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## Conversion subsidies for organic production: results from Sweden and lessons for the United States

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### Abstract

Organic conversion subsidies used in Europe are less likely to be politically acceptable in the United States, where organic agriculture development is market-driven. Persistent barriers to conversion in the United States include limited availability of and access to production and market information, training in management systems and cost of conversion-related investments. By determining whether these factors affect the requirement of a subsidy to convert, we can suggest whether U.S. policy makers need to provide subsidies to encourage conversion and identify policy variables consistent with market-based approaches that could stimulate conversion. A utility difference model is used with Swedish data to analyze factors that determine whether a subsidy is required to motivate organic conversion. The results show that farmers requiring subsidies manage larger less-diversified farms and are more concerned with organic inspection, quality, and adequacy of technical advice. Access to more market outlets and information sources substitutes for payment level in the farmer's utility function, indicating that services rather than subsidies may be used to encourage organic agriculture. To the extent that conditions are similar in the U.S. organic sector, market-based programs such as cost-sharing for conversion and market access improvement should stimulate growth of this industry. © 2000 Elsevier Science B.V. All rights reserved.

**Keywords:** Organic agriculture; Public policy; Utility difference model

### 1. Introduction

Organic agricultural policy is evolving in both the United States and in Europe. In the United States, organic development is market-driven and has relied on state and industry promotion. National policy is aimed at developing standards to govern the production, processing and labeling of organically produced

foods to facilitate the flow of market information. Organic farmers may participate in any farm support programs for which they qualify, but no programs at the federal level explicitly encourage conversion. States are empowered to set priority areas for cost-sharing under the federal Environmental Quality Incentives Program (EQIP), which provides payments for 5-to-10-year contracts based on conservation plans. In 1997, Iowa became the first state to qualify organic crop production practices for EQIP funds (USDA, 1997).

European countries have moved beyond voluntary certification to establish organic conversion and pro-

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duction supports (Holden, 1993). Lampkin and Padel (1994) summarized financial support programs from 1987 to 1992 in Denmark, Sweden, Norway, Finland, Switzerland, Austria and Germany. Most of these direct subsidies were of a limited term (up to 3 years during conversion), but required complete conversion of at least a portion of the farm and continued organic production following the termination of the payment period. These policies were justified by environmental protection and surplus output reduction goals, which could be achieved with organic production systems (OECD, 1993). European experience indicates that conversion subsidies can increase the organic farming sector by 300% (Lampkin and Padel, 1994).

Conversion subsidies for adopting organic agriculture intensify information and management inputs, rather than chemical inputs. With emphasis on soil management, resource conservation, nutrient cycling, prohibition of synthetic chemicals, mechanical and cultural pest control practices and enterprise diversification, organic agriculture may reduce the cumulative adverse impact of agriculture on the environment even if more land comes into production. Lewandowski et al. (1997) found that for conventional agriculture, reducing support through agricultural assistance programs in high income countries tends to extensify production with more land being farmed. As the United States phases out conventional subsidy programs, encouraging organic agriculture may limit the environmental impacts of extensification.

Government programs to support organic agriculture in the United States could include cost-sharing transition expenses, supporting research and extension, assisting in market development and insuring quality of organic certification. These would address persistent barriers to conversion such as limited availability of and access to production and market information, training in management systems and conversion-related investments (OFRR, 1994, 1996). By quantifying the effect of these barriers on requirements for subsidies, we can suggest whether U.S. policy makers need to provide financial incentives to encourage conversion and identify market-based policy variables that could have the same effect with less interference.

Iowa's application of EQIP payments for organic production practices over 5 years is based on the assumption that a form of subsidy is needed to sti-

mulate conversion. Iowa's cost share pays a per acre fee of \$40 per acre for the first 2 years, which declines by \$10 per acre per year to \$10 per acre for the fifth year applied to a maximum of 40 acres (USDA, 1997). In addition a required component is 75% of the annual certification fee, not to exceed \$150 per year. If such incentives are required to stimulate conversion to organic production, federal spending via state-administered programs could be substantial. However, if farmers would convert to organic production without a payment, then funding could be diverted to other programs, such as market and trade enhancement, that would improve competitiveness using market-based approaches.

Given Iowa's trend-setting approach to cost-sharing for organic crop practices, it is imperative that implications of such policies be evaluated in the context of empirical results. Sweden offers a case study to examine the effect of subsidy to stimulate conversion to organic production practices. In 1989, a terminal subsidy for 1–3 years was provided to 1781 farmers who agreed to follow a national certification agency's regulations for at least 6 years (Svensson, 1991). More than half of the farmers surveyed had converted or had begun conversion to organic methods before 1989. Thus, for a relatively large share of farmers, the subsidy was not necessary to induce conversion. While not identical, there is sufficient similarity in the context, history and behavior of the organic sectors in Sweden and the United States to permit implications to be drawn about the effects of subsidization on U.S. organic agriculture.

We analyze the factors that determine under what conditions are subsidies required to motivate organic conversion in Sweden. A utility maximization model is used to compare farmers who converted as a result of the subsidy with those who did not require the payment to convert. The objective is to delineate policy variables and describe the implications of their manipulation for organic conversion in Sweden, with applications to the United States.

## **2. Comparability of Sweden and the United States**

The applicability of Swedish results to the United States is moderated by similarities and differences in the organic sectors and the policy environments. Dif-

ferences in availability and format of the data across countries preclude exact matching of statistics, but sufficient detail is available to document the comparison. Since the Swedish survey was conducted only among organic farmers, this discussion is limited to that agricultural sub-sector and related institutional and policy contexts.

Assessments of enviro-agricultural policies in Sweden and the United States in a recent OECD (1993) report reveal commonalities in attention to soil conservation, wetlands protection and farmland preservation. Sweden's agricultural policy program in the subsidy period included crop insurance, price supplements, fertilizer and pesticide environmental charges and compensation for voluntary conversion of grain acreage to forests and wetlands, as well as a dairy retirement program (Federation of Swedish Farmers, 1992). The United States had programs with similar income and environmental goals in place, but less reliance on direct payments (OECD, 1993). Chemical taxation for environmental purposes was implemented at the state level in the United States (Center for Science in the Public Interest, 1995).

The requirements under which a farm is certified affect the choice sets available for enterprise management. At the time of the subsidy, organic certification in Sweden was conducted by one of two organizations — KRAV (described below) and Svenska Demeterförbundet (Svensson, 1991). KRAV was the dominant certifier, accounting for 88% of certified farms in 1990, increasing to 91% of certified farmers by 1992 (Svensson, 1991; KRAV, 1992b). In the United States, 90% of growers used only one certification agency in 1995 (OFRF, 1996), mostly choosing non-governmental certifiers established by organic farming associations. In both countries, certification requirements and related education programs adhere to principles of crop selection, pest and nutrient management, and soil improvement that prohibit synthetic chemicals.

In 1992, KRAV-certified producers accounted for 40,000 ha, equivalent to about 1.5% of arable acreage in Sweden, an increase of 21% over 1990, the year after the introduction of the subsidy (KRAV, 1992b). Average organic farm size in 1992 was 23 ha for fully converted farms allocated among 1407 crop farmers, 74 greenhouse farmers and 70 livestock farmers. About 32% of organic acreage was in grains, 54%

in pasture or hay, 4% in fruit and vegetables, and 9% in other crops. Of certified livestock, 19% were dairy cows, 30% lamb or sheep, 28% veal and beef, 15% swine, and the rest poultry and goats.

Detailed production information is unavailable for the United States because certification is dispersed. OFRF undertook national surveys of certified producers in 1993 and 1995, reporting 550 responses (20% of mailout) and 945 responses (27% of mailout), respectively (OFRF, 1994, 1996). At least 38,940 ha were certified in 1993, with owned acreage averaging 54 ha (OFRF, 1994), over twice as large as the average Swedish organic farm in the same time period. A total of 54,900 certified hectares was reported in the 1995 survey (OFRF, 1996). Certifying agencies in California, Florida, Idaho, Wisconsin and Texas reported that organic vegetable acreage increased by an average of 47% across the five states between 1993 and 1996, representing 1.5% of all vegetable acreage in those states (Greene and Calvin, 1997).

Respondents in the OFRF surveys reported the number and types of crops grown, rather than acreage. In 1992, 19% of farmers grew six to ten commodities and another 19% grew 11 to 25 commodities (OFRF, 1994). Primary crops were field crops, including pasture (40% of respondents), vegetables (61%), root crops (30%), vine fruit (26%) and tree fruit (35%). Also, 14% of the respondents raised beef, 10% produced eggs, 8% raised poultry, 7% raised sheep and lesser percentages reported raising bees, swine, goats, and dairy cattle. Despite the difference in average farm size, farm enterprise diversity is similar for Swedish and U.S. organic producers. Enterprise diversity is greater in both countries for organic than for conventional farmers and organic enterprises more often incorporate livestock.

Marketing outlets are diversified among organic farmers in both countries. The top four categories named by Swedish farmers in a 1990 survey were organic and conventional cooperatives (listed by 40% of respondents), farm shops (26%), direct-to-retail (17%) and outlets similar to farmers markets (11%) (Svensson, 1991). OFRF (1994) found similar diversity in outlets used by American organic farmers, although the choice set of outlets was larger, encompassing wholesalers, brokers, processors, restaurants, and subscriptions that are not accessible in Sweden. For the categories comparable to the Swedish outlets,

cooperatives were used by 12% of American growers (ranking ninth), direct on-farm sales were used by 47% of U.S. growers (ranking first), direct-to-retail sales were used by 38% (ranking third) and farmer markets were used by 36% (ranking fourth) (OFRF, 1994). Other important outlets for U.S. farmers included wholesale (44%, ranking second), and restaurants (30%, ranking fifth).

Swedish and American organic farmers are similar in choice of information sources. The top choices for information in both countries were books and periodicals (57% of Swedish farmers and 87% of U.S. farmers). Other farmers were second most important (28 and 84%) and certifier or growers' association fourth most important (21 and 61%) (OFRF, 1994; Svensson, 1991). Publicly funded specialists (state advisors and local boards of agriculture in Sweden, extensionists and researchers in the United States) were third ranked in Sweden, used by 29–39% of farmers and were sixth ranked in the United States, used by 45–53% of American farmers, depending on the source. American farmers also relied on private sector advisors such as suppliers (66%) and crop consultants (45%).

Although country-level data on organic sales are not available, consumer surveys suggest similar demand for organics. From interviews of 1000 households in the United States, The Packer (1996) found 36% had purchased organics in grocery stores in the previous 6 months. A Swedish survey of 529 consumers in three major regions of the country indicated that 36% were regular or occasional buyers of organic produce, mostly from grocery stores (Ekelund and Fröman, 1991). Among American buyers, fresh organic produce was selected for appearance (24% of respondents), freshness (17%), health benefits (16%), taste or flavor (15%) and non-use of agrichemicals (12%). The most important reasons for purchase in Sweden were no chemicals in production (45%), health (28%), taste (11%) and environmental concerns (7%). American organic consumers place more emphasis on aesthetic qualities, while Swedish consumers appear to value food safety aspects more.

Of the 620 American respondents who did not purchase organics, 19% did not see any difference from conventional foods and 28% said the higher price for organic over conventional was the reason (The Packer, 1996). In Sweden, 25% of 339 respondents not

purchasing organic food were satisfied with conventional produce and another 9% gave expense of organics as the reason (Ekelund and Fröman, 1991). Average premiums in Sweden are 40–50% while some Americans pay about 62% more for organic produce (Ekelund and Fröman, 1991; The Packer, 1996). The 12–22% higher average premium cited in the U.S. survey is associated with a larger percentage of consumers who felt expense was a important barrier to purchase.

Organic farmers' attitudes in both countries are similar when timing of adoption is considered. A truism in organic agriculture is that later adopters are more often motivated by profitability. Among early adopters of organic practices in Sweden (those who converted prior to the subsidy), 76% listed environmental reasons for converted, while 25% listed food quality as a reason and only 18% stated financial reasons (Ekelund and Fröman, 1991). In the United States, early adopters were smaller farmers who overwhelmingly listed ecological or health concerns as reasons for organic production compared with financial reasons (85% compared to 5%) (Cook, 1988). Of post-subsidy adopters in Sweden, 67% listed environmental reasons, but only 12% listed food quality reasons while 33% listed financial reasons for organic production (Ekelund and Fröman, 1991). Similarly, in the United States, among larger, later entrants, only 55% were motivated by ecological or health concerns, while 30% listed financial reasons for their choice (Cook, 1988).

In summary, Swedish and American organic growers offer similar crops and livestock products as their conventional counterparts. Growers in both countries utilize multiple market outlets and information sources, but tend to use only one certifier. In both countries, there is a substantial segment of the population seeking organic produce and similar attitudes among organic farmers. Given similarities in policy environments, markets and production situations, results obtained from analysis of Swedish data should have applicability to the United States.

### **3. The Swedish organic subsidy**

In the 1980s, Sweden began to implement policies that favored shifts toward reduced and no-chemical

production systems. In 1985, Swedish agricultural policy for the first time included a goal addressing environment and resources (Kumm, 1991). To reduce production and pay for exports of surplus, price regulation charges were applied to fertilizers in 1982 and to pesticides in 1986. In addition, an input tax of 5% of the price of fertilizers and pesticides was introduced in 1984. Funds from the tax support research on reducing and eliminating chemicals in agricultural production and help pay for conservation and extension education efforts. Altogether the charges and taxes represent about 20% of the price of fertilizer (Kumm, 1991). The policy aim was to halve by 1995 pesticide use from the 1990 levels, which had already been halved between 1986 and 1990 (Federation of Swedish Farmers, 1992).

In 1985, a number of organizations committed to organic agriculture founded KRAV, the main Swedish national organic certification agency<sup>1</sup> (KRAV, 1992a). Government grants provided start-up funds in 1988, but support now derives from producer fees for inspection and membership. KRAV is independent of government and grower control, except for union and cooperative membership on the general assembly that oversees operations. KRAV certifies arable and horticultural production, livestock husbandry, food processing and manufacturing, marketing, retailing, wild-growing production such as berries harvested from woods, and imported produce (KRAV, 1992a).

As shifts toward reduced and no chemical agriculture occurred, the economic effects of system-level transition became apparent. The legal transition to organic agriculture is commonly set at 3 years in the United States and 1–2 years in Europe, requiring on-farm inspections and record-keeping. After the legal transition period is finished, the farmer may obtain price premiums for certified organic products, which helps offset the physical transition costs. These are penalties in yield or cost due to agroecosystem adjust-

ments and management inefficiencies while learning new practices (Irwin Hewitt and Lohr, 1995). Management cost penalties may be reduced by farmer education, but biophysical adjustments are determined by crop, current practices and farm situation.

The most important financial constraints during conversion are lack of access to premium prices until conversion is complete, conversion-related investments and disinvestments and information-gathering costs for production and marketing (Padel and Lampkin, 1994). Transition costs related to management and yield penalties constitute the main reasons for lack of conversion to sustainable farming in the United States (U.S. General Accounting Office, 1990). One of the reasons for the Swedish subsidy program was to overcome these factors among farmers who had not already converted to organic methods.

By distinguishing between the farmers who required a subsidy to convert and those who did not, it is possible to evaluate what policy variables may offset or reduce transition effects and encourage conversion. The model described in the next section accounts for the subsidy's effect on conversion.

#### 4. Data and methodology

Following Hanemann (1984), the observed yes/no decision to require the subsidy for conversion to organic methods is viewed as the outcome of a utility maximizing choice by the farmer. The indirect utility function for each farmer,  $V$ , depends on the subsidy offered, which differs by county, income and other behavioral characteristics and institutional factors that affect decisions on agricultural practices. The subsidy will be required only if:

$$V_j(1, \text{Inc}_j + S_j; A_j) + \epsilon_{j1} > V_j(0, \text{Inc}_j; A_j) + \epsilon_{j0}. \quad (1)$$

For individual  $j$ , the indirect utility when conversion is due to the subsidy is designated with 1 and is compared to the indirect utility when conversion to organic methods is not related to the subsidy, designated with 0. The decision of interest is whether subsidy has a significant influence on conversion, not whether the individual converts to organic agriculture.

The individual's preferences are influenced only by income,  $\text{Inc}_j$ , and other observable attributes,  $A_j$ , when he or she is not motivated by the subsidy. The offered

<sup>1</sup> Demeter, an international organization known as Svenska Demeterförbundet in Sweden, is the second largest certifying body in Sweden. Demeter incorporates more intensive soil stewardship requirements than KRAV. In the sample used for this research, 76% of farmers were certified by KRAV, 12% by Demeter, and the remaining 12% were under a special support program or were not officially certified. The key requirement for subsidy was that the KRAV standards were followed, even if certification was through another program.

subsidy,  $S_j$ , is added to the farmer's income when a payment is required to induce conversion. Random factors that influence the respondent's indirect utility function are defined by  $\epsilon_{j0}$  and  $\epsilon_{j1}$ , which are independent and identically distributed random variables with zero means.

If the difference between these two utility functions is greater than zero, the subsidy payment is needed to induce the farmer to convert. The utility difference model derived from this specification is:

$$\Delta V_j = \beta f(S_j, A_j) + \eta_j \quad (2)$$

where  $f(\cdot)$  denotes the functional form that depends on observed explanatory variables and a vector of estimated parameters  $\beta$ . Base income is the same with or without the subsidy for each farmer because the payment does not influence whether organic price premiums are received. The unobserved factors that influence whether a subsidy is required for conversion are represented by  $\eta_j$ , the difference in the error terms of the indirect utility functions defined as  $\epsilon_{j1} - \epsilon_{j0}$ .

The utility difference model yields the probit specification when the probability of the subsidy requirement is specified as  $\Phi_{\eta_j}$ , the cumulative distribution function of a standard normal variable

$$\text{Prob}(\text{Yes}) = \text{prob}(\eta_j \leq \Delta V_j \equiv \phi_{\eta_j}(\Delta V_j) \quad (3)$$

By specifying  $A_j$  and  $S_j$ , we may test which factors influence the requirement of a conversion subsidy.

In 1990, a survey questionnaire was sent to 1781 farmers who accepted the 1989 subsidy for organic conversion, with a response rate of 41% (Svensson, 1991). After excluding observations from Svensson's (1991) dataset that were missing data for key variables, we had a sample of 550, of whom 234 converted after the subsidy was offered. The questionnaire, which differentiated respondents by year of conversion, asked farmers about farm size, livestock and crop-types, sources of information about organic production, reasons for conversion, outlets for sale of organic products and perception of organic inspection quality, among other things.

Using data in the survey and data collected at the län (county) level, we tested several hypotheses related to factors that affect necessity of subsidy for conversion. Ease of conversion is a major determinant of converting to organic agriculture without a subsidy. While there is no one indicator of ease of conversion, eco-

nomics theory suggests that those with the lowest marginal costs of conversion, or the highest marginal benefits (e.g. from lifestyle choices) would have converted before the availability of the subsidy.

The amount of subsidy should be important if farmers respond to the incentive to convert. Differential payments were offered across län, with eligibility for up to 3 years depending on land quality, yield potential and land use. The subsidy was payable for only 1 year on grassland and green manure crops, and was not payable on horticultural crops. Payments ranged from SEK 700 to SEK 2900 per hectare per year across 24 län (Svensson, 1991). Farms had to be registered in 1989 to be eligible, but conversion could begin through 1992. Organic practices consistent with KRAV regulations had to be continued for 6 years. Payment level should be positively related to subsidy requirement.

Farm size, measured in acreage, has been shown to be inversely related to both organic certification and lack of certification (Cook, 1988). However, for farms with diverse enterprises that have mixed acreage (some organic, some non-organic), the relationship between farm size and certification is positive. Cook (1988) suggested that management changes and differences in input mix required for organic production might be scale-dependent, so that the mixed farm has some advantage in allocation of resources. Padel and Lampkin (1994) noted the same inconsistency in scale results across countries, attributing the conflicting results to longevity of organic farming traditions within the country. They commented that average organic farm size is increasing in countries with organic sectors dominated by small farms. This may be part of a general trend toward extensification of agriculture. If larger farms are more commercially oriented, then increased farm size should correlate positively with a subsidy requirement for conversion to organic farming.

The National Research Council (1989) stressed the importance of combined crop-livestock operations in achieving a sustainable system. Kumm (1991) noted the declining proportion of farms with livestock and leys (pastures) in Sweden. According to the Federation of Swedish Farmers (1992), only 8% of farms have 'mixed farming' as their main production system. Farms that have a diverse crop and livestock mix would be in a better position to convert to organic

production without a subsidy, so diversity is expected to be negatively correlated with a subsidy requirement.

Information and technical assistance are key factors in reducing the management costs of the transition period. Farmers might use a single source intensively or obtain information from a variety of sources. Adequacy of technical and economic advice on conversion reduces the risk of financially or environmentally costly management errors. As Padel and Lampkin (1994) pointed out, direct costs of information and experience-gathering constitute major barriers to organic conversion, suggesting that both access to and adequacy of information should be positively related to a subsidy requirement.

Satisfaction with certifying agencies should be positively related to conversion, though the relationship to subsidy requirement is unclear. When the inspection quality is good, farmers considering conversion have greater faith in the ability of the certification system to detect cheating, so that the cost of certification is compensated by consumer confidence and price premiums. Consumers are willing to pay more for certified products only if there is assurance that organic standards have been met in production and processing (Lampkin and Padel, 1994). If good quality certification costs are high relative to farm income, then a subsidy should be required to convert.

Availability of outlets for certified organic products should be negatively related to the subsidy requirement for conversion. Cook (1988) showed that market availability is critical, and that market niches may be expensive to establish and maintain. U.S. organic farmers consistently rate market development as a top industry need (OFRF, 1994, 1996). Certified outlets permit growers to obtain the price premium that helps offset organic production costs. Farmers who have access to multiple markets would have a better chance of selling their organic product at premium prices, and should not require a subsidy.

Social pressure from other farmers and passive awareness of organic operations should positively affect the decision to convert, even without a subsidy. If relatively more farmers in a län are producing organically, then non-organic producers are able to observe successful practices, and feel reassured that organic systems are feasible in their locale. Lampkin and Padel (1994) recognized that existing organic

farmers are an important source of information and expertise for farmers converting. The more organic farmers in a län, the more potential for networking, and the less likely that a subsidy is required to induce farmers to convert.

Padel and Lampkin (1994) noted that non-economic factors such as husbandry concerns, personal considerations and political, ideological, philosophical and religious perspectives may influence the conversion decision. They theorized that early adopters of organic systems tend to be different from the farming community as a whole to the extent that their non-economic concerns contribute significantly to their utility, perhaps enough to offset adverse economic effects of early adoption. Non-economic factors should be negatively correlated with subsidy requirement.

## 5. Results

Based on the hypotheses presented, the specification of the indirect utility function is:

$$\begin{aligned}\Delta V_j = & \beta_0 + \beta_1 \text{Paymt}_j + \beta_2 \text{Arable}_j + \beta_3 \text{AnimDiv}_j \\ & + \beta_4 \text{InfoTot}_j + \beta_5 \text{AdeqHelp}_j + \beta_6 \text{InspQual}_j \\ & + \beta_7 \text{SellTot}_j + \beta_8 \text{NrOrg88}_j + \beta_9 \text{NonEcon}_j + \eta_j.\end{aligned}\quad (4)$$

The variable  $\text{Paymt}_j$  represents  $S_j$  from Eq. (2) and all other variables are elements of the vector  $A_j$ . Table 1 describes the data used and variables estimated. The dependent variable in the probit model,  $\text{Effect}_j$ , is the probability that a farmer required a subsidy to convert to organic agriculture. This variable was constructed from the intersection of those who had not converted as of 1989, the sign-up date of the subsidy program, and those who said the subsidy had a substantial influence on their decision to convert. Twenty-seven percent (147 farmers) in the sample met this definition. It is assumed that this group would not have converted without a subsidy.

Table 2 shows the maximum likelihood estimates and elasticities for the probit model in Eq. (3). In this table and in subsequent text, the subscript  $j$  is dropped for convenience. For the three binary variables, marginal effects were calculated by subtracting the cumulative distribution function of Eq. (4) with the binary



Table 1  
Data and variable description

Variable	Description	Mean	Standard Deviation
Effect	Not converted before 1989 and farmer said the subsidy influenced conversion, dichotomous, 1 if yes	0.267	0.443
Paymt	Subsidy to farmers, ranging from SEK 700 to SEK 2,900 per hectare per year, by län	1743.200	560.290
Arable	Arable hectares, ranging from 5 to 200 hectares	34.991	40.117
AnimDiv	Number of livestock types on farm, sum of dummy variables for milk cows, beef cows, pigs for slaughter, ewes, horses and hens, ranging from 0 to 6	1.709	1.393
InfoTot	Number of sources consulted for advice on organic farming, sum of dummy variables for state advisor, local advisor, other advisor, control official, farmer, study circle, books or other source, ranging from 0 to 4	1.891	1.022
AdeqHelp	Adequacy of technical and economic advice on conversion, 1 if adequate or did not want, 0 if not adequate	0.793	0.406
InspQual	Satisfaction with inspection service for monitoring organic compliance, 1 if good, 0 if too superficial or too detailed	0.884	0.321
SellTot	Number of sales outlets, sum of dummy variables for organic farmers' cooperative, saltå mill, growers' cooperative, kommun, grocery, local shop, farm shop or other outlet, ranging from 0 to 4	1.013	0.876
NrOrg88	Number of farms fully converted or in conversion to organic methods as of 1988, by län	9.849	5.017
NonEcon	Primary reason for converting was non-economic: 1 if reason was enjoyment, anthroposophy, environment, health, food quality, ergonomic or previous experience, 0 if reason was reduce grain surplus, market adjustment, better economy or support provided	0.789	0.408

variable set to zero from that generated when the variable is set to 1, then taking the mean of the differences for all individuals (Caudill and Jackson, 1989).

The subsidy payment (Paymt) was significant and positively related to the need for a conversion inducement. The average payment was SEK 1743 per hectare, although the entire range from SEK 700 to

Table 2  
Probit model parameter estimates and elasticities for required conversion subsidy<sup>a</sup>

Explanatory variable	Coefficient	Elasticity at means
Subsidy to farmers (Paymt)	0.0002* (1.866)	0.446
Arable hectares on the farm (Arable)	0.0024* (1.677)	0.110
Diversity of animal operation on farm (AnimDiv)	-0.089* (-1.949)	-0.194
Sources of advice on organic farming (InfoTot)	-0.043 (-0.690)	-0.104
Adequacy of technical advice on organic farming (AdeqHelp)	0.391* (2.406)	0.114
Satisfaction with inspection service (InspQual)	0.348* (1.662)	0.100
Sales outlets for organic products (SellTot)	-0.281* (-3.619)	-0.362
Number of organic farms in län, 1988 (NrOrg88)	0.023* (1.899)	0.284
Non-economic reasons for conversion (NonEcon)	-0.128 (-0.883)	-0.042
Intercept	1.333* (-3.688)	
Maddala $R^2$	0.08	
Observations at 1	147	
Observations at 0	403	
Percentage of correct predictions	73.5	

<sup>a</sup> The dependent variable is *Effect*. Asymptotic *t*-values for the probit model are given in parentheses. Asterisk indicates significance at the 0.10 confidence level. Marginal effects for dichotomous variables were calculated using the method described in Caudill and Jackson (1989).

SEK 2900 was represented in the sample. Farm size (Arable) also was significant and positively related to the probability of subsidy being required for conversion. Average farm size was 35 ha, but the full range from 5 to 200 ha was included in the sample. This implies that larger farms were more likely not to have converted on their own. These results suggest that smaller farmers who might have dominated the sector will face more competition from larger farms when a conversion subsidy is instituted.

Diversity of enterprises was measured by number of six livestock-types present on the farm prior to conversion, quantified by the AnimDiv variable. Animal diversity subsumes crop diversity since all farms with animals also had pasture and other crops. The average for the sample was 1.7 animal species, with a range from zero to six. Livestock diversity was significant and negatively correlated with the probability of a subsidy requirement. The role of livestock in nutrient cycling, converting pasture to animal products and producing manure for crop nutrients may account for a cost-reducing effect in conversion as animal diversity increases. This would ease transition to organic production even in the absence of a subsidy.

The variable InfoTot counts the number of sources that the respondent consulted when seeking advice on organic farming, from one to eight possible sources. Most farmers consulted books and periodicals (55%), while other choices were state advisors (38%), local advisors (28%), other farmers (25%), certification officials (20%), study circles (12%) and other farm advisors (4%). The average number of sources consulted was 1.9, but the maximum consulted was only four of the possible eight, suggesting that the marginal benefit of investing in additional sources of information was relatively lower than the marginal cost. Lack of significance on InfoTot indicates that more information sources do not alter the probability of needing a subsidy, hence, that all producers found availability of sources equally important in the conversion decision.

The adequacy of the technical and economic advice provided for converting to organic methods, given by the variable AdeqHelp, was assigned a value of 1 if the respondent felt that sufficient advice was available. About 79% of the sample felt advice on conversion was adequate. Thus, quantity of sources may be less important than types of sources consulted. AdeqHelp

was positive and significant. Adequacy of information increases the probability of farmers requiring a subsidy to convert, possibly because good quality information is more costly to obtain.

Satisfaction with inspection services provided by KRAV and Demeter for controlling and monitoring compliance (InspQual) was significant and positively related to the subsidy requirement. This implies that the cost of high quality certification is not entirely compensated by price premiums, and a subsidy is required. Since consumers' willingness to pay organic price premiums depends on credibility of inspection, this is a critical factor in farmers' decisions to certify. Over 88% of farmers felt the service was satisfactory.

The count of total outlets used by each respondent, from zero to eight possible, was recorded by the variable SellTot. SellTot was significant and negatively related to the subsidy requirement for conversion. Availability of marketing opportunities can substantially reduce the cost of collecting information and establishing contacts, thus reducing need for a subsidy. An average of one outlet was used by respondents, possibly due to quantity of output available for sale and distance from outlet choices. Local shops (24%), grower cooperatives (19%), organic farmers' cooperatives (17%), grocery distributors (13%), farm shops (13%), saltå mill (9%) and kommun (3%) accounted for most farmers' choices.

The number of organic farms in each county prior to the subsidy (NrOrg88) ranged from zero to a maximum of 18. The average was 9.8, indicating that most of the farmers in the sample had exposure to other organic farmers. NrOrg88 was significant and positively related to the subsidy requirement, which is counter to the expected relationship. This result may be an artifact of the structure of organic agriculture in the län. The more organic farmers already in the län, the more likely that all who would convert without financial inducement had done so by the time the subsidy was available. Observing their neighbors, the remaining non-organic farmers could perceive conversion as too costly relative to price premiums to consider using organic methods without a subsidy.

Non-economic factors, measured by NonEcon, were cited as the primary reason for conversion by 79% of the sample. Among non-financial reasons for conversion Swedish organic farmers listed are enjoyment of the farming system, consistency with anthro-

posophy, environmental and human health protection, enhanced food quality, ergonomic advantages and long time experience with organic systems. NonEcon took a value of 1 if any of these reasons was given. The estimated coefficient on NonEcon was negative, but not significant. This variable does not indicate strength of held beliefs. While the majority of organic converters cite non-economic reasons for adoption, different expectations about costs and price premiums and their values relative to non-economic factors may be held by pre-subsidy and post-subsidy converters, so that economic factors appear to be the determinants of subsidy requirement.

Elasticities and marginal effects (for the dichotomous variables) are given in Table 2. Policy variables that can be affected by government programs are payment level, number and quality of information sources, inspection quality and accessibility to sales outlets. A 10% decrease in the payment level results in a 4% decrease in likelihood that a subsidy is required for conversion, indicating that if subsidies were eliminated, some farmers would not convert without compensation through another policy variable. A 10% increase in sales outlets produces a 4% reduction in probability of a subsidy requirement, while a 10% increase in sources of advice generates a 1% reduction. Based on the marginal effects of adequate advice and inspection quality, if a farmer is satisfied with these services the probability that a conversion subsidy is required increases by 0.1%. This suggests that as support services improve in quality, more commercially oriented farmers convert.

While not policy variables, farm size and animal diversity elasticities give an idea of scale effects. If farm size increases by 10%, the probability of a subsidy requirement increases by 1%. If livestock diversity increases by 10%, the probability decreases by 2%. Larger, less-diversified farms are more likely to require a subsidy to convert. Diversifying a large farm may reduce the need to provide a subsidy for these farmers to switch to organic methods. Technical support for diversification might be implemented through existing outreach programs.

As both Sweden and the United States adopt more market-oriented agricultural policy, attention turns to alternatives to direct subsidies. Targeted market development, technical assistance and inspection quality assurance are more consistent with this philosophy

than is direct subsidization. It is useful for planners to know the trade-offs between payments and policy variables, especially given the payment elasticity result previously mentioned.

Following Cragg and Kahn (1997), we calculated the marginal substitution between the subsidy payment and the other parameters such that the probability of requiring a subsidy to convert to organics remains unchanged. Holding all other variables constant, the trade-off may be computed for any variable,  $x_k$ ,  $k \neq 1$  with the subsidy payment,  $x_1$ , as:

$$d \text{Prob(Yes)} = \beta_1 \phi_{nj}(\Delta V_j) dx_1 + \beta_k \phi_{nj}(\Delta V_j) dx_k = 0 \quad (5)$$

$$dx_1 = -\frac{\beta_k}{\beta_1} dx_k \quad k \neq 1$$

where  $\phi_{nj}$  is the first derivative of the cumulative distribution function in Eq. (3). The trade-off is based on the marginal rate of substitution between  $x_1$  and  $x_k$ , shown in the second line of Eq. (5). The parameter estimates from Table 2 were used to determine the marginal rates of substitution.

The change in conversion subsidy,  $dx_1$ , is assessed for relevant marginal changes in other variables,  $dx_k$ , from their means. For variables measured in discrete units, Arable, InfoTot, SellTot, AnimDiv and NrOrg88,  $dx_k$  was set at 1 or  $-1$ . The latent binary variables, AdeqHelp, InspQual and NonEcon, were originally constructed from multiple response choices to opinion questions as described on Table 1. Marginal changes in these variables represent changes in the likelihood of answering a question with one of the opinions that represents a constructed 'yes' response. For consistency,  $dx_k$  for these variables was set at 0.10 or  $-0.10$ , a 10% change in probability of agreement with a stated opinion.

Consistent with Cragg and Kahn (1997), the trade-offs were expressed as willingness to pay for the change in the variable  $x_k$ . This is the amount of subsidy that would be given up if the change occurred, while keeping the probability of requiring a subsidy constant. The trade-offs are shown on Table 3. All payment trade-offs may be compared with a reference mean subsidy of SEK 1743.

Farmers would be willing to give up SEK 214 to increase information sources by one from the mean of two and SEK 1397 to increase marketing outlets by

Table 3  
Trade-offs between payment level and other variables to hold probability of subsidy requirement constant<sup>a</sup>

Change in variable	Willingness to pay (SEK)
One unit <i>decrease</i> in arable hectares	12.22
One unit <i>increase</i> in number of information sources	214.11
Ten percent <i>decrease</i> in probability of believing that assistance is adequate	194.05
One unit <i>increase</i> in number of marketing outlets	1396.70
Ten percent <i>decrease</i> in probability of satisfaction with inspection quality	172.94
One unit <i>increase</i> in animal diversity	443.20
One unit <i>decrease</i> in number of organic farmers in län	112.70
Ten percent <i>increase</i> in likelihood of non-economic reason for conversion	63.64

<sup>a</sup> 1 Swedish Krona (SEK) was equal to 0.1599 U.S. Dollar (USD) on 3 January 1990.

one from the mean of one. If the probability of agreeing that technical assistance is adequate declines by 10%, the subsidy could be reduced by SEK 194. A 10% lower probability of satisfaction with inspection quality is worth SEK 173.

Marketing outlets have the greatest marginal rate of substitution with payment level of all the policy variables. An additional marketing outlet was worth about 80% of the average subsidy in Sweden. One more information source was worth 18% of the average subsidy, a figure that would be magnified in the United States, where government support for research and extension in organic agriculture is much more limited. Although the survey listed eight possible marketing outlets and eight information sources, it is apparent that accessibility must be insured for farmers to take advantage of the additional units of either.

Quality of services provided affects the trade-off. A lower subsidy was associated with lower probability of satisfaction with technical assistance (11% of the average subsidy) and inspection quality (10% of the average subsidy). Farmers expect to receive lower payments if they have less confidence in the success of conversion and the credibility of the certification process. Unlike numbers of market outlets and information sources, which a farmer can alter through individual action, the quality of inspection and technical services are taken as given. While lower quality services make conversion harder, higher payment levels will not compensate for inadequate services. Instead, farmers view higher quality services as costing more, and expect payment levels to be sufficient to cover that cost. The policy maker should not oversupply quality of services if reducing subsidy levels is a goal.

## 6. Implications for the United States

The organic conversion subsidy instituted in Sweden in 1989 had a substantial impact on the conversion decision for 27% of the farmers in the sample. The subsidy helped offset transition costs to organic methods for these farmers, but this was not the only effect. As Padel and Lampkin (1994) explained, social acceptance and public support for organic farming are increasing, but rural communities still may resist change associated with widespread conversion to organic systems. The existence of a subsidy demonstrates that government and society recognize positive externalities associated with organic agriculture and are willing to pay to obtain these benefits. National policies that favor organic agriculture send a strong message about social preferences to non-organic farmers as well, encouraging conventional agriculture to seek more environmentally and socially sound practices. Providing a subsidy to already-converted farmers may seem redundant. This policy rewards the information-gathering and risk-taking of the early innovators and promotes equity in distribution of rewards for practicing sustainable agriculture.

In a climate of reduced direct support for agricultural production and greater reliance on market incentives, would an organic subsidy be acceptable? Fundamentally, organic agriculture is not believed to be an environmentally and socially superior production system in the United States by a majority of the populace. Even as observable indicators (demand) demonstrate increasing support for organic food systems, research that documents the social benefits of eliminating synthetic chemicals in food production is neutralized by assertions of dramatically reduced

yields in organic systems. Such assertions often are based on comparisons made during the transition period when organic yields are depressed. Definitive research on yields and public benefits of organic agriculture is needed for evidence to justify subsidization.

A payment offered in the form of cost-sharing is more palatable for market-oriented agricultural policy. Cost-sharing arrangements for environmental improvements in management and infrastructure are common. This approach can help offset the transition costs, although it has less visibility from the standpoint of demonstrating public support. Iowa's application of EQIP to organic production practices is an example of cost-sharing that supports both certification and conversion. The inclusion under the EQIP is explicit recognition of the water quality benefits of organic production systems. The extension of payments to 5 years is acknowledgment that the physical and financial transition period may be greater than the legal transition period, which is 3 years under most standards. The declining payment schedule is consistent with decreasing costs as new management systems are incorporated into the farm activities. As the federal government transfers more authority in selecting practices for cost-sharing to states, it is possible that more such programs will be implemented. However, given the uneven support for organic agriculture in the United States, such cost-sharing is likely to be limited to regions where farmers already have invested in organic agriculture and the benefits are recognized.

If a direct payment or a cost-share is possible, what effect might be expected, based on the results from Sweden? The 1781 farmers receiving organic subsidy represented about 4% of the 45,000 full-time and part-time farmers in Sweden at that time. Of these, 27% required a subsidy to convert. Payment level, farm size, exposure to other organic farmers and satisfaction with technical assistance and inspection services were positively related to the subsidy requirement, while livestock diversity, sources of information, number of marketing outlets and non-economic reasons for conversion were negatively related. The lack of significance on the reason for conversion suggests that while larger, less-diversified farmers required a subsidy, they viewed organic agriculture favorably and were likely to be inclined to make the conversion. Market structure and institutional support were not

barriers. Market outlets and information sources were available, and inspection quality and technical assistance were satisfactory for a majority of respondents. The subsidy made it economically feasible for about 1% of Sweden's farmers to convert who otherwise would not have.

There is substantially less exposure to and support for organic systems among farmers in the United States. The infrastructure for transport, handling, packaging and marketing is geared toward conventional production systems. There are virtually no publicly funded organic farm advisors and few government-funded researchers studying organic production and marketing systems (Lipson, 1997). Most organic information is disseminated by farmers and private organizations. These factors combine to generate formidable barriers to organic conversion.

A subsidy or cost-share would have little effect on these factors, and so it is likely that a payment would affect the same cohort of farmers in the United States as in Sweden. That is, farmers having some familiarity with and support for organic systems who have access to credible information about conversion and existing market outlets. This tends to favor regions where larger numbers of organic farmers and strong networks already are, and where demand for organics is greatest, as in the West, the Great Lake States and the Northeast (OFRF, 1996; The Packer, 1996).

Financial assistance is likely to speed the conversion process in these areas, but would not necessarily induce mass conversion. Even if organic acreage growth continues at the pace indicated by data from OFRF (1994, 1996) and Greene and Calvin (1997), that is, about 41–47% every 2–3 years, organic acreage will not achieve 10% of total acreage in the United States for 10–15 years.<sup>2</sup> If European results were achieved, and a 300% increase in conversion occurred after subsidization or cost-sharing, this would mean the 10% share for organics would be achieved in 4–6 years. This assumes that organic input sectors are available to provide expertise, equipment and materials needed for conversion on such a scale, and that price premiums do not decline. There is no information about what percentage of U.S. farmers are

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<sup>2</sup>This calculation assumes that organic acreage makes up as much as 2% of total acreage currently, as suggested by some sources, and that growth is 47% per 2–3 years.

inclined to convert to organic methods, so the upper limit on conversion with a subsidy or cost share is unknown.

Incentive compatibility of a conversion scheme with other agricultural and environmental policies that influence farmers' decisions would be required for maximum response to a payment or cost share. Environmental damage from extensification due to reductions in current farm assistance programs could be prevented by substituting management inputs for chemical inputs when adopting organic systems. More research on yields, efficiency and environmental effects of organic agricultural systems is needed to justify support for a conversion subsidy in the United States. Aid in the form of market development, technical assistance and inspection quality assurance may be more politically acceptable.

Accessibility to more markets and technical information sources substituted for conversion payments in the Swedish farmer's utility function, indicating that inducements need not be financial. The same concerns for technical information and market outlets were expressed by farmers responding to the OFRF surveys (OFRF, 1994, 1996). To the extent that these farmers represent all organic farmers in the United States, federal support that reduces entry costs via marketing and technical programs can offset the need for conversion subsidies to individual farmers. A step in this direction was taken in 1999, when the USDA Foreign Agricultural Service (FAS) for the first time awarded the Organic Trade Association a cost share under the Market Access Program (MAP) to explore foreign markets for organic food products (Amontree and Goldich, 1999). Providing assistance in this form has a more permanent impact on conversion since market infrastructure is established that benefits all organic farmers, not just later adopters who would qualify for conversion subsidies or cost-sharing.

While farmers knowledgeable about and favorable to organic production are more likely to convert their operations, all farmers benefit from increased research and extension in organic agriculture through greater exposure to chemical-reducing practices and agroecosystem functioning. The United States has recognized that the organic sector "...is becoming very much a part of the agricultural mainstream and it holds out the potential for enormous profit, as it grows to an

estimated \$6.6 billion market in the next year" (Glickman, 1999).

The results from Sweden show that factors other than direct payment affect the decision to convert to organic production. Market enhancement such as the FAS MAP and increased federal assistance for organic extension education could substitute for direct spending and encourage conversion where state support is lacking or funds for cost-sharing are unavailable.

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