Economic Approaches to Estimating Benefits of Regulations Affecting Addictive Goods

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The question of how to evaluate lost consumer surplus in benefit–cost analyses has been contentious. There are clear health benefits of regulations that curb consumption of goods with health risks, such as tobacco products and foods high in fats, calories, sugar, and sodium. Yet, if regulations cause consumers to give up goods they like, the health benefits they experience may be offset by some utility loss, which benefit–cost analyses of regulations need to take into account. This paper lays out the complications of measuring benefits of regulations aiming to curb consumption of addictive and habitual goods, rooted in the fact that consumers' observed demand for such goods may not be in line with their true preferences. Focusing on the important case of tobacco products, the paper describes four possible approaches for estimating benefits when consumers' preferences may not be aligned with their behavior, and identifies one as having the best feasibility for use in applied benefit–cost analyses in the near term.

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Introduction

Consumption of certain addictive and habitually consumed goods entails significant harms to public health. Some 42.1 million adults smoke cigarettes.[1] One third of U.S. adults are obese, and one third have high blood pressure, reflecting diets high in calories, fat, sugar, and sodium and lifestyles low in exercise.[2,3] Regulations aiming to bring consumption of addictive and habitual goods down to levels consistent with maintaining good health can have substantial health benefits. Yet, consumers may also lose some satisfaction from their consumption if they cut back on goods they especially like. Benefit–cost analyses of new federal regulations, such as those put forth by the U.S. Food and Drug Administration (FDA), are expected to analyze both positive and negative effects of regulations on consumers, as well as on businesses and government.[4] This makes it important to examine the extent to which health benefits of regulations that reduce consumption of addictive or habitual goods may be offset by lost utility.

For standard consumer goods, methods of measuring lost utility in welfare analyses are well established. When people's consumption choices are in line with their preferences and reflect accurate information about a good's attributes, the quantities of the good they buy and the prices they are willing to pay contain full information about how their utility would change if their consumption fell. In this case, economists expect that regulations shifting consumers away from their preferred consumption choices will usually make them worse off. Because the prices they pay and quantities of the good they buy reflect the value they receive from it, this information can be used to quantify the utility loss they experience if a regulation causes them to reduce their consumption of the good.

For goods like tobacco products and alcohol, however, the standard approach can be misleading, for two reasons. First, consumption of these goods has spillover effects on others, such as secondhand smoke, risks of fires, extra litter, and drunk-driving accidents. Thus, using information from observed demand for the good would mis-state its social value, because prices paid by those who consume it overlook the costs that their consumption imposes on others. A large literature

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considers how to account for such externalities in welfare analysis.[5-7]

Second, with consumption of health-harming addictive and habitual goods, a number of "internalities" may compound the traditional problem of externalities.[8,9] Consumers may overweight the short-run costs of reducing consumption relative to the long-run benefits; as a result, they may recurrently postpone reducing their consumption, even if they want to cut back.[10] They may hold inaccurate beliefs about how easy it will be for them to reduce their consumption in the future or the extent to which health risks apply to them.[11] For addictive goods like cigarettes, they may have started smoking and become addicted when they were young, before they had full ability to balance benefits, costs, and risks of their decisions.[12] Thus, even if they now choose their consumption levels in a reasoned way, this is conditional on having "addicted preferences" they may regret ever having acquired.[13] Such internalities cause people's willingness to pay (WTP) for the product to overstate the value they receive from it.

Although these problems are well recognized in the research literature, methods for taking them into account in benefit–cost analysis are only beginning to be developed. Recent benefit–cost analyses from the FDA have attempted to estimate utility offsets to health benefits from reducing smoking, using the cigarette smoking model of Gruber and Kőszegi,[10] in which smokers have time-inconsistent preferences. Calibrations of this model show the gap between how much people smoke and how much they would prefer to smoke to be large, but also to imply that smokers receive significant utility from smoking.[14] Thus, FDA's benefit–cost analysis of a rule requiring graphic warning labels to be added to cigarette packs took lost utility to be between 10% and 90% of the health benefits, with 50% used as the primary estimate.[15] Its preliminary analysis of a proposed rule deeming non-cigarette tobacco products to be subject to its regulatory authority assumed utility losses would offset 70% of the rule's health benefits.[16] Similarly, its analysis of a rule requiring nutrition information to be included in restaurant menus said utility offsets could be between 0% and 100% of health benefits, depending on how vigorously people shifted away from foods they like to less-preferred options.[17] Offsets of these magnitudes have been criticized,[18] and debates about appropriate ways of accounting for lost utility in benefit–cost analysis remain unsettled.

To advance thinking in this area, the Office of the Assistant Secretary for Planning and Evaluation of the U.S. DHHS initiated a year-long project undertaken by the authors, which included literature reviews, discussions with prominent health and behavioral economists, and original research on possible approaches. The project considered strengths and weakness of alternative approaches for measuring utility losses in regulations affecting addictive and habitual goods, with concerns for both conceptual grounding and empirical feasibility.[19] The intention was to identify approaches that could be used in the benefit–cost work of FDA and other DHHS agencies in the near-term. Focusing on the important case of tobacco products, this paper gives an overview of the issues and potential approaches considered, and describes the approach that has the best potential for immediate use in benefit–cost analysis.

Conceptual Issues

Figure 1 summarizes potential benefits and costs of regulations affecting addictive or habitual goods that harm the consumer's health. Although economic analysis makes no sharp distinction between addictive and habitual goods, medical and scientific research understands addiction to be a brain-based disease involving compulsive seeking and use of the product despite harmful consequences, as well as tolerance, psychoactive affects, and withdrawal.[20,21] As the paper's concern is with methods for measuring utility offsets, the analysis is confined to individuals who consume or may start consuming the good; effects for these two groups are shown in the left- and right-hand panels of Figure 1, respectively. As mentioned, effects of regulations on people who do not consume the good can be considerable (as when tobacco regulations reduce nonsmokers' exposure to secondhand smoke), but these are beyond the current paper's scope.

The primary purpose of regulations addressing addictive and habitual goods is generally to reduce morbidity and mortality from their consumption. Existing research can often be used to project how a regulation's provisions will affect consumption of the good or goods at issue. Then, evidence from medical and public health research can be used to estimate effects on morbidity and mortality. Well-established methods can then be used to value the rule's expected health benefits in monetary terms.[22]

And yet, other effects of the regulation may augment or offset the health gains. On the plus side, people who cut back their consumption of the good or who are deterred from starting to use it save money that can now be spent on other goods. For existing users who quit, their self-esteem or sense of self-efficacy may improve from having overcome an addiction, or they may feel less social stigma from having gotten rid of a bad habit. On the negative side, when existing users cut back their consumption, their quality of life may deteriorate as they go through withdrawal or adjust their habits.[19] Though this sort of loss should be time delimited, some existing users who stop consuming the good may experience

Existing users who reduce their consumption	
Positive	Negative
Increased life expectancy Improved health Money freed up for spending on other goods Increased sense of self-efficacy, reduced self-loathing Loss of social stigma from having a bad habit	Possible substitution into other consumption 'bads' Costs of withdrawal or changing habits (incurred when consumption is reduced) Loss of positive attributes of consumption (possibly ongoing)
Potential users deterred from initiating	
Positive	Negative
Increased life expectancy Improved health Money freed up for spending on other goods	Possible substitution into other consumption 'bads' Small to no utility offset

Figure 1. Effects of a regulation on existing users who reduce their consumption of a health-harming addictive good and potential users deterred from initiating.

ongoing utility loss if they cannot get as much utility out of a consumption bundle that excludes the good as one that had it in. Although some observers have argued that the utility losses of existing users should not be counted as effects of the rule if they became addicted to it while young,[23] the preferences they now act upon have been reshaped by their addiction, so withdrawal costs they experience from reducing their consumption of the good are a real cost.

Whether potential users who are deterred from starting to use an addictive or habitual good experience any utility loss is less clear.[8,19] If preferences are fixed over time, those deterred from initiating will suffer lost utility. However, many addictive and habitual goods have the property that use of the good itself changes preferences. For example, the strong "taste" for cigarettes generally grows out of having become addicted to cigarettes.[21] Thus, people who do not start consuming the good will not value it as highly as current users. If the average person deterred from starting to smoke finds a consumption bundle without cigarettes to be no less satisfying than one that includes them, a regulation that deters them from starting to smoke will cause no utility loss.[8]

Although cigarettes and drugs such as heroin are likely at one extreme in terms of tastes growing with use, this may not be the case for all addictive and habitual goods. For goods like alcoholic beverages, where many consumers are not addicted and drink moderately, for example, potential users may get less utility if they do not consume the good. But in cases where addiction figures centrally in current users' demand for the good, it seems likely that utility losses from deterring initiation will be small or negligible compared with those from reducing consumption among existing users. This underlines the importance of analyzing utility offsets of regulations separately for potential and existing users.

Finally, in some cases, people may substitute out of one good with health harms into another "consumption bad," such as if a regulation causes people to curb their consumption of cigarettes but some switch over to smoking small cigars.[24,25]

To incorporate nonhealth items into measurement of benefits, two strategies are possible. The first devises a method of measuring the rule's total benefits to consumers without explicitly breaking out the health and nonhealth items. For example, a survey-based or experimental research project could be used to elicit information on what consumers would be willing to pay for a regulation's provisions in toto. The second estimates the value of the health and monetary benefits of the regulation, then finds ways of valuing the other items. A disadvantage of the first approach is that, if problems of misvaluation partly explain why people overconsume addictive and habitual goods, the same problems may affect valuations of a regulation's benefits elicited from consumers. For this reason, the second strategy of estimating health benefits and utility offsets separately may be the best option.

The remainder of this paper discusses the advantages and limitations of four possible approaches for estimating benefits to consumers of regulations, taking the possibility of utility offsets into account: WTP for cessation, directly measuring changes in subjective well-being, structural approaches to calibrating utility, and use of rational benchmarks for valuing benefits. It is worth noting that aspects of different approaches can be used in combination; for example, Ashley et al.[14] used a rational benchmark approach conceptually, but used an estimate from structural study to quantify utility offsets. The discussion gives special attention to the case of tobacco products, as the new regulatory authorities that FDA received under the 2009 Family Smoking Prevention and Tobacco Control Act imply a substantial new need to advance methods of doing benefit–cost analyses for addictive and habitual goods.

Possible Approaches

Willingness to Pay for Cessation

In line with the idea of measuring the total benefit of a regulation, a number of studies have estimated existing

smokers' WTP for smoking cessation. WTP can be recovered either by using preference elicitation methods or experiments to collect information on how consumers value products (real or hypothetical) that increase their odds of quitting, or by using information from prices and usage of cessation products to back out "revealed" WTP. For cigarette smoking, there are many products available that improve smokers' odds of quitting; these include nicotine-replacement products (patches, lozenges, gum), prescription medications (Chantix and Zyban), counseling, and combinations of these. Products that promote weight loss include membership in support groups, supervised diets, dietary supplements, and gastric bypass surgery.[26]

The intuition of the WTP approach is as follows. If consumers are found to be willing to pay W dollars for the cessation product, the benefit they expect to receive from using the product must equal or exceed this cost. The product's expected benefit is the increase in the probability of cessation it provides over unassisted quitting, Δp, times the value the user perceives of quitting, V. The latter should be the present discounted value of health and financial gains of quitting, net of utility losses. Purchasing the product implies $\Delta p \times V \geq W$. Then, from information on Δp and W, the lower bound of V can be inferred to be $W/\Delta p$.

Several studies of the value of smoking cessation have made use of this approach. Paterson and colleagues[27] collected survey data on smokers' WTP for smoking-cessation options delivering various increases in probabilities of quitting over a 1.5% baseline, finding values of cessation between $750 and $3,200 (Canadian). Based on an RCT, Schauffler et al.[28] estimated that smokers were willing to pay $320 for a product that would increase their odds of quitting by 5 percentage points, implying a value of cessation of $6,400. Volpp and colleagues[29] considered the impact of financial incentives to stop smoking using an RCT in which members of a treatment group received up to $750 to quit smoking. The finding that the probability of sustained abstinence was about 10 percentage points higher for the treatment group implies a value of quitting of about $7,500.

These estimates seem implausibly low relative to monetary values of the health benefits of quitting—which are often in the hundreds of thousands of dollars.[8] Possibly this means that utility offsets to health benefits are indeed very large. But, equally possible is that the same misvaluation issues that cause people to smoke when they would prefer not to also affect their WTP for cessation. For example, if smokers believe it is not hard to quit on their own, or if they doubt that smoking-cessation products do much to increase their odds of quitting, their WTP for such products may be low. Thus, additional research aiming to capture measures of WTP that are not biased down by informational, expectational, or valuation issues is needed before the approach can be reliably used in benefit–cost work.

Direct Measurement of Subjective Well-Being

A second approach is to measure what happens to people's subjective well-being when they stop consuming an addictive or habitual good. Subjective well-being can be measured using single comprehensive questions (*How satisfied are you with your life as a whole right now?*) or indexes that cover multiple dimensions of people's lives. If changes in self-reported well-being can be interpreted as changes in "experienced utility," this method can give direct insights into how people's utility changes after reducing consumption of an addictive or habitual good. In principle, measured changes in well-being can be converted into monetary values by estimating the change in income that provides the same change in subjective well-being as the event of interest. An important advantage of this approach is that it is agnostic about the sign of the utility change; curbing consumption of the addictive or habitual good could increase or decrease utility.

A growing body of work examines the relationship between smoking and subjective well-being.[30,31] Piper et al.[32] tracked smokers who quit and others who continued to smoke over a 3-year period. They found that various measures of former smokers' well-being rose after they quit, relative to those who continued to smoke, and none of them declined. Weinhold and Chaloupka have a similar finding for Dutch smokers (D Weinhold and F Chaloupka, London School of Economics, unpublished observations, 2014). Contrary to perceptions that quitting smoking could erode people's ability to manage anxiety, depression, or stress, a meta-analysis of 26 studies found smokers who quit to have fewer symptoms of depression, anxiety, and stress and improved positive mood and quality of life compared with people who continued to smoke.[33] This body of research supports the idea that smoking cessation has important nonhealth benefits.

As intriguing as these findings are, some important questions remain about their relevance to benefit–cost analysis. First, measures of well-being used in existing research may or may not differentiate between improvements from better health versus other changes. Estimates of health benefits in benefit–cost analyses may already include gains from improved health-related quality of life, so subjective well-being information has to be used in a way that avoids double counting. Second, turning quantified measures of changes in subjective well-being into monetary values is not straightforward,

yet accurately valuing effects in monetary terms is important for comparing benefits to consumers to costs borne by industry and government. Finally, it is not clear whether findings for smokers who quit on their own will be representative of outcomes for smokers who quit as a result of regulation, as the former may quit because their utility gains from quitting are relatively high (or utility losses are relatively low). Only one study has examined the impact of policy-induced changes in smoking on subjective well-being. Gruber and Mullainathan[34] find that higher cigarette excise taxes are associated with increased happiness among those with a propensity to smoke in the U.S. and Canada; because higher taxes are known to promote quitting, this finding suggests that smokers are happier after they quit even if a policy change is part of what prompts them to quit. In general, the promise of this approach will likely improve in the years ahead, as the science of analyzing policies using subjective well-being progresses.[35]

Structural Approaches

The structural approach takes an explicit or "structural" economic model of addictive consumption that incorporates features that cause divergences between people's behavior and their preferences (e.g., time inconsistency, inaccurate expectations, among others). Then, calibration of the model is used to quantify the difference between utility with and without regulation. This is the approach of Gruber and Köszegi[10] that is drawn on by FDA[15,16] and further developed in Ashley and colleagues.[14]

Clear advantages of this approach are theoretical rigor and solid foundation in welfare analysis.[36,37] Yet, the approach has several problems that limit its use in applied analyses. Current models of addictive consumption are highly stylized and not usually intended as realistic representations of addictive or habitual consumption.[10,38,39] Models often explore a single, specific departure from the standard model, rather than allowing for multiple possible departures.

Finally, conclusions from structural models can be very sensitive to choice of parameter values used for calibrations. As a notable example, in the model of Gruber and Köszegi,[10] the hyperbolic discount factor β drives the estimate of the extent of overconsumption. If smokers are not hyperbolic at all ($\beta=1$), their behavior correctly reflects their preferences, and they do not overconsume. If they are fully hyperbolic ($\beta=0$) and naïve about their ability to constrain themselves, their smoking decisions do not reflect adverse health effects at all. Values in between imply offsets in between these extremes. A general consensus is that the average β in the population is about 0.7.[40] But, there is enormous variation across studies, with estimates as low[41] as 0.4 and as high[42] as 0.9. Studies find considerable heterogeneity in β within the population as well, with relatively low values for current smokers, problem gamblers, and children.[43] Given the extent of this uncertainty, the model implies such a wide range of possible utility offsets as to be noninformative about the degree of overconsumption. As such, more work needs to be done to develop and test structural models before they can be used in applied policy analysis.

Rational Benchmark

The final "rational benchmark" approach identifies consumers most likely to be well informed and to choose their consumption levels in ways that rationally weigh costs, benefits, and risks, then uses the values these consumers place on consumption to estimate losses in utility that may result from regulations. The Australian Productivity Commission used this approach to analyze the benefits of policies affecting gambling.[44] Distinguishing between "recreational" and "problem" gamblers, they took the gambling behavior of the recreational group to reflect how people would gamble if they had no gap between their behavior and preferences; the difference between the amount of gambling they actually do and the amount they would do if they only gambled recreationally then reflects the extent of their overconsumption.

Weimer et al.[9] apply a similar framework to cigarette smokers, estimating the benefits of tobacco regulations using a contingent valuation survey to elicit smokers' preferences. They take smokers low on a measure of self-reported addiction to be representative of a nonaddicted demand curve. Ashley and colleagues[14] make a similar argument conceptually. In a retrospective analysis of benefits of antismoking policies, Jin et al.[45] use college-educated smokers aged 30−45 years as an approximation for the rational group, then use a demand curve estimated for this group to value consumption changes in the rest of the population.

Cutler and colleagues[8] extend the approach of Jin et al.[45] to analyze issues of utility offsets to health benefits taking three groups into account: existing users who reduce their consumption, potential new users deterred from initiating, and continuing users and initiators who may lose utility if the regulation increases the product price or alters its attributes. Reflecting uncertainty about how to identify people whose behavior is relatively close to a rational, well-informed benchmark, they use two alternative groups: smokers who do not meet criteria for high nicotine dependence, whose smoking is presumably more in line with their preferences than smokers who are

nicotine-dependent, and college-educated smokers aged 30–45 years. The latter came of age after health risks of smoking were relatively widely known, so they can be taken to be relatively well informed; additionally, their education can be expected to have developed their abilities to process information about health risks, and it correlates with having time and resources to make decisions in forward-looking ways.[46,47]

For a hypothetical regulation that reduces cigarette consumption by 10%, Cutler and colleagues[8] show that utility offsets to health benefits are much smaller than estimates used in recent benefit–cost analyses: For existing users who quit, these are on the order of 5% if most people who quit experience transitory utility losses only, ranging up to 20% if some people experience persistent losses. Because most regulations will induce quitting among people for whom utility losses are relatively small, they hypothesize that offsets will usually be at the lower end of the range. The overall offset ratio that aggregates over all users will depend on several factors, including how deeply the regulation cuts into the pool of existing smokers, how important deterred initiation is relative to quitting among existing users, and whether the regulation increases the product's price or alters its attributes (thereby affecting continuing smokers).[19] But, in general, offset ratios are likely to be far below the rates used in recent benefit–cost analyses.

The rational consumer approach has several advantages over the other approaches. It is consistent with welfare theoretic analysis, being rooted in standard analysis of consumer surplus. Unlike the structural approach, it allows for multiple departures from the rational benchmark without requiring assumptions about what these are. Its data requirements are less stringent than with the other approaches, primarily requiring information on product demand. The potential difficulty of this approach is identifying consumers whose consumption plausibly approximates a rational benchmark. If there are important uncertainties in this respect, using multiple possible benchmarks will help ensure that the analysis is robust to plausible alternatives.

Conclusions

Appropriately measuring utility offsets is important for analyzing the benefits and costs of policies affecting addictive and habitual goods. This paper describes the advantages and limitations of several methods and their current use in regulatory benefit–cost analysis. The paper identifies the rational benchmark approach as currently most tractable, given available models and data. However, valuing benefits in the presence of gaps between preferences and behavior is an area ripe for future research, both to improve the foundation and precision of estimates using the rational benchmark approach and to develop the other methods that might be used.

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