similarly, orange juice is about five times more costly than soda per calorie. It is apparent from other data diagramed in the article by Drewnowski and Specter that five times may be an underestimate of the average required multiple. Drewnowski & Specter, *supra* note 287.

293. The calculation proceeds as follows. One begins with the range of 51.5 billion to 78.5 billion for the annual United States medical cost of overweight and obesity reported in Eric A. Finkelstein, Ian C. Fiebelkorn & Guijing Wang, *National Medical Spending Attributable to Overweight and Obesity: How Much, and Who's Paying?*, HEALTH AFFAIRS, May 14, 2003, at W3-223, W3-224. The figures are then adjusted to 2002 dollars using the same factor as in the Finkelstein study, yielding an adjusted range of 60.75 billion to 92.6 billion. Based on evidence that around 27% of energy intake in the United States is from EDNP foods, it is assumed that average daily consumption of such foods is five hundred calories per person. Based on a total population of 290 million, one then finds that the obesity-related cost per calorie of EDNP food ranges from 0.1115 to 0.175 cents. One then uses the calorie per dollar

Other aggregate features of foods aside from energy density have implications for satiety, satiation, and obesity. Two important examples are the glycemic index of foods and the fiber content. Foods with a high glycemic index raise blood sugar more rapidly than those with a low index.[295] Consumption of low glycemic foods consistently results in increased satiety, delayed return of hunger, and decreased food intake.[296] There are significant problems with basing a tax on this index. The glycemic index for a particular food measures the blood sugar response from eating that food *by itself*. The form and method of preparation, as well as the other foods in a meal, may mitigate or accentuate the glycemic impact of any given food.[297] A general tax based on the index would be a blunt instrument for reaching eating patterns of concern.

Fiber is not digestible and reduces energy density. Viscous fibers, however, have additional satiety-inducing properties that are independent of energy density.[298] Unfortunately, there is evidence that the energy-intake impact of fiber depends strongly on gender and body weight status.[299] Although this heterogeneity does not rule out the desirability of a general viscous fiber subsidy, it does reduce the potential welfare gains from such a subsidy.

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figures for cookies, chips, and soda from the literature as a base to express the tax in terms of a multiple of the current price of these foods. *See supra* note 292.

It is important to emphasize that this calculation is extremely crude. Among other things, it attributes all overweight and obesity in the population to EDNP foods and assumes that the present value of the ensuing medical costs is equal to the estimated current year medical cost, which is the quantity computed by Finkelstein. Nonetheless, the calculation does give a glimpse of the likely order-of-magnitude of a tax designed to create implicit insurance premiums covering the medical costs of overweight and obesity arising from consuming EDNP foods. *See also* Eric A. Finkelstein, Ian C. Fiebelkorn & Guijing Wang, *State-level Estimates of Annual Medical Expenditures Attributable to Obesity*, 12 OBESITY RES. 18, 18 (2004) (exhibiting a $75 billion estimate for annual United States medical cost of obesity in 2003 dollars).

294. If the tax were imposed at an earlier stage on items such as sugars and oils, the ratio of tax to current price would be much larger. A similar back-of-the-envelope calculation yields a range of 12 to 18 times the price for oils and 5.5 to 8.4 times the price for sugars.

295. *See supra* note 100 (computing the glycemic index for individual foods).

296. For a good discussion and review of the literature, see Ludwig, *supra* note 100, at 281S.

297. *Id.* at 280S.

298. For a good survey and discussion, see Britt Burton-Freeman, *Dietary Fiber and Energy Regulation*, 130 J. NUTRITION 272S, 273S (2000). It appears that the effect is due to the fact that viscous fibers slow dietary fat absorption, allowing an individual or animal to experience fat-induced satiety for a longer period of time. *Id.*

299. There is biological as well as statistical evidence that women are more sensitive to fiber effects than are men. In addition, fiber has a much larger impact on food intake for those who already are obese. *Id.* at 274S.

Some features that have important behavioral or cognitive implications for obesity involve the presentation of food rather than its content. Three such features of particular importance are: variety, portion size, and restaurant versus home meals. The results for these three features are easy to summarize. Increasing variety *within* any food class—for example, vegetables, or pastries—increases consumption of that class of food. Therefore, increasing the variety of energy-dense foods will tend to increase fatness, while increasing the variety of foods with low energy density will have the opposite tendency.[300] It would be extremely difficult to reach variety as an *independent* factor via general tax instruments. Although a tax based on energy density would promote the consumption of low-energy-density foods, variety-related choices are largely unobservable and therefore would be difficult to tax or subsidize.

Portion size affects energy intake, at least in the short run.[301] A recent study finds that this effect is independent of the impact of energy density.[302] That is, larger portions resulted in more consumption regardless of the energy density of the foods consumed. The existence of an independent effect of portion size suggests imposing a surcharge on large portions. Clearly such a tax would be difficult or impossible to enforce in cases such as home consumption where portion size is largely a matter of consumer choice rather than retail packaging. From both an administrative and a substantive standpoint, the most logical place to impose such a tax might be on prepackaged snack foods and beverages. These foods make up a big part of the EDNP category,[303] and increased energy intake from snacking has coincided with increases in overweight and obesity at the population level.[304]

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300. *See* McCrory et al., *supra* note 272, at 277S–278S; McCrory et al., *supra* note 277, at 3831S. There has been a marked increase in the variety of foods available in the United States, and variety has increased most noticeably for EDNP foods. *Id.*

301. *See* Tanja V.E. Kral, Liane S. Roe & Barbara J. Rolls, *Combined Effects of Energy Density and Portion Size on Energy Intake in Women*, 79 AM. J. CLINICAL NUTRITION 962 (2004); McCrory et al., *supra* note 277, at 3831S–3832S; Barbara J. Rolls et al., *Increasing the Portion Size of a Packaged Snack Increases Energy Intake in Men and Women*, 42 APPETITE 63 (2004). Most of the studies look at the effect of portion size on immediate consumption or on immediate consumption and consumption over the next few meals or days. The fact that the typical portion size of snacks, restaurant items, and grocery items has increased in conjunction with increasing obesity is suggestive, but no study to the author's knowledge has provided strong evidence of a long-term effect.

302. Kral et al., *supra* note 301.

303. Kant, *supra* note 279, at 930.

304. Corinne Marmonier et al., *Snacks Consumed in a Nonhungry State Have Poor Satiating Efficiency: Influence of Snack Composition on Substrate Utilization and Hunger*, 76 AM. J. CLINICAL NUTRITION 518 (2002); Rolls et al., *supra* note 301, at 63–64.

Even here, however, administration would not be easy. First, there is the problem of specifying which foods would be subject to the tax. It would be important not to burden the bulk purchase of healthy foods at bargain prices. Classification problems have derailed junk food taxes in the past.[305] Second, setting up the tax schedule in the face of heterogeneity would involve difficult tradeoffs. The portion size that is small enough to warrant no tax will vary sharply by age and gender. If the tax-free size is too small, some people will be encouraged to buy multiple packages to eat at a single sitting. Although there still may be a damping effect, it is not clear how much of the effect would remain, and there is inefficiency associated with the added packaging costs for these consumers. If the tax-free size is too large, the tax will not affect the eating behavior of important groups such as children.[306] In the face of these administrative difficulties, ex post remedies such as litigation may be more effective than taxes with respect to features such as portion size.[307]

Finally, there is the impact of restaurant consumption and other meals consumed away from home. There is a statistical association between high energy intake, greater body fatness, and eating away from home.[308] United States government data indicates that foods consumed away from home tend to be lower in nutritional value, "being higher in total fat and saturated fat, and lower in fiber and essential micronutrients."[309] What is not clear at present is whether an "eating out" levy in addition to a tax on food attributes would be desirable. First, it is not clear from the statistical and survey data whether eating out is an independent factor for health detriments after controlling for food content. Second, although restaurant and convenience food are currently associated with unhealthful eating, this

305. *See supra* text accompanying note 209.

306. Interestingly, some of the experimental evidence suggests that very young children are not subject to portion-size effects. However, the effects do seem to be present by five years of age. Cara B. Ebbeling, Dorota B. Pawlak & David S. Ludwig, *Childhood Obesity: Public-health Crisis, Common Sense Cure*, 360 LANCET 473, 476 (2002).

307. Perhaps fearing such litigation, some convenience food companies have backed away from "super-size" servings or have cut portion sizes. *See* Barrett, *supra* note 207 (reporting that McDonald's announced the end of super-size meal offerings in early March 2004, "citing the need to simplify its menu"); Gloria Lau, *Food Firms Aim to Boost Image, but May Not Avert Obesity Suits*, INVESTOR'S BUS. DAILY, July 17, 2003 at A01 (detailing Kraft's plans to reduce the portion size for various convenience foods); Parker, *supra* note 32, at 3A (reporting that McDonald's announced its intention to end super-size servings and to add nutritional information to its paper tray liners at restaurants); Karen Robinson-Jacobs, *Lawyers Put Their Weight Behind Obesity Cases*, L.A. TIMES, July, 2, 2003, at A1 (reporting that Kraft announced that it will cut the size of snack foods and that it will end marketing campaigns in schools).

308. McCrory et al., *supra* note 277, at 3832S.

309. *Id.*

result might not hold up in a price/tax environment that disfavored EDNP foods. Because of economies of scale and scope, restaurants and the food industry have advantages over home production in putting together healthy, low-cost fare.

V. CONCLUDING REFLECTIONS

Many factors would make imposing a food tax difficult. At the same time, because of the strong links between diet and health, the stakes are very high. This Article 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 in which food taxes may play a salient role and, if so, which 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 and the public health initiatives may be very worthwhile, 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. Given the high human and economic costs of our current eating culture, these goals are laudable, and I greatly admire the public health professionals who have spearheaded efforts to achieve them. At the same time, it is important to situate the proposals in a broader framework than that of the "public health perspective"—the view that better health is desirable regardless of the costs that must be sacrificed. Otherwise, the proposals will not be either as normatively or as politically appealing as they might be.

Going beyond the public health perspective, there is the classic externality justification for taxation and the newer "internality" rationale, which 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.

Bounded rationality also is a potential motivation for taxation. In the face of constantly changing information and advertising touting certain products, it is difficult and costly for consumers to understand the health effects of individual foods. Imposing a tax equal to the expected health or medical cost of each food would summarize these effects in a price signal. But such a scheme would result in consumers incurring the cost of unhealthful eating twice—the tax plus the costs when they occur—and, in cases where consumers are partially informed, the double-cost problem would be associated with an even larger welfare loss.

The strongest case for food taxes is as an adjunct to health insurance systems. Food taxes set equal to the expected medical cost arising from consuming each item would tend to alleviate ex ante moral hazard, adverse selection, and incomplete-market problems in such systems. Ex ante moral hazard would be reduced or eliminated because individuals who choose unhealthful eating habits would have to cover the expected cost of such behavior in advance. Using the proceeds of the tax to pay the actual medical costs as they arise would mitigate adverse selection tendencies by automatically "risk-adjusting" for a series of disease conditions. One way in which current insurance markets are incomplete is the lack of availability of long-term insurance. Using food taxes as implicit insurance premiums would partially address this problem by building a long-term component into the system. Finally, food 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 in actual insurance systems.

Using food taxes as implicit insurance premiums set at the level of future expected medical cost also would have subsidiary effects on other goals. Some of these effects would be distinctly positive. For instance, such taxes would impound signals in food prices that would help consumers who are confused about the health effects of various foods. The fact that the taxes would fund the associated medical cost removes the double cost problem that would exist if the tax were used for informational purposes alone. In addition, if the taxes increased the price of unhealthful foods,[310]

310. As is clear from the voluminous literature on "tax incidence," a commodity tax may have a wide range of impacts on the price of the taxed good. If the tax is meant to aid in self-control or to achieve public health goals by influencing eating patterns, tax incidence is critical. Unless the tax increases prices, there is no scope to affect eating behavior or to provide incentives for self-control. Even if the tax does increase prices, there is the possibility that eating behavior is not very price-elastic.

they would serve as a "self-control" device for individuals struggling to free themselves from bad dietary habits. Since the taxes would fund an actuarially fair insurance system, they would tend not to harm, and might even benefit, individuals with no demand for a self-control device. As a result, the heterogeneity problems with using food taxes strictly as a self-control device would be greatly reduced or eliminated.

With respect to other aspects, the subsidiary effects would be more ambiguous. For example, the taxes would shift the externality calculus. Costs arising from earlier or more expensive medical care for those with poor eating habits would be covered by taxes paid by those individuals; thus, the costs would no longer be cross-subsidized by others in the insurance system. The impact might well reduce a small net negative externality from risky eating behavior to zero or even transform it into a small positive externality.

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 as a public policy measure. Nonetheless, the insurance-based rationale is very powerful, and it is possible to overestimate the political problems and implementation difficulties in light of the potential gains. One of the gravest political concerns in the United States 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 at least one of three drastic changes: a significant reduction 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

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Recent work suggests that at least this second link in the chain may not be a problem. *See* Simone A. French, *Pricing Effects on Food Choice*, 133 J. NUTRITION 841S (2003) (presenting two separate studies in which prices had a significant effect on vending machine snack choices and secondary school cafeteria choices). For a more general discussion of price effects, see HAWKES & LANG, *supra* note 220, at 7–9.

Tax incidence is much less of a concern if the goal is to create an implicit insurance scheme or to help consumers with their food choices. After tax, the prices would reflect the cost of insurance and the expected medical cost from consuming the particular foods. The fact that supply or demand may shift in response to the tax so that the overall impact on price is not one-to-one does not matter. As long as the final price reflects total social cost, the price will send the correct overall "signal." There is, however, reason to be skeptical about whether prices in most developed countries would meet this criterion even after adding a perfect insurance-based food tax. In these countries, various agricultural subsidy regimes and international trade policies may cause prices to deviate widely from the levels that would exist in a market that was not manipulated.

retirement.[311] Given these unpleasant alternatives, the idea of substantially 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 sectors of the food industry and other interested parties.[312]

Part IV made the point that scientific uncertainty and complexity may be a major obstacle to designing food taxes that make sense, using osteoporosis as a particularly vexing and clear example. 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 may be possible to identify at least some dietary factors that play a strong and fairly clear role.

Whether the goal is public health or the desire to charge implicit ex ante insurance premiums via food taxes, Part IV also indicates that human behavioral and cognitive tendencies may play a big role in tax design. In particular, despite the "fat tax" moniker, a tax scheme aimed at those goals might target properties such as energy density or portion size in addition to, or instead of, components such as saturated fat. Although targeting such properties involves complexity, the gains in tax efficiency may justify the added administrative costs. It might be possible, for example, to have an effective tax based largely on energy density, especially if obesity and its associated costs are the main concern. This approach might be particularly efficacious if it proved administratively feasible to focus the tax on foods that are both energy-dense and nutritionally poor.

It is easy to say a food tax might be desirable to combat moral hazard, adverse selection, or certain behavioral tendencies. It is another task entirely to show how the tax might apply for specific diseases and behaviors or how it might operate in a general system that addresses many diseases and behaviors simultaneously. There is much work to be done to

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311. *See* Victor R. Fuchs, *Medicare Reform: The Larger Picture*, 14 J. ECON. PERSP. 57 (2000) (providing a general discussion of Medicare reform); Saving, *supra* note 154, at 86 (proposing mandatory prepaid accounts for young workers).

312. Social conflict from the "moral hazard externality" due to individuals taking health risks that potentially will be underwritten by others in the same insurance system is already apparent at the micro level. *See* Timothy Aeppel, *Ill Will: Skyrocketing Health Costs Start to Pit Worker vs. Worker—Employees Gripe that Those with Bad Habits Drive Up Insurance Charges for All—Is the Forklift Driver Too Fat?*, WALL ST. J., June 17, 2003, at A1.

A major report supporting a fat tax in New Zealand relies partially on the argument that "making people take some responsibility for their dietary choices" is "a basic principle of fairness." SINNER & DAVIES, *supra* note 23, at 36. *See also id.* at 17.

lay the groundwork for a successful tax approach or to show that there is no such approach. Given the stakes, such work is eminently worthwhile.