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Designing a Voluntary Beef Checkoff

F. Bailey Norwood, Chris Winn, Chanjin Chung, and Clement E. Ward

Recently, the U.S. Supreme Court considered whether the mandatory fees imposed by the beef checkoff violates the First Amendment. As a precaution, many states began forming voluntary beef checkoffs, where funds would be raised through voluntary contributions. This study conducted a survey of Oklahoma cattle producers to determine what type of voluntary checkoff design would receive the greatest support. The most popular checkoff placed a large emphasis on advertising and a slightly lower checkoff fee. The survey also tested the ability of a provision point mechanism to limit free-riding. The mechanism was not as effective as in other studies which used laboratory experiments.

Key words: beef marketing, checkoff, free-rider, provision point mechanism, public good

Introduction

The beef checkoff began in 1986, when a majority of cattlemen voted in favor of the Beef Promotion and Research Act. The checkoff is managed by the Cattlemen's Beef Promotion and Research Board, commonly referred to as the Beef Board. Checkoff funds are raised by assessing all U.S. cattle producers a mandatory fee of $1 for each head of cattle sold. A $1 per head-equivalent fee is placed on all imported cattle and beef imports as well. Since its inception, the checkoff has sought to improve beef demand through research, advertising and promotion, consumer information, industry information, foreign marketing, and producer communications.[1]

The legality of the beef checkoff has been frequently challenged in courts, but prior to 1998, posed little threat to the checkoff. These challenges include the 1989 *United States v. Frame* and the 1998 *United States v. Goetz* cases. Later, the U.S. Supreme Court provided beef checkoff opponents with an opportunity when it ruled the mushroom order unconstitutional in 2001 on the grounds that it violated free speech. Consequently, the Livestock Marketing Association and the Campaign for Family Farms challenged the beef checkoff on similar grounds. On June 21, 2002, a federal judge in South Dakota ruled the beef checkoff unconstitutional, and this ruling was later upheld by the 8th U.S. Circuit Court of Appeals. Unless these rulings were appealed, the only way the beef checkoff could continue its activities would be to raise funds through voluntary

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[1] The Beef Promotion and Research Act limits research to activities beyond the farm-gate (*Federal Register*, 1986). Therefore, "research" in this study does not include farm-level activities.

contributions. To maintain the checkoff's mandatory nature, an appeal was made to the Supreme Court, where checkoff proponents argued the checkoff did not violate the First Amendment because it constituted government speech (Smith, 2003a,b, 2004).

Meanwhile, 17 states developed contingency plans for a voluntary checkoff as the Supreme Court deliberated (Barrett, 2004). Oklahoma passed a bill that would allow creation of a voluntary beef checkoff where all producers are assessed a checkoff fee—just as they are now—but their fees would be refunded if requested within 45 days. Both Texas and Tennessee passed similar legislation (Barnett, 2003; Delta Farm Press, 2004). If state-level checkoffs sought to conduct large-scale advertising campaigns, due to the high cost of television ads, they would likely want to pool their resources. Currently, for every dollar collected by the checkoff, $0.50 is returned to the state where it was collected. An organization called the Federation of State Beef Councils could then pool these funds for large-scale projects. If this federation was maintained under a voluntary checkoff, it could coordinate state-level funding in a way that mimics a nationwide voluntary checkoff.

After months of anxious waiting by interested parties, the Supreme Court announced the beef checkoff did indeed reflect government speech, and therefore did not violate the First Amendment (Smith, 2005). A ruling against the checkoff would have been unfortunate for the 70% of beef producers who support the checkoff. Approximately 80% of producers believe the checkoff increases retail beef demand and increases profits at the farm level, and 60% believe beef demand would decline if the checkoff was eliminated (*High Plains Journal*, 2004; Smith, 2003a). For now, it appears the beef checkoff is safe. However, checkoff opponents will likely continue to attack the mandatory nature of the beef checkoff, and while it is unknown whether these attempts will be successful, it is constructive to look back and question whether the checkoff could have survived on a voluntary basis, and what could have helped the checkoff survive.

Between the time checkoff supporters filed an appeal with the Supreme Court and the time the appeal was officially ruled upon, we conducted a survey of Oklahoma cattlemen to gauge their attitudes toward a voluntary checkoff. The type of voluntary checkoff considered mimicked the voluntary checkoff being developed by the Oklahoma legislature. Each cattle producer would be assessed a fee for each head of cattle sold, just as they are now, but this fee would be refunded if requested. These voluntary fees would then be used to fund advertising, research, and other activities just like the current checkoff. Both a state- and a national-level voluntary checkoff were considered.

The survey was designed to answer three questions: (*a*) What level of voluntary fee per head of cattle sold and what budget allocation do cattle producers prefer? (*b*) Could a provision point mechanism limit free-riding? and (*c*) What participation rate can be expected from a voluntary checkoff? The answers to these questions are important despite the fact that the Courts ruled in favor of the checkoff. The first question, concerning preferences for checkoff design, partially dealt with how cattle producers feel checkoff funds should be spent across advertising, research, and other activities. This information can be used by checkoff administrators to tailor the current checkoff budget in accordance with their constituents' preferences. Also, future attempts at removing the mandatory nature of the beef checkoff may be successful. If this occurs, then the survey results provided here will be of immediate guidance in how a voluntary checkoff should be designed, how voluntary fees should be assessed, and what type of participation rate to expect.

Finally, the free-rider problem is a recurring issue in public-good provision, and economists should seek effective tools for limiting free-riding. Mechanisms exist which can alter one's dominant strategy away from free-riding. One example is a provision point mechanism, where all contributions are refunded if a specific level of support is not reached. These refunds are made to all individuals, regardless of whether they requested it. Provision point mechanisms can be specified as a specific amount of money that must be generated or a percentage of producers who donate. In the past, checkoffs have been evaluated based on a referendum, where each producer gets one vote. It then stands to reason that if a provision point mechanism is used, it will be specified as a minimum percentage of producers who donate—a *threshold level of provision* (*TLP*).[2]

Provision point mechanisms alter an individual's dominant strategy in noncooperative games, and in some instances can achieve a social optimum allocation of public goods through donations (Bagnoli and Lipman, 1989).[3] Experiments have also concluded that provision point mechanisms increase voluntary contributions and the probability of funding a public good (List and Lucking-Reiley, 2002; Messer, Kaiser, and Schulze, 2004; Messer, Schmidt, and Kaiser, 2005; Poe et al., 2002). The 2004 study by Messer, Kaiser, and Schulze is especially relevant because its lab experiment was designed to mimic a voluntary checkoff. The authors found a *TLP* of 70% was met in more than 90% of trials. Messer, Schmidt, and Kaiser (2005) provided even more innovative experiments in a study aimed at identifying the optimal *TLP* in a checkoff setting. Under certain settings, the optimal *TLP* is around 80% and is met 76% of the time, supporting the notion that voluntary checkoff managers should consider *TLP*s when designing checkoffs.

However, implementing a *TLP* introduces risk. If a *TLP* is not met, the checkoff board must refund all fees, losing momentum and expected contributions in future years. This risk is greatest when the benefit-cost ratio for public goods is low (Rondeau, Poe, and Schulze, 1999). The prospect of issuing full refunds is too risky to warrant the use of *TLP*s based on laboratory experiments alone. It would be prudent to also measure cattle producers' reaction to *TLP*s through surveys.

The remainder of this paper is organized as follows. First, a description of the survey is presented. The next section estimates a random utility model describing Oklahoma cattle producers' preferences for a voluntary beef checkoff. The effectiveness of the provision point mechanism is then examined, followed by a section predicting donation rates in a voluntary beef checkoff. The concluding section provides a summary discussion and final comments.

Survey Description

In the beginning of January 2004, a total of 2,950 surveys were mailed to Oklahoma cattle producers, yielding 670 usable surveys. Eighty-three surveys were returned due to undeliverable addresses, giving a final response rate of 23%. The mailing list was a

[2] A case in point is when acclaimed author Stephen King attempted to provide his novel *The Plant* directly to readers over the internet. Readers were told they would receive monthly installments of the book to download, and were asked to voluntarily contribute $1 per month for the installment. To limit free-riders, King warned readers that if fewer than 75% of readers made the voluntary payment, the offer would cease. By the last chapter, only 46% of readers made the voluntary payment (Wheeler, 2002).

[3] Provision points only create a second, dominant set of Nash equilibria when the benefit-cost ratio of the public good is greater than one.

stratified random sample obtained through the National Agricultural Statistics Service database. The survey was pre-tested through mailing of draft surveys to 15 Oklahoma cattle producers, as well as students who manage cattle, and colleagues. A reminder notice was mailed two weeks after the initial survey mailing. A sample survey is presented in the appendix.

The survey provided a brief description of the beef checkoff program and the recent court rulings concerning the program. Next, through the use of choice experiments (often referred to as conjoint analysis), respondents were asked what type of voluntary program they would support, should the mandatory program be ruled unconstitutional.

A hypothetical voluntary checkoff program was described, similar to the refundable checkoffs being prepared in Oklahoma, Tennessee, and Texas. Producers were told checkoff fees would be collected as a fee per head sold, just as they are now. If they wish, producers could then request their checkoff fees be refunded in full. Remaining funds would then be spent on checkoff programs. However, if a threshold level of provision is not met, all fees would be refunded, even if a refund was not requested.

Next, producers were presented with two hypothetical checkoffs that differed in the checkoff fee, threshold level of provision, and the allocation of funds across advertising, research, and other activities. Producers were asked to which checkoff they would most prefer to donate. If they would not donate to either checkoff, they could indicate they would request a refund. Producers were asked to make this choice both if the checkoff was a national program and a state program. By varying the fee, threshold level of provision, and funding allocation across surveys, a random utility model can be estimated to predict donations to a national- and state-level voluntary beef checkoff.

At the national level, the beef checkoff budget allocation was 53% advertising and promotion, 10% research, and 37% other in 2004 (Smith, 2003b). The "other" category includes export promotion and consumer education, among other activities. In the choice experiment for the nationwide checkoff, producers were given an option between donating to two hypothetical checkoffs and an option not to donate. In all surveys, the percentage of funds spent on promotion, research, and other in one of the hypothetical nationwide checkoffs is allocated according to the current budget mentioned above, and the alternative nationwide checkoff contains a different budget randomly generated to ensure the percentages sum to one. A similar question was posed for state-level checkoffs, but the budget allocations for both hypothetical checkoffs were randomly generated. The state-level checkoff question was always preceded by the nationwide checkoff question, so an ordering effect may be present. The range of values for the voluntary fee, budget allocation, and the threshold level of provision were randomly chosen for each survey and survey question (see table 1) to maximize the D-efficiency score, which ensures both balanced and orthogonal attributes within and across surveys.[4]

Evidence suggests producers will more willingly commit to a hypothetical checkoff than a real checkoff where a monetary payment is made. This is referred to as hypothetical bias, and is pervasive in stated preference studies (List and Gallet, 2001). Hypothetical values are calibrated downward based on individuals' expressed uncertainty

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[4] Attributes are randomly chosen such that they are within the bounds in table 1. The budget allocation is chosen whereby the mean percentage allocation is approximately 33% and all budget allocation percentages sum to one. Given these constraints, attributes are then randomly chosen across and within surveys iteratively, until the value of $|(\mathbf{X'X})^{-1}|^{1/P}$ is maximized ($\mathbf{X}$ is the vector of explanatory variables and P is the number of explanatory variables). The measure $|(\mathbf{X'X})^{-1}|^{1/P}$ is referred to as the D-efficiency score.

Table 1. Value of Checkoff Attributes Across Surveys

Checkoff Attribute	Average	Minimum	Maximum
Checkoff Fee (*FEE*)	$1.00/head sold	$0.20/head sold	$2.00/head sold
Percent of Funds Spent on:			
▸ Advertising (*ADV*)	33%	10%	85%
▸ Research (*RES*)	33%	0%	75%
▸ Other (*OTHER*)	33%	5%	80%
Threshold Level of Provision (*TLP*)	50%	5%	90%

Note: For the nationwide checkoff, one of the hypothetical checkoff's budget allocation was set to equal the current allocation. This checkoff was not included in these summary statistics. All checkoff fees and percentages change in $0.05 and 5% increments, respectively. The attributes are chosen from a uniform distribution, with consideration that the budget constraint must sum to 100%.

about how they would behave if the checkoff were real. If a producer responds she would contribute to a checkoff by not requesting a donation, we asked her to answer a certainty question similar to that used by Champ and Bishop (2001). This question states, "On a scale of 1 to 10, where 1 means "very uncertain" and 10 means "very certain," how certain are you that you would voluntarily pay the checkoff fee for the option you chose in Question 1 if given the opportunity?" If the subject indicated a certainty level less than eight, her survey answer was changed to "no donation." This calibration strategy using the eight-threshold is referred to here as a *certainty-calibration*.

Champ and Bishop (2001) found that the certainty-calibration (using an eight-threshold) eliminated hypothetical bias in a study of willingness to pay for wind energy. Similar results have been reported in other studies (Blumenschein et al., 1998; Vossler et al., 2003). More recent studies have illustrated a definite link between answers to the certainty question and hypothetical bias (Johannesson et al., 1999), indicating that the certainty-calibration is not an arbitrary method of decreasing hypothetical values. In all studies comparing values using the certainty-calibration to true values, the certainty-calibration either provides unbiased estimates of true donations or under-predicts true donations (Johannesson et al., 1999; Blumenschein et al., 1998; Champ and Bishop, 2001; Poe et al., 2002). Each of these studies evaluated the certainty-calibration in a dichotomous choice setting.

However, a recent study by Norwood (2005) shows previous results regarding the certainty-calibration also extend to conjoint analysis involving public goods. Norwood mimicked a voluntary beef checkoff in an experimental setting, where students could voluntarily contribute toward a public good. Just like the survey in this study, the donation could be a fixed amount, was voluntary, and involved a threshold level of provision. Before contributions could be made, subjects were administered a conjoint analysis survey containing a certainty-calibration. The survey results were then used to predict donation rates to the public good. Consistent with previous studies, uncalibrated survey responses over-predicted participation, while use of the certainty-calibration under-predicted participation rates. Since uncalibrated models should over-predict true donation rates due to hypothetical bias, the use of calibrated and uncalibrated models should provide a lower and upper bound to the true willingness to donate to a voluntary checkoff.

It is worth noting our survey followed a year of record-setting high cattle prices. These high prices survived the discovery of bovine spongiform encephalopathy (BSE) in the United States, partly due to limited supplies and partly due to the growing popularity of high-protein diets. These events prior to the survey point to producer optimism, which may imply a greater willingness to support checkoff programs than in more pessimistic times.

Most of the respondents were involved with both cow-calf (77% of respondents) and stocker production (68%), while 28% indicated they had sold fed-cattle, 7% had sold veal cattle, and 21% had sold purebred cattle. Analysis of the survey responses suggests preferences for a voluntary checkoff differ little across farm type and sizes (Winn, 2004). For the remainder of this paper, all producers are assumed to have identical preferences for a voluntary checkoff, regardless of the farm type they operate or the number of cattle they sell.

Producer Preferences for a Voluntary Checkoff

Survey responses described previously are used to estimate a random utility model for a voluntary checkoff. Utility is specified to be a function of the checkoff attributes. Attributes include the voluntary fee per head of cattle sold (*FEE*); percentage of contributions spent on advertising (*ADV*), research (*RES*), and other (*OTHER*); and threshold level of provision (*TLP*). First, a simple linear random utility model is used to determine whether responses to the national-level and state-level checkoffs can be pooled to estimate a single utility model for both checkoff types. Pooling of data is possible if producers' willingness to donate toward a checkoff and preferences for how the checkoff dollars are spent do not depend on whether it is an Oklahoma checkoff or a nationwide checkoff.

The ability to pool data is determined by first estimating the random utility function:

$$(1) \qquad U_i = \mathbf{X}_i\beta + \varepsilon_i = \mathbf{x}_i\beta_1(1 - S_i) + \mathbf{x}_i\beta_2(S_i) + \varepsilon_i,$$

where $\mathbf{x}_i = [FEE_i\ ADV_i\ RES_i\ OTHER_i\ TLP_i]$, S_i is a dummy variable equal to one if the checkoff is at the state level and zero otherwise, and the β_i's are conformable parameter vectors. The S_i variable switches utility from representing a state checkoff when $S_i = 1$ to a nationwide checkoff when $S_i = 0$. The term ε_i is assumed distributed according to the extreme-value distribution. There is no intercept, and all explanatory values are set to zero when "no checkoff" is chosen.[5] This sets utility from not donating equal to the error term ε_i.

Since the extreme-value distribution has a fixed variance, the estimates of the β_i's are partly a product of the utility variance. Mathematically, the estimate of β_i equals the true value times a scale factor, $\hat{\beta}_i = \bar{\beta}_i\mu_i$, where $\bar{\beta}_i$ is the true utility parameter and μ_i is a scale factor (Swait and Louviere, 1993). To jointly test whether the utility parameters and scale factors are identical across both checkoff types, the pooled model is also estimated:

[5] This assumption is necessary. Since the budget shares for *ADV*, *RES*, and *OTHER* must sum to one, including an intercept would introduce perfect collinearity in the explanatory variables.

(2) $$U_i = \mathbf{X}_i\beta + \varepsilon_i .$$

The assumption of an extreme-value distribution for the error term leads to the standard conditional logit model that can be estimated through maximum likelihood as described in Greene (1997). For example, if t refers to an observation, and $Y_{t,i} = 1$ only if option i is chosen and zero otherwise (i can equal 1, 2, or 3 for the first checkoff, second checkoff, and neither, respectively), then the maximum-likelihood function is:[6]

(3) $$\max_{\beta} LLF = \sum_t \sum_{i=1}^{3} Y_{t,i} \ln \left\{ \frac{\exp(\mathbf{X}_{t,i}\beta)}{\sum_{i=1}^{3} \exp(\mathbf{X}_{t,i}\beta)} \right\}.$$

In an effort to be conservative, unless noted otherwise, all results are based on calibrated data. Thus, implicit in the results is an assumption about respondent behavior. The assumption is that respondents will not donate to a checkoff just because they state they will; they must also indicate a certainty level of eight or higher.

Model estimation using a likelihood-ratio test for the null hypothesis that $\beta = \beta_1 = \beta_2$ yields a p-value of 10%. This implies that if a 5% confidence level is used, one would not reject the null hypothesis, but at a 10% confidence level the null hypothesis would be rejected. Thus, the difference in the preference profile between state and federal checkoffs is only marginally significant, so the remainder of this paper pools the state and federal checkoff data and estimates a single utility function for both. The main results change only slightly if different utility functions are estimated for both checkoffs. To view this study's results disaggregated across state and federal checkoffs, or how results change when data are not calibrated, see Winn (2004) and Winn et al. (2004).

The pooled data are used to answer three questions: (*a*) How should a voluntary checkoff be designed? (*b*) What rate of participation should we expect from a voluntary checkoff? and (*c*) How does the *TLP* perform at increasing donation rates? A quick look at a simple linear utility model (which is not a linear probability model) provides initial insights into these questions, although a more flexible model will be utilized for better results later. The linear model estimate is provided due to its ease of interpretation. The linear utility model estimates (table 2) reveal all attributes are important to producers, as determined by the significant coefficients. The negative sign on *FEE* indicates that over the range of *FEE* in the survey, producers generally preferred a smaller *FEE*. However, a subsequent, more flexible model will show that *FEE* actually has a positive effect on utility at lower levels. The positive sign on *ADV*, in contrast to the negative signs on *RES* and *OTHER*, indicates producers prefer checkoff funds to focus mostly on advertising.

The signs on *RES* and *OTHER* should not be interpreted to imply expenditures in these categories detract from utility, as a more flexible model could discover an interior solution for *RES* or *OTHER*. Producers respond to the threshold level of provision (*TLP*) by increasing their willingness to donate, as shown by the significant coefficient on *TLP*

[6] Other, more flexible models were estimated, including a mixed logit where all the utility parameters were both random and correlated with one another. This approach allows a flexible utility and error structure that permits preferences to be correlated within surveys. However, because the mixed logit did not produce substantially different results, requires reporting many parameters, and can be difficult to interpret, we elected to report only the results of the simple models.

Table 2. Parameter Estimates from Conditional-Logit Models Using Calibrated Data

	Linear Utility Function		Flexible Utility Function	
Variable	Parameter Estimate	Test-Statistic	Parameter Estimate	Test-Statistic
FEE	-0.8043***	(-7.22)	2.1507***	(3.45)
FEE^2	—		-1.4274***	(-5.05)
ADV	0.5546***	(2.58)	-0.4945	(-0.48)
ADV^2	—		-1.5894	(-1.34)
RES	-0.9456***	(-3.82)	-3.6369***	(-3.55)
RES^2	—		0.7840	(0.56)
OTHER	-1.5930***	(-6.69)	0.1769	(0.16)
$OTHER^2$	—		-5.0123***	(-3.73)
TLP	0.7058***	(3.30)	2.1510*	(1.95)
TLP^2	—		-1.2122	(-1.24)
$FEE*TLP$	—		-0.2589	(-0.48)
Log-Likelihood Function Value	-1,178.03		-1,152.16	
Sample Size	1,278		1,278	

Note: Single, double, and triple asterisks (*) denote significance at the 10%, 5%, and 1% levels, respectively.

in table 2. This result supports previous findings (Messer, Kaiser, and Schulze, 2004; Messer, Schmidt, and Kaiser, 2005), where subjects increased donations toward public goods in an experimental setting when *TLP*s were used.

Next, the following more flexible model is used to better portray producer checkoff preferences:

$$(4)\qquad U_i = \mathbf{X}_i\beta + \varepsilon_i = \beta_1(FEE_i) + \beta_2(FEE_i^2) + \beta_3(ADV_i) + \beta_4(ADV_i^2) + \beta_5(OTHER_i) + \beta_6(OTHER_i^2) + \beta_7(TLP_i) + \beta_8(TLP_i^2) + \beta_9(FEE_i)(TLP_i) + \varepsilon_i.$$

As before, utility from not donating to any checkoff equals the random error ε_i. Each variable enters the utility function in a quadratic form due to the expectation that producers may prefer an interior solution for some variables. For example, producers likely believe that a *FEE* consisting of a few cents will do little good, but also have a limit on how high *FEE* should be. While coefficients associated with prices are typically expected to be negative, such is not the case with checkoffs. In a checkoff, *FEE* is an investment which yields a return. So long as producers wish to make this investment, *FEE* will have a positive impact on utility at some level.

If one designs a checkoff to maximize the linear utility function in table 1, 100% of the funds would be devoted toward advertising. However, it is possible that producers want a majority, but not all funds, focused on advertising. Since the current checkoff funds all three activities (advertising, research, and other), producers would be expected to prefer some amount spent on each. Quadratic terms for each budget category allow for these interior solutions.

Producers may not want a provision point mechanism. Instead, they may want the *TLP* set close to 100%, or they may desire a more balanced *TLP* such as the 70–90% range that was successful in the Messer, Schmidt, and Kaiser (2005) experiment. To allow all three possibilities, the *TLP* enters utility in a quadratic form as well. Finally, it seems plausible that the effect of *TLP* on utility may depend on the value of *FEE*. Producers may wish to invest a larger amount of money in the voluntary checkoff, but only if other producers are making the larger investment as well. The interaction term (*FEE*)*(*TLP*) allows for this feature.

The coefficient estimates of (4), reported in table 2, suggest the *TLP* has a quadratic effect on utility, which will ultimately lead to an interior solution if the checkoff is designed to maximize utility. Of course, the significance of the quadratic effect partially depends on the covariance between the *TLP* parameters, which is not reflected by test-statistics. Interpreting the coefficients for the three budget categories (advertising, research, and other) is more difficult due to the numerous terms and differing signs. Thus, an optimization routine is employed to help decipher what the flexibly utility function estimates imply for producer preferences. This routine utilizes the flexible utility estimates in table 2 to design an optimal voluntary checkoff, using two definitions for optimality.

In this paper, it is assumed that the goal of the checkoff is to maximize aggregate producer welfare, which will be identical to maximizing participation rates. Since total utility equals expected utility times the number of producers, total utility can be maximized by maximizing expected utility. While the survey allows producers to choose between two checkoffs or neither checkoff, a real voluntary checkoff entails a choice of either donating to a single checkoff or not. If the utility of donating to a checkoff whose attributes are described by the vector $\mathbf{X}$ is $U = \mathbf{X}\beta + \varepsilon_1$, and the utility from not donating is $U = \varepsilon_0$, the expected utility of the choice for a single producer is:

$$E(U) = \ln\{\exp(\mathbf{X}\beta) + \exp(0)\} \tag{5}$$

plus a constant which is omitted here (Champ, Boyle, and Brown, 2003). Several constraints are needed. First, all checkoff attributes (*FEE*, *ADV*, *RES*, *OTHER*, and *TLP*) must be nonnegative. Second, the budget allocation must sum to one, i.e., *ADV* + *RES* + *OTHER* = 1. Third, the actual participation rate must exceed the *TLP*. Moreover, checkoff designers will want to set the *TLP* with a reasonable certainty it will not be violated, so that checkoff activities can continue without interruption. The expected participation rate is $PR = \exp(\mathbf{X}\beta)/[1 + \exp(\mathbf{X}\beta)]$ (Train, 2003). Notice that maximizing the participation rate is the same as maximizing (5). Using the delta method, the variance of this participation rate is $[\nabla PR]V(\hat{\beta})[\nabla PR']$, where ∇PR is the gradient of *PR* with respect to β. The optimization routine is programmed to ensure that the expected participation rate minus three standard deviations exceeds the value of *TLP*. These constraints lead to the following optimization problem:

$$\begin{aligned} &\max_{\mathbf{x}} E(U) = \ln\{1 + \exp(\mathbf{X}\beta)\}; \\ &FEE,\ ADV,\ RES,\ OTHER,\ TLP \geq 0; \\ &ADV + RES + OTHER = 1; \\ &PR - 3\sqrt{[\nabla \mathbf{PR}]V(\hat{\beta})[\nabla \mathbf{PR}']} \geq TLP. \end{aligned} \tag{6}$$

Table 3. Utility-Maximizing Checkoff Design

Checkoff Attribute		Optimal Checkoff Attribute[a]	Standard Deviation[b]
Checkoff Fee (*FEE*)		$0.71/head	($0.08)
Percent of Budget Allocated to:	▸ Advertising (*ADV*)	69%	(6%)
	▸ Research (*RES*)	3%	(5%)
	▸ Other (*OTHER*)	29%	(5%)
Threshold Level of Provision (*TLP*)		35%	(8%)

[a] The point estimate using the parameter estimates in table 2.
[b] Standard deviations are obtained using simulations. The utility parameters were simulated from their estimated distribution 500 times, and the optimal checkoff was calculated at each simulation.

Optimization results indicate producers prefer a voluntary fee of approximately $0.70 per head, with 70% of the funds spent on advertising and 30% spent on other activities (table 3). Surprisingly, the optimal solution for research is zero. The utility-maximizing threshold provision level is 35%, and will be given greater discussion later. One might wonder how this optimal checkoff design would change in repeated samples. Fortunately, this is easily addressed using simulations. At each simulation, utility parameters are simulated assuming a normal distribution and using the mean and covariance matrix estimated in table 2. After simulating new utility parameters, the optimization problem is repeated to yield a new optimal checkoff design. After 1,000 iterations, the standard deviation of each optimal attribute (table 3) can be used to assess how the optimal checkoff could change in repeated samples. A histogram of the optimal checkoff attributes is provided in figure 1.

According to the simulation, in repeated samples the optimal advertising budget is roughly 60–80% (two standard deviations below and above the point estimate in table 3). This finding confirms that producers place a greater priority on advertising. They also prefer a fee between $0.60 and $0.80, and place little importance on research. As suggested by figure 1, most of the time the optimal research allocation is zero. The histogram also reflects a very low probability of the optimal threshold level of provision (*TLP*) being less than 20%.

Presumably, producers wish the checkoff to follow the equi-marginal principle as described by Cranfield (2003)—i.e., the marginal utility of an additional dollar spent on each budget category should be equal. Otherwise, a change in the budget allocation could yield higher utility. Producers' emphasis on advertising over research and "other" suggests they believe that the marginal return evaluated at any funding level is greater for advertising than the other two categories. The simulation also suggests that the marginal utility of increasing research expenditures may be zero.

Performance of the Provision Point Mechanism

Perhaps the greatest threat to the survival of a voluntary beef checkoff is free-riders. No producer will want to bear most of the checkoff cost when all producers share in its benefits. One tool that can potentially control free-riders and enhance contributions is a provision point mechanism (PPM). A PPM establishes a minimal level of support needed before a public good is provided. In this case, the minimum level of support is a

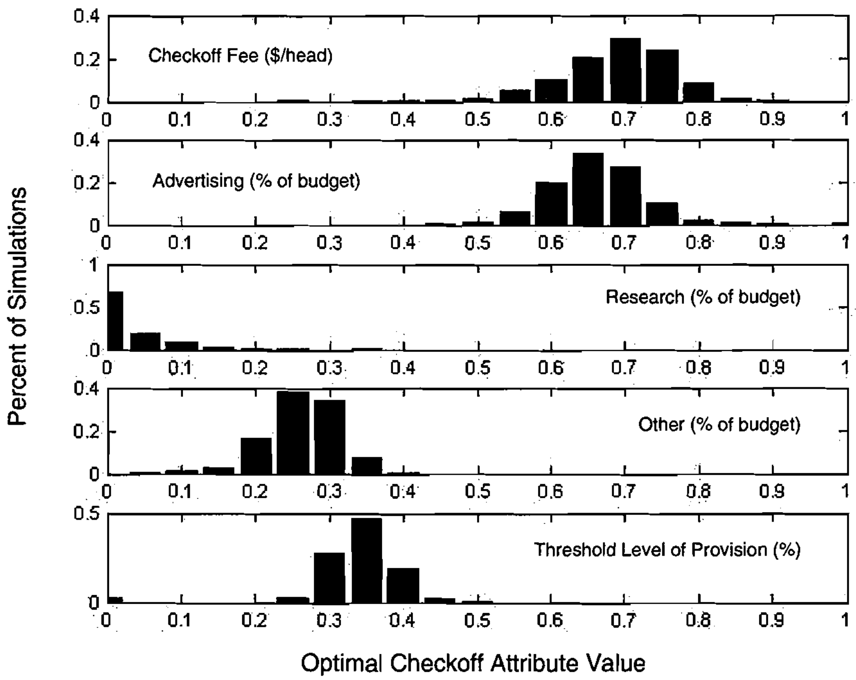


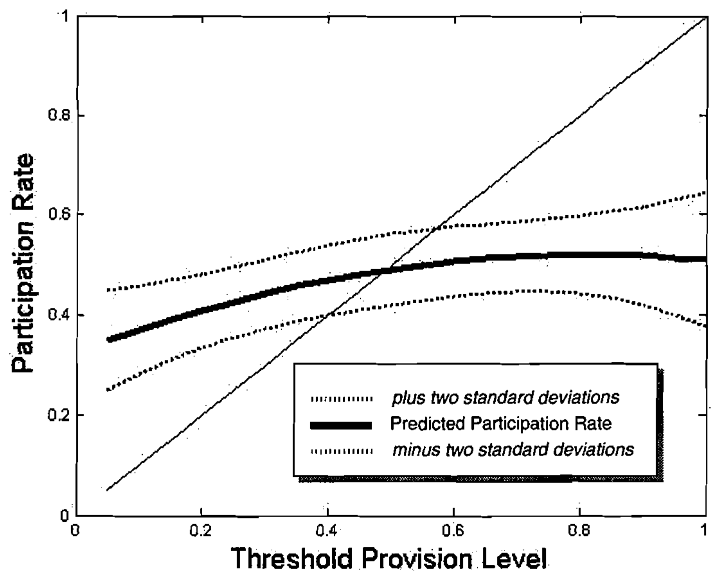
Figure 1. Histogram of optimal checkoff attributes across 1,000 simulations

minimum percentage of cattle producers who do not request a refund of their checkoff fees, referred to as a *threshold level of provision* (*TLP*).

Studies by Messer, Kaiser, and Schulze (2004) and Messer, Schmidt, and Kaiser (2005) (hereafter referred to as the Messer studies) have already evaluated the performance of *TLP*s (along with other institutions) in an experimental setting designed to mimic voluntary checkoffs. Under certain conditions, such as a checkoff benefit-cost ratio of 4:1, the optimal *TLP* is 82% and can be expected to be met 76% of the time. Our study seeks to test the performance of the *TLP* using a stated preference survey, which differs from the experimental settings of the Messer studies.

Perhaps the most important difference is that the survey cannot control the checkoff benefit-cost ratio. Producers contribute to the checkoff if they believe the ratio high, and request a refund if they believe the ratio low. Therefore, the survey results are conditional on producers' perceptions regarding the benefits and costs of a voluntary checkoff. As studies have shown, the benefit-cost ratio can profoundly change the performance of a *TLP* and the optimal *TLP* value (Messer, Schmidt, and Kaiser, 2005; Rondeau, Poe, and Schulze, 1999). The "optimal" *TLP* value in this study depends on the benefit-cost ratio perceived by cattle producers, whereas the benefit-cost ratio in laboratory experiments is determined by the researcher.

As shown in table 3, when the objective is utility maximization, the optimal *TLP* value is around 35%, which is significantly lower than the optimal range of 68% to 90% in the Messer studies. Numerous reasons can be offered for this low value. Perhaps the perceived benefit-cost ratio of a checkoff is lower than the ratio used in the Messer experiments. Another reason may be that producers are not very familiar with the *TLP*, and in a single survey did not give it much thought. Compare this to the Messer studies



Note: The values of *FEE*, *ADV*, and *OTHER* are set at their utility-maximizing level as given by table 3.

Figure 2. Relationship between threshold level of provision (*TLP*) and participation rate

where the *TLP* was carefully explained to subjects verbatim, and subjects were given practice with the *TLP* before the experiment began.

Some may argue that since the quadratic term on *TLP* is not significant, there may not be an interior solution. In fact, there is a valid reason for believing the optimal *TLP* value to be zero. Figure 2 illustrates the impact of the *TLP* on participation rates. Only at low *TLP* values of 35% or less can one be confident the *TLP* will be met. At high *TLP* values (above 60%) like those in the Messer studies, the *TLP* will almost certainly be violated, because the projected participation rate is lower than the *TLP*. Also, in the next section, we show that participation rates do not fall dramatically when the provision point mechanism is eliminated. Although the *TLP* did not perform as well at limiting free-riders in this study as in the Messer studies, the survey results clearly show that producers respond to the *TLP* by increasing their propensity to donate. Combining this finding with the results of the Messer studies, we can conclude provision point mechanisms are a useful tool for limiting free-riders.

Had a voluntary checkoff been initiated and checkoff administrators considered using *TLP*s, two important features should be noted. The confidence interval in figure 2 is calculated based on the assumption that sampling variability is the only uncertainty. In reality, there is model uncertainty, as well as heterogeneity across producers in different regions. These will widen the confidence intervals, increase the chance of having to cease checkoff activities, and issue full donations even at low *TLP* levels. Second, note that the function in figure 2 has a small slope. An increase in the *TLP* (when *TLP* is below 80%) increases participation, but only slightly. In fact, it appears participation is not much lower at a *TLP* of 5% (reasonably low to approximate a checkoff without a *TLP*) compared to its optimal level of 35%. Checkoff administrators may feel the gain in participation due to the use of a *TLP* does not outweigh the risks *TLP*s entail, such as having to cease checkoff activities and issuing full refunds to producers.

Projected Participation Rates

If a voluntary checkoff were warranted, what percentage of producers would contribute? Donation rates will depend partially on how the checkoff is designed. As discussed previously, producer participation is maximized by the checkoff design, as given by the second column of table 3. However, administrators may feel a more equitable budget allocation across advertising, research, and other will yield greater long-term benefits. Specifically, they may feel more qualified to identify the proper budget allocation than the average producer. If they are right, a budget allocation that differs from the one in table 3 may deliver more long-term benefits and elicit higher future participation rates. But how would initial participation rates fall if a checkoff design differed from the presentation in table 3? And what if checkoff administrators feel the risks inherent in a provision point mechanism are not worth the benefits? Will participation rates fall slightly or dramatically? This section seeks to answer these questions.

As described earlier, the percentage of producers who will willingly donate to a voluntary checkoff can be estimated as follows:

$$PR = \exp(\mathbf{X}\beta)/\left[1 + \exp(\mathbf{X}\beta)\right], \tag{7}$$

where **X** is a vector of checkoff design attributes and β is the utility parameter vector from the model in equation (4) (Train, 2003). Variations in participation rates can then be studied by varying the checkoff design characteristics in **X**.

Recall survey responses are calibrated using a certainty question, and the literature suggests this will result in an underestimation of participation rates. The literature also suggests if the results are repeated using uncalibrated data, participation rates will be overestimated. This provides an opportunity to use both calibrated and uncalibrated data to obtain a lower and upper bound to true participation rates.

The calibrated rates are estimated using the flexible utility model estimates in table 2, and evaluating the participation rates at alternative specifications for the checkoff design matrix **X**. The uncalibrated rates are obtained by reestimating (4) using uncalibrated data. Participation rates under various checkoff designs are shown in table 4. All participation rates in the same column (rates using calibrated or uncalibrated data) are significantly different from one another as indicated by bootstraps (see the footnote to table 4). First, consider participation under the utility-maximizing checkoff. The lower and upper bounds are 46% and 69%, respectively. This suggests that, as a best guess, under the best conditions participation would be a little more than 50%.

Starting from the utility-maximizing checkoff design, if the threshold level of provision (*TLP*) is decreased from 35% to 5%, the lower and upper bounds fall by 11 and 14 percentage points, respectively. The participation rate in the absence of a *TLP* cannot be estimated directly, because the lowest *TLP* in the surveys is 5%. However, readers may feel a 5% *TLP* is sufficiently low to approximate a checkoff without a provision point mechanism. These readers can use table 4 to infer that the provision point mechanism used here will increase participation, but the increase will probably not exceed 15%. Deviating from the optimal budget allocation to an equal budget allocation decreases participation—it must do so by model construction—by about 10 percentage points (compare alternatives A and B in table 4).

Table 4. Projected Voluntary Checkoff Donation Rates

	Lower Bound Using Calibrated Data		Upper Bound Using Uncalibrated Data	
Checkoff Design	Projected Participation Rate	Std. Dev.	Projected Participation Rate	Std. Dev.
Utility-Maximizing Checkoff Design: *FEE* = 0.72; *ADV* = 0.7; *RES* = 0.0; *OTHER* = 0.3; *TLP* = 0.35	46%	(4%)	69%	(3%)
Alternative A Checkoff Design: *FEE* = 0.72; *ADV* = 0.7; *RES* = 0.0; *OTHER* = 0.3; *TLP* = 0.05	35%	(5%)	55%	(5%)
Alternative B Checkoff Design: *FEE* = 0.72; *ADV* = 1/3; *RES* = 1/3; *OTHER* = 1/3; *TLP* = 0.05	24%	(4%)	45%	(5%)

Notes: All participation rates under column two are statistically different from one another, and so are the rates under column three. Statistical significance is evaluated by simulating the utility parameters from their estimating distribution and calculating the participation rates under each simulated utility. The participation rates under each checkoff design are subtracted from one another, and the percentage of times this term is positive or negative is calculated as a *p*-value to the null hypothesis that the rates are identical. The standard deviation of each rate is calculated by taking the standard deviation of each rate in the simulations. A total of 500 simulations are used.

Summary and Additional Comments

If the Supreme Court had ruled the beef checkoff violates the First Amendment, the beef industry was poised to initiate voluntary checkoffs across numerous states. This study sought information from Oklahoma cattle producers on how to best design voluntary checkoffs, to assess the ability of a provision point mechanism to limit free-riders, and to predict donation rates across producers. While it now appears the mandatory checkoff will remain in place, these survey results are still important. Checkoff opponents will likely continue to seek to abolish mandatory fees imposed by the current checkoff. If successful, checkoff administrators will have the following results readily available to aid in implementation of a voluntary checkoff.

Oklahoma cattle producer preferences for how voluntary checkoffs are designed differ little for state-level or nationwide checkoffs. Advertising should take greatest priority and should comprise around 70% of the checkoff budget, with "other activities" (consumer education, export promotion) being of second importance. If checkoff money is spent on research, it should probably not exceed 10%. If the voluntary fee and budget allocation are set to maximize producer utility, roughly 46%–69% of producers will not request that their checkoff fee be refunded.

However, this participation rate may increase, perhaps greatly, in the presence of a status-quo bias induced by the refundable nature of a voluntary beef checkoff. A voluntary checkoff will likely collect fees from all producers, returning the fee if the producer requests. Producers will be more likely to contribute if they must ask for money back, rather than give up money voluntarily (Kahneman, Knetsch, and Thaler, 1991). The survey used in this study does not contain this bias because it is hypothetical and no money is initially taken. Although the checkoff is described as a refundable checkoff, the status-quo bias will not exist unless real money is taken.

Experiments by Messer, Kaiser, and Schulze (2004) show this status-quo bias can be large. In their study, when mimicking voluntary checkoffs without a refund mechanism, contribution rates are approximately 50%, which is within the range estimated here.[7] But when the refund mechanism was introduced, contribution rates increased to 85%, which is outside the range estimated here but consistent with the participation rates experienced in some voluntary wheat checkoffs (Lyford, Tilley, and Carlberg, 2003). This suggests that the feasibility of a voluntary beef checkoff may depend crucially on the refund mechanism and the status-quo bias it creates.

Survey results also provide information on a tool touted to minimize free-riding—the threshold level of provision (*TLP*). The *TLP* often experiences success in the laboratory, even those experiments mimicking a voluntary checkoff. However, while producers responded to the *TLP* by increasing their propensity to donate, the response was small, and a voluntary checkoff could arguably stand a better chance of surviving without a *TLP*.

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[7] This 50% was taken from the first round of the Messer, Kaiser, and Schulze (2004) experiment, which best represents responses to a one-time survey.

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Appendix:
Sample Survey

This survey asks your opinion on a hypothetical voluntary beef checkoff. We are interested in your input. Please read the following information before answering the questions.

We would like you to consider a hypothetical voluntary checkoff. This is a potential checkoff that might emerge if the current checkoff is eliminated. The voluntary checkoff would be implemented as follows:

- Checkoff funds would be collected as a fee per head sold for all cattle sold—just as they are now.
- Any producer may request for his or her checkoff fees to be refunded in full.
- Collections remaining after refunds would then be spent on checkoff programs (e.g., generic advertising and promotion, beef safety research, etc.).
- However, if a minimum participation rate is ***not*** met, all producers will receive a full refund—regardless of whether they requested the refund. The minimum participation rate is defined as a percent of producers who ***do not*** request a refund. For example, if the minimum participation rate is 60%, but only 40% of producers do not request a refund, all producers will receive a full refund.

Below are three options. Options A and B represent different voluntary checkoffs you could participate in by not requesting your refund. If you would request a refund instead of participating in Options A or B, please choose Option C.

(1) Please check the ONE option from the table below you prefer the most if this were a *NATIONWIDE* voluntary beef checkoff, assuming these are the only options available. These are hypothetical checkoffs, and studies have found that people overstate their willingness to participate in hypothetical situations. Before answering, please think hard about the choice you would make if it involved real money.

CHECKOFF ATTRIBUTE	OPTION A	OPTION B	OPTION C
Checkoff Fee	**$1.60/head sold**	**$1.50/head sold**	Neither A nor B is preferred. If these were the only two options available, I would request my checkoff fees be refunded in full.
Minimum Participation Rate	**70%**	**15%**	
Percent of Funds Spent on Advertising and Promotion	*53%*	*10%*	
Percent of Funds Spent on Research	*10%*	*10%*	
*Percent of Funds Spent on Other Activities**	*37%*	*80%*	
I would choose (please check **ONLY ONE OPTION**):	☐ I choose Option A and ***would not*** request a refund	☐ I choose Option B and ***would not*** request a refund	☐ I choose neither A nor B. I ***would*** request a refund

*Other activities include export promotion, industry information, consumer education, and personal communications.

If you chose Options A or B in Question 1, please answer the following question (if you chose Option C, please continue to Question 3).

(2) On a scale of 1 to 10, where 1 means "very uncertain" and 10 means "very certain," how certain are you that you would voluntarily pay the checkoff fee for the option you chose in Question 1 if given the opportunity? (CIRCLE ONE NUMBER)

1	2	3	4	5	6	7	8	9	10
very uncertain									**very certain**

(3) We would like you to now check the ONE option you prefer the most if this was an *OKLAHOMA* voluntary beef checkoff, where contributions are collected only in Oklahoma and a board of Oklahoma cattle producers determines how the funds are spent. Assume there is no nationwide voluntary checkoff, and that these are the only options available. Again, please think carefully about your answer and respond as if you were contributing real money.

CHECKOFF ATTRIBUTE	OPTION A	OPTION B	OPTION C
Checkoff Fee	**$1.70/head sold**	**$0.40/head sold**	Neither A nor B is preferred. If these were the only two options available, I would request my checkoff fees be refunded in full.
Minimum Participation Rate	**90%**	**20%**	
Percent of Funds Spent on Advertising and Promotion	*20%*	*0%*	
Percent of Funds Spent on Research	*10%*	*70%*	
*Percent of Funds Spent on Other Activities**	*70%*	*30%*	
I would choose (please check **ONLY ONE OPTION**):	☐ I choose Option A and ***would not*** request a refund	☐ I choose Option B and ***would not*** request a refund	☐ I choose neither A nor B. I ***would*** request a refund

*Other activities include export promotion, industry information, consumer education, and personal communications.

If you chose Options A or B in Question 3, please answer the following question (if you chose Option C, please continue to Question 5).

(4) On a scale of 1 to 10, where 1 means "very uncertain" and 10 means "very certain," how certain are you that you would voluntarily pay the checkoff fee for the option you chose in Question 3 if given the opportunity? (CIRCLE ONE NUMBER)

1	2	3	4	5	6	7	8	9	10
very uncertain									very certain

Please describe your cattle operation and views on the beef checkoff by answering the following questions.

(5) In the boxes below, please indicate the average number of cattle and calves you sell each year.

Average number of weaned calves sold per year:
☐ none ☐ less than 50 ☐ 50–99 ☐ 100–199 ☐ 200–499 ☐ 500 or greater

Average number of feeder cattle sold per year:
☐ none ☐ less than 100 ☐ 100–499 ☐ 500–999 ☐ 1,000–4,999 ☐ 5,000 or greater

Average number of fed cattle sold per year:
☐ none ☐ less than 500 ☐ 500–999 ☐ 1,000–9,999 ☐ 10,000–19,999 ☐ 20,000 or greater

Average number of veal calves sold per year:
☐ none ☐ less than 50 ☐ 50–99 ☐ 100–199 ☐ 200–499 ☐ 500 or greater

Average number of purebred heifers and bulls sold per year:
☐ none ☐ less than 50 ☐ 50–99 ☐ 100–199 ☐ 200–499 ☐ 500 or greater

(6) Do you raise beef or dairy cattle?

☐ beef breeds only ☐ dairy breeds only ☐ both beef and dairy breeds

(7) Please check any farm organizations in which you are a member:

☐ Oklahoma Cattlemen's Association ☐ National Farmers Union
☐ National Cattlemen's Beef Association ☐ Oklahoma Farm Bureau Association
☐ R-Calf USA ☐ American Farm Bureau Association
☐ Other (please list) ____________________

(8) Were you aware of the recent litigation and court rulings on the beef checkoff before receiving this survey?

☐ Yes ☐ No

(9) Which best describes your feelings toward the challenge to the mandatory beef checkoff?

☐ I am in favor of *eliminating* the mandatory beef checkoff.
☐ I am in favor of *keeping* the mandatory beef checkoff.
☐ Undecided

(10) Who, in your opinion, receives the greatest benefit from checkoff funds spent on ***advertising***?

☐ Cattle producers ☐ Cattle producers and processors and retailers benefit equally
☐ Beef processors and retailers ☐ Undecided

(11) Who, in your opinion, receives the greatest benefit from checkoff funds spent on ***research***?

☐ Cattle producers ☐ Cattle producers and processors and retailers benefit equally
☐ Beef processors and retailers ☐ Undecided

(12) How much do you feel the beef checkoff funds benefit cattle and beef producers outside of the U.S.?

☐ more than U.S. producers ☐ less than U.S. producers
☐ equal to U.S. producers ☐ other or not sure

(13) Please estimate your household's yearly income before taxes by checking the appropriate box. This question is used to ensure our sample is representative of all producers. Please remember that your responses are anonymous and will be held strictly confidential.

☐ less than \$20,000 ☐ \$60,000–\$79,999
☐ \$20,000–\$39,999 ☐ \$80,000 or greater
☐ \$40,000–\$59,999

(14) Do you have any comments you would like to add? If so, please list them below.