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Presented at Western Agricultural Economics Association 1997 Annual Meeting
July 13-16, 1997
Reno/Sparks, Nevada

July 1997

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Abstract: Livestock feed subsidies have not been the subject of previous economic research. Across federal fiscal years (FFY) 1992-1996, the USDA paid out an annual average of $73.2 million in feed subsidies. This research examined the market and welfare effects of livestock feed subsidies using welfare analysis in southeastern New Mexico.

Introduction

The potential for input subsidies to increase production (and also encourage excess input use and damage the environment) is well known (Knutson et al.1995). Unlike many other federal agricultural subsidies, livestock feed programs have not been the subject of previous economic research. In federal fiscal years (FFY) 1992-1996, the USDA paid an annual average of $73.2 million in feed subsidies. The objective of this research was to examine the market and welfare effects of feed subsidies. This research addresses a politically sensitive research topic at a time when very little other analysis or information is available.

Background

The Emergency Feed Program (EFP) was authorized by the Agriculture Act of 1949 as amended by the Disaster Assistance Act of 1988 (P.L. 100-387) and the Disaster Assistance Act of 1989 (P.L. 101-82) (U.S. Dept. of Agriculture Aug. 1994). The objectives of the EFP were to provide emergency feed assistance in areas affected by disease, insect infestation, flood, drought, fire, hurricane, earthquake, hail storm, hot weather, cold weather, freeze, snow, ice, and winterkill, or other natural disasters (U.S. General Services Administration Dec. 1996). The EFP was designed to prevent reductions in breeding animal numbers during short-term feed emergencies, and thus prevent fluctuations in livestock prices. “Livestock” were defined as cattle, sheep, goats, swine, poultry, equine animals used in the production of food, and fish used for food (Code of Federal Regulations Jan. 1996).

The distribution of EFP monies between species and industries is unknown. However, an FSA representative estimated that 75-80% of the funds went to beef cattle, 15-20% to dairy cattle, and less than 5% to swine and other species (Newcomer 1996). The county-level distribution of net federal EFP expenditures is illustrated in figure 1[1] for FFY 1992-1996[2].

Under EFP, requests to implement the programs were initiated by county Agricultural Stabilization and Conservation Service (now Farm Service Agency (FSA)) committees or by the state governor. Producers in approved counties or in contiguous counties who suffered at least a 40% loss of feed production could apply for assistance. A 50% cost share payment for purchased feed was based on calculations of the amount of feed needed to maintain livestock weights during the disaster or emergency period.

The feed subsidies were historically paid on an advance basis. A livestock owner's losses were based on disaster or emergency conditions or predictions early in the feeding season[3]. The magnitude of the feed subsidy was based on feed losses, feed availability, number of animals, and other criteria. As time passed, eligibility would fluctuate according to changes in weather conditions or animal numbers. The county FSA would

[1]Figure 1 was developed using PC ARC/INFO 3.5 and ARCVIEW 2.1 software by ESRI - Environmental Systems Research Institute, Inc. U.S. Geological Survey digital line graphs of county boundaries were converted to ARC/INFO format, projected to Albers Conformal Conic and merged with county level program data. State and county boundaries appear at 1:1,000,000 with the exception of Alaska and Hawaii (which are not to scale).

[2]Aggregated county level data for years previous to 1992 are not available from USDA.

[3]The livestock feed program crop year is defined as the period beginning on the date the grazing of new pasture growth begins in the spring and ends twelve months later. This crop year varies between states, counties, and within counties.

reexamine each EFP recipient's eligibility at the end of the feeding season. If underpaid, the recipient was awarded the difference. In the case of overpayment, the recipient reimbursed the USDA. EFP has been a difficult program to administer due to continuously changing eligibility levels of recipients. Combined farming/ranching operations have been ineligible for EFP because of their grain or forage crop production.

For FFY's 1992-1996, the total EFP payments were $366,296,502 (USDA, Office of the Chief Financial Officer 1996) (table 1). Distribution of funds among species varies. For example, Texas (Hedges 1997), Missouri (Engelbrecht 1997), and New Mexico (NM) (Sanchez 1997) FSA officials estimated funds in those states were primarily allocated to beef producers, although the Missouri representative estimated 40% of the funds were used to subsidize dairy feeding. The majority of EFP subsidies in Wisconsin went to dairy cattle (Schwartz 1997). FSA does not keep records of EFP payments per animal or per AUM.

The Federal Agricultural Improvement and Reform Act of 1996 (Section 171(b)(L)), signed on 4 April 1996, suspended the USDA's authority to carry out EFP through 2002. A new emergency livestock assistance program introduced in both the House and Senate by New Mexico legislators in May 1996 received strong bi-partisan support. These congressional efforts were superseded by an Executive Order, signed by President Clinton in June 1996, to authorize funds generated through the sale of strategic grain reserves to fund the Disaster Reserve Assistance Program (DRAP). Since June 1996

DRAP has provided feed cost-share assistance under criteria similar to previous feed subsidy programs. In early 1997 the USDA made additional emergency feed assistance available to livestock producers as a result of weather conditions in several regions of the country.

Recently, several articles and editorials dealing with livestock feed subsidies were published (Hess and Holechek 1994; Hess 1995; Holechek and Hess 1995; Hess and Holechek 1995; DiSilvestro 1995; and Bixby 1996). In various forums, Hess and Holechek asserted that feed subsidies to beef producers have led to range overstocking and deterioration, increased cattle supply and reduced cattle prices. These hypotheses were not tested but were widely publicized by environmental interests (e.g., DiSilvestro 1995; Hess and Holechek 1995; Bixby 1996). The publicity extended to national news coverage by ABC.

New Mexico ranks 22nd nationally in terms of beef mother cow numbers (USDA - National Agricultural Statistics Service 1995-96), but for the FFY's 1992-1996 ranked 2nd in terms of total EFP monies awarded to the states (see table 1). For FFY's 1992-1996, 82% of NM's 33 counties received feed subsidies in three or more of the five years. From 1989-1995, NM received $40.6 million in feed subsidies (table 2). (NM Agricultural Statistics Service, various years; USDA-Office of the Chief Financial Officer 1996). For livestock feeding program crop years 1990-1995, an average of 95% of all NM applications for feed subsidies was approved, while the average payment per application was $4,353 (USDA-Office of the Chief Financial Officer 1996).[4]

Methods

The lack of EFP data makes quantitative analysis of the subsidies difficult; however, market effects, net social welfare costs, and the distribution of welfare costs and benefits can be estimated with limited data. New Mexico was chosen for analysis to illustrate and discuss the potential market and welfare effects of EFP because of the level of program usage within the state. Sensitivity analysis was also performed to evaluate the range of subsidy effects.

The methodology used draws from Foster et al. (1986); Lichtenberg et al. (1988); and Ebel et al. (1992). Since feed cost subsidies reduce the marginal cost of production for subsidy recipients, elimination of that subsidy would increase the marginal cost of production for former recipients. Theory suggests producers adjust output to equate marginal cost and price. Establishment or elimination of an input subsidy would thus lead to output adjustments. Clearing of the output market implies that supply and demand are equal. These conditions can be described using the system of equations below:

$$(1) \qquad MC_U(Q_U, a_U) = P, \qquad D_D(Q_D) = P,$$
$$MC_{NU}(Q_{NU}) = P, \qquad Q_U + Q_{NU} = Q_D,$$

where MC_U is the marginal cost function of subsidized producers, MC_{NU} is the marginal cost function for unsubsidized producers, Q_U is the output of subsidized producers, Q_{NU} is the output of unsubsidized producers, a_U is a shift variable representing the impact of a

[4]The livestock feed program crop year starts on the date the grazing of new pasture growth begins in the spring

change in subsidy policy on the marginal cost function of subsidized producers, D_D is inverse domestic demand, and Q_D is domestic consumption (Lichtenberg et al. 1988). The market impacts of a change in input subsidy policy can be obtained by totally differentiating the system of equations above, where the marginal cost function is the inverse supply function. Total differentiation of (1) gives (see Lichtenberg et al. 1988):

$$(2)\qquad (1 / \varepsilon_U)(P / Q_U)\, dQ_U - dP = -MC_U^a\, da_U; \qquad (1 / \varepsilon_{NU})(P / Q_{NU})\, dQ_{NU} - dP = 0;$$
$$(1 / \eta)(P / Q_D)\, dQ_D - dP = 0; \qquad dQ_U + dQ_{NU} - dQ_D = 0.$$

Estimates of the impact of changes in subsidy policy on marginal costs ($MC_U^a\, da_U$) were first made and the system of equations was then solved for subsidy policy change impacts on price (dP), output of subsidized producers (dQ_U), output of non-subsidized producers (dQ_{NU}), and domestic demand (dQ_D).

Market and welfare effects can be estimated assuming supply and demand are approximately linear around the subsidized (or pre-elimination) equilibrium (Lichtenberg et al. 1988; Foster et al. 1986). Changes in non-subsidized producer surplus (PS) resulting from policy changes were estimated as $dP(2Q_{NU} + dQ_{NU}) / 2$ and consumer surplus (CS) changes were calculated as $-dP(2Q_D - dQ_D) / 2$. Changes in subsidized PS were estimated as the sum of change in revenue, $(P + dP)(Q_U + dQ_U) - PQ_U$; change in feed costs, $dC_U (Q_U + dQ_U)$; and the change in total cost due to changes in output, PdQ_U. Regional welfare effects were calculated as the sum of subsidized PS, non-subsidized PS, and CS changes.

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and ends twelve months later. This crop year varies between states, counties, and within counties.

Empirical Application

Southeastern NM accounted for about 25% of the state's beef calf production in 1993 (Torell and Hawkes 1995). The region has received high levels of EFP payments in recent years, although not all of the state's highly subsidized counties are located in the southeast (figure 1). The year 1993 was selected as it is the last for which published livestock cost and return estimates for NM are available.

A typical ranch in the southeastern region had 350 cows (Torell and Hawkes 1995). Based on table 2, an average ranch would have received $4,755, or $13.59/cow in EFP subsidy in 1993. This payment was 22.7% of per cow feed costs (including purchased hay, grain, liquid feed, protein block, salt, and minerals). The typical ranch sold 249 calves in 1993, for an average weighted (across heifers and steers) gross return of $496.79/calf. Calves are the primary output for the typical ranch (not cows), thus the EFP payment was converted to a per calf sold basis of $19.10 (.04/lb liveweight). The per calf EFP subsidy is the change in marginal cost per unit of output for subsidized operators. Without the EFP payment, the marginal cost of production would have been $19.10/calf higher.

Marsh's (1994) feeder calf price elasticity of demand estimate of -0.887 and Brester and Marsh's (1983) estimate of the elasticity of placements of cattle on feed relative to the price of feeder steers of 0.411 were selected for use here.

It was assumed that 50% of the calves in southeastern NM in 1993 were produced in herds receiving an EFP payment. Since no information is available as to the actual number of calves produced by operators who received EFP payments, sensitivity analysis was used to evaluate changing levels of participation.

The system of equations presented in (2) above was solved using spreadsheet matrix operations to derive a unique solution, given the assumptions outlined in the preceding section. Altering one of the assumptions (e.g., the percentage of calves produced in herds receiving a feed program payment), and resolving the equation system (2) for the four unknown variables led to the derivation of the results presented in table 3. The solution values for the variables dP, dQ_U, dQ_{NU}, and dQ_D were used to derive the estimates of regional welfare effects discussed below and shown in table 3.

Results

If the $19.10/calf subsidy had not been available to 50% of southeastern NM beef calves produced in 1993, producers not receiving the EFP payment would have produced 167 more calves, while subsidized producers would have produced 889 fewer calves (table 3), with overall calf production reduced by 0.5%. Gross return per calf would have been $3.02 higher (negligible for an average calf sold at 521 pounds).

In the absence of EFP, non-subsidized PS would have been $202,439 higher, while subsidized PS would have been $1,060,591 lower. Producer surplus included $242,280 less revenue, $1,260,089 in higher feed costs, and $441,777 in reduced production costs. Without the EFP payment to 50% of the region's calves, CS would have been $405,464 lower. Eliminating EFP to 50% of the region's calves in 1993 would have reduced net welfare by $1,265,616. Assuming a per calf subsidy of $19.10, the total feed subsidies to the region were $1,277,313 (excluding all administrative costs). Elimination of EFP payments in 1993 would have resulted in a small net social welfare gain when the narrow range of welfare effects outlined above is considered.

While price and output effects of EFP were small, the welfare impacts of eliminating EFP in southeastern NM in 1993 would have been unevenly distributed. Non-users' gains would have been 19% of users' losses. Each 10% increase (drop) in the calf crop subsidized reduced (increased) price by $0.60/calf.

Conclusions

Feed subsidies in southeastern NM, including the taxpayer burden for the payments, have been largely a federal tax dollar redistribution process in which non-subsidized producers lose, subsidized producers gain, the supply of beef calves is increased, calf prices are reduced, and federal tax costs are almost equal to within-region welfare gains. Alternatively, in the absence of the subsidy, the reduced federal tax burden is almost equal to within-region welfare losses. This research demonstrates that the EFP has resulted in the predicted market effects of an input subsidy (i.e., more output and lower prices). However, the magnitude of these effects in southeastern NM is small. The question of EFP impacts for the national beef industry remains open. The magnitudes of the effects would depend on the percentage of national calf output produced under feed subsidies, the consistency of feed program payments throughout the years to individual producers, and the subsidy per cow.

This static analysis did not take into account the potential lag effects of an input subsidy, has assumed that EFP is a dependable factor in cow-calf production decisions, and is also founded on the assumption that cattle producers are profit maximizers who adjust output according to the MC=MR criterion. Further, more dynamic, research is needed to examine these factors or assumptions.

The broader welfare effects of EFP not addressed in this analysis also include the benefits and/or costs of preventing herd liquidation. There might be social value in stable cattle numbers (and thus prices), assuming that EFP contributes to the stability; however, EFP could have negative impacts if reductions in cattle numbers would have been in the best interests of the grazing resources. The incidence of the broader welfare effects is also of interest. For instance, to whom do the benefits of cattle market stability accrue when the region in question is not a large contributor to the national meat supply? Also, if public grazing resources are impacted through private financial incentives to maintain cattle numbers, the assessment of social costs and benefits becomes even more complex.

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