

Survey Techniques and Responses

A major stumbling block facing economists who analyze meat and poultry food safety is a lack of data on the types of food safety technologies processing/slaughter plants are using, the types of markets served by the plants, and the costs plants incur to ensure food safety. Given these limitations, USDA's Economic Research Service (ERS) funded a survey of meat and poultry processing plants on their use of various food safety processing practices and technologies and their costs of implementing and complying with the PR/HACCP rule.

Researchers at ERS will use the data to examine the incremental costs of the PR/HACCP rule on meat and poultry plants, the characteristics of plants using particular types of food safety technologies, the impact of various types of food safety technologies and practices on plant costs, the effect of food safety technologies and practices on pathogen reduction, and the food safety technology profile of plants exiting the industry. Economists will be able to cite these results and the statistical information contained in this report to support economic thought dealing with issues surrounding the use of food safety practices.⁴

Techniques

ERS contracted with the Social and Economic Sciences Research Center (SESRC), Washington State University at Pullman, to conduct a survey of meat and poultry plants on their costs of complying with the PR/HACCP rule and their use of food safety equipment, practices, and technologies. After ERS created a questionnaire and received approval to proceed from the Federal Office of Management and Budget (OMB), SESRC fielded a two-part survey consisting of pilot and main studies in late summer 2001. The study was deemed complete in May 2002.

SESRC used some innovative techniques that likely improved response rates.⁵ The first step was to verify addresses and, to the extent possible, provide a person's name to whom the survey information could be sent. The survey itself consisted of five contacts made over a 2-month period: a prenotification letter, a survey questionnaire, a followup postcard, a second questionnaire, and a final notice. SESRC sent letters from a high-ranking USDA food safety official and five industry trade associations with the prenotification letter and the first questionnaire to encourage support. The most important innovation, however, was including a \$5 incentive with the questionnaire in a package sent to each recipient in the full survey by 2-day priority mail.

OMB stipulated that incentives could only be used if a pilot study demonstrated their effectiveness. As a result, SESRC conducted a pilot study in which it packaged the questionnaire mailings differently for three separate groups in each of the two main industries (meat and poultry). The three mail packages were:

⁴The data cannot be made available directly to economic researchers because of concerns about confidentiality. However, it may be possible to conduct cooperative studies with ERS researchers who would use the data at ERS.

⁵SESRC is under the direction of Dr. Don Dillman, a renowned innovator in survey methodologies. This project was led by Dr. Danna Moore.

- (1) questionnaire sent by first-class postage mailing, no money incentive,
- (2) questionnaire sent by 2-day priority mail with no money incentive enclosed, and
- (3) questionnaire sent by 2-day priority mail with a \$5 incentive enclosed.

The response rate for the third option—priority mail plus incentive—was about 20 percent greater than the priority/no incentive option and about 50 percent greater than the first class/no incentive option. The pilot study also showed that the two types of mailings without incentives would not achieve the same response rate as the priority mail plus incentive option even if the savings from their lower postage and incentive costs were used in followup mailings.

The use of letters of support from five meat and poultry industry associations was another innovative feature of the survey. One letter, shown in appendix A, asks operators to provide information that would aid in understanding the true costs and effectiveness of the (FSIS) inspection system in their plants. It adds that the information could help influence or affect the way future changes are made in inspection requirements.

Responses

ERS drew the sample of plants surveyed by SESRC from the 2000 version of FSIS' Enhanced Facilities Database (EFD). The EFD contains a wide variety of detailed data on plant activities for all plants monitored by FSIS. It also contains some information on plants inspected by State inspection agencies. In total, the EFD contains at least some information on the more than 9,000 meat and poultry plants inspected by FSIS and State agencies. The vast majority of these plants produce meat or poultry products as side businesses. Data include the number and types of animals slaughtered, Standard Industrial Classifications, plant sales, whether a plant produced meat or poultry, and categorical data on process types. We also merged pounds of meat production from the 1997 EFD dataset to these data because the 2000 EFD does not have pounds of meat and poultry output.

The population of plants that we drew from the EFD included only the 1,725 plants that produce meat or poultry products as a primary business. These plants consisted mainly of FSIS-inspected plants and included all for-profit meat and poultry slaughter facilities identified for 2000 in the EFD and the largest cooked-meat and raw-meat further processors that were defined in the EFD as meat packers (SIC 2011), meat processors (SIC 2013), or poultry slaughter or processors (SIC 2015). Canned meat and poultry producers were excluded.

Table 1 describes the sample of plants and the respondents by type of production operation—either slaughter or processing. It shows that 996 (58 percent) of all plants responded to the survey. Hog slaughter plants had the highest response rate at 67 percent while chicken slaughter plants had the lowest response rate at 50 percent. Not all plants answered all questions but

plants did complete most questions.⁶ Completed questionnaires were returned by plants that slaughtered 42 percent of all cattle, 75 percent of all hogs, 42 percent of all chickens, and 48 percent of all turkeys, and accounted for 55 percent of all processed meat and poultry products from processors with no slaughter operations. The overall survey response rate of 58 percent of all plants was substantially higher than that achieved in recent surveys of much smaller samples of plants by Hooker et al. (1999), who had a less than a 50-percent response rate (41 out of 98 questionnaires) and Boland et al. (2001), who report a 36-percent response rate (18 of 50 questionnaires).

We attribute the relatively high response rate to three factors:

- (1) The survey was sponsored by a government agency whose reports are widely read by policymakers and research institutes.
- (2) The five major meat and poultry industry associations and the acting undersecretary for food safety wrote letters of support of the survey and were sent to respondents with the questionnaire.
- (3) The use of a \$5 incentive and 2-day priority mail encouraged survey participation.

Survey Respondents

Survey participants varied substantially both in plant size and types of inputs and outputs. In tables 2-6, we show how plant output in terms of volume and product composition varies by plant size. For each slaughter industry, we include all plants that slaughter a particular animal species, e.g., cattle, regardless of whether that plant also slaughters other animals, e.g., hogs. Thus, the cattle slaughter plant category contains all plants that slaughter cattle, including those that also slaughter hogs. Since the hog slaughter plant category is structured in the same way, plants slaughtering both hogs and cattle are included in each classification.

The size percentile ranking in each of the first five tables is based on total pounds of output as indicated in the survey (see Q41 for output and Q47 and Q49 for output mix for red meat and see Q42 for output and Q48 and Q50 for output mix for poultry). We use a percentile ranking to reflect plant size rather than the very small, small, and large plant size categories used by FSIS because a percentile ranking gives a direct measure of output over five plant sizes for a particular type of output.

Table 1—Survey sample description

| Plant type | Population | Respondents | Percent |
|------------------------------|------------|-------------|---------|
| Cattle slaughter | 108 | 55 | 51 |
| Hog slaughter | 114 | 76 | 67 |
| Cattle and hog slaughter | 185 | 121 | 65 |
| Chicken slaughter | 181 | 91 | 50 |
| Turkey slaughter | 33 | 19 | 58 |
| Chicken and turkey slaughter | 21 | 12 | 57 |
| Processing only | 1,063 | 622 | 62 |
| Total | 1,705 | 996 | 58 |

Source: ERS.

⁶The survey was not designed to be a nationally representative sample of all plant types. In addition to excluding all nonmanufacturing plants, the sample includes only those plants that responded to the survey, making the sample inherently biased. There does appear to be a fair degree of balance in the responses in that the share of total output of plant respondents closely tracks the number of plants that participated.

Table 2—Animal inputs per plant by plant size for cattle and hog slaughter plants¹

| Input type | Cattle slaughter Size percentile | | Hog slaughter Size percentile | |
|---------------------------------------------------------|-------------------------------------|---------|----------------------------------|-----------|
| | 0-19 | 80-99 | 0-19 | 80-99 |
| <i>-----Number of animals slaughtered per year-----</i> | | | | |
| Animal inputs: | | | | |
| Cattle | 161 | 191,781 | 142 | 19,952 |
| Hogs | 387 | 0 | 542 | 1,848,234 |
| Other animal inputs | 36 | 0 | 203 | 25,319 |
| Number of plants | 28 | 30 | 37 | 47 |

¹Animal inputs based only on plants reporting one or more animal input.

Source: ERS.

Table 3—Product output share by plant size for cattle and hog slaughter plants¹

| Product type | Cattle slaughter Size percentile | | Hog slaughter Size percentile | |
|------------------------------------------------------|-------------------------------------|---------|----------------------------------|---------|
| | 0-19 | 80-99 | 0-19 | 80-99 |
| <i>Percentage of output</i> | | | | |
| Raw meat products: | | | | |
| Carcasses | 22.0 | 26.3 | 14.6 | 29.5 |
| Ground beef or pork | 19.2 | 11.2 | 20.7 | 10.6 |
| Trim or other boneless beef or pork | 14.8 | 27.9 | 11.1 | 14.2 |
| Subprimal and fabricated cuts. | 10.2 | 15.2 | 11.6 | 17.7 |
| Other raw meat products | 8.0 | 9.3 | 6.4 | 5.7 |
| Total raw meat products | 74.2 | 89.9 | 64.4 | 77.7 |
| Cooked or otherwise further processed products | 25.8 | 10.1 | 35.6 | 22.3 |
| Mean pounds of output (1,000s of pounds per year) | 186 | 260,127 | 340 | 259,308 |
| Number of plants | 28 | 27 | 42 | 47 |

¹Average output shares are based on all reporting plants. About 40 percent of all plants did not respond to question about cooked products. Similarly, 20 percent of all plants failed to respond to questions about raw product outputs.

Source: ERS.

Table 4—Animal inputs per plant and mean output by plant size for poultry slaughter plants¹

| Input type | Mean output by plant size Size percentile | |
|-------------------------------------------------------|----------------------------------------------|---------|
| | 0-19 | 80-99 |
| <i>Birds per year (thousands)</i> | | |
| Animal inputs: | | |
| Chickens | 1,081 | 597,457 |
| Turkeys | 22 | 53,135 |
| Other poultry | 855 | 10,169 |
| Mean pounds of output (1,000s of pounds per year). | 8,459 | 236,146 |
| Number of plants | 20 | 25 |

¹Animal inputs based only on plants reporting one or more animal input.

Source: ERS.

Table 5—Product output share by plant size for poultry slaughter plants¹

| Product type | Size percentile | |
|-------------------------------------------------------------------|-----------------|---------|
| | 0-19 | 80-99 |
| <i>Percentage of output</i> | | |
| Raw poultry products: | | |
| Cut-up poultry and parts | 45.9 | 43.7 |
| Raw chicken processed beyond cut-up, such as marinated or deboned | 17.4 | 27.4 |
| Other raw poultry products | 33.1 | 13.6 |
| Total raw products | 96.4 | 84.7 |
| Cooked or otherwise further processed products | 3.6 | 15.3 |
| Mean pounds of output (1,000s of pounds per year) | 8,459 | 236,146 |
| Number of plants | 19 | 25 |

¹Average output shares are based on all plants. About 40 percent of all plants did not respond to question about cooked products. Similarly, 20 percent of all plants failed to respond to questions about raw product outputs.

Source: ERS.

Table 6—Mean plant output and product output share by plant size for processors with no slaughter operations¹

| Product type | Cooked meat processors—no slaughter | | Raw meat processors—no slaughter | |
|---------------------------------------------------------------|-------------------------------------|--------|----------------------------------|---------|
| | Size percentile | | Size percentile | |
| | 0-19 | 80-99 | 0-19 | 80-99 |
| <i>Percentage of output</i> | | | | |
| Raw meat products: | | | | |
| Carcasses ² | 0.6 | 1.8 | 1.6 | 5.2 |
| Ground beef or pork | 11.0 | 5.8 | 20.1 | 22.9 |
| Trim or other boneless beef or pork | 9.0 | 2.9 | 13.9 | 9.7 |
| Subprimal and fabricated cuts | 2.6 | 3.2 | 8.6 | 8.7 |
| Other raw meat products | 9.7 | 7.5 | 16.2 | 19.3 |
| Total raw meat products | 32.9 | 21.2 | 60.4 | 65.8 |
| Cooked or otherwise further processed products: | | | | |
| Bologna, frankfurters and other luncheon meats | 15.2 | 19.7 | 9.6 | 6.0 |
| Pepperoni and other fermented, aged, dry or semi-dry products | 8.6 | 8.5 | 3.8 | 1.6 |
| Cooked beef or pork such as roast beef or oven-cooked hams | 6.9 | 15.7 | 6.0 | 8.9 |
| Smoked products, such as bacon | 8.6 | 15.3 | 5.4 | 6.5 |
| Other cooked or further processed products | 27.8 | 19.6 | 14.8 | 11.2 |
| Total cooked meat products | 67.1 | 78.8 | 39.6 | 34.2 |
| Mean pounds of output (1,000s of pounds per year) | 3,698 | 91,518 | 4,407 | 101,848 |
| Number of plants | 63 | 67 | 67 | 77 |

¹Average output shares are based on all plants. About 40 percent of all plants did not respond to questions about cooked products. Similarly, 20 percent of all plants failed to respond to questions about raw product outputs.

²Producers that also sell products or serve as intermediaries for other processors may have animal carcasses that they sell or ship intact even though their plant may not slaughter animals.

Source: ERS.

By contrast, plant categories specified by FSIS are based on the number of employees. If plants produce a substantial amount of nonmeat products, then most employees would have tasks devoted to nonmeat production. Thus, the FSIS designation reflects overall plant size but not the size of the meat or poultry operation.

Processing practices for the largest cattle slaughter plants differed dramatically from those of their smaller competitors. Plants in the top quintile slaughtered, on average, 60 times more cattle per year than the average of plants in the 2nd through 4th quintiles and butchered no other animals. By contrast, cattle slaughter plants that were smaller than the first quintile, on average, slaughtered more hogs than cattle, with the smallest plants slaughtering less than one head of cattle per day. Types of outputs also differed. Trimmings—boneless meat as a byproduct of fabricating other meat products or meat trimmed from bones for the direct purpose of producing boneless meat, such as ground meat—made up a large share of output from large cattle slaughter plants, while a sizeable share of meat products from small plants were further-processed products.

The tables also show that the smallest hog slaughter plants processed only 2 hogs per day while the largest ones butchered almost 7,700 per day and, in contrast to cattle slaughter plants, handled animals other than their primary species (hogs). In terms of outputs, fabricated cuts constituted the largest share of output from the biggest hog slaughter plants while the smallest plants did more further-processing.

Due to confidentiality requirements, we combined chicken and turkey slaughter under the more general poultry slaughter category. The largest poultry plants slaughtered almost 600 times more chickens and 2,000 times more turkeys per year than the smallest plants (table 4). Nearly half of poultry slaughter plants' output was in the form of cut-up poultry parts and about a fourth was processed beyond cut-up parts (table 5). Except for the largest plants, poultry slaughter establishments sold less than 10 percent of their products as further-processed products. The bigger share of cooked products for the largest plants is likely due to proportionately more turkey slaughter plants, which typically produce more poultry hams and luncheon meats than do chicken slaughter plants (Ollinger et al., 2000).⁷

ERS survey data from 350 cooked-meat processing plants with no slaughter operations show that about three-fourths of their output came from cooked, smoked, fermented, dried and other further-processed products and the remainder from raw processed products (table 6). About two-thirds of the products from raw-meat processors without slaughter operations were raw meat products. Ground beef and pork was the main product group, accounting a fifth of output. Carcasses claimed a very small share of output for both types of processors.

⁷“Cooked products” refer to all products subjected to heat treatment.