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# Food Safety Regulation in the United States

## *An Empirical and Theoretical Examination*

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Consumers in the United States are frequently exposed to news about food poisoning outbreaks. The year 2009 started with a *Salmonella* outbreak caused by contaminated peanut paste (Blaney 2009). The year 2008 featured a *Salmonella* outbreak caused by peppers but initially blamed on tomatoes (Garber 2008b). The memory of three deaths in 2006 from spinach contaminated with the virulent O157:H7 serotype of the bacterium *Escherichia coli* (*E. coli*) is still vivid (Levine 2007). Outbreak news is often accompanied by editorials that advocate larger budgets for food safety regulatory bodies (see, for example, Alliance for a Stronger FDA 2009). It is almost accepted wisdom that food safety regulation is indispensable and that the food safety authorities should do more to guarantee the safety of food sold on the U.S. market.

Before we expand any existing program, however, we need to examine whether that program is working as projected. The constant demand by the news media, politicians, and advocacy groups for greater funding for food safety agencies suggests that previous budget increases for these agencies have not produced the expected safety improvement. In this article, I first present the result of an empirical

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examination of the effectiveness of major food safety regulations in the United States, which shows that the effects of these regulations were not discernible in the food-borne-illness outbreak statistics collected by the Centers for Disease Control and Prevention (CDC). If government programs for food safety have not reduced food-borne illnesses, we need to doubt the accepted wisdom and ask the fundamental question: Is government intervention in the food market appropriate in the first place? I then examine the theoretical justification for food safety regulation and demonstrate that the theory is fundamentally flawed. I explain how the commonly used cost-benefit analysis rests on flawed methods and thus can always create the appearance of market failure and justify further government intervention in the food market.

### **Empirical Testing of Major Food Safety Regulations**

The U.S. government maintains a complex patchwork of food safety bureaucracies that have multiplied over the past century. The activities these bureaucracies undertake may be divided into regulation of plant/factory sanitation, product inspection, restaurant inspection, consumer education, and compilation of disease outbreak statistics. These activities are shared by regulators at the federal, state, and local levels. In the federal government, fifteen agencies have legal mandates to provide food safety, with the Food and Drug Administration (FDA), the U.S. Department of Agriculture (USDA), and the CDC playing major roles (Walker 2007). The FDA and the USDA inspect domestic and imported food products as well as food-processing plants. The USDA inspects meat, poultry, eggs, and the processing plants for these products, and the FDA inspects the rest of foodstuffs and their plants (U.S. General Accounting Office [GAO] 1998, 2). Both federal and state agencies issue consumer advisories (Institute of Medicine 2007, 21–24). Restaurant inspection is usually carried out by local, county, or state health department personnel (Jones et al. 2004). The CDC compiles food-borne-disease outbreak statistics in cooperation with state governments, which also inspect food products and food-processing plants in their jurisdictions (Institute of Medicine 1991, 302–3).

The federal food safety mechanism has been criticized for its complex mandatory sharing and overlapping of activities among various agencies (see, for example, National Research Council 1998; Robinson 2005; “Import Alert” 2007; Trust for America’s Health 2008). These criticisms, however, typically look at organizational arrangements, mandates, regulatory methodology, staff levels, and inspection efforts and do not examine whether the regulations are actually reducing food-borne illnesses. Their approach is analogous to evaluating the effect of policing on crime reduction by looking only at the levels of police activity. Here we look into the effect of regulatory activities on the food-borne-disease outbreak statistics collected by the CDC.

The CDC statistics include outbreaks but not isolated single cases, so they underestimate the true food-borne-disease burden in the United States. However, the CDC defines an outbreak as “the occurrence of two or more cases of a similar

illness resulting from the ingestion of a common food” (CDC 2000). This definition makes the statistics comprehensive enough to be “the basis for public health action” (CDC 2000). Moreover, outbreaks are what attracts media attention and galvanizes agencies into action. For example, after an *E. coli* O157:H7-contaminated hamburger outbreak in 1993 that killed four children, both the FDA and the USDA introduced several new regulations (Golan et al. 2004, 10). In addition, a CDC estimate of the total food-borne-disease burden based on these outbreak statistics (Mead et al. 1999) has been widely cited as evidence of the significance of food-borne illnesses (see, for example, Golan et al. 2004, 2; Shute 2007). Furthermore, the FDA and the USDA use the CDC outbreak statistics when they estimate the benefits of proposed regulations (Williams and Zorn 1993; Crutchfield et al. 1997). Therefore, it is appropriate to use the CDC outbreak statistics to examine the effectiveness of food safety regulations.

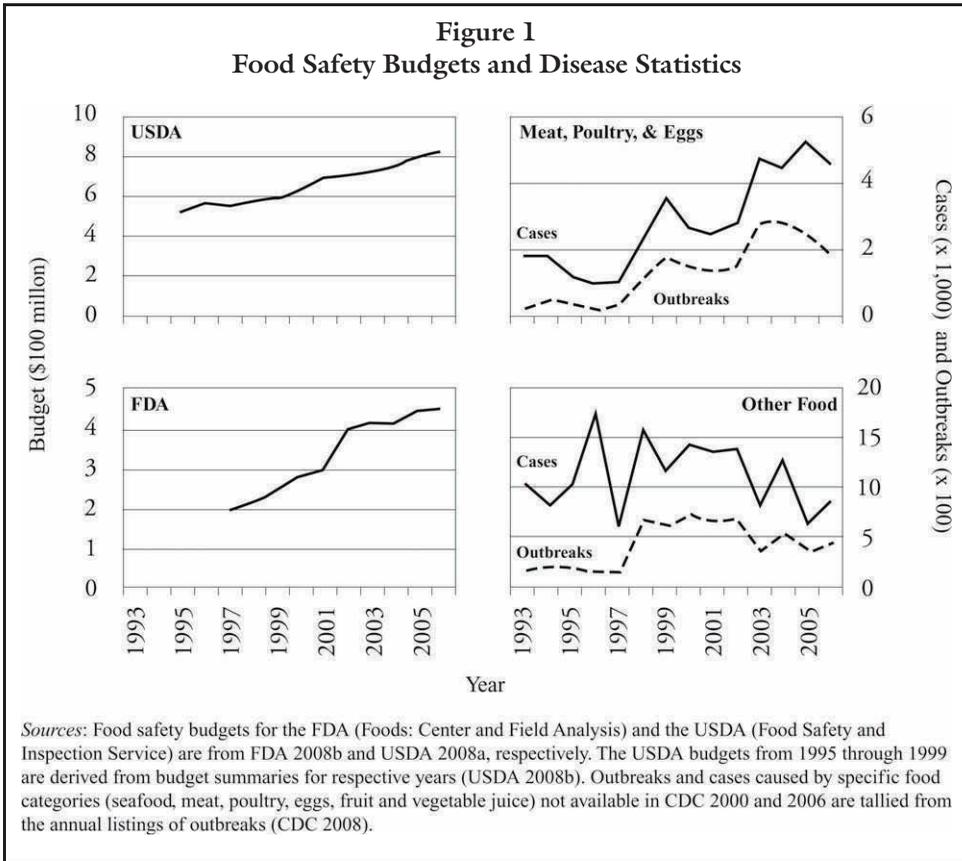
### *Overall Performance of FDA and USDA Food Safety Activities*

In the following subsections, I examine the performance of the four major food safety regulations: plant sanitary regulation, food-product inspection, restaurant inspection, and consumer education. Before going into these specific activities, I compare the recent budget increases given to the FDA and the USDA for their food safety activities and the U.S. food-borne-outbreak statistics collected by the CDC (figure 1).

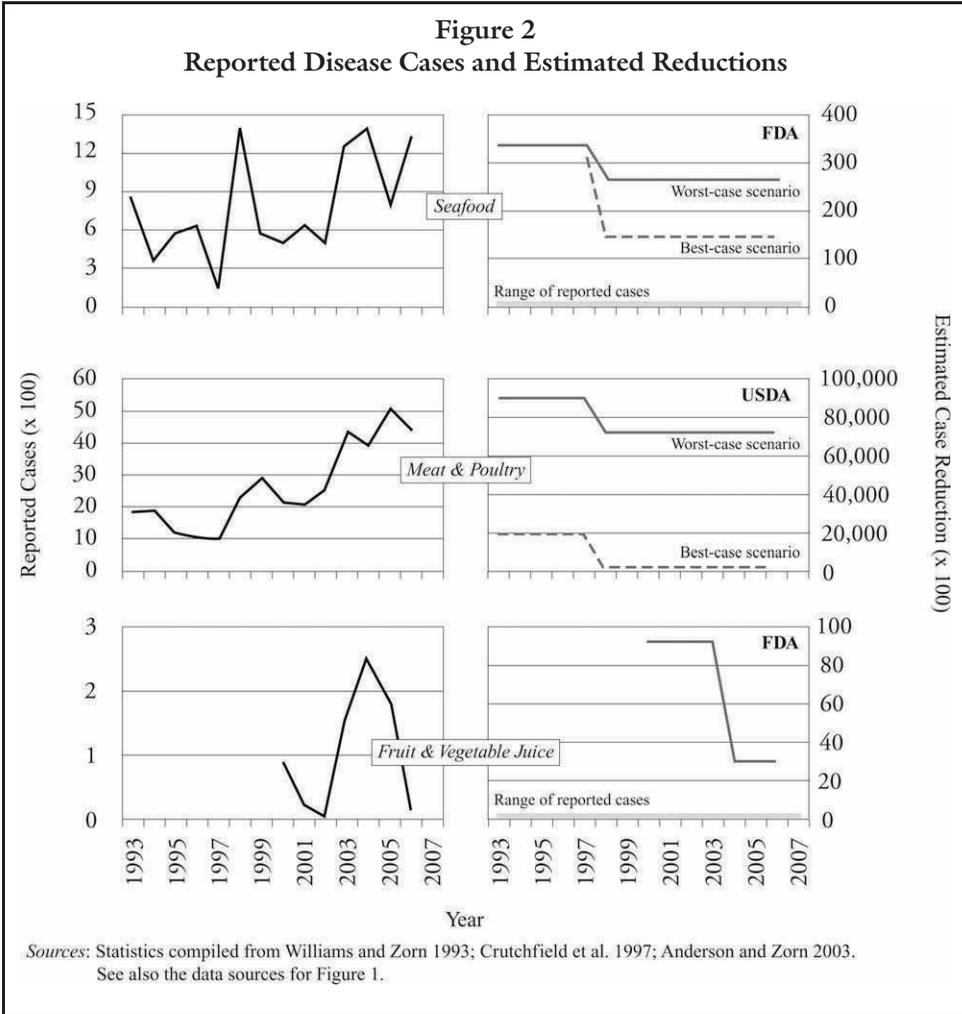
Food safety budgets for the FDA have increased steadily over the past decade even as the numbers of outbreaks and cases caused by the foodstuffs for which the FDA is responsible (that is, all foodstuffs except meat, poultry, and eggs) fluctuated wildly (CDC 2000, 2006, 2008; FDA 2008b). No correlation is recognizable between the FDA budgets and the disease statistics. The food safety budgets for the USDA also increased, but the outbreaks and cases caused by meat, poultry, and eggs showed increasing trends with wild fluctuations (CDC 2000, 2006, 2008; USDA 2008a, 2008b). Other potentially relevant factors—such as the decline in the dollar’s purchasing power, population growth, and food-consumption pattern shifts—were much less dramatic than changes in disease statistics, and they cannot explain the wild fluctuations in outbreak statistics. This analysis suggests a lack of a causal relationship between the recent FDA and USDA funding levels and the fluctuations in food-borne-disease statistics. One therefore must doubt the effectiveness of the FDA’s and USDA’s overall food safety regulations.

### *Sanitary Regulation of Food-Processing Plants*

Both the FDA and the USDA have been promoting Hazard Analysis Critical Control Point (HACCP) as a major improvement to their century-old food safety programs (Crutchfield et al. 1997, 7; Kvenberg et al. 2000). HACCP requires food processors



to identify potential sources of pathogen contamination and establish procedures to prevent contamination (Crutchfield et al. 1997, i). Mandatory HACCP requirements have been imposed on seafood (1997), meat and poultry (1997), and fruit and vegetable juice (2003) processors (FDA 1996, 2001b; Kvenberg et al. 2000). The FDA and the USDA carried out cost-benefit analyses of the HACCP requirements for these three categories of food processors before their implementation (Williams and Zorn 1993; Crutchfield et al. 1997; Anderson and Zorn 2003). These analyses projected great reductions in the numbers of disease cases in their benefit estimation. Figure 2 shows what happened to the CDC disease statistics after the implementation of these requirements and compares the agency projections plotted in the respective years of their implementation. Note that the scale for the reported actual cases (*left column*) is much smaller than that of the agency-estimated cases before and after the implementation (*right column*). When placed on the scale of the agency-estimated cases, the fluctuation ranges of the reported disease cases become unrecognizable (*right column*). Both the FDA and the USDA inflated reported statistics to compensate for unreported disease cases. (This practice of inflation raises a theoretical problem that I discuss later.) What is clear from figure 2 is that the agency projections do



not match the wild fluctuations in the reported cases caused by these food categories. We cannot conclude from the reported cases that the HACCP requirements have reduced disease incidence.

Mandatory milk pasteurization is a plant sanitary regulation that has attracted media attention lately because some people enthusiastically seek unpasteurized milk (Garber 2008a), which has been banned from interstate commerce since 1987 (Headrick et al. 1998). Twenty-two states ban the sale of unpasteurized milk, whereas the other twenty-eight states allow its sale within their territories (“What’s Happening with Real Milk?” 2008). The question here is not whether pasteurization reduces pathogenic bacteria in milk, but whether banning the sale of unpasteurized milk reduces disease incidence when more than 99 percent of milk sold in the United States was already pasteurized in 1995 (Headrick et al. 1998) and some people eagerly consume unpasteurized milk. Thirteen outbreaks with 245 cases occurred in

the twenty-two prohibition states in the five years from 2002 through 2006, whereas seventeen outbreaks with 248 cases were reported during the same period from the twenty-eight nonprohibition states (CDC 2008). Consumption data on illegal unpasteurized milk are unfortunately not available, and the prohibition states as a whole account for only 36 percent of the U.S. population (Berry and Mackun 2001). Given the small outbreak numbers, which can be affected by chance, notwithstanding the large population difference, it is difficult to conclude that banning the sale of unpasteurized milk is effective in reducing disease incidence.

### *Product Inspection*

In addition to plant regulation, product inspection is regarded as a major defense against tainted food, especially because of a strong concern over the safety of imported food (U.S. GAO 1998; Associated Press 2007; “Import Alert” 2007; Shute 2007; Zhang 2007). The regulatory detection of contaminated food of foreign origin depends largely on the FDA’s physical and laboratory product inspection at seaports, airports, and crossing points at national borders (U.S. GAO 1998, 15–17).

For the past decade, the FDA’s “port-of-entry” inspection rate has been stable at approximately 1 percent of total import shipments, and this rate has been highlighted as evidence of the inadequately low funding levels for the FDA (Associated Press 2007; Shute 2007; Zhang 2007). Even though this 1 percent rate of inspection casts a doubt about the effectiveness of the FDA’s border inspection, this rate itself does not prove the inspection to be a failure. As the FDA insists, targeting only high-risk products for inspection through preinspection screening *might* be an effective strategy to reduce health hazards from imported food (U.S. GAO 2001, 50).

We need to ask whether the FDA’s border inspection has produced a difference in disease statistics. Before it stabilized at approximately 1 percent, the FDA’s border-inspection rate declined from 8 percent in 1992 to 1.7 percent in 1997 (U.S. GAO 1998, 25). The share of imported food (by volume) gradually increased from 12 percent to 15 percent between 1990 and 2005 (Jerardo 2008). If the concern over the health risks posed by imported food is justified and the FDA’s border control of imported food is truly “necessary to safeguard the food we eat” (FDA 2008a), this dramatic decline in the inspection rate might have produced a significant increase in food-borne-disease statistics. However, the food-borne-disease statistics have been steady during the period, with 411 outbreaks and 11,083 cases in 1992 and 504 outbreaks and 11,940 cases in 1997 (CDC 2000, 2008).<sup>1</sup> The decline in FDA’s border-inspection rate had no discernible effect on the total food-borne-disease burden. This finding suggests that a funding increase that boosts the FDA’s inspection

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1. Time-series analysis over this period could not be conducted because the FDA does not publicize the data on its border inspection (“Import Alert” 2007, 16; Buzby, Unnevehr, and Roberts 2008, 6).

capacity from the current 1 percent level to, say, an 8 percent level would not produce a significant effect.

### *Restaurant Inspection*

Restaurants in the United States are inspected periodically by local health authorities on a fee-for-service basis, so a great amount of resources is devoted to such inspections. Little is known, however, about their effectiveness (Jones et al. 2004).

Disease statistics are not collected separately or disaggregated by local jurisdiction. There are no data regarding the strictness of restaurant sanitary standards and their enforcement among different jurisdictions. Restaurant inspection, therefore, defies the use of CDC disease statistics for testing its effectiveness. A few studies have looked into inspection results of restaurants and patrons' subsequent complaints of food poisoning (Cruz, Katz, and Suarez 2001; Jones et al. 2004; Hedberg et al. 2006). These studies have failed to show that restaurants with poor inspection scores cause more food poisoning complaints than restaurants with better inspection scores.

Regulators themselves seem to concede the ineffectiveness of mandatory restaurant inspection. The Massachusetts state auditor looked into the state's restaurant-inspection activities and found lower staff levels, lower training levels among inspectors, and less inspection frequency, among other things, than those specified by relevant regulations (DeNucci 2007). An official at the Massachusetts Department of Public Health defended the department's current practice by stating that the numbers of complaints about food-borne illnesses had gone down over the three years before the audit (Daniel 2007).

### *Consumer Education*

Within the regulatory toolset for consumer education, advertisement restrictions and food labels have been criticized for their lack of positive results (see, for example, Hawkes 2004 and Zhang 2005). Here I focus on a consumer advisory the FDA issued in 2001.

The FDA has set a regulatory limit of methylmercury in food at one part per million (Institute of Medicine 1991, 288–92). However, reports have claimed that the greater part of certain species of finfish sold in the United States does not meet the limit, and the agency's ability to enforce the limit has been questioned (“Fair Warning” 2005; Burros 2008). The FDA turned to a consumer advisory to warn consumers against methylmercury in seafood (FDA 2001a).

However, the FDA's 2001 methylmercury advisory has caused a controversy over whether it has produced net social benefits or not.<sup>2</sup> Pregnant women were the

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2. Harvard University's Department of Environmental Health and the Harvard National Institute of Environmental Health Sciences Center for Environmental Health organized a symposium on the topic titled “Contaminants in Seafood: How Fishy Are the Facts?” on February 2, 2006.

advisory's major target group, and they lowered their consumption of seafood and reduced the risk of methylmercury poisoning. However, consumers at risk of cardiovascular diseases, who might have benefited by consuming seafood, have also reduced their consumption of seafood because of the advisory and hence increased this risk (Okun et al. 2003; Cohen et al. 2005; Konig et al. 2005). The controversy about the advisory's effectiveness remains inconclusive among public-health experts (Institute of Medicine 2007, 232–33). The FDA's methylmercury advisory therefore is not clearly a success story.

So far I have empirically examined the major categories of food safety regulations in the United States and found that none of the examined regulations has unequivocally reduced food-borne-disease incidence. In addition, reduction of disease cases alone is insufficient to justify a government regulation. Any regulation requires resources for its implementation, and a regulation's benefit associated with reduction in disease must surpass its cost. Furthermore, as I show later in detail, these resources should have come from the resources people were willing to sacrifice to avoid food-borne health hazards when the regulation was introduced. The last criterion is unfortunately ignored in the evaluation of food safety regulations.<sup>3</sup>

Some might say that the previous list of regulations examined is not exhaustive or that other regulations might have succeeded or that evidence of positive effects of regulations might be found if we looked harder. Some might insist further that the current poorly performing regulations can be reformed into effective ones. The problem is that little attention has been paid to food safety regulation's real effects, and greater budgets have been demanded on the assumption that government's regulatory activities are effective at preventing food-borne diseases. The foregoing empirical examination, however, casts strong doubt on the current regulations' effectiveness.

Although my empirical examination alone cannot clinch the argument regarding the effectiveness of the government's intervention, an examination of the economic theory used to justify food safety regulation, to which I now turn, shows that the theory has no grounds and, further, that the analytical method based on the theory violates the foundation of that theory itself.

## Theoretical Justification of Food Safety Regulation

Policymakers often introduce government regulations hastily without careful examination of their likely consequences. For these regulations to be continuously enforced, they need to be regularly rejustified because their expense might otherwise go to support other ongoing governmental activities. Existing regulations are usually justified by some economic theory, and this theory thereafter justifies their

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3. In the historical evaluations of related regulations in Law 2006 and Hansen and Law 2006, the authors do not consider consumer demand. More on this issue follow later in my text.

continuation and expansion. The *economic* justification of government intervention usually rests on a claim of *market failure* (Cowen and Crampton 2002), and food safety regulation is no exception. In the following subsections, I examine the economic theory that supports the claim that the market fails in the food safety market and that government can remedy this failure.

### *Theory of Imperfect Information about Food Safety*

The prominent market-failure theory for food safety regulation is the argument that consumers lack perfect information on the safety of food they buy, and as a result their current demand for food safety is lower than it might otherwise be. Consider statements made by some of this theory's major advocates. For example, John Antle writes:

[T]he simple textbook theory of consumer demand is based on the assumption that consumers have perfect information about all products on the market. Yet many food product markets are characterized by imperfect information. . . . [T]he theory requires that consumers know how product characteristics affect their health and well-being. Yet we know that some consumers may not be well informed about the relationship between product attributes and food safety. . . . [A]ll attributes relevant to the value of the product are not known. (1995, 40–41)

Along similar lines, Julie Caswell and Eliza Mojdzuska state: “The level of safety supplied by the market interaction of demand and supply reflects a level of risk which is acceptable, not necessarily zero. Under perfect market conditions, these curves interact at a particular market clearing price providing the optimal level of food safety. The above scenario assumes that all market participants are fully informed about the nature of the product. . . . We know, however, that the market for food quality is not perfect” (1996). Stephen Crutchfield and his coworkers write:

In an ideal world, consumers would make consumption decisions with full information about product attributes, and so choose the foods that maximize their well being. In the real world, however, there are numerous food safety information problems, which complicate the consumer's decision making. . . . The lack of consumers' food safety information and the lack of producers' incentives to provide such information lead to a market failure. The working of a non-regulated market may yield greater-than-optimal levels of pathogens in the food supply and excessive human-health risk, which could result in higher levels of illness and mortality from foodborne pathogens. In such a case, the public welfare could be enhanced if society

regulated the food-processing industry to reduce the level of foodborne pathogens and increased consumers' knowledge, so they could take action to reduce their risk of exposure to foodborne illness. (1997, 1–2)

That the names “John Antle,” “Julie Caswell,” and “Jean Buzby” (the second author of Crutchfield et al. 1997) appear as the top three key authors when I carried out a search on Google<sup>TM</sup> Scholar using *food safety* and *policy* as key words indicates the prominence of this argument for food safety regulation.<sup>4</sup> In the following two paragraphs, I first present the theoretical framework for this argument in order to show its inconsistency in the authors' own terms. Simply put, these imperfect-information theorists find fault with the real market of food safety by contrasting it against their ideal interpretation of the market. A graphic depiction is useful to clarify their characterization of the real market and the meaning of their ideal market.

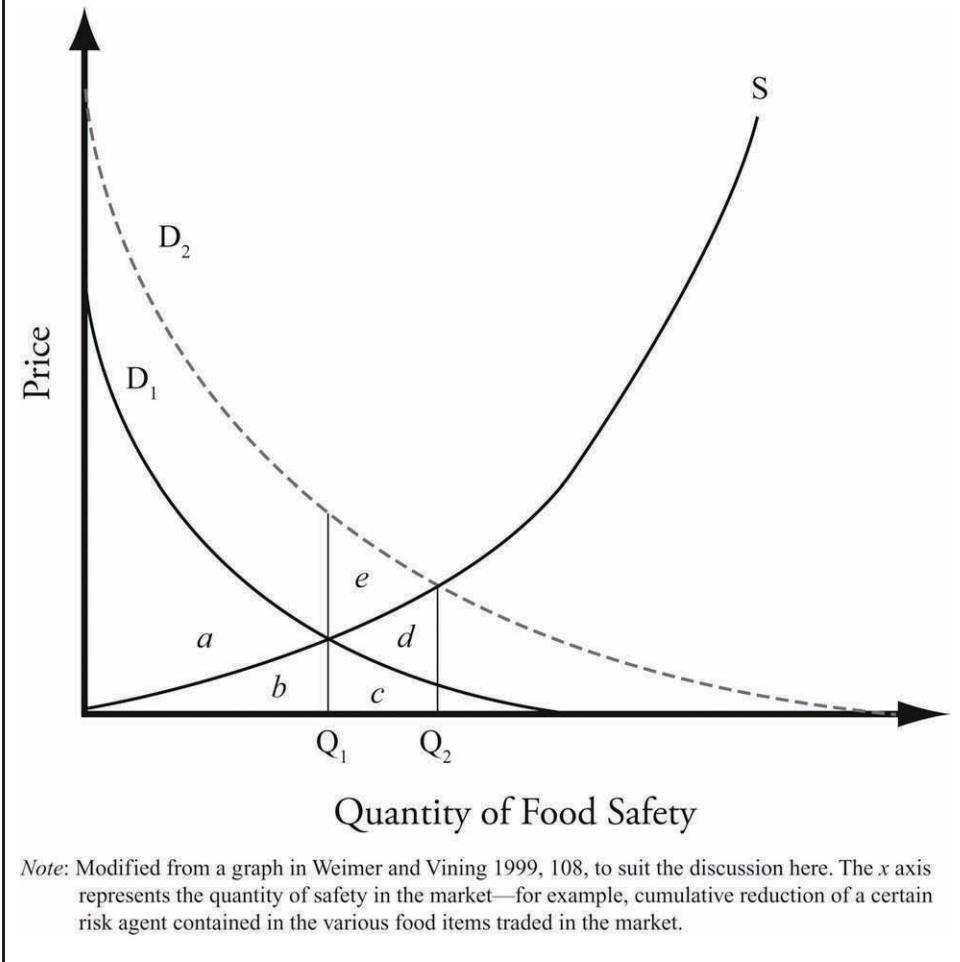
Figure 3 shows the supply-and-demand relationship in the food safety market, with the  $x$  and  $y$  axes representing the quantity of food safety and the price of food safety, respectively. The supply ( $S$ ) and demand ( $D_1$ ) curves represent the supply and demand schedules. At the intersection between  $S$  and  $D_1$ , the market achieves the quantity of food safety  $Q_1$ . This quantity is treated by food safety authors' “textbook” theory as economically efficient because at this quantity the net social benefit (area  $a$ )—that is, consumer valuation of food safety (area  $a + b$ ) minus suppliers' sacrifice, or the costs of producing food safety (area  $b$ )—is maximized. As Caswell and Mojdzuska point out, this economically efficient quantity does not eliminate all health hazards. Provision of food safety greater than the intersection quantity  $Q_1$  forces suppliers to sacrifice more than consumers are willing to compensate them.

The authors I have quoted casually state that they *know* that the demand curve is suppressed lower than what consumers are really willing to pay for food safety. In other words, they claim that the demand curve  $D_1$  in figure 3 is not the real one and that the higher demand curve  $D_2$  represents consumers' real demand schedule, which would materialize if consumers had access to perfect information on the safety of food products when they make purchasing decisions. According to this theory, consumers are now constrained by imperfect information to enjoy only the current safety quantity ( $Q_1$ ), which is less than the quantity  $Q_2$  at the intersection between their “real” demand curve  $D_2$  and the supply curve  $S$ . In order to correct this inefficiency, the argument maintains, the government should regulate the market to bring the safety quantity up from  $Q_1$  to  $Q_2$ . The foregoing account briefly describes the market-failure rationale based on imperfect information. Let us now examine this rationale more closely.

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4. I carried out this Google<sup>TM</sup> Scholar search on June 30, 2008.

**Figure 3**  
**Graphic Description of “Imperfect Information”**



### *Fallacy of the Theory of Imperfect Information*

In the preceding citations, the imperfect-information theorists assume as a matter of fact the existence of market failure. However, careful reasoning and real-world observation reveal that this assumption is false. The fact that society continues to experience some food-borne illnesses gives plausibility to the assumption that the food market is not producing an efficient level of safety. However, safety information is a commodity whose production and distribution require resources. Color and smell are examples of inexpensive safety information, whereas other sorts of information, such as gluten-free labels, involve resource consumption. In the real world of limited resources, perfect supply of safety information is unrealizable. When applied to the supply of and demand for food safety information, even the imperfect-information

theorists' scenario predicts that the market supply of such information settles at an imperfect point. "Perfect" provision of safety information is a nebulous criterion by which to judge the market's performance because nothing in this world is perfect, and, for this reason, use of the word *perfect* implies the user's a priori acceptance of market failure.

In fact, the assumption of perfect information is not necessary for the market to work *toward* the intersection of the supply curve and the demand curve. The real market is dynamic and is constantly moving toward the intersection as participants learn about others' expectations and modify their own expectations through successive market interactions (Hayek 1948, 50–55). This constant drive toward the intersection of the curves qualifies the market as a mechanism that leads society toward efficiency. The supply-and-demand diagram in figure 3 is a useful aid to understand the direction of this dynamism. Whether the real market ever reaches the intersection in this pedagogical diagram has no relationship with the workings of the real market. The condition that all participants know others' expectations perfectly *before* they enter the market—an unrealistic assumption in the real world—should not be used as a benchmark against which we judge the real market (Hayek 1948, 100).

The citations given earlier also imply that these imperfect-information theorists are concerned about types of information that are unattainable at this time in human history. Currently nonexistent information, even if highly desired by public-health experts, is irrelevant to the question of whether the current market is moving toward *its* efficient level of food safety supply. Many health risks posed by various bacterial and viral pathogens or by industrial and natural chemicals contained in food are currently unknown to humanity. Consumers cannot take into account what they are unaware of, and the nonavailability of nonexistent information has nothing to do with real demand.

In addition, various types of knowledge are unevenly distributed in society as a result of the division of knowledge-producing labor (Hayek 1948, 50). Medical knowledge concentrated in that profession needs to be processed into information products, such as labels, to make an impact on individual consumers' behavior in the market. A few grocery store chains introduced "healthful products" with easy-to-distinguish visual symbols (Shulman 2008). This effort is an attempt to commoditize general nutritional and safety knowledge into information products relevant to consumers at their purchasing points. Such commoditization of medical knowledge requires resources. Perfect dissemination of products' safety information, an impossibility to achieve, cannot be used as a criterion to judge the real market.

Furthermore, contrary to the lack of suppliers' incentives assumed in the market-failure model, we may expect the profit motive to drive suppliers to respond to unfulfilled consumer demand. When suppliers detect profit opportunities, they will invest in particular equipment to measure particular chemicals or pathogens in their particular products. A specific invention of this type is not general information, and

their competitors will not immediately imitate it. For example, innovative meat processors know that their competitors need some time to catch up and that during this period they can collect returns on their initial technological investment (Golan et al. 2004, iv–v). Basic safety information embedded in specific products with brand names and labels can exclude use of such new information by those who do not purchase it. A consumer who pays a premium for a certain safety label attached to a particular food item can consume *that* safety exclusively because the label is relevant only to that specific item. A generic and open-access resource, such as medical and nutritional knowledge, is appropriated when the gains of appropriation become larger than the costs of appropriation (Demsetz 1967). Product-tracking technology, epitomized by the bar code, whose development was spearheaded by the U.S. grocery industry (Brown 1997), has reduced the cost of selectively passing on safety-related product backgrounds to a final product that incorporates various ingredients with different backgrounds. Together with the recent increase in consumers' willingness to pay for food safety, these technological developments have enabled food suppliers to process relevant product backgrounds into information commodities. Safety-related labels, such as *gluten free* and *peanut free*, were not offered in the market until recently. Appropriation of generic safety information is taking place as market and technological conditions change.

It is claimed that sellers, who generally possess more information on their products than buyers, often withhold that information from potential buyers, and as a result that information is not available to such buyers when they make their purchases (Akerlof 1970). A real-life example, however, challenges this notion of “information asymmetry.” Fish and shellfish that are both caught and eaten by the same person pose more health risks than commercially sold seafood. Although recreational fishers tend to ignore warnings about hazardous chemicals in certain waters, commercial fishers voluntarily avoid such contaminated areas. Also, in handling the catch, commercial fishers pay greater attention to sanitation than do recreational fishers (Institute of Medicine 1991, 28, 245, 92, 330).

Private firms have developed their own brands to distinguish their products from their competitors' products on the market (“China's Toxic Toymaker” 2007), and this development alleviates the problem of information asymmetry. Large companies with brand names are keen to maintain their products' safety because once their brands are tarnished by a food-borne-disease outbreak, losses from drops in sales and share prices may be immense (Libecap 1992). Jack in the Box, a hamburger chain, lost \$160 million in reduced sales and legal fees after four children died from eating hamburgers it sold that were contaminated with *E. coli* O157:H7 in 1993 (Golan et al. 2004, 10). After that outbreak, big-brand hamburger chains, such as McDonald's, Burger King, Wendy's, and Jack in the Box, with combined retail sales totaling \$60 billion annually (Technomic 2009), heavily influenced the safety practices of the meat-processing industry by imposing their own strict safety standards on their suppliers (Golan et al. 2004, iv).

Riskier products from China tend to be found in discount stores in the United States (Bogdanich 2007). Sales of organic foods in the United States had been growing rapidly until price spikes in gasoline and groceries, combined with the onset of the recession that began late in 2007, ameliorated this trend somewhat (Naughton 2008; “Organic Food Sales Slow” 2009). The current supply of both safety and safety information reflects consumers’ trade-offs between safety and other goods and services.

The authors cited earlier point to market failure to justify government intervention in the food market. They state that a nonfailing market achieves economic efficiency. Yet in the foregoing paragraphs we have seen the fallacious nature of their a priori assumption of market failure. If we stick to their logic, we must accept that no matter how much food safety is currently supplied, the market is moving toward efficiency in the currently prevailing circumstances. Also, “economic efficiency” is defined as the condition that wholly voluntary exchange of goods and services among individuals brings about, and the economic term *market* includes this process toward efficiency. As we have seen, a food safety market exists, and people engage in voluntary transactions in food safety.<sup>5</sup> As a matter of logic, we must accept the market result as efficient unless a market failure is proven. The mere assumption examined earlier does not constitute a proof. I turn my attention next to the alleged proof of market failure and reveal its methodological inconsistency.

### *Difficulties with Cost-Benefit Analysis*

The advocates of food safety regulation have attempted to prove both the existence of market failure and government’s ability to correct the failure through cost-benefit analysis. Here I examine methodological issues related to cost-benefit analysis to show that the cost-benefit analysis methods used to justify regulations violate the concept of consumer demand, which is an essential element in the argument presented by the authors cited earlier.

Regulations not only require compliance costs, which push up the supply curve in figure 3 and bring the quantity of safety lower than  $Q_2$ , but also impose taxes and higher product prices on consumers. A government regulation forces all consumers to give up some of their resources, which they would have used for other purposes, such as housing, education, and saving. Such purposes might include spending more money on food safety of particular types, and this consumer spending spurs suppliers to invest in specific research to capture such spending. The consumer demand for food safety represents the result of numerous trade-offs consumers make between food safety and other goods and services. Regulatory food safety “benefits” in excess of consumer demand is regarded as *inefficient* according to the market failure

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5. Exploring the market mechanisms for providing food safety is not my purpose in this article. On this matter, see, for example, Klein and Leffler 1981; Klein 1998, 2002.

rationale presented with figure 3. The rationale stipulates that any food safety regulation is justified if and only if it satisfies consumers' food safety demand, which has not materialized under current market conditions. As I discuss further, this requirement is breached in cost-benefit analyses used to justify regulations for food safety.

Before examining the issues related to cost-benefit analysis, I first need to put cost-benefit analysis in the theoretical framework of market failure presented with figure 3 because I intend to reveal its inconsistency in its own framework. As shown in figure 3, the net benefits are maximal when the market is at the intersection of the demand and supply curves. Therefore, if a government intervention intended to raise the safety quantity from  $Q_1$  to  $Q_2$  produces positive net benefits ( $e$ )—that is, the total benefits ( $c + d + e$ ) minus the total costs ( $c + d$ )—advocates of regulation regard the intervention as moving the market from the current inefficient point to the ideal and efficient situation. Because supply and demand curves are invisible in reality, regulators use this comparison of total benefits and costs to prove both market inefficiency and the regulatory ability to correct such market inefficiency.<sup>6</sup>

Let us now examine the use of cost-benefit analysis in the real world. In reality, there are insurmountable obstacles to measuring consumer demand. When demand is regarded as suppressed by market failure, it cannot be measured by observing market transactions. Regulators may instead ask consumers, through questionnaires and interviews, how much money they would pay for a certain quantity of food safety. The problem with this method, though, is that consumers do not act in real life as they tell pollsters they would act. Consumer demand is by definition expressed in consumers' real purchasing actions when they make choices among various goods and services. If consumers were not constrained by their incomes and did not face trade-offs, they would desire to acquire limitless amounts of various goods and services. However, it is virtually impossible to create an experimental environment in which survey participants face real-life choices with their own money to spend.

We also need to distinguish public-sector and private-sector market research. A private company must withdraw its new products when sales are not as great as research predicted. A new business takes off because consumers demand its products. When a private industry's innovation reduces the cost of producing a certain product, we can automatically assume that consumers benefit from the cost reduction because they ultimately pay for the innovation. Conversely, a regulation does not give consumers the choice not to pay for the costs the regulation imposes. Once a regulation is introduced, it is difficult to adjust it to changing consumer demand. With coercive taxing power, government can continue to produce goods and services that consumers do not truly demand. A market failure can be corrected only when the "market-failed" demand, in terms of its quantity and quality, is restored by regulation. An overcorrection of the failure by regulation results in inefficiency. It is therefore

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6. Precisely speaking, proving government's capacity for corrective intervention does not constitute a proof of market failure because it does not eliminate the possibility of the market's self-correction.

necessary to measure market-failed consumer demand for particular regulations, and measured demand needs to be genuine.

To make matters more difficult, if not impossible, demand is in constant flux, reflecting changes in consumers' preferences, health conditions, and financial situations. It takes time to design a survey, collect and analyze data, and formulate a regulation. Consumer demand may not be the same when the regulation is finally implemented. Once introduced, regulations are slow to respond to changes in demand. The slowed sales of organic food mentioned previously suggest a downward shift in consumer demand for perceived food safety when the economy entered a recessionary period in 2007. However, regulators have made no attempt to adjust existing food regulations to this decline in demand.

### *Misuse of Disease Statistics in Demand Estimation*

In place of suppressed demand measurements, the total monetary estimate of food-borne-disease damages is commonly used to measure consumers' willingness to pay to avoid food-borne health risks. Total cases of a disease are multiplied by the sum of medical costs and lost production per case to calculate the disease's monetary damage to society. As people consume more food safety, their marginal demand for it should diminish. However, the per case data used to calculate total health damages are uniform over different safety levels (that is, along the  $x$  axis in figure 3) and have no relationship with consumers' willingness to pay to avoid food-borne illnesses. Another problem is that the willingness to pay to avoid a food-borne risk *before* the consumption of food is conceptually different from the willingness to pay to receive medical treatment *after* experiencing food poisoning. People suffer from food poisoning even at the efficient safety level. Treating this remaining disease incidence as unfulfilled demand for food safety *always* creates a facade of market failure.

In addition, not all patients who suffer food poisoning, with only diarrhea as a symptom, seek medical attention. As a result, the number of food poisoning cases reported to health authorities is less than the actual number of people who have suffered food poisoning. A problem arises when the reported incidence is adjusted for this "underreporting" *and* this inflated number is used to estimate consumer demand for food safety. In reality, when people suffer from food poisoning, they make a decision as to whether they should seek medical attention based on their personal situations, such as the severity of their symptoms and how much money and time they would lose by seeing a doctor. Patients who have decided not to seek treatment are *not* willing to pay for treatment. Inflated disease statistics adjusted for underreporting thus exaggerate even the consumer demand for medical treatment for food poisoning.

Both the FDA and the USDA used disease statistics in their cost-benefit analyses presented in figure 2. The FDA's analysis used arbitrary "inflation factors" to estimate the total disease burden from reported cases (Williams and Zorn 1993, 34). The USDA's analysis does not show scientific bases for its estimated shares of food-borne

cases within the total disease burden (Buzby and Roberts 1996) or for its estimated shares of meat- and poultry-caused cases within the total food-borne cases (Crutchfield et al. 1997, 11). It is, therefore, not surprising to see in figure 2 the disproportionately higher “before-the-regulation” estimates of disease cases relative to the reported number. With this practice of inflation, the agencies can produce large benefit estimates, which are represented by the height differences between their estimates of before- and after-the-regulation disease cases in figure 2. Large estimates of benefits in turn allow the agencies to set wide ranges for their proposed programs’ disease-reduction rates—for example, 20–90 percent—and still come up with positive net benefits (Williams and Zorn 1993, 36; Crutchfield et al. 1997, 9). These analyses cannot be treated as a proof either of market failure or of regulations’ ability to correct the failure.

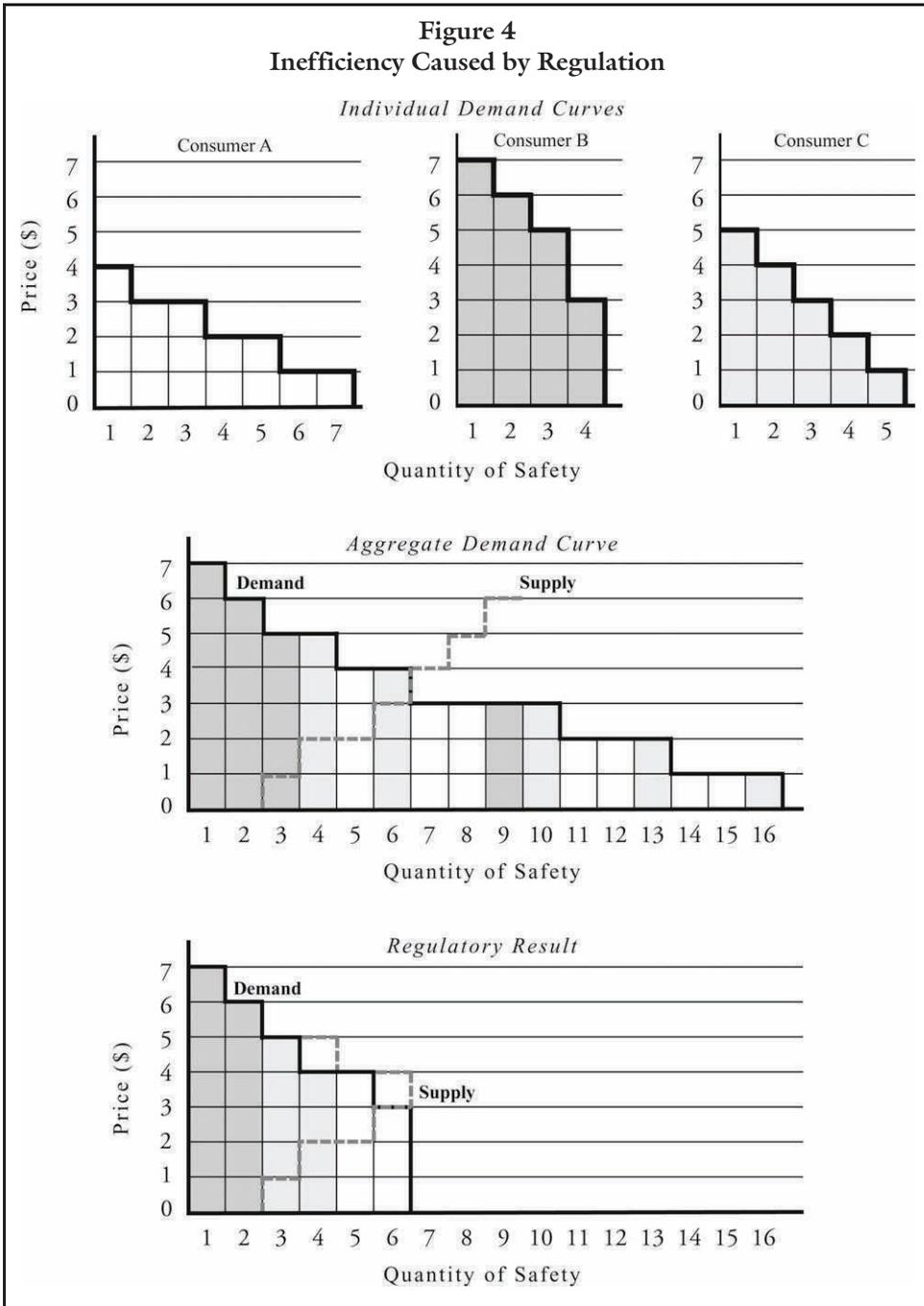
The inaccuracy of reported disease statistics led regulators to risk assessment to estimate disease damages (see, for example, Roberts and Foegeding 1991). However, risk assessment poses similar problems when used to estimate consumer demand for food safety. In risk assessment, the disease burden on a population from a particular risk agent is extrapolated from a dose-response curve. A dose-response curve illustrates the effect on or response from an organism, such as rats, caused by different doses of a hazardous agent. Regulatory concentration limits for pesticides in food are calculated on the basis that a person can consume food for a seventy-year lifetime at the concentration limits without experiencing a chronic, noncancer health effect (Byrd 1997). However, this criterion of no effect for seventy years is arbitrary and has nothing to do with the efficient safety quantity defined by the intersection between the supply and demand curves for safety. In addition, consumers making purchasing choices are not aware of the health effect caused by the risk agent under investigation. Consumers cannot change their demand based on unknown factors. A health damage estimated from a dose-response curve should not be confused with the consumer demand to avoid that damage.

### *Infeasibility of Customized Distribution*

Thus far in this analysis, we have seen insurmountable problems in measuring consumer demand for food safety and the misuse of disease burden as consumer demand. In this section, I examine yet another insoluble problem in the actual use of demand measurements. The individual and subjective nature of demand for food safety renders demand measurements practically useless *even if* the measurements are accurate and timely.

The problem is the regulators’ inability to distribute regulation-gained food safety to *each* consumer according to his or her willingness to pay. Unless government intervention can provide each consumer with food safety in the safety units he would have paid for if perfect information prevailed in the market, it cannot restore the nonmaterialized demand.

Again I consider this problem within the framework of cost-benefit analysis used by regulators (figure 4). In this hypothetical society, there are only three consumers, A, B, and C. Their demand curves (*step-shaped curves*) are shown as three graphs at the top of the figure. Now we assume that regulators can accurately measure the



demand for and the costs of food safety. The results are shown in the middle graph as the intersecting demand and supply curves. The demand curve is the aggregation of the three consumers' individual demand curves. At six units of food safety supply, the total benefit (total willingness to pay) is \$31 (the area or total number of blocks underneath the demand curve at the quantity level 6), and the total cost is \$8 (the area or total number of blocks underneath the supply curve at the quantity level 6). Therefore, at the quantity level 6, the net benefit is \$23. By carrying out similar cost-benefit analyses at different safety levels, regulators find out that efficiency can be achieved at the quantity level 6 with the *maximum* net benefits at \$23. At any other safety levels, efficiency cannot be achieved.

In the middle graph in figure 4, each unit of safety is pattern-coded according to which consumer must receive the unit when these units are distributed in order to achieve efficiency. At the quantity level 6, consumers A, B and C will need to receive 1, 3, and 2 units, respectively. Note that this distribution of safety units is unequal among the three consumers.

In the real world, however, this simple result cannot be achieved because regulators have no mechanism to distribute the six units of safety according to each consumer's demand. Assume that they have decided to distribute the safety equally among consumers by enforcing a uniform allowable level of a chemical in all kinds of food-stuffs. After all, all food safety standards and guidelines have this one-size-fits-all nature. As a result, each consumer will get two units of safety, as shown at the bottom of figure 4. The demand curve in the bottom graph is lower than the original curve predicted by the cost-benefit analyses. As a result, the regulation produces \$2 less of benefit than was promised by cost-benefit analyses (shown as the two dotted-lined blocks on top of the demand curve in the bottom graph). Going back to figure 3, this result means that the demand curve  $D_2$  ends up being lower than regulators desired it to be.<sup>7</sup>

Also, *without* making anybody worse off, one safety unit for Consumer A, who received one unit more than he wanted, can still be reallocated to Consumer B, who received only two units even though she wanted three units. This condition means that the regulation created only another inefficient situation. Furthermore, there is no theoretical foundation to assume that consumers are made better off in this regulatory result. It is possible that consumers A and B are feeling worse off than before by receiving two units, each against his own will. In other words, once the regulatory distribution fails to achieve the target efficiency, the result is simply a failure. This failure cannot be resurrected as a welfare improvement because regulators possess no information on whether individual consumers are made better off or worse off through the regulation when the target efficiency cannot be achieved. Unless the government has an ability to distribute gained safety to each consumer according to

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7. This particular example in figure 4 sets the regulatory result of collective safety level higher than the level before the regulation. However, the regulatory safety level can end up lower than the original level depending on the magnitude of the sum of individual deviations from the regulatory standard.

his individual willingness to pay, economic efficiency, which is the stated goal of government intervention, cannot be achieved.

### *Discrepancies Between Collective Social Goals and Consumer Demand*

Regulatory tools to “guide” consumers to conform of their own will to the “socially appropriate” safety levels have attracted public-health experts’ attention (Antle 1995, 73; Caswell and Mojduszka 1996). Tools in point include advisories, labels, taxes on “junk food,” subsidies on “healthful food” (Nestle 2002, 365), and food rationing (Davey 2004). Consumer-guidance tools require resources, and regulators still need to prove that market failure prevents consumers from learning what they want to know and that manipulation of consumers can correct this failure. The previously mentioned FDA consumer advisory against the consumption of seafood containing methylmercury has demonstrated, however, the difficulty of manipulating consumers to attain collectively set policy goals.

Methylmercury poisoning differs from cardiovascular diseases in terms of symptoms, and it is impossible to compare the burden of the two conditions directly. In studies assessing the social net benefits of the advisory, the burdens from the two conditions were converted into a single unit called the disability-adjusted life year (DALY), which uses fixed and objective conversion factors (Homedes 2000). When the combined actual health damages in DALYs from the two types of health conditions are suspected to be larger than the health damages expected in connection with the original advisory, regulators try to improve their manipulation techniques to achieve their goal of minimal social damages (see, for example, Institute of Medicine 2007). However, their efforts are destined to fail because of the individual and subjective nature of consumer demand.

Consumers have different health conditions, ages, and income levels, and therefore each consumer has a unique willingness to pay to reduce the two different risks posed by methylmercury poisoning and cardiovascular diseases. In addition, individuals subjectively feel pain and disability. These attitudes are not constant, reflecting changes in consumers’ health conditions, income levels, and prices of relevant food items. As a result, the market demands for the reduction of the two different risks are also in a state of flux, and the ratio between the two demands is not stable. On the other hand, objective population health indicators such as the DALY do not take into account this individual and subjective nature of health risk perception, pain, and suffering. Except by accident, there will always be discrepancies between the demand ratio set by consumers and the conversion factors used in DALY calculations.

An objective population health indicator such as the DALY cannot be used as a yardstick to measure the performance of the food safety market, which is by definition a result of the interaction between numerous consumers’ individual willingness to pay and numerous suppliers’ willingness to sell. Discrepancies from policy goals require

constant fine-tuning of the techniques of advisory issuance, which pushes up enforcement and compliance costs. In addition, this attempt to put individually felt health damages and collectivist policy goals into accord will inevitably increase suffering, or inefficiency, from individual consumers' points of view. If regulators are faithful to the definition of demand, which is the summation of individual demands, they need to respect the market outcomes that result from consumer choices.

## Conclusions

My empirical examination of the performance of major food safety regulations in the United States shows no unequivocal sign of reductions in food-borne-disease outbreaks and cases. We thus need to stop automatically demanding greater budgets and mandates for regulatory authorities whenever we hear news about food-borne-disease outbreaks.

The economic justification of government intervention in the food safety market, based on the assumption that consumers suffer from "imperfect information" in the market, has no theoretical basis. Food safety information is costly to produce, and perfect information and perfect dissemination of information are impossible to achieve in a world of scarcity. An impossible situation should not be used to judge the workings of the real market. The real market is dynamic and constantly working toward its participants' maximum satisfaction. Evidence from the real world testifies to this dynamism.

Cost-benefit analysis faces insuperable obstacles to demonstrating market failure and regulatory ability to rectify it. The current use of disease burden in demand estimation is ill founded. The demand for avoiding food poisoning when buying food is theoretically different from the demand for medical treatment after suffering food poisoning. An efficient market leaves some disease burden, and treating this remaining disease burden as unfulfilled demand for food safety always produces a false conclusion that market failure suppresses the current demand.

Economic efficiency, projected by cost-benefit analysis, cannot be achieved because of regulators' inherent inability to distribute benefits among consumers according to each consumer's demand. Government intervention, claimed to correct market inefficiency, creates a new situation of inefficiency. The poor track record of food safety regulations, combined with the practical impossibility of successful government intervention in the food safety market, means that government intervention cannot provide the level of food safety consumers actually demand.

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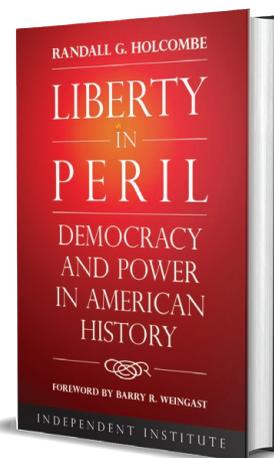
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