Comparing the Cost Effectiveness of Several Policy Tools at Conserving Groundwater in the Kansas High Plains

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Introduction

In the Kansas High Plains where natural precipitation is scarce, crop production depends primarily on groundwater from the Ogallala Aquifer. Irrigation consumes around 3 millions acre-feet of water per year, which accounts for over 90% of total groundwater withdraws in the state. Compared to the water withdrawal rate, the aquifer recharges very slowly and its water table has been steadily declining over the past 40 years. Given the current decline rate, in most places of west-central and parts of northwest and southwest Kansas, the estimated usable lifetime of the aquifer is less than 50 years. The near exhaustion of the aquifer in some areas has prompted our interest in regional policies to conserve groundwater.

In the 2002 Farm Bill, the Ground and Surface Water Conservation (GSWC) program has been enacted as an extension to the Environmental Quality Incentives Program (EQIP). It is a voluntary program, which provides cost-share assistance and incentive payments to producers who wish to implement water conservation practices. Until 2005, approximately \$190 million was allocated to the GSWC program. Kansas is scheduled to receive \$3.2 million for fiscal year 2006 out of the \$60 million national authorization. With millions of dollars spent each year, relatively little is known about the performance of the GSWC program. It is of particular interest for policy makers and producers to know: (*a*) how much water could be saved through the subsidized conservation practices, and (*b*) whether the current cost-share rates and incentive payments are cost effective.

A common conservation practice implemented is to improve irrigation technology and increase irrigation efficiency. In Kansas, eligible producers can receive cost-share assistance for conversion from flood irrigation systems to sprinklers. Although the more efficient irrigation technologies are suggested to be water-saving, there is substantial controversy in the literature on the conservation effects of efficiency improvements (Huffaker and Whittlesy 1995, 2003; Peterson and Ding 2005). Responding to the increased efficiency, profit maximization producers may increase net irrigation at the intensive margin, or/and adjust irrigated acreage or cropping system at the extensive margin (Moore, Gollehon, and Carey, 1994).

Another frequently discussed conservation practice is to convert irrigated cropland to nonirrigated cropland. Incentive payments are provided to participating producers for retiring their consumptive water rights within the contract period (usually 10 years). The difficulty with this policy is to determine an appropriate payment rate in absence of an active water market. Since producers are diversified in the cropping system, production practice and hydrologic conditions, the compensation payment they are willing to accept for giving up irrigation could vary dramatically.

The objective of this paper is to analyze and quantify the effectiveness of cost share and incentive payment program in terms of how much water can be saved for each dollar of government payment.

Suppose a profit maximizing producer is eligible for both the cost-share program and the incentive payment program. Since the enrollment is voluntary, he has three options: 1) not enroll into any program and stay with the old irrigation system; 2) accept the cost-share assistance and convert the existing flood system to sprinklers; 3) take the incentive payment and switch to nonirrigated production. Given the profit maximization assumption, the producer would always choose the one which is most profitable given his current conditions. If we consider nonirrigated production as another irrigation technology, the profit maximization problem is actually one of making the optimal irrigation technology choice. The only difference is that the cost and benefit associated with certain irrigation technologies would be changed by the government program. Some alternatives would not be feasible or profitable without program assistance. Therefore, to evaluate the effectiveness of a program, we first need to determine the optimal choice of technology; and then we need to calculate and compare the cumulative water use under alternative irrigation technology over the contract period to find out how much water could be saved if the producer chooses to participate a certain program.

Model Development

Many studies have analyzed the determinants of technology choices and irrigation water use (Caswell and Zilberman; Buller andWilliams; Negri and Brooks). The previous findings suggest that determinants include but not limited to: commodity prices, energy prices, pump lift and well capacity. A factor affecting technology selection could affect water use as well. Because the investment in irrigation technology is a long-run decision which has dynamic effects on future crop selection and irrigation water use, a future-regarding optimizing irrigator will make the choice which maximizes the sum of current and discounted future profits.

To model this dynamic optimization problem, Ding (2005) constructed a nested framework involving three optimization problems. First is the optimal choice of irrigation technology, which requires the irrigator to weigh up-front investment costs against future benefits, where the benefits in future period are not constant due to aquifer decline. The Bellman equation (Bellman) of the dynamic optimization problem is written as:

(1) $$V(s,m) = \underset{x=0,1,2}{Max}\{\Pi(s,x) - K(m,x) + \beta V(s',m')\}$$

x denotes the discrete choice variable that equals 0 if the irrigator chooses to stay with the flood system, 1 if she chooses the center pivot sprinkler, and 2 if she converts to nonirrigated production. β is the discount factor. $V(.)$ represents the maximized (discounted) total profits that the irrigator could obtain given the current state (s, m). In this study, the state variables include the saturated thickness of the aquifer (s), and the age of the existing irrigation system (m). As the saturated thickness declines, the depth to water table increases, which increases pumping cost; meanwhile, well capacity decreases which limits the water supply. Therefore, the irrigator with lower saturated thickness is expected to have more incentive to adopt the more efficient irrigation technology. The common usable life time of the irrigation system is 15-20 years. In this study, we assume the usable life time is 20 years for both the flood and center pivot system with no savage value. The old system must be completely replaced at the age of 20. Therefore, the irrigator with an older system is more likely to abandon the existing system and participate in the government program.

$K(m,x)$ denotes the cost of the initial investment, which depends on the choice of irrigation system and the age of the existing system.

(2) $$K(m,x) = I(m<20)(I(x=1)K_1) + I(m=20)[I(x=0)K_0 + I(x=1)K_1]$$

where $I(.)$ is a binary indicator function that equals 1 if its argument is true and zero otherwise. K_0 and K_1 are the initial investment costs on the flood and center pivot system, respectively. s' and m' are the expected values of saturated thickness and age of the irrigation system for the next period based on current states and decision. Let z denote the water table decline rate, and then $s' = s - z$. m increases by one year for the next period: $m' = m + 1$.

Given the irrigation technology selected by solving the optimization problem in the equation (1), the second step for the profit-maximizing irrigator is to make the optimal crop choice. In the equation (1), $\Pi(.)$ is the maximized return to land and irrigation capital for a given irrigation technology. A standard parcel in Kansas is a 160-arce square field. It is the common combination of one well and one parcel. Assume the flood system irrigates the total 160-acre field, while the center pivot system only irrigates a 126-acre circle within the field and with dryland production on the four corners. So, we write

(3) $\Pi = 160\pi_0^* I(x=0) + (126\pi_1^* + 24\pi_2^*) I(x=1) + 160\pi_2^* I(x=2)$

where π_0^*, π_1^*, and π_2^* are the maximized profits per acre under the flood system, the center pivot system, and the dryland production, respectively. Assume there are J alternative crop choices available, and then the irrigator makes the crop choice by solving the problem below:

(4) $\pi_x^* = Max \sum_{j=1}^{J} \rho_j \pi_{xj}^*$

where π_{xj}^* is the maximized profit under the combination of technology x and crop choice j, and ρ_j is the share of land planted to crop j. Let w_x^* denote the water use under technology x, which is the optimal quantity of water use under the selected crop.

The final step for the irrigator is to solve for the optimal irrigation water use (w_{xj}^*) to maximize the profit under selected irrigation technology and crop (i.e. π_{xj}^*). The maximization problem is written as

(5) $\pi_{xj}^* = \underset{w_{xj}}{Max}\left\{ p_j y_j - r(u,l)w_{xj} - I_{xj} + \lambda_j(\bar{w} - w_{xj}) \right\}$

where p_j and y_j are the price and yield of crop *j* respectively; *r* is the marginal pumping cost, which is a function of energy price (*u*) and pump lift (*l*); I_{xj} is the production cost other than pumping cost (including the cost of seeds, fertilizer, machinery, labor, etc.); and $\bar{w}$ is the water supply constrained by well capacity[1][2]. Assume that crop yield is a function of effective water, *e*, the water utilized by the crop, and that effective water is the product of the water applied through the irrigation system (*w*) and the irrigation efficiency (*h*).

(6) $y_j = f_j(e) = f_j(hw)$

The three-staged optimization problem specified in equation (1), (4), and (5) can be solved by backward induction. First, the optimal quantities of irrigation water are selected for all combinations of crop choices and irrigation technologies; and then, the crop choices are compared and the most profitable one is determined under a certain irrigation technology; and finally, the technology choice is made by comparing the sum and discounted future profits across alternative irrigation technologies. Numerically, the

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[1] If the well capacity is 900 gallons per minute (GPM), and the water pump runs for 2,400 hours in a season, then no more than 4,772.7 acre-inches of water can be pumped. This implies a maximum application rate of 30 inches per acre for a 160-arce parcel, or 38 inches per acre for a 126-arce circle.

[2] In this study, the well capacity is directly related to the saturated thickness by the following equation (Hecox 2003): $GPM = \frac{(k)(s)(s-10)}{267} * 0.6$, where k is the hydraulic conductivity.

dynamic optimization problem specified in equation (1) is solved by using a computation package in Matlab developed by Miranda and Fackler (2002)

After reviewing how an irrigator optimally chooses the irrigation technology without the assistance of government program, we now return to our original question: when the cost-share assistance and incentive payment are available, how would the irrigator respond? Assume that the starting value of the saturated thickness is s_0, and the age of the existing system is m_0. The profit associated with option 1 (not participate any program and stay with the old system) is: $V_0 = V(x=0, s_0, m_0)$; the profit associated with option 2 (share cost with the government and replace the old flood system with the new center pivot system) is: $V_1 = V(x=1, s_0, 0) + \theta K_1$, where θ is the cost-share rate; the profit associated with option 3 (accept the incentive payment and retire the water right during the contract period[3]): $V_2 = \sum_{t=0}^{T-1} \beta^t (160\pi_2^*) + \beta^T V(x=2, s_{+T}) + C$, where s_{+T} is the expected value of saturated thickness in 10 years, and C is the compensation payment for retiring water right. The irrigator would compare the profits associated with alternative options and choose the one most profitable:

(7) $Max(V_0,\ V_1,\ V_2)$

After determine the irrigator's technology choice, we can calculate the corresponding crop choice and water use over year, and compare the cumulative water use under alternative policy scenarios.

[3] Assume it is a *T*-year contract, and the irrigator is free to resume irrigated production or stay with dryland production when the contract ends.

Let N denote the number of producers eligible for cost-share assistance and incentive payment in the targeted program area. Assume that N_1 producers accept cost-share assistance (θK_1) and convert to the center pivot system; that another N_2 producers accept the incentive payment (C) and convert to the nonirrigated production; and that the rest of the $N_0 = N - N_1 - N_2$ producers do not participate in any program and stay with the flood system. The total payments from the government are:

(8) $\Lambda = N_1(\theta K_1) + N_2 C$

And the total water saved during T years is:

(9) $W = \sum_{n=1}^{N_1} \sum_{t=1}^{T} (w_{0nt}^* - w_{1nt}^*) + \sum_{n=N_1+1}^{N_1+N_2} \sum_{t=1}^{T} (w_{0nt}^* - 0)$

where w_{xnt}^* is the optimal water use under technology x for irrigator n at time t. The coefficient of cost effectiveness (CE), in terms of the amount of water saved per dollar, is calculated as:

(10) $CE = \dfrac{W}{\Lambda}$

If the goal of the conservation program is to reduce the consumptive water use by at least W^g, then the most effective way to achieve this goal is to solve:

(11) $$\begin{aligned} &\underset{\theta,C,T}{Max}\ (CE) \\ &s.t. \quad W \geq W^g \end{aligned}$$

Using the model developed, we can evaluate the effectiveness of the prevailing groundwater conservation programs in Kansas, and also find ways to improve them.

Model Parameters

The model requires several economic, production, and hydrologic parameters, including crop prices, pumping costs, irrigation capital requirements, production costs, crop response functions, saturated thickness and the decline rate of the aquifer. Estimates of these parameters are based on common crop production practices, hydrologic characteristics and weather conditions specific to irrigators in the Kansas High Plains.

The Crop Production Functions

For this study, assume corn and sorghum are the two alternative crop choices for irrigators. Both are major irrigated crops in the Kansas High Plains. Corn is the dominant irrigated crop, planted on over 50% of all irrigated acreage. Sorghum is a water-extensive crop, and is usually regarded as a replacement for corn (a water-intensive crop) when there are limited water supplies. Assume the production function in equation (6) takes a quadratic functional form:

(12) $y = \alpha_0 + \alpha_1 e + \alpha_2 e^2$

This function is estimated for corn and sorghum respectively, using the data generated by the Crop Water Allocator (K-State Research and Extension Mobile Irrigation Lab, 2004). This program was designed by Kansas State University Research and Extension to simulate irrigated crop yields under growth conditions typical of western Kansas. The default relationships between yield and irrigation built into the program are based on the Kansas Water Budget Model developed by Stone et al. (1995), which was in turn calibrated to yield data obtained at field trials in western Kansas. The parameters (α 's) were estimated using Ordinary Least Squares and results are reported in Table 1.

The effective water (e) is the product of the applied water (w) and the irrigation efficiency (h). In western Kansas, water application efficiency with the flood system is generally in the range of 50 to 75 percent depending on the field characteristics while with the center pivot system it is in the range of 75 to 95 percent. For this study, we set the irrigation efficiency to be 60 and 90 percent for the flood and center pivot systems, respectively.

Prices and Costs

For the prices of corn and sorghum, the 10-year (1993-2002) average values of Market Year Average prices in Kansas are used in the model (Data from USDA/NASS). The price of natural gas is used to represent the fuel price because natural gas is the most popular fuel used in western Kansas for pumping water. Again, the 10-year (1993-2002) price average is used (Data from DOE/EIA).

Kansas State University Farm Management Guides (2001) provide data and information for non-water production costs and irrigation system investment costs. Non-water production costs include expenses for seed, herbicide, insecticide, fertilizer, crop consulting, machinery, and interest. These costs are calculated for alternative crop choices and irrigation systems (see Table 1). The investment cost of the flood system is much lower than that of the center pivot system. The cost is \$5,257 (K_0) for the flood system, and \$45,474 (K_1) for the center pivot system.

The profit from dryland crop production, for simplicity, is set to be the cash rent of the nonirrigated cropland. It equals to \$31 per acre in western Kansas according to Kansas Agricultural Statistics (2004).

The pumping cost (r) is assumed to be a function of fuel price (u) and pump lift (l). Set $r = u\delta l$, where δ is the energy required to lift one unit of water one unit of distance. Assuming that the pump plant is 75% efficient (this is distinct from the water application efficiency of the delivery system), 0.000155 (mcf) of natural gas is required to lift one acre-inch of water one inch high (i.e., δ =0.000155) (Rogers and Alam 1999). Pumping water also incurs costs of repair and maintenance (rp). According to the data from Kansas State University Farm Management Guide (2001), we set $rp = \$0.3$ per acre-inch of water.

Hydrologic Characteristics

The pump lift is the sum of the depth to the water table (*dtw*, measured in feet) and the pressure of the water at the exit from the well (measured in pounds per square inch, psi). The water pressure is converted to feet by a conversion factor of 2.31 feet per psi. Assume that the pressure is 5 psi for the flood system, and 20 psi for the center pivot system (Williams et al. 1997). The depth to the water table is the distance from the land surface to the groundwater level. As the level of saturated thickness decreases, the pump lift increases correspondingly.

The decline rate of the water table would be affected by total groundwater withdrawal. However, since an individual irrigator's water use is only a tiny portion of the total groundwater withdrawal, it has little effect on the overall water table level. Bearing this in mind, an individual irrigator would expect the decline rate to be exogenous to her water use. For this study, we assume a constant decline rate of 6 inches per year, which is the average decline rate of the Ogallala aquifer in Kansas during the 1990s (Kansas Geological Survey).

Results

Assume that there are 100 eligible irrigators in one of the program target areas, i.e., N=100. Most irrigation wells in western Kansas have a water level ranging from 70 to 130 feet, averaging 100 feet. Therefore, we assume that the saturated thickness for each irrigator is a random draw from a normal distribution with a mean of 100 and a variance of 100. Similarly, the age of the existing irrigation system is a random number drawn from 1 to 20. For each irrigator, we first determine whether she will enroll into any conservation program or not; and then, if she will enroll, how much water will be saved during the contract period. The results from each irrigator are summarized to obtain the enrollment rate, total government payments, and total water saved. These values are then used calculate the cost effectiveness as specified in equation (10). To even out the variability of random draws, the above procedure is repeated for 100 times, and the final reported results are the average values from the 100 iterations.

Assume the contract lasts for 10 years. The cost effectiveness we calculated is interpreted as the amount of groundwater saved during the 10 years for one dollar spent today. In Tables 2, 3, and 4, we report the cost effectiveness, total water saved and total government expenditures under different cost-share rates and incentive payment levels, respectively. From Table 2, we see that when there is no incentive payment for conversion to dryland production available, setting the cost-share rate at 10% leads to the highest level of cost effectiveness, 0.478, implying 0.478 acre inches of water saved per dollar. On the other hand, when the cost-share rate is zero, setting incentive payment at \$60,000 for a 10-year conservation contract achieves the highest level of cost effectiveness, 0.467. When both the cost-share assistance and incentive payment are available, the best strategy is to set the cost-share rate at 10% and the incentive payment at $30,000, resulting in the cost effectiveness of 0.479 which is slightly higher than the one we get when only cost-share assistance is available.

In the above analysis, we choose the maximal cost effectiveness without considering any constraints. However, a government program usually has a certain goal to accomplish, and also has budget limit. Suppose the conservation program is required to reduce groundwater use by at least 10%. Our model predicts that, without any policy intervention, the 100 irrigators would consume the total of 3,485,000 acre inches of water during 10 years. Therefore, at least 348,500 acre inches of water should be saved to accomplish the program goal. Reviewing Table 3, we find that this goal can be achieved by any cost-share rate no less than 40% or incentive payment amount no less than $60,000. Among all the potential solutions, the highest cost effectiveness occurs when cost-share rate is 10% and incentive payment amount is $60,000. However, the corresponding total government expenditure reported in Table 4 equals to $3,000,913, which is close to the total fund allocated to the Kansas GSWC program (3.2 million for fiscal year 2006). In case that the program is intended to cover multiple sites, this solution is not viable given the limited budget. Bearing this in mind, we could set the cost-share rate to 20% and the incentive payment amount to $60,000, which results in a slightly lower cost effectiveness of 0.411. This solution will cut off the total water use by 352,135 acre inches with $858,971 of total government expenditure, satisfying both requirements of the program target and budget control.

Currently, the Kansas GSWC program shares 40% of the average investment cost for conversion from the flood system to the center pivot sprinkler irrigation; and also pays up to $50,000 per contract for temporarily retiring the consumptive water right (Source: USDA/NRCS). Based on our results, we expect to improve the effectiveness of the program by reducing the current cost-share rate and increasing the incentive payment amount.

In the above analysis, we assume that the program offers a flat rate to all eligible irrigators, which does not differentiate the irrigators by their hydrologic conditions. An irrigator with lower level of saturated thickness is expected to have more incentive to convert to the center pivot system; because the more efficient irrigation system would reduce the pumping cost and increase the effective water supply. Therefore, a relatively lower cost-share rate would induce the irrigation to make the conversion. On the contrary, the irrigation with higher saturated thickness level might require a higher cost-share rate to commit the conversion.

Suppose that we can divide irrigators into two groups by their saturated thickness. Irrigators with saturated thickness level lower than 100 feet are eligible to receive 10% cost-share assistance, while irrigators with saturated thickness level higher than 100 feet are eligible for 40% cost-share assistance. With no incentive payment available, the cost effectiveness of the program reaches 0.578, with the total water saving of 422,600 acre inches and total government expenditure of $729,770. Compared with results under the flat cost-share rate, the cost effectiveness is increased significantly by differentiating irrigators.

The incentive payment for conversion to dryland production competes with the cost-share program for irrigators' enrollment, especially for those with lower level of saturated thickness. Those irrigators would expect low returns from irrigated crop production given limited well capacity, and therefore would be more likely to accept the incentive payment for conversion to dryland production. For this reason, the incentive payment program could be used to replace the cost-share program for targeting the irrigators with lower saturated thickness. Assume that only irrigators with saturated thickness higher than 100 feet are eligible for cost-share assistance and the cost-share rate is 40%; and the incentive payment of $50,000 are available for all irrigators. Under this assumption, the cost effectiveness is 0.591, with the total water saving of 410,880 acre inches and total government expenditure of $696,620. The cost effectiveness is slightly increased, which indicates that the incentive payment program is more effective than the cost-share program for irrigators with poor hydrologic conditions.

Conclusions

In this study, we have analyzed the effectiveness of the cost-share program for irrigation investments and the incentive payment program for nonirrigated crop production in the Kansas High Plains. Our empirical results indicate that the prevailing conservation programs are capable of reducing irrigation water use; however its cost effectiveness could be improved by reducing the current cost-share rate. In addition, differentiating irrigator into groups based on their hydrologic conditions and targeting different groups with different cost-share rates could enhance the cost effectiveness significantly. Third, the incentive payment for dryland production currently available is only attractive for irrigators with poor hydrologic conditions. This program can be implemented with the cost-share program for targeting irrigators with different saturated thickness levels, and improve the overall cost effectiveness of the conservation programs.

Since the GSWC program was recently enacted, little performance data are available now. Our conclusions are derived from the simulated results based on the economic conditions, production practice and hydrologic characteristics typical to the Kansas High Plains. In the future, when the real performance data are available, we can examine our results and refine the model.

Table 1: Model Parameters

Parameters	Values
Coefficients of Production Function	
Corn	
α_1	33.4525
α_2	16.0891
α_3	-0.4023
Sorghum	
α_1	42.6486
α_2	7.1289
α_3	-0.1963
Non-water Production Costs ($/acre)	
Corn	
Flood	238.2
Center Pivot Sprinkler	232.3
Sorghum	
Flood	138.7
Center Pivot Sprinkler	132.4
Corn Price ($/bushel)	2.35
Sorghum Price ($/bushel)	2.18
Natural Gas Price ($/mcf)	5.1

Table 2: The cost effectiveness under different cost-share rates and incentive payments.

Incentive Payment ($)	Cost-Share Rate 0	0.1	0.2	0.3	0.4	0.5
0	0.000	0.478	0.401	0.342	0.302	0.273
10,000	0.000	0.478	0.401	0.342	0.302	0.273
20,000	0.020	0.478	0.401	0.342	0.302	0.273
30,000	0.107	0.479	0.402	0.343	0.302	0.273
40,000	0.288	0.479	0.404	0.343	0.302	0.273
50,000	0.414	0.471	0.407	0.347	0.304	0.274
60,000	0.467	0.468	0.411	0.353	0.309	0.276
70,000	0.441	0.441	0.441	0.441	0.328	0.283
80,000	0.415	0.415	0.415	0.415	0.415	0.415

Table 3: The total water saved under different cost-share rates and incentive payments.

Incentive Payment ($)	Cost-Share Rate 0	0.1	0.2	0.3	0.4	0.5
0	0	112,722	231,187	335,297	429,849	519,830
10,000	0	112,722	231,187	335,297	429,849	519,830
20,000	408	112,834	231,299	335,410	429,849	519,830
30,000	3,829	114,679	232,661	335,700	429,963	519,943
40,000	18,050	124,996	238,035	337,421	431,324	520,233
50,000	81,569	161,027	258,336	348,742	437,793	523,144
60,000	1,446,600	1,404,412	352,135	388,050	460,362	533,867
70,000	2,233,412	2,233,412	2,233,412	2,228,351	581,727	578,662
80,000	2,963,473	2,963,473	2,963,473	2,963,473	2,963,473	2,963,473

Table 4: The total government expenditures under different cost-share rates and incentive payments.

Incentive Payment ($)	Cost-Share Rate 0	0.1	0.2	0.3	0.4	0.5
0	0	236,419	577,884	979,919	1,424,609	1,906,043
10,000	0	236,419	577,884	979,919	1,424,609	1,906,043
20,000	600	236,619	578,084	979,983	1,424,609	1,906,043
30,000	7,200	239,774	580,065	980,410	1,424,728	1,906,115
40,000	39,600	261,282	590,646	983,609	1,426,791	1,906,561
50,000	193,500	346,006	636,469	1,007,551	1,439,560	1,911,768
60,000	3,095,400	3,000,913	858,971	1,100,913	1,491,088	1,935,480
70,000	5,065,200	5,065,200	5,065,200	5,054,492	1,775,366	2,042,160
80,000	7,144,000	7,144,000	7,144,000	7,144,000	7,144,000	7,144,000

Table 5: The enrollment rates for each program under different cost-shares and incentive payments. [a]

Incentive Payment ($)	Cost-Share Rate 0	0.1	0.2	0.3	0.4	0.5
0	0%, 0%	52%, 0%	64%, 0%	72%, 0%	78%, 0%	84%, 0%
10,000	0%, 0%	52%, 0%	64%, 0%	72%, 0%	78%, 0%	84%, 0%
20,000	0%, 0%	52%, 0%	64%, 0%	72%, 0%	78%, 0%	84%, 0%
30,000	0%, 0%	52%, 0%	63%, 0%	72%, 0%	78%, 0%	84%, 0%
40,000	0%, 1%	51%, 1%	63%, 0%	72%, 0%	78%, 0%	84%, 0%
50,000	0%, 4%	50%, 2%	62%, 1%	71%, 1%	78%, 0%	84%, 0%
60,000	0%, 52%	2%, 50%	58%, 6%	69%, 3%	77%, 2%	83%, 1%
70,000	0%, 72%	0%, 72%	0%, 72%	0%, 72%	72%, 7%	81%, 3%
80,000	0%, 89%	o%, 89%	0%, 89%	0%, 89%	0%, 89%	0%, 89%

[a] The first number in a cell is the enrollment rate of the cost-share program, and the second number is that of the incentive payment program.

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