

Voluntary Funding for Generic Advertising Using a Provision Point Mechanism: An Experimental Analysis of Option Assurance

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The mandatory nature of check-off programs remains a contentious policy issue. A provision point mechanism with a money-back guarantee offers an attractive, alternative voluntary funding approach, yet faces the problem of how to maintain future administrative capacity should contributions fall short of the funding threshold in the present period. To address this concern, a novel two-threshold, provision point mechanism is tested that sets a high threshold to fund marketing and a low threshold, if necessary, to secure administrative capacity for future advertising. Experimental results demonstrate that providing such “option assurance” sustains high overall contributions and, in some settings, can increase producer surplus.

Most agricultural commodities produced in the United States are covered by mandatory check-off programs that fund generic marketing and promotion activities designed to increase overall demand. By law, such programs are created via a referendum process. Once a majority of producers vote for the program, funding comes from a coercive tax on all firms in the industry that is collected at the point of sale. These programs are controversial because producers that do not support mandatory check-off programs are nonetheless forced to contribute.

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Despite an abundance of economic studies suggesting that generic promotion programs are generally beneficial to firms (see Kaiser et al. and Ferrero et al. for a thorough summary of this literature), a vocal minority of producers opposes these mandatory programs for various reasons. For example, many organic producers oppose paying for promotion of conventionally produced commodities because they believe that such promotion undermines their efforts to differentiate their organic production methods. Also, some large producers maintain that they are better off marketing their individual commodities rather than relying on a collective generic advertising campaign.

Because of these and other concerns, mandatory check-off programs have faced numerous legal challenges and the U.S. Supreme Court has heard three cases in the past decade. The diversity of challenges raised in these cases has led to seemingly contradictory decisions by the Court. In 1997, the Court ruled that the check-off program for California peaches, plums, and nectarines did not violate the plaintiff's right to free speech since generic advertising was part of a larger set of regulations designed to help producers. In 2001, the Court ruled the mushroom check-off program was unconstitutional because it was a stand-alone advertising program that was not part of a broader set of economic regulations. In 2005, the beef advertising check-off program was determined to be constitutional because the advertising was considered "government speech" and, hence, immune to First Amendment challenges.

Although the 2005 Supreme Court decision established a legal precedent in favor of the constitutionality of check-off programs, the programs remain vulnerable. A large number of cases are still being litigated and the history of this litigation suggests that, as new arguments are raised and the composition of the courts changes, courts may yet rule against some mandatory check-off programs.¹ Also, and perhaps more importantly, the 2005 Supreme Court decision did not resolve the fundamental point of conflict that some producers continue to oppose these programs.

Mandatory programs for many commodities will likely continue to have the backing of the majority of producers in the short term. However, support for these coercive programs may dwindle as producers increasingly seek to differentiate their products and identify niche markets, thereby reducing the perceived need for generic advertising. Furthermore, support for mandatory check-offs may diminish if producers perceive that the benefits of generic advertising are not uniformly distributed and that those who obtain the greatest benefit should provide the funding.

The check-off program for fresh cut flowers in the United States, PromoFlor, provides an example of a mandatory program that was converted to voluntary participation. In June 1997, 58% of the industry voted against continuing the mandatory assessments. The assessments were rejected despite the widely distributed results of an economic evaluation by Ward (1997) that concluded that the program provided considerable benefit to the industry, as evidenced by a benefit-cost ratio of 5.6. Ward had also noted, however, that there were persistent concerns among the participants regarding the equity of the program because flower growers paid *all* of the costs of the program even though retailers benefited as well. Subsequent to the referendum, PromoFlor reorganized under the name Flower

Promotion Organization and began collecting voluntary contributions from both growers and importers. After the reorganization in 2000, a subsequent study by Ward (2005) again found considerable benefits relative to the costs of the now voluntary program.

Voluntary programs, however, also suffer from problems that have been well documented. General economic theory (Samuelson) and empirical evidence (Messer, Kaiser, and Schulze) from the economic literature regarding commodity promotion suggest that a voluntary marketing program may yield aggregate net benefits to producers but also provides a strong incentive for self-interested producers to “free ride” by refusing to contribute to programs from which they benefit. In the case of cut flowers, annual contributions decreased from about \$4.5 million to \$2.5 million after the conversion to voluntary assessments.

In a seminal paper, Brubaker argued that free riding can be attributed to an “assurance” problem at an individual level. In group settings, an individual wants to be assured that:

he doesn't waste his own scarce resources supporting an ineffectual collective effort. Just as an individual consumer of a private good needs to be assured of its provision in a specified quantity and quality before he will be willing to make a payment, so a major concern for the individual consumer of a collective good will be a 'money back' guarantee that the good as offered will, in fact, be provided (p. 151).

Anticipating what would later be referred to as a provision point mechanism with a money-back guarantee rule (PPM-MBG), Brubaker suggested that modifying standard voluntary contribution approaches by setting a minimum threshold (provision point) for contributions that must be met to implement the program could solve this individual assurance problem. Under a commodity promotion program, for example, promotion efforts would be implemented only if total contributions meet or exceed the minimum threshold and then would be expended based on the amount of funds collected. If the threshold is not met, the promotion campaign would not be conducted and all funds would be returned to the contributors. Brubaker's conjecture that adding a PPM-MBG would increase voluntary contributions in both a statistical and an economic sense relative to a standard voluntary contribution mechanism (VCM) has been demonstrated empirically in a number of studies conducted over the past three decades (see, among others, Cadsby and Maynes, 1999; Messer, Kaiser, and Schulze; Rapoport and Eshed-Levy; and Rondeau, Poe, and Schulze).²

In solving the individual assurance problem, however, a PPM-MBG mechanism to provide group goods opens the door to the possibility of complete efficiency loss in the current period. Rondeau, Poe, and Schulze (in the general public goods case) and Norwood et al. (specifically in a commodities marketing setting) note that failure to reach the specified threshold of funding in a PPM-MBG can result in an outcome that is inefficient relative to a more conventional VCM. Whereas in a VCM there is partial implementation of a desirable but potentially under-funded good (a smaller than desirable promotion campaign), no program is implemented with the PPM-MBG if the threshold is not achieved. Hence, some aggregated positive efficiency level is achieved by a VCM for any positive contribution level. Under a PPM-MBG, on the other hand, aggregate contribution levels that do

not meet the threshold result in the least possible efficiency for programs with favorable benefit–cost ratios.

Moreover, failing to fund a promotion program could result in dismantling the program’s administrative capacity, which may preclude (or at least seriously hinder) future promotion efforts. Imagine, for example, the consequences of a situation in which contributions to a commodity promotion program fail to meet the threshold. Under the PPM-MBG system, not only would the marketing program be canceled but all of the collected funds would be returned.³ Subsequently, it would likely be prohibitively costly to sustain or re-establish the administrative capacity needed for any future marketing program. As a consequence, just one failure to achieve the threshold would likely hamper the generic advertising campaign in following years regardless of the level of future contributions. Based on the within-period efficiency risks and these between-period consequences, Norwood et al. concluded that “check-off administrators may feel the gain in participation from using a [PPM-MBG] does not outweigh the risks” (p. 85).

Thus, for implementation of real-world programs with significant shut-down and start-up administrative costs, a second form of assurance in a PPM-MBG may be needed so that future opportunities are not negated by a single threshold failure. We call this second form “option assurance” because it guarantees that the option for future provision of the collective good remains open. Motivated by a practical need to address this intertemporal funding challenge for check-off programs, we explore the effect of providing option assurance in a repeated fund-raising setting by building upon recent work on PPM-MBGs in the context of generic commodity advertising (Messer, Schmit, and Kaiser).

We next briefly discuss the economic-theoretic foundations of single-tier and multi-tier provision point mechanisms. In the third section, we present the experimental economic procedures and four alternative PPM-MBG designs we used to explore the impacts that option assurance has on funding and participation. We then report the results of the experiments and our comparative analysis of each mechanism in terms of contribution level and efficiency. In the final section, we assess the results from the perspective of implementation of such option assurance programs in real-world contexts.

Two-Tier Provision Point Thresholds

Translated into a commodity-program-funding framework, option assurance establishes a two-tier threshold. One tier is the minimum contribution level required to conduct a promotion program. The second is the minimum level of funds required to maintain an administrative organization when contributions are not adequate to support promotion. To explore the demand revelation features of option assurance, we introduce a two-threshold PPM-MBG in which the lower threshold (M) corresponds to the minimum amount of funding needed to sustain the administrative capacity of the marketing program for another year. A higher threshold (F) corresponds to the level of contributions needed to authorize the promotion effort. Using an experimental platform calibrated to the funding of generic advertising for agricultural commodities, we evaluate (*a*) whether contributions to the marketing program increase in the two-threshold PPM-MBG designs with option assurance relative to a conventional PPM-MBG scenario without assurance

and (b) alternative ways of sequencing solicitation of funds for the two thresholds to examine whether different strategies affect levels of contributions and producer surplus.

Economic theory provides little guidance regarding how to implement a two-threshold PPM-MBG in real-world settings. Examining the single unit, “one street light” case, Bagnoli and Lipman established that the PPM provides additional Nash equilibria beyond the degenerate zero contributions equilibrium concept associated with the standard VCM. Under the assumption that the aggregate benefit–cost ratio of the program exceeds unity and that no firm contributes more than its private value, the locus of contributions summing to the threshold provision level provides a set of what has been termed “threshold” Nash equilibria (Cadsby and Maynes, 1998; 1999). This set is socially and individually preferred to the symmetric equilibrium of zero contributions by all subjects.^{4,5}

Using data from a set of economics experiments, a subsequent paper by Bagnoli and McKee demonstrated that such a mechanism can obtain Pareto-efficient outcomes for provision of a public good in natural settings. Recent papers (Krishnamurthy; Messer, Kaiser, and Schulze; Messer, Schmit, and Kaiser) have experimentally extended PPMs to decisions about how much funding commodity marketing programs require and have explored the optimal relationship between the benefit–cost ratios of such programs and provision point levels.

Bagnoli and Lipman extended this single-unit funding game to a “multiple streetlight problem” in which funding of each additional unit (streetlight) involves a sequential, increasing-units PPM. Yet in a subsequent paper, Bagnoli, Ben-David, and McKee concluded that the restrictive assumptions enabling Bagnoli and Lipman’s positive results do “not adequately represent individual behavior” (p. 87). Even with their highly restrictive assumptions, Bagnoli and Lipman were not able to provide theoretical support for nonzero Nash equilibria for simultaneous provision points (i.e., when a fund drive is conducted, the highest threshold exceeded indicates the level of provision) or for sequential decreasing-units fund drives. Hence, existing economic theory provides limited guidance, at best, regarding implementation of multi-tiered provision point mechanisms.

In this study, we instead adopt Plott’s notion of using experiments to compare the effectiveness of alternative mechanism designs in situations in which theory provides no direct guidance: “Like a wind tunnel to test airplane design, lab experiments provide a testbed for what is called *economic design*—the process of constructing institutions and mechanisms to examine resource allocation” (Shogren, p. 1218).

Experimental Design

All experiments were conducted at the Cornell University Lab for Experimental Economics and Decision Research. Subjects were recruited from undergraduate economics and business classes. Each session lasted approximately seventy-five minutes and subjects earned an average of \$15. A session was comprised of eleven subjects who were randomly assigned to a computer equipped with a privacy screen to ensure confidentiality.⁶ Each subject assumed the role of a generic commodity producer and the experiment administrator was the buyer. Producers were informed of their unique production costs, and subjects recorded their decisions

Table 1. Experimental design

Total subjects:	176 (44 per each treatment type)
Group size:	Eleven for each session
Average earnings:	\$15 for seventy-five minutes
Part I:	Five rounds without advertising
	Five rounds with mandatory funding for advertising
Part II:	Up to five minutes of "cheap talk" at the start of part II
	Group vote on whether to implement the specified PPM-MBG
	Twenty rounds with voluntary funding for advertising

and received information regarding their profits via an Excel spreadsheet programmed with Visual Basic for Applications. The experiment consisted of parts I and II (table 1). Producers were neither informed about the number of parts of the experiment nor about the number of rounds associated with each part. At the beginning of each part, subjects read the corresponding written instructions and, aided by a PowerPoint presentation, the administrator orally reviewed the instructions and answered all questions.

In part I of the sessions, producers learned via experience how their production costs and the stochastic demand interacted to create a uniform market price. Specifically, in the first five rounds, subjects indicated when they were ready to proceed and then demand was determined for that round. When notified by the administrator, subjects retrieved the uniform market price and learned which of their units were sold and how much profit they earned in that round. Each subject could sell up to three units of the generic commodity and the producers' costs remained constant throughout the experiment. Subjects only incurred production costs if the units were sold, a simplification that ensured experimental control over the rate of return on advertising, which is the key economic factor in this study. Each of the subjects' first two units was relatively low cost, ranging from \$0.90 to \$1.00, and the third unit was more costly, ranging from \$1.19 to \$5.06. Since the minimum possible demand was set at twenty-two units, the cost of the third unit served as the relevant part of the steep, upwardly sloped supply curve to determine the market price. In this range, the own-price elasticity of supply was 0.25.

Following the design approach used in Messer, Schmit, and Kaiser, demand was assumed to be perfectly price-inelastic. Since this research sought to investigate the efficiency of various PPM-MBG designs, this simplifying assumption was made to ensure that demand was transparent to the subjects and to control the rate of return on the marketing program throughout the experiment. Furthermore, the assumption of perfectly inelastic demand is consistent with the actual situation frequently found for agricultural commodities.

To mimic the price changes observed for most agricultural commodities, demand varied stochastically by having a volunteer subject draw a bingo ball from a bag; the number on the ball was designated as the number of units sold. A symmetric triangular distribution was used: three bingo balls were labeled with average demand, "24"; two were labeled "23"; two were labeled "25"; one was labeled "22"; and one was labeled "26." Units were purchased in the order of their

cost, beginning with the least expensive one. The market price was determined by the cost of the first nonpurchased unit. Thus, the market price without advertising ranged from \$1.19 to \$2.27, with an average price of \$1.67.

The final five rounds of part I included the mandatory marketing program so that subjects would experience the additional costs associated with the program and the benefits from increased demand. The marketing program was funded by a mandatory \$0.25 assessment collected on each unit sold. The marketing program increased demand in the subsequent round creating a one-round lag between the program's benefits and costs. To mimic the publicity associated with marketing programs that traditionally inform producers of the benefits of the programs, subjects were informed that the increase in demand in "previous experiments" also resulted in higher prices and greater profits for sellers.

The marketing program consisted of two separate components, administrative costs and the advertising campaign that directly affected the level of demand. To simulate guidelines for federal marketing orders that limit a check-off program's administrative expenses to 5% of total program costs, administrative costs were set at \$0.50 and did not vary with the stochastic demand.⁷ The objective was to balance the desire to have administrative costs as low as possible (thereby keeping the corresponding PPM threshold for option assurance as low as possible) with the need to obtain adequate funds to sustain the administrative capacity through the funding cycle. In our experiments, administrative costs did not provide any direct benefit to producers as administrative capacity does not, by itself, increase demand. Consequently, when considered alone, the administrative costs resulted in a negative benefit–cost ratio. However, these expenses were necessary in order to have a future advertising campaign using the PPM-MBG.

Throughout the experiment, the demand increase in the next round, I_{t+1} , due to the marketing program was determined as

$$(1) \quad I_{t+1} = \delta [A * (D_t + I_t) - M]$$

where D_t is stochastic demand, I_t is the previous round's increase in demand from advertising, A is the assessment rate, M is the administrative cost, and δ is a conversion factor. The benefit–cost ratio was held constant throughout the experiments by setting δ equal to three-fifths, which established the benefit–cost ratio for the advertising campaign as roughly four to one. As detailed in Messer, Schmit, and Kaiser, a four-to-one benefit–cost ratio is well within the range of the rates of return observed for a broad array of generic commodities. The written instructions provided subjects with estimates of the price that would result from the various amounts of assessment collected. For each round, in addition to the market price, the administrator announced the total amount collected and the corresponding increase in demand.

To examine the efficiency of funding alternatives in a PromoFlor-type setting in which mandatory programs are terminated, part II of the experiment used four different PPM-MBG designs (discussed in greater detail later in this section). Part II lasted twenty rounds (subjects were not aware of the actual number of rounds) and each subject participated in a single design scheme. To mimic the democratic decision-making process that occurs among producers participating in a referendum on a generic advertising programs, subjects were asked to submit

a confidential vote indicating whether they preferred to have (a) no marketing program or (b) a marketing program funded by the PPM-MBG design that was preselected for that experiment session.⁸ Before casting their votes, subjects were permitted to discuss the referendum and possible contribution strategies for up to five minutes. Such nonbinding discussion is commonly referred to as “cheap talk” since only multilateral promises are possible, actual decisions remain confidential, and no binding deals are allowed.

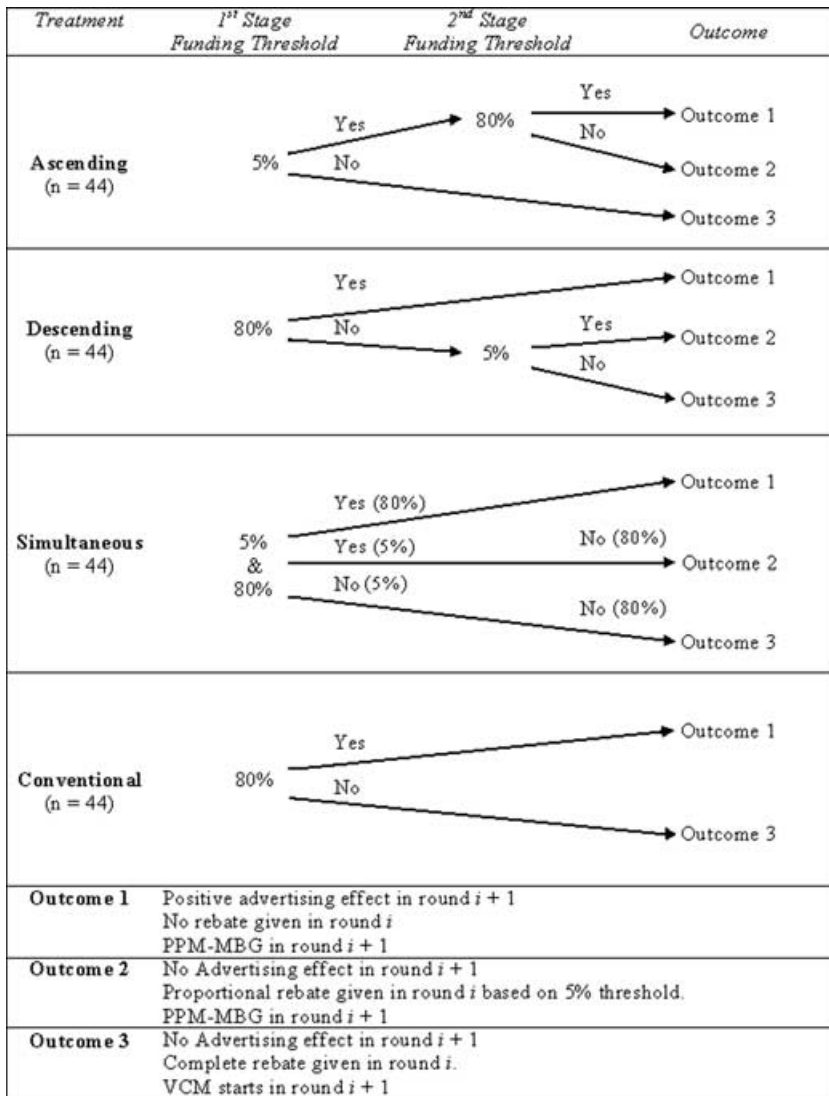
If a majority of producers supported a marketing program that included a PPM-MBG, subjects experienced a contribution process similar to that commonly used by generic marketing programs. Assessments for the marketing program were automatically deducted from producer profits in the round in which the profits accrued. Producers were allowed to confidentially request a refund of the assessment. Thus, producers contributed to the marketing program by *not* requesting a refund of their assessment.⁹ Subjects chose the amount of their net contributions by completing a confidential one-sentence request stating the amount of the desired refund. The request could be for any amount between zero and a maximum of \$0.75 when three units were sold. For subjects who did not want a refund (i.e., they wanted to contribute to the program), no message was required. All refund requests were granted and the amount of the request was added to the subject’s profits for that round. After each round, the administrator informed the subjects of the level of contributions made by announcing the percentage of the total possible assessment that was actually collected and how this would affect demand in the next round.

The four alternative PPM-MBG mechanisms involved the use of two different thresholds. A 5% threshold was set to equal minimum administrative costs, M , as described previously. The full funding threshold, F , was set at 80% based on Messer, Schmit, and Kaiser’s research on the PPM-MBG threshold for a marketing program with a similar benefit–cost ratio that maximized contributions and producer surplus. If total contributions collected met or exceeded the 80% threshold, the funds were dedicated to the marketing program, which would effectively shift demand for the product outward. Funds in excess of F were used to extend “benefits” by investing further in a market program to shift demand.¹⁰

Since the parameters of the experiment were set to ensure a four-to-one benefit–cost ratio for advertising, the average marginal per capita return for the marketing program was 0.32. In the experimental economics literature, this marginal per capita return is considered to be low and has been shown to lead to significant free riding in VCMs (Davis and Holt).

In settings where the marginal per capita return is less than one and the aggregate and individual benefits exceed their respective costs at F , the “threshold” Nash equilibria of aggregate contributions equaling the 80% threshold exists for the conventional PPM-MBG without option assurance.¹¹ If group contributions exactly equal the threshold, then, under the conditions previously stated, it is in no one’s best interest to deviate unilaterally by reducing the contribution. In the case of extended benefits, contributions exceeding the threshold are subject to the same incentive as in a VCM since there is no money-back guarantee for the excess. Thus, when contributions exceed the 80% threshold, subjects have an incentive to “cheap ride,” providing them with the highest possible net earnings in any

Figure 1. Flow chart for the four provision point mechanisms



particular round. Figure 1 provides a decision tree depiction of the alternative PPM-MBGs designs.

PPM-MBG Design 1—Ascending Sequential Thresholds with Option Assurance

The first mechanism considered, referred to as “ascending,” closely approximated Bagnoli and Lipman’s sequentially increasing PPM. In this design, subjects decided in the first stage how much to donate to the 5% threshold. If the first-stage

5% threshold was achieved, subjects next decided how much to contribute to the second-stage 80% threshold.¹² If the 80% threshold was achieved, then the collected funds were expended on the advertising campaign and subjects retained the PPM-MBG in the next round, which operated as just described, and did not receive a rebate of their contributions (Outcome 1).

In the case where the first-stage 5% threshold was achieved but the second-stage 80% threshold was not, the advertising campaign was not implemented and demand was not increased in the next round (Outcome 2). Subjects were informed whether the threshold had been met but did not learn of the actual contribution percentages until the end of the round. While the advertising campaign was not implemented and producers earned a negative return due to administrative costs, producers retained option assurance for the next round—the option of funding the advertising campaign with the PPM-MBG in the next round (but not beyond the next round). Additionally, all producers received, as their money-back guarantee, a “proportional rebate” based on their contributions to the first-stage 5% threshold. An individual’s proportional rebate, R_i , was calculated based on the percentage of the total contributions from producer i , according to

$$(2) \quad R_i = \frac{C_i * \left(C_i + \sum_{i \neq j} C_j - M \right)}{\left(C_i + \sum_{i \neq j} C_j \right)}$$

where C_i indicates individual i ’s contribution to the 5% threshold and M represents the 5% threshold, which was based on administrative costs. For example, if the contribution C_i from producer i was \$0.25, M was \$0.50, and the sum of the contributions from the other ten producers in the group, $\sum_{i \neq j} C_j$, was \$2.25, then the subject would receive a proportional rebate, R_i , of \$0.20, which is 10% of the amount of contributions that exceed the administrative costs, M . Note that a producer who did not contribute anything to the 5% threshold ($C_i = 0$) did not receive a proportional rebate.

The third possible outcome occurs when the first-stage 5% threshold is not achieved (Outcome 3). In this case, subjects did not face the decision regarding the second-stage threshold and instead received an immediate, complete refund of their contributions. Since the advertising campaign was not funded, demand was not increased in the next round. As a result of failing to meet the 5% threshold, the producers permanently eliminated option assurance—the opportunity to fund the marketing program with a PPM-MBG in subsequent rounds—and the funding mechanism converted to a standard VCM.¹³ To simulate the historic experience of generic marketing programs funded by a VCM, subjects were informed that, in “previous experiments” where the marketing program was funded by a VCM, contributions “decreased over time.” Messer, Kaiser, and Schulze demonstrate that such a decrease does occur in a VCM commodity marketing setting.

We chose the VCM as the default alternative over other mechanisms, such as mandatory funding or no funding, primarily because it simulates the most likely

real-world transition in funding structure when a PPM-MBG threshold is not met and a loss of efficiency occurs. The historical example of PromoFlor supports this assumption as it was converted to a VCM after the previous funding system failed to receive producer support.

PPM-MBG Design 2—Descending Sequential Thresholds with Option Assurance

The second PPM-MBG design, referred to as “descending,” operated in much the same way as the first design except that the order of the thresholds was reversed. Thus, producers in the first stage decided how much to contribute to the 80% threshold. If the first-stage 80% threshold was achieved (and therefore also the 5% threshold), the funds were expended on the advertising campaign, no rebate was provided, and the subjects retained the opportunity to fund the thresholds in the subsequent round (Outcome 1).

If the first-stage 80% threshold was not achieved, subjects next decided how much to contribute to the second-stage 5% administrative threshold. As in the ascending case, subjects were informed only whether the threshold was achieved and did not learn of the actual amount of total contributions until the end of the round. If total contributions exceeded only the second-stage 5% threshold, no advertising was implemented in the present round but producers retained the option of achieving the thresholds in the next round and received the money-back guarantee of a proportional rebate (Outcome 2). If neither the first-stage 80% nor the second-stage 5% threshold was achieved, then no marketing program was undertaken, subjects received a complete rebate of their contributions, and all future funding for the marketing program was made by a VCM, as previously discussed (Outcome 3). While economic theory does not provide expectations about whether the ordering of the thresholds makes a difference in producer contributions, the descending order offered the real-world advantage of being simpler to implement since the second stage of donations was needed only if the initial 80% threshold was not achieved.

PPM-MBG Design 3—Simultaneous Thresholds with Option Assurance

The third design, referred to as “simultaneous,” further simplified administration of the check-off program by combining the two thresholds into a single decision. Subjects decided on one contribution amount since the thresholds are simultaneous and not in two stages. If total contributions exceed the 80% threshold, the advertising campaign was implemented and demand in the subsequent round increased (Outcome 1). Producers received no refunds and the PPM-MBG was again employed in the next round. If total contributions were sufficient to achieve only the 5% threshold, no advertising campaign was implemented (Outcome 2). In this case, subjects received a proportional rebate calculated by equation (2) and were given the opportunity to achieve the PPM-MBG thresholds in the next round. If subjects failed to contribute enough to reach the 5% threshold, they received a complete rebate of their contributions and the marketing program relied on VCM funding for all future rounds (Outcome 3).

PPM-MBG Design 4—Conventional PPM-MBG without Option Assurance

To provide a baseline, the fourth mechanism, referred to as “conventional,” corresponded to the single-threshold PPM-MBG that does not provide for option assurance (i.e., the conventional PPM-MBG widely used in the experimental economics literature). Administration of this program was made less onerous by including only an 80% threshold. With this design, if donations exceeded the threshold, they were used for the marketing program as previously described, producers had the opportunity to achieve the PPM-MBG threshold in the next round, and no refunds were provided (Outcome 1). If the 80% threshold was not met, producers received a complete rebate of their contributions and the funding mechanism switched permanently to the VCM in the next round (Outcome 3). As described previously, the VCM default modeled the likely real-world funding transition and, in contrast to having no program once the PPM-MBG threshold was not achieved, it offered a more rigorous test of the importance of option assurance in the alternative PPM-MBG designs.

Results

We present the results of sixteen experimental sessions, each involving eleven subjects ($N = 176$). Since the referendum passed in each session, we include the results of all of the experimental sessions. First, we examine the contribution behavior for all four PPM-MBG designs, including the 5% administrative cost threshold and the 80% advertising-campaign threshold. Next, we evaluate how overall efficiency differs in the four designs. In both cases, econometric analyses are presented that examine the performance of the three designs with option assurance relative to the baseline conventional design.

Contributions to the 5% Administrative Cost Threshold

As previously described, each of the four designs involved a different way of collecting contributions for the 5% threshold. The ascending design had subjects first contribute to the 5% threshold while the descending design had subjects contribute to the 5% threshold only if they had failed to achieve the 80% threshold (31.8% of the time) (table 2). For the simultaneous design, subjects submitted a single contribution that was evaluated against both thresholds. The conventional design did not include a specific threshold for administrative costs but had the same benefits function that included the administrative costs. In each of the three designs with option assurance, subjects achieved the 5% threshold in all rounds. The amount of contributions given in the scenarios with a 5% funding threshold varied significantly, however, even though all of the designs theoretically had the same economic incentives and contribution decisions were independent from decisions made for the 80% threshold.¹⁴ Regardless, procedural invariance appears to be violated by path dependency.

Contributions to the 80% Advertising-Campaign Threshold

As previously described, the advertising-campaign threshold was set at 80% and contributions were collected by the four designs in a variety of ways. The ascending design collected contributions once the lower threshold was met (which

Table 2. Results by treatment

	5% Administrative Cost		80% Advertising Campaign		
	Threshold Achieved ¹	Contributions ^{2,*}	Threshold Achieved ³	Contributions ^{4,*}	Efficiency ⁴
Ascending	100%	84.9% ^{d,s}	77.5% ^c	86.1% ^{d,s,c}	75.6% ^s
Descending	100%	49.4% ^{a,s}	68.8% ^{s,c}	82.4% ^{a,s,c}	72.3% ^s
Simultaneous	100%	91.8% ^{a,d}	86.3% ^{d,c}	91.8% ^{a,d,c}	84.2% ^{a,d,c}
Conventional	NA	NA	41.3% ^{a,d,s,†}	68.2% ^{a,d,s}	72.7% ^s

^aDifferent than ascending design (0.05 level).

^cDifferent than conventional design (0.05 level).

^dDifferent than descending design (0.05 level).

^sDifferent than simultaneous design (0.05 level).

¹*N* = 80 for simultaneous and ascending designs and *N* = 25 for descending design.

²*N* = 185 (Tobit models with round as a class variable).

³*N* = 80 for each treatment (two-sample test of proportions).

⁴*N* = 320 (Tobit models with round as a class variable).

* Average contribution percentage derived from the maximum possible in the particular round, which varied based on demand.

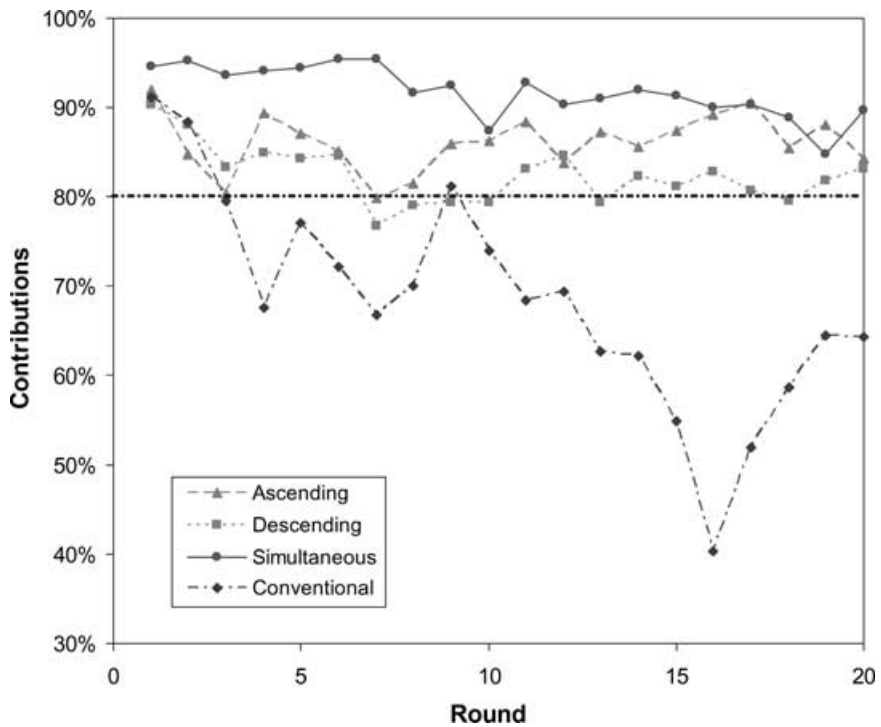
† Percentage of times that the conventional design met or exceeded 80% contributions.

it was in all cases). The descending, simultaneous, and conventional designs involved collecting contributions for the 80% threshold either first or concurrently. Subjects in all sessions had twenty opportunities to achieve the 80% threshold. In general, subjects usually decided to give all of their assessments as contributions (67.3%) and 12.1% of the time they requested a full refund. Thus, only 20.6% of the contributions were partial sums.

In general, the 80% threshold was frequently achieved for the designs with option assurance. As indicated in table 2, contributions under the simultaneous design met or exceeded the threshold 86.3% of the time. The threshold-achievement rate for the descending design (68.8%) was statistically lower than for the simultaneous one, but the rate for the ascending design (77.5%) was not. The descending and ascending threshold-achievement rates were not significantly different from each other. The threshold-achievement rate for the conventional design (41.3%) was significantly lower than the rate for the other three design variants.¹⁵

Average contributions to the 80% threshold ranked similarly. The three PPM-MBG designs with option assurance showed average contributions that exceeded 80% and exceeded the average for the conventional design (table 2). Figure 2 shows that the simultaneous design generated average contributions of 91.8% and yielded the highest average contributions in nineteen of the twenty rounds. Similarly, the ascending design resulted in average contributions of 86.1%, which exceeded average contributions generated by the descending design in sixteen of the twenty rounds and surpassed average contributions from the conventional design in seventeen of the twenty rounds. Though the descending design showed the lowest level of contributions of the three designs with the option assurance, it still resulted in average contributions of 82.4% of total possible contributions for each round. This was statistically higher than the 68.2% achieved by the conventional

Figure 2. Contributions to 80% advertising threshold by treatment



design, which corresponds with the observation that the descending design resulted in higher average contributions in seventeen of the rounds.

Econometric models were applied to explore the impact of different PPM-MBG designs on contributions, both initially and over time. Group-level data were used, because subjects were able to interact during cheap talk sessions, the referenda, and through contribution behavior over rounds.¹⁶ A Tobit model was used, since contributions were limited to between 0% and 100%, however, since group contributions were never 0%, the Tobit model involved only a single limit at the upper bound of 100%. Explanatory variables included a constant, three dummy variables for the PPM-MBG designs, the round, and interaction terms between the dummy variables and the round variable. Following a mixed model structure, we specified the empirical model as

$$\begin{aligned}
 (3) \quad PERCENT_CONT_{it} = & \beta_0 + \beta_1 SIMULTANEOUS_i + \beta_2 ASCENDING_i \\
 & + \beta_3 DESCENDING_i + \beta_4 ROUND_{it} \\
 & + \beta_5 SIMULTANEOUS_i * ROUND_{it} \\
 & + \beta_6 ASCENDING_i * ROUND_{it} \\
 & + \beta_7 DESCENDING_i * ROUND_{it} + Z_i u_i + e_{it}
 \end{aligned}$$

where $PERCENT_CONT_{it}$ was the percentage of contributions for group i in round t and $ROUND_{it}$ was the round number for group i , which accounted for the change in contribution behavior over time that was not captured by the random, mean-zero, normally distributed errors of $Z_i u_i$ and e_{it} . To address autocorrelation within groups across rounds, the model assumed a compound, symmetric, within-subject covariance structure consistent with Messer, Schmit, and Kaiser.

As seen in table 3, β_0 , representing the conventional design baseline, was statistically significant and the coefficient for *SIMULTANEOUS* was significant at the 0.01 level, indicating that the estimated first-round contributions in the simultaneous design were statistically higher than the baseline. Coefficients for the other two dummy treatment variables, *ASCENDING* and *DESCENDING*, were positive but not statistically different than the baseline. The coefficient for *ROUND* was significant and negative, implying that the contributions in the conventional design were decreasing over time. In contrast, the three interaction terms for *ROUND* and the treatment dummy variables were all positive and significant, indicating that these treatments slowed the rate of decay in contributions relative to the baseline conventional design. When we ran similar Tobit models with each of the

Table 3. One-limit Tobit results for group-level contributions and efficiency

Variable	Dependent Variable	
	Contributions to 80% Advertising Threshold (%)	Efficiency (%)
<i>INTERCEPT</i>	0.8226** (0.0349)	0.8746** (0.0885)
<i>ASCENDING</i>	0.0583 (0.0502)	-0.0332 (0.1263)
<i>DESCENDING</i>	0.0416 (0.0498)	0.0242 (0.1257)
<i>SIMULTANEOUS</i>	0.2034** (0.0524)	0.4001** (0.1396)
<i>ROUND</i>	-0.0152** (0.0031)	-0.0093 (0.0077)
<i>ASCENDING * ROUND</i>	0.0157** (0.0045)	0.0118 (0.0110)
<i>DESCENDING * ROUND</i>	0.0115** (0.0045)	-0.0007 (0.0109)
<i>SIMULTANEOUS * ROUND</i>	0.0090* (0.0047)	-0.0148 (0.0117)
Log likelihood	52.03	-158.84
Wald χ^2	154.48	26.43
# of uncensored	259	193
# of left-censored	0	0
# of right-censored	61	111

Notes: Standard errors in parentheses. Significance is indicated by * for 5% significance level and ** for 1% significance level or less.

Table 4. Estimated contributions to the 80% advertising threshold by treatment

Design	1st Round	20th Round
Ascending	0.8809 ^{s,c} (0.0361)	0.8906 ^c (0.0359)
Descending	0.8642 ^{s,c} (0.0355)	0.7949 ^{s,c} (0.0349)
Simultaneous	1.0261 ^{a,d,c} (0.0392)	0.9087 ^{d,c} (0.0373)
Conventional	0.8226 ^{a,d,s} (0.0349)	0.5342 ^{a,d,s} (0.0348)

Notes: Based on the estimates from the Tobit model. Estimated standard errors in parentheses.

^aDifferent than ascending design (0.05 level).

^cDifferent than conventional design (0.05 level).

^dDifferent than descending design (0.05 level).

^sDifferent than simultaneous design (0.05 level).

other three PPM-MBG designs as the baseline, none of models exhibited a decay in contributions that was statistically significant at the 0.05 level.

Using the results from the Tobit analysis, we can provide estimated contribution levels for the four designs. These estimates again support the finding that the highest initial contributions come from the simultaneous design and that both the ascending and descending designs provide higher initial contributions than does the conventional (table 4). Analysis of the estimates for the last round reveals a similar pattern. In the simultaneous design, contributions were significantly greater than in the descending and conventional designs and all three PPM-MBGs with option assurance again resulted in estimated contribution levels that were greater than those from the conventional design.

Measures of Efficiency

A second important area for analysis was whether the PPM-MBG designs with option assurance matched or exceeded the efficiency levels achieved with the conventional design. While efficiency ultimately depends on the functional form of the benefits, the results from this research permitted an analysis of the systematic directions that may exist among the PPM-MBG designs. This research defined efficiency, EFF , for group i in round t as $EFF_{it} = PS_{it}/\text{Max}(PS_t)$, where PS_{it} is the producer surplus for group i in round t in the voluntary PPM-MBG setting and $\text{Max}(PS_t)$ is the maximum possible producer surplus (given the random demand for that round) that could have been achieved if funding was either compulsory or contributions were always 100%. For example, in the rounds from part I of the experiment that did not have the marketing program, producer surplus averaged \$18.59 per round, while rounds with the mandatory marketing program generated an average producer surplus of \$41.80 per round.¹⁷ Therefore, it can be calculated that the rounds without the marketing program had an average efficiency of 44.5%.¹⁸

When we converted the producer surplus measures into efficiency measures and controlled for the random element in the stochastic demand, it was evident that the conventional design did considerably better with regard to efficiency than it did for contributions. As previously noted, PPM-MBGs achieve minimum efficiency whenever contributions fall short of the 80% threshold. Under a VCM, however, any contributions are used for the marketing program and partial efficiency is therefore achieved. Subject level efficiency in the conventional scenario averaged 72.7%, which was statistically indistinguishable from the 72.3% generated by the descending scenario and the 75.6% from the ascending scenario (table 2). However, the superiority of the simultaneous design was again evident—the resulting average efficiency from the simultaneous design was a significantly higher 84.2% and statistically different from the other designs.

A Tobit model with an upper limit of 100%, similar to equation (3), was used to model how group-level efficiency, EFF_{it} , was affected by the treatments and how efficiency changed over time. As table 3 shows, when compared with the baseline of the conventional design, none of the three PPM-MBG designs with option assurance fared worse statistically and the simultaneous design exhibited significantly higher initial efficiency. While it is impossible to prove the null hypothesis, the results are an encouraging sign that inclusion of option assurance does not result in lower efficiency.¹⁹

A more nuanced comparison of the various designs comes from using the simultaneous design as the baseline. These tests show that, compared to the simultaneous design, the conventional, ascending, and descending designs all result in lower initial efficiency at the 0.01 significance level. This analysis further suggests that contributions in the simultaneous design have a statistically significant level of decay, albeit starting from a higher initial level. This finding is consistent with other experimental tests of the PPM-MBG, such as Messer, Kaiser, and Schulze, which showed that, when contributions start out high, a pattern of decay toward the Nash equilibrium of the threshold level is often evident. None of the other designs exhibited a significant rate of decay. Nevertheless, contributions from the simultaneous design, even after twenty rounds, were estimated to be the highest (90.8%) of all the designs considered (table 4).

Conclusion

Economic-theoretic presentations and empirical analyses provide compelling evidence that provision point mechanisms with money-back guarantees offer an improvement over the application of standard voluntary contribution approaches to funding generic commodity promotion programs. And, should a mandatory program ever be declared unconstitutional or be rejected by referendum, such mechanisms provide a relatively efficient fall-back method of collecting future contributions.

However, as attractive as provision point mechanisms may be in theoretical presentations and in experimental economics laboratory settings, a practical concern with applying such mechanisms to commodity promotion programs is that effective advertising and marketing programs involve a costly investment in administrative capacity. Even a slight shortfall in contributions relative to a funding threshold in one period could result in a dismantling of the administrative capacity

with potent negative results for future promotion efforts. Such a risk is likely to be deemed unacceptable by commodity program institutions.

Our exploration of an option assurance addition to repeated provision point mechanism settings, such as those characteristic of ongoing commodity promotions, obviates this concern about an irreversible loss of administrative structure after failing to achieve a threshold. This study used an experimental setting germane to the context of commodity marketing to explore alternative two-threshold provision point funding mechanisms that would separately fund minimum administrative capacity and the more costly full marketing program. In such a two-threshold setting, the option of maintaining the administrative structure remains when funding for a promotion program falls short.

The results presented here suggest that concerns about assurance can be overcome while retaining the provision point benefits of increased contributions and the resulting producer surplus. While it would be premature to design a promotion program based solely on a single set of experiments, these results do provide a solid basis for considering provision point mechanisms as a viable alternative to existing voluntary and mandatory approaches. Indeed, based on our results and those reported previously in connection with funding generic advertising, the two-threshold PPM-MBG approach may emerge as a preferred alternative.

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Endnotes

¹Former Justices O'Connor and Rehnquist voted with the majority 6-3 decision in the 2005 *Johanns v. Livestock Marketing Association* "beef advertising" decision.

²Examples of PPM-MBG funding applications in real-world settings include local parks (Brookshire and Coursey), sports arenas (Marks and Croson, 1999), and green electricity programs (Rose et al.).

³For a real-world example of a provision point program that failed to reach the stated threshold and did return the contributions, see Poe et al.'s discussion of the Niagara Mohawk Power Company GreenChoice™ program.

⁴A third set of Nash equilibria are created by the addition of a money-back guarantee to the provision point mechanism. Bagnoli and Lipman show that any vector of contributions summing to less than the threshold value "and having the property that the sum would still be less than [the provision point] if any one [subject] chose to contribute its entire valuation, is a Nash equilibrium" (Bagnoli and McKee, p. 355). Discounting these equilibria, Bagnoli and co-authors (Bagnoli and Lipman; Bagnoli and McKee), refer to these outcomes as "not sensible."

⁵The terminology used to describe the additional Nash equilibria introduced by adding a threshold level of provision has been complicated by whether continuous or discrete contributions are being considered and whether aggregate contribution levels exceeding the threshold are, in the case of a fixed level of public goods, not refunded, are proportionally refunded, or, in the case considered here, provide additional increments of the public good (advertising). Marks and Croson (1998) refer to this latter structure as a "utilization rebate" and for the conditions defined in the main body of text, the threshold provides a continuum of Nash equilibria in which the firms contribute "exactly enough to achieve the provision point and provide the public good. . . These equilibria have the same group contribution levels, and are not Pareto-Rankable" (Marks and Croson, 1998, p. 204). Other authors have referred to this loci of contributions as "undominated perfect equilibria" (Bagnoli and Lipman), "the only sensible equilibria" (Bagnoli and McKee), "threshold equilibria" (Cadsby and Maynes, 1998; 1999), "dominant Nash equilibrium" (Messer, Schmit, and Kaiser), or "payoff-dominant Nash equilibrium" (anonymous reviewer of this manuscript). Regardless of the name, while this set

of equilibria is sometimes referred to as efficient, it is not so in the case of a utilization rebate in which the benefit–cost ratio exceeds one and hence additional contributions are efficiency-improving in the sense that they enhance social welfare. In this case, contributions exceeding the threshold do not satisfy Nash equilibrium conditions as long the *marginal* per capita rate of return is less than unity.

⁶In addition to the new PPM-MBG designs outlined here, this study involved three primary procedural differences from Messer, Schmit, and Kaiser. First, groups were comprised of eleven producers instead of twenty and producers did not submit offer prices and instead took price as a given. Finally, the thresholds were based on what percent actual contributions were of the total possible instead of a percentage of the number of producers not requesting refunds. We adjusted all of the relevant economic factors to keep the advertising rate of return consistent.

⁷The amount for administrative cost of \$0.50 was slightly more than 5% to ease transparency, avoid the cognitive challenges associated with the stochastic demand, and provide a conservative estimate of potential administrative costs.

⁸As shown in Messer, Schmit, and Kaiser, this type of referendum process can lead to higher contributions in voluntary settings; and since referenda are a common component of generic commodity programs, this element was included in all experiments to more closely parallel real-world conditions.

⁹As shown by Messer, Kaiser, and Schulze, this refund by request feature tends to increase contributions.

¹⁰In a single-threshold public good funding case, Marks and Croson (1998) argued that the extended benefits from contributions that exceed the threshold do not change the individual incentives to contribute to the marketing program.

¹¹The notion that zero contributions by all subjects remains a Nash equilibrium is sustained by the additional realistic assumption that no one individual has an endowment exceeding the designated threshold and/or it is not in an individual's self-interest to unilaterally contribute F (a natural consequence of the marginal per capital rate of return of less than one). Hence, no individual can benefit by deviating unilaterally from zero contributions.

¹²In the ascending and descending PPM-MBG designs, if a contribution decision was required in the second stage, subjects entered any amount of contribution and were not bound to their first stage contributions. In the ascending design, if second stage contributions fell below the 5% minimum needed for program administration, then for all subsequent rounds the funding mechanism would convert to the standard VCM as described below for Outcome 3. Finally, in both designs, subjects were informed only whether the first-stage threshold was met and did not learn of the actual contribution until the end of the round.

¹³To retain experimental control, contributions for the VCM also were collected via a refund by request feature to avoid changing the status quo of the donation, which has been shown to be an important context feature for contributions (Messer, Kaiser, and Schulze).

¹⁴A significant difference existed between the ascending and descending designs—subjects in the ascending design contributed 84.9% while subjects in the descending design contributed 49.4% of total possible assessments for the 5% threshold (table 2). A potential explanation for this difference is that subjects may have tried to signal future promises (or threats) to others in their groups since the highest contributions occurred when the 5% threshold was addressed *prior* to the 80% threshold and the lowest contributions occurred *after* an unsuccessful attempt at the 80% threshold.

¹⁵On average, contributions in the conventional design failed to rise to the 80% threshold by the sixth round and the contribution structure was converted to a voluntary system. Therefore, as described in table 2, the 41.3% includes the percentage of times that the conventional design met or exceeded the 80% threshold in either its PPM-MBG or VCM form.

¹⁶A similar analysis predicting individual contributions yields very similar results and is available from the lead author upon request for up to five years following the publication of this article.

¹⁷The producer surplus measures were designed to facilitate analysis of the key treatment effects and should not be interpreted as predictions of the magnitude of change in producer surplus that might be expected.

¹⁸For any particular round, $\text{Max}(PS_t)$ varied due to the stochastic demand.

¹⁹Reduced forms of these models that do not include the nonsignificant treatments, according to joint effect tests, do not change the results presented in table 3 and are available from the lead author upon request for up to five years following the publication of this article.

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