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Consumer willingness-to-pay to reduce the probability of retail foodborne pathogen contamination

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ABSTRACT

The US Department of Agriculture applies a cost-of-illness approach to value reductions in morbidity, which may understate the projected benefits from proposed food-safety improvements by ignoring costs such as pain, suffering and worry. We use a national survey with a hypothetical food-choice experiment to estimate a more comprehensive measure of consumer willingness-to-pay for food-safety improvements. Our approach differs from previous evaluations of food-safety improvements because we: (1) provide the respondent with information about the promised change in the probability of pathogen contamination in retail food packages rather than changes in the probability of becoming ill, (2) elicit changes in respondents' subjective probability of becoming ill, and (3) elicit predicted changes in the quantity demanded for products that have enhanced food-safety properties. We estimate the consumer's choice between a safety-enhanced and an existing product, the change in subjective probability of contracting foodborne illness associated with the enhanced product and the change-in-demand for the enhanced product in a manner that recognizes the correlation among unobserved elements. The aggregated results suggest benefit estimates that are significantly larger than previous estimates for similar improvements.

Introduction

Foodborne illness is a global public health issue. While global statistics are difficult to determine, the United Nation's World Health Organization (2007) estimates that 1.8 million people died from diarrhoeal diseases in 2005 alone, and that a large fraction of these deaths were attributable to foodborne or waterborne illnesses. In countries where foodborne illness rates are systematically monitored, annual incidence rates range from 1210 cases per 100,000 inhabitants in France (Institute de Veille Sanitaire, 2004) to 2600 cases per 100,000 inhabitants in the United Kingdom (Adak et al., 2002) to more than 25,000 cases per 100,000 inhabitants in Australia (Australian Government Department of Health and Ageing, 2005) and the United States (Mead et al., 1999).

National governments and world regulatory bodies have responded to the incidence of foodborne illness in a variety of ways (Spencer and Caswell, 1999) with many countries implementing substantial regulation to reduce the incidence and burden of these illnesses. The extent of regulation undertaken will depend upon the predicted effectiveness of the regulation and the estimated balance of costs and benefits associated with reaching the predicted level of effectiveness. One on the many challenges policymakers face when conducting such analyses is deriving a reliable estimate for the benefits of heightened food safety regulations.

One popular approach to deriving such benefit estimates is the cost of illness approach. In this approach the benefits are measured as the reduction in medical costs plus the reduction of productivity losses plus the value of the statistical lives saved under the new policy compared to a baseline scenario. This approach is used broadly by regulators and policymakers that deal with disease and illness issues (Segel, 2006) and forms the basis for regulation of food safety in key US agencies such as the United States Department of Agriculture (Roberts, 2007). Importantly, however, this approach misses values associated with the disutility caused by foodborne illnesses, such as pain, suffering, worry and loss of leisure time. Although these utility losses may be relatively small on an individual basis, the fact that millions of foodborne illness cases occur annually suggest that estimates of the benefits derived from cost-of-illness studies will underestimate the true benefits

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and potentially bias food safety programs away from non-fatal illnesses.

The weakness of excluding values associated with the disutility of foodborne illness are well understood by economists and regulators and intuitively relayed by a simple example. Consider a person who suffers for 48 h from nausea, diarrhea and vomiting related to a foodborne pathogen, but does not buy medicine or see a doctor. If the illness and symptoms begin on a Friday night, but allow the person to return to work on Monday (assuming a standard weekday work schedule), the USDA method would register no benefits from eliminating this incident as no work time was lost, no medical expenses were incurred and no one died. Clearly, however, the person in this example would have preferred not to have incurred the illness and, before the fact, may have been willing to pay to reduce the probability of such an incidence. These benefit estimates are critical inputs to policy discussions and evaluations of proposed policies. Hence, ascertaining the willingness-to-pay (WTP) for all the benefits associated with improvements in food safety helps inform policy decision making.

While the deficiency in the cost-of-illness valuation approach is widely acknowledged, it is often difficult to assign a defensible dollar value to the WTP for reduced foodborne illnesses due to several methodological challenges. First, due to a lack of market data with adequate variation in the *ex ante* probability of contracting foodborne illness, estimates of WTP often make use of constructed markets, e.g., experimental markets (Nayga et al., 2006; Hayes et al., 1995), hypothetical choice experiments (Baker, 1999; Loureiro and Umberger, 2007) or contingent valuation surveys (Goldberg and Roosen, 2007; Beattie et al., 1998). Each method faces challenges in generating policy-relevant estimates of WTP.

Experimental markets, while featuring binding financial incentives, often involve small convenience samples that evaluate food transacted in an unfamiliar manner, e.g., via repeated auctions[1] or with money endowed by the researcher.[2] Furthermore, experimental markets designed to value food safety interventions often involve products intended for immediate consumption, similar to a restaurant setting,[3] so that experimental participants must consume the product as is rather than taking the product home and perhaps throwing it away or using risk-mitigating preparation techniques (e.g., Fox et al., 2002).[4] Another limitation is that experimental approaches typically fail to gauge how many units of the quality enhanced food product will be demanded by auction participants across time (i.e., beyond the single experimental session), which is crucial data necessary for aggregating benefits.[5] Note that none of these critiques of previous studies are general critiques of experimental techniques. All these issues could be addressed in the context of experimental studies with sufficient resources and ingenuity.

However, all products used in an experimental setting must meet a minimum quality threshold due to ethical constraints. Many policies are aimed at reducing the number of quality lapses where the quality of products consumed during such lapses could never be introduced into experimental settings while the revealed preference data necessary to trace out changes in consumer behavior is often unavailable to researchers in a form that allows for clean identification of welfare effects. Therefore, hypothetical approaches are often left as the sole viable technique to assess consumers' valuation of reducing the risk of quality lapses.

Hypothetical approaches do allow respondents to assess wider ranges of food quality and to project changes in units demanded attributable to the quality improvements.[6] However, hypothetical approaches face other difficulties because the non-binding nature of the choice decision can lead to upwardly biased and noisier valuations than those obtained when money exchanges hands (Harrison, 2006), though a meta-analysis of studies featuring parallel hypothetical and non-hypothetical valuation exercises finds no bias for items with a value of $10 or less (Murphy et al., 2005, p. 321). Another critique of hypothetical studies has been that results regularly fail to value changes in the probability of foodborne illness in a manner that is consistent with theory. Specifically, many studies fail the scope and proportionality tests, which require the WTP for a change in risk to be significant and to scale linearly with the risk change (Hammitt and Graham, 1999).[7]

In addition to the standard methodological challenges, our particular context – the safety of food sold for home preparation – presents several other hurdles. One challenge is assessing how the reduced probabilities of food contamination that a policy can deliver translate into reduced probabilities of contracting foodborne illness for a given individual.[8] For example, a consumer exhibiting meticulous handling and preparation techniques (i.e. defensive actions) may benefit very little from a reduced probability of buying food with dangerous pathogens because this person's normal procedures would kill these pathogens prior to consumption. Alternatively, some individuals (e.g., the elderly, those with weakened immune systems), may perceive their risk of contracting a foodborne illness as relatively high. Hence, lower (higher) sensitivity to promised reductions in the probability of foodborne pathogens would be expected in the former (latter) case. For studies that promise reductions in the probability of contracting foodborne illness (rather than reductions in the probability of buying food with foodborne pathogens), one would expect consumers to adjust the projected reductions to translate promises into personally relevant data. Hence, scope and proportionality tests should consider individual subjective probabilities, which are often not elicited in either hypothetical or experimental settings. Another related challenge is that of endogenous risk (Shogren and Crocker, 1999), which, in our context, implies the consumer may handle and prepare food differently in response to any quality improvements. Indeed, researchers have documented so called 'lulling effects' in markets such as child-proof medicine containers (Viscusi, 1984) and seatbelts (Peltzman, 1975) and analyzed the potential for such effects with respect to foodborne pathogens (Roe, 2004).

In this paper, we use stated preference data obtained from a national survey to estimate consumer WTP for reductions in the probability of buying products contaminated with pathogens in

[1] See Louviere (2006) for a critique of such an approach for valuing goods usually purchased in standard retail settings and Lusk and Schroeder (2006) for evidence that auctions yield significantly different welfare estimates to comparable, financially binding choice experiments.

[2] See Lusk et al. (2004), Corrigan and Rousu (2006) for discussion of issues related to experimenter endowments.

[3] Food eaten away from home constitutes less than half of the average US consumer's caloric intake (Guthrie, 2002).

[4] An exception is Nayga et al. (2006), who allow subjects to take home the product purchased in the experiment. However, unlike Fox et al. (2002), Nayga et al. do not assess an individual's change in the subjective probability of illness, which means one cannot test for theoretical consistency of consumer responses to promised changes in the probability of illness.

[5] Corrigan et al. (2009) use a binding choice experiment to assess the number of units demanded for a food product with novel attributes. However, even this approach ascertains only the number of units demanded at the experimental session rather than the number of units demanded over longer periods of time.

[6] While assessing the change in the number of units demanded when quality changes is quite simple within a hypothetical product choice setting, there are only a few studies that feature such a component. Such elements are commonly added to recreation site choice models, which often couple a hypothetical contingent demand question with revealed data concerning site choice (e.g., Alberini et al., 2007).

[7] More recent research suggests this may be a more general difficulty of human response to small probabilities that also manifests in settings with binding incentives (Hurley and Shogren, 2005; Fehr-Duda et al., 2006).

[8] This challenge is not unique to food safety situations; it would plague any situation where individual can take defensive actions in the face of risk or face heterogeneous response to the same threat.