Media Advertising and Ballot Initiatives:
An Experimental Analysis

Timothy J. Richards
trichards@asu.edu
7171 E. Sonoran Arroyo Mall
Mesa, AZ. 85212
Arizona State University

William Allender
wallende@asu.edu
7171 E. Sonoran Arroyo Mall
Mesa, AZ. 85212
Arizona State University

Di Fang
dfang3@asu.edu
7171 E. Sonoran Arroyo Mall
Mesa, AZ. 85212
Arizona State University

1 Introduction

In 2008, the citizens of California voted in favor of Proposition 2, which bans the use of cages for housing egg-laying chickens.[1] Similar propositions in Arizona (Proposition 204 in November, 2006) and other states mandate stall-free and crate-free housing for sows and calves for veal, respectively. Media advertising is used heavily in state-level propositions because of the narrow focus of the issue, the geographic concentration of likely voters and the (typically) highly polarized nature of the campaigns. There is evident support for this issue among some consumers as cage-free eggs sell for a significant premium in retail stores (sometimes $1.75 per dozen or more). What is less clear, however, is whether voting in initiatives similar to Proposition 2 is driven by advertising-inspired mass-support of the issue at hand, or whether it is highly motivated support by a small segment of the population that cannot be influenced by advertising. In this study, we examine the role of media advertising in the initiative process using an experimental analysis of ads used by both supporting and opposing sides for Proposition 2 in California in November 2008.

Polling voters' intentions is fraught with difficulties. Often, likely voters will tell the pollster what they think the pollster wants to hear. Second, more important for the narrow issues that are often the subject of public referenda, many voters simply do not care, or are unaware of the issue (Rothschild, 1975). In the issue at hand, only a certain percentage of the population are even egg consumers or animal lovers so the issue seems abstract, at best. Third, voters sometimes lack a sense of consequentiality if they are asked their intent and they are not actually in the voting booth so put little thought into their response. In this study, we circumvent these problems by facing voters – consumers in this case – with real economic incentives in an experimental environment to determine their willingness-to-pay for cage-free eggs. Willingness-to-pay, while important from a food marketing perspective, is also a valuable proxy for likely voting intentions and an accurate gauge of the importance consumer-voters place on an issue. Ultimately, if a policy is a good one and "deserves" a vote, it should be welfare-improving. Therefore, in this study we assess the value of political advertising not on how many votes it generates, but on how it impacts the way the vote *should* go, or how the ad affects economic welfare.

Animal welfare is an important issue in its own right, and has become increasingly prominent as consumers become more conscious about what they eat, and where it came from. Several studies suggest that consumers perceive products with animal-friendly attributes to have a higher quality due to ethical beliefs, taste, food safety or health benefits (Harper and Makatouni, 2002; Ophuis, 1994; and Lusk et al., 2007).[2] Regulating animal welfare, however, presumes a market failure, but how does the market fail to adequately provide for the well-being of animals used to produce our food? To the extent that the method of production is a credence attribute – an attribute that can impact the individual agent's health, well-being or satisfaction with the product, but is not readily apparent in inspecting or consuming the product – then the usual asymmetric-information arguments arise (Larue, West, Gendron, and Lambert, 2002; Lusk, Fox, and Roosen, 2003; and Hartl and Herrmann, 2009). Alternatively, if we consider animals in general to be an appropriable resource similar to water, minerals or lumber, then many believe that producing food according to commer-

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[1] In July 2010, the governor signed follow-on legislation that banned the *sale* of caged eggs in California, preventing the importation of eggs from other states that are produced in a way that is deemed inconsistent with the principles laid out in Proposition 2.

[2] The issue has assumed a global dimension as initiatives similar to Proposition 2 in Canada have begun to take shape on University campuses and among other animal-welfare interest groups (Potstra, 2008). Uzea and Hobbs (2009), however, suggest that a subset of Canadian consumers has very high standards for animal welfare and tend to drive legislation that risks "over-regulating" industry.

cial methods imposes a negative production externality on society. Producing cage-free eggs or stall-free pork are thus means of internalizing the negative externality. Advertising in animal welfare ballot initiatives can therefore be interpreted as a means of convincing voters to voluntarily self-impose a tax meant to address the externality problem, much like a tax on fossil fuel is a means of reducing the costs imposed by greenhouse gas accumulation.

The welfare impacts of taxing egg-producers or imposing inefficient production techniques are critically dependent on whether advertising shifts the demand curve by changing preferences through "hype" (Dixit and Norman, 1978) or rotates the demand curve through the provision of "real" information about the product and its alternatives (Nelson, 1970, 1974). While the current orthodoxy in empirical advertising studies is to either assume advertising only shifts the demand curve, or to interact advertising and prices to obtain some type of ad-hoc measure of the rotational effect, we apply a new empirical approach to distinguish between the two. If consumers are indeed heterogeneous in their preferences, then a demand curve essentially represents a probability distribution of willingness to pay across consumers that are highly knowledgeable and involved with the product, and those with only casual knowledge of, and preference for, the product. This is the observation that lead Johnson and Myatt (2006) to develop a formal model of how advertising, and other media activities, really affects demand. We develop the model more completely below, but the intuition is straightforward. If a product appeals to a "niche" market, or if the issue is of intense interest to a concentrated group of voters, then advertisements that appeal to the core of this market will increase the dispersion of consumers' willingness to pay and rotate the demand curve clockwise, increasing the willingness-to-pay of the marginal consumer whose willingness-to-pay is above the mean and reducing it if the marginal consumer is below the mean. Reducing the dispersion of demand means that the advertisement contains real information as it allows consumers to sharpen their opinion of the product or, in this case, the issue. If a consumer strongly prefers a product or side of an issue, then real information regarding that issue will merely reinforce his or her position and move them away from the mean of all voters. If, on the other hand, the issue is of interest to the mass market or all voters who have at least a passing interest in the topic, then a successful ad will reduce the dispersion of demand and rotate the demand curve counter-clockwise (make it more elastic). In this case, the ad will increase the willingness-to-pay of the marginal consumer who begins with a valuation below the mean.

In either case, if the "hype" content of the ad dominates, then the pure shift effect dominates either rotation effect. If successful, exposure to the ad will change everyone's attitude to toward the issue and move the entire distribution of preferences in the direction of either favoring or opposing the issue. Econometrically, the test is straightforward: if the ad reduces the variance of willingness-to-pay, then it appeals to the diffuse mass of voters with casual interest, but if it increases the dispersion of willingness-to-pay then we conclude that the ad appeals to a small, yet focused group of voters. If the dispersion does not change, but preferences do, then the hype content is more important. Either way, we have a better understanding of how political advertisements can be better crafted depending on the nature of the issue at hand.

Our econometric model provides another way of testing for asymmetric effects of different types of information. Positive and negative information tend to have fundamentally different effects on consumer's attitude toward a product or an issue. The same is likely true in the case of political initiatives, where advertisement is inherently manipulative. Swartz and Strand (1981) and Smith, van Ravensway and Thompson (1988) conduct empirical studies of positive and negative information regarding contaminated food scares and find that the initial, negative information has a far stronger effect in reducing demand than subsequent positive information has in restoring demand. Similarly, Fox, Hayes and Shogren (2002) use an experimental method similar to the one used here to find that negative information regarding the potential health effects of irradiated pork greatly outweigh any positive information. Strongly negative information effects can be explained by the loss-aversion theory of Viscusi, Magat and Huber (1987) in which consumers are particularly sensitive to any negative variation in utility from the status quo. Losses are magnified while gains are minimized.

The Viscusi-Magat-Huber theory, however, is observationally equivalent in these situations to the predictions of prospect theory developed by Kahneman and Tversky (1979). Prospect theory maintains that individuals assess losses and gains with respect to a reference point, which in this case is their expectation that eggs are produced in uncontroversial ways. When confronted with information that reality is somewhat worse than their expectations, they magnify the negative result, while ignoring any information that may lead them to believe that hens are more happy than they expect. Our experimental data, and the econometric model used to test our hypotheses regarding willingness-to-pay are well-suited to examining the issue of asymmetry and loss-aversion in the informative content of political ads.

This article makes a number of contributions to the policy and marketing literature. First, we develop a new method of estimating the effect of marketing activities in an important, yet little studied category of advertising expenditure: voter behavior in public referenda. Second, our econometric model provides a way of separating the hype content of advertising from its informative content. In doing so, we also offer a new explanation for the observed asymmetric effects of positive and negative information on consumers' preferences. Third, we propose and apply a metric against which policies may be judged as being either for or against the public interest. The role of marketing in the formation of public policy is too often overlooked, despite its obvious importance in the exercise of direct democracy.

Our research has three objectives. The first and primary objective of this study is to determine the willingness-to-pay for food products raised in a "humane" way, or one that is fundamentally different from current practice. The second objective is to determine the relative effect on WTP of media advertising presented either in support of an animal welfare initiative, or counter to it. The third objective is to determine whether media advertising shifts or rotates the demand curve, and the welfare implications of whether the dominant effect is a shift or a rotation. Ultimately, we seek a better understanding of the role of campaign spending on matters that materially impact the ways in which firms can conduct themselves.

2   Research Method and Experimental Design

To determine the willingness-to-pay for cage-free eggs, we use a non-hypothetical experiment in which we offer subjects the opportunity to purchase eggs that are clearly labeled as cage-free. Stated preference methods, such as surveys or choice experiments (conjoint analysis), are often used to determine consumers' willingness-to-pay for new food products (Lusk, et al., 2001, for example). If the products do not currently exist, however, it is difficult to elicit "homegrown" or personal values for these products as the buyers have no basis for accurate comparison. Moreover, participants in stated choice data-gathering exercises have no real incentive to reveal their true demand as they have no economic stake in the outcome of the survey. List and Gallet (2001) find that respondents state values 2-20% greater in hypothetical questions relative to non-hypothetical valuation questions. A non-hypothetical experiment, on the other hand, has the ability to uncover consumers' true willingness-to-pay because participants in the experiment are provided real economic incentives to make decisions that provide the most benefit at the lowest possible cost. Consequently, we conduct a non-hypothetical experiment in which we use real economic incentives to elicit consumers' willingness to pay for cage-free eggs. Because these attributes are not apparent by inspecting the goods themselves in the absence of labels to that effect, we are essentially obtaining likely market prices for what are termed "credence" attributes, or attributes that the consumer must trust the producer to include in the product.

Specifically, we use a Becker-deGroot-Marschak (1964, BDM) auction mechanism to determine willingness-to-pay. Using a BDM mechanism is intended to ensure truthful value elicitation while minimizing the possibility that we exclude marginal bidders (those who are likely to have a low value for cage-free eggs) from the auction. The BDM auction works as follows. All subjects are initially endowed with a regular-size candy bar and a dozen regular

(non-cage-free) eggs. In each round (and in the practice round), subjects were asked to submit their willingness-to-pay to upgrade to either a king-size candy bar (practice round) or cage-free eggs (actual auction). The experimenter then draws a price at random from a uniform distribution between zero and the maximum willingness-to-pay submitted. All bidders willing to pay equal to or more than this random price receive the upgrade, while those below the random price do not. The "market price" in the auction is the random price. The BDM mechanism is demand revealing because the bidder does not know what the market price will be, but does understand that every price between zero and the maximum bid has an equal probability of becoming the market price. Therefore, if he or she were to shade their bid in order to save money, they may lose an item they value and if they bid above their true value, they risk buying something for more money than it is worth.

In this way, the results of our research may be used to inform policymakers as to the true economic cost of the propositions, the distributional effects of regulating production practices, and to inform marketing managers in egg marketing firms as to how they should price and promote new food products to maximum advantage. More importantly, the empirical model described in the next section is able to determine whether media advertising of either type "shifts" the demand curve for cage-free eggs or rotates it. This distinction is important both in the calculation of welfare outcomes, and in determining the nature of the advertising effect: whether it provides information to consumers / voters, causing the demand curve to become more elastic (Norman, 1970, 1974), or whether it is inherently persuasive, changing tastes and causing demand to become less elastic (Dixit and Norman, 1978).

3   Empirical Model of Media Advertising

We test for shift or rotation effects of media advertising using an empirical model that captures the theoretical effects of advertising described by Johnson and Myatt (2006). Conceptually, the information content of advertising is difficult to separate from what may otherwise be described as "hype." While the historical debate centers on whether advertising changes preferences (Dixit and Norman, 1978), provides information (Norman, 1974) or provides a complementary good to the product being purchased (Becker and Murphy, 1983), Johnson and Myatt (2006) develop a general theory of demand that relies on none of these behavioral assumptions. Rather, Johnson and Myatt (2006) develop a fundamentally new perspective on how advertising works. Rather than simply shift demand, advertising in their model operates on the dispersion of consumer valuations for the product. If advertising provides "real information," in their terminology, then the dispersion of valuations for the product is likely to rise. Consumers who value the product relatively highly before the advertisement will like it even more after the ad, and those who value it less highly will like it even less. Demand rotates clockwise. For firms that sell a homogeneous product, designed to sell to the mass-market, this rotation in demand reduces the valuation of the marginal consumer, reducing profits. In this case, the marginal consumer is "below average" in terms of his willingness to pay for the product. Firms that sell highly differentiated products, designed to appeal to a niche market, however, prefer advertisements that rotate demand in this way because their marginal consumer is "above average." The willingness to pay for this consumer rises with a clockwise rotation in demand. Firms that sell homogenous goods, therefore, prefer to use advertising that is "pure hype" as it shifts demand outward at each price. These firms would rather minimize the dispersion of valuations and thus rotate the demand curve counter-clockwise, raising the valuation of their marginal consumer and, hence, profits.

The analogy to political ads is straightforward. Polarizing issues that tend to have both passionate supporters and equally passionate detractors are "highly differentiated products," while more mundane issues that are not likely to inspire as much controversy are more akin to "homogeneous products." Same-sex marriage is an example of the former, while bond issues for local sports stadiums are good examples of the latter. The marginal voter in a polarizing campaign is likely to have a valuation greater than the mean, so ads that provide

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real information are likely to increase the dispersion of demand, rotate the demand curve clockwise, increase the valuation of the marginal voter, and raise the "total take" on voting day. On the other hand, real information in a run-of-the-mill campaign is expected to reduce the dispersion of demand, essentially moving voters to the center of the issue, rotating the demand curve counter-clockwise, and increasing the willingness-to-pay of the marginal voter who began with a valuation that is below the mean.

Formally, consider the definition of a rotation in the demand curve described by Johnson and Myatt (2006). Assume there is a unit mass of consumers, each willing to pay w for one unit of the item in question. The distribution of w is represented by $F_s(w)$, which is twice continuously differentiable in both s and w with density $f_s(w)$. The parameter s governs the shape of the distribution of valuations such that an increase in s represents a spread in the density of w and, hence a clockwise rotation of $F_s(w)$ about some point $\hat{w}$ (figure 1, Johnson and Myatt, 2006). We next derive the effect of a spread in valuations on the distribution of market demand. At any price, p, the proportion of consumers who purchase the good is given by: $q = 1 - F_s(p)$. Inverting this expression gives an expression for the inverse demand curve: $P_s(q) = F_s^{-1}(1 - q)$, so a change in s rotates the inverse demand curve in a manner analogous to the change in the distribution of valuations (figure 2, Johnson and Myatt, 2006). Namely, if demand is below the pivot point, $\hat{q}$, then an increase in the spread of valuations causes a rise in the market price, and vice versa, or:

$$q < \hat{q} \implies \frac{\partial P_s(q)}{\partial s} > 0, \; q > \hat{q} \implies \frac{\partial P_s(q)}{\partial s} < 0. \tag{1}$$

Equation (1) implies that if we are below the pivot-point in demand, greater dispersion in valuations causes the valuation of the marginal consumer, and hence the market price, to rise and if we are above the pivot-point in demand, an increase in the dispersion of demand causes the price to fall. In the former case, the issue with the product is more likely to be of interest to a concentrated special interest, or niche group of voters, and in the latter the issue is likely to be of interest to the mass of voters.

We use the theoretical framework developed in this model to derive a structural model of pro- and anti-animal welfare regulation advertising. Our model is structural in the sense that it is derived directly from the utility-theoretic model of advertising hype versus real information. We derive the willingness to pay (WTP) for cage-free eggs in a random utility framework in which the distribution of consumer heterogeneity reflects the distribution of marginal valuations in the theoretical model above. In the random utility model, consumer utility is the sum of a deterministic and stochastic part such that:

$$U_{ij} = V_{ij} + \varepsilon_{ij}, \tag{2}$$

for product j by consumer i, where V_{ij} is the deterministic component of utility, and ε_{ij} is an iid error term. Utility, in turn, is a function of attributes of the chooser (x_i) and of the choice (z_j), a vector of advertising exposures (a_k) and income (y_i). The marginal value consumer i places on product $j = 1$ is defined as the amount of income that leaves his or her utility at least as great with and without the purchase:

$$V_{i0}(\mathbf{z}_0, \mathbf{a}_0, \mathbf{x}_i, y_i) + \varepsilon_{i0} \leq V_{i1}(\mathbf{z}_1, \mathbf{a}_1, \mathbf{x}_i, y_i - c_{i1}) + \varepsilon_{i1}, \tag{3}$$

where c_{i1} is the marginal value of product 1 by consumer i . We solve for the willingness to pay by consumer i by invoking the random utility assumption and recognizing that:

$$\Pr(WTP_{i1} \geq c_{i1}) = \Pr(V_{i0} + \varepsilon_{i0} \leq V_{i1} + \varepsilon_{i1}), \tag{4}$$

Assuming the error term is double-exponential distributed with mean 0 and variance $\pi^2 \mu^2 / 3$, the willingness to pay becomes:

$$\Pr(WTP_{i1} \geq c_{i1}) = \frac{\exp(V_{i1}/\mu)}{\exp(V_{i1}/\mu) + \exp(V_{i0}/\mu)}, \tag{5}$$

where μ is the logit scale parameter. Solving for the willingness to pay from this expression, we write the odds ratio of choosing product 1 relative to product 0 as:

$$\frac{\Pr(j=1)}{1 - \Pr(j=1)} = \frac{\exp(V_{i1}/\mu)/(\exp(V_{i1}/\mu) + \exp(V_{i0}/\mu))}{\exp(V_{i0}/\mu)/(\exp(V_{i1}/\mu) + \exp(V_{i0}/\mu))} = \exp(V_{i1}/\mu), \tag{6}$$

where we normalize $\exp(V_{i0}/\mu)$ to one and $\Pr(j=1)$ is the probability of purchasing good 1. Taking logs of both sides of the odds ratio gives an expression for the willingness to pay by consumer i as a function of choice and chooser attributes, the level of advertising and the scale parameter (which we normalize to 1 without loss of generality in the empirical application below):

$$\ln\left(\frac{\Pr(j=1)}{1 - \Pr(j=1)}\right) = WTP_{i1} = V_{i1}/\mu. \tag{7}$$

With an appropriate specification for V_{i1} it is possible to test for both the direct effect of pro- and anti-animal welfare advertising on the willingness to pay for cage-free eggs, and the indirect effect through the dispersion of valuations.

Utility in a random utility framework is typically additive over attribute arguments. Writing V_{i1} in terms of an empirical, or estimable, model of utility, we assume that:

$$V_{ij}(\mathbf{z}_j, \mathbf{a}_{mj}, \mathbf{x}_i, y_i) = \alpha_j + \sum_{k=1}^{K} \beta_k z_{jk} + \sum_{l=1}^{L} \gamma_l x_{il} + \sum_{m=1}^{M} \delta_m a_{mj} + \xi_j, \tag{8}$$

where α_j is a choice-specific constant, β_k are marginal values for each product attribute, γ_l represent the influence of each demographic attribute on willingness to pay, δ_m is the impact of advertising of type m (pro- or anti-animal welfare) on indirect utility and ξ_j is the iid econometric error term. Advertising, however, is hypothesized to have both a direct effect through creating hype and shifting the demand curve, and an indirect effect through the dispersion of valuations. We model this latter effect by recognizing the that advertising response term is a function of unobserved consumer heterogeneity through the distribution of preferences, F_s above. Each advertising-impact parameter is randomly distributed according to:

$$\delta_m = \delta_{m0} + \delta_{m1}\sigma_m + \nu_m, \ \nu_m \sim N(0,1), \tag{9}$$

where δ_{m0} is now interpreted as the direct effect of advertising of type m (shift effect), δ_{m1} is the indirect, or rotational effect caused by changes in the dispersion of valuations, and σ_{mj} is the variability in tastes associated with each type of ad. Substituting this utility model into the expression for WTP_{i1} provides an estimable model of the impact of advertising on the willingness to pay under each type of advertising. Table 1 summarizes the hypotheses we test with this model.

[table 1 in here]

4   Results and Discussion Summary

Our results show that the "hype" or shift effect dominates the rotation effect for each type of ad. Moreover, the persuasiveness of the ads supporting Proposition 2 were sufficiently effective in changing preferences to outweigh the negative effects associated with the opposing ads. Because the notion that animals may be mistreated in the production of food comes

as a revelation to many consumers (who are also voters), this result can be explained by Kahneman and Tversky's (1979) prospect theory. Framed by the assumption that all farm animals are happy, the ads supporting Proposition 2 revealed sometimes shocking images of animals being mistreated and caused consumers to perceive a measure of risk to animal welfare that they didn't fully appreciate before the campaign. This small amount of "bad news" regarding animal welfare was enough to outweigh many strong, but conventional economic arguments, on the other side.

The real information content of the ads was not inconsequential. Perhaps because the supportive ads revealed information that was not previously known to many voters, and participants in our study, the rotation effect for the "Pro" ads was nearly three times the strength of the rotation effect for "Anti" ads. Using measures of consumer welfare to convert our econometric estimates to a dollar-measure, we found that over 6% of the change in consumer welfare associated with the ads came from the real information effect as opposed to the hype effect. Therefore, the ads both changed preferences and managed to harden some voters' opinions on either side.

Politics has become as much about marketing as it is about political science or public administration. As Johnson and Myatt (2006) point out, all advertising consists of varying amounts of real information and hype. With the method used here, we sort out how much of each lies in each ad. Our insights thus generalize beyond the animal welfare case to any type of advertising program in which advertising is neither purely informative nor purely persuasive. Staying in the public policy realm, "issue ads" are now the order of the day given the unrestricted amounts interested parties can contribute to political campaigns. Issue ads are often even more partisan than state-level ballots so this method could be use to evaluate how voters perceive the message contained in the ads – do they understand the true motivations of the money behind the ad? From another perspective, tools like this can help ad agencies design political ads to maximize the effectiveness of ad spending. If an issue is particularly misunderstood among the electorate, then designing an ad with a high real information content may be able to skew the distribution of preferences such that the "willingness to pay" for the issue at hand rises significantly.

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Table 1: Hypotheses for Advertising Effect

Hypothesis	Parameters	Expectation
1. "Pro" advertising increases WTP for all voters	$\delta_{10} > 0$	"Pro" ads are pure hype and shift demand curve out for all voters
2. "Pro" advertising increases the dispersion of preferences	$\delta_{11} > \delta_{01}$	"Pro" ads have real information and rotate demand clockwise
3. "Anti" advertising increases WTP for all voters	$\delta_{20} > 0$	"Anti" ads are pure hype and shift demand curve out for all voters
4. "Anti" advertising increases the dispersion of preferences	$\delta_{21} > \delta_{01}$	"Anti" ads have real information and rotate demand clockwise
5. "Pro/Anti" advertising increases WTP for all voters	$\delta_{30} > 0$	"Pro/Anti" ads are pure hype and shift demand curve out for all voters
6. "Pro/Anti" advertising increases the dispersion of preferences	$\delta_{31} > \delta_{01}$	"Pro/Anti" ads have real information and rotate demand clockwise

Note: δ_{00} and δ_{01} are constant shift and rotation terms, respectively. Index m=1 refers to "Anti" ads, index m=2 refers to "Pro" ads and m=3 refers to "Pro/Anti" ads.