



Lessons learned from the national household food acquisition and purchase survey in the United States



John A. Kirlin^{*,2}, Mark Denbaly^{1,2}

USDA Economic Research Service, ISD-RSB, Room 05A62, 355 E Street SW, Washington, DC 20024-3221, United States

ARTICLE INFO

Keywords:

Food
Expenditures
Prices
Environment
Food assistance

ABSTRACT

The National Household Food Acquisition and Purchase Survey conducted in 2012 (FoodAPS-1) was an ambitious survey of Americans' food acquisitions sponsored by the U.S. Department of Agriculture (USDA). The survey was challenging due to its goals of collecting comprehensive acquisition information and including data from extant sources to broaden the survey's research capabilities. Some challenges were foreseen, and efforts were taken to overcome them through survey design features. Other challenges came as a surprise. This paper shares the experiences of the authors and others at USDA with survey design, survey implementation, and post-survey processing of data to ensure the availability of high-quality data to the research community. Lessons from FoodAPS-1 can inform similar future data collections both in the U.S. and abroad.

1. Introduction

The National Household Food Acquisition and Purchase Survey conducted in 2012 was an ambitious survey of Americans' food acquisitions sponsored by the U.S. Department of Agriculture (USDA).³ Prior to this survey, which we refer to as FoodAPS-1⁴, data containing detailed information about specific household food purchases, including quantities and prices for both food-at-home (FAH) and food-away-from-home (FAFH) events⁵, were limited or nonexistent in the U.S. The premier source of food expenditure data in the U.S., the Consumer Expenditure Survey, provides spending information for about 100 food categories but does not capture prices or quantities. A report by the Committee on National Statistics (CNSTAT) at the National Academies (National Research Council, 2005) identified the need to have such data, and noted that linking such data to other datasets, such as program administrative records and geographic locations of food stores and restaurants, would greatly enhance our ability to study

U.S. household food choices. The USDA sponsored FoodAPS-1 to address these data gaps and to expand research possibilities on the relationships between foods acquired and diet quality, health, food insecurity, and food assistance program participation.

FoodAPS-1 is unique in that it collected detailed information about all foods acquired, by all household members, over seven days. This included purchases from grocery stores and restaurants, as well as free or subsidized foods (from schools, work, own production, food pantries, community centers, and family and friends). The survey also collected individual- and household-level information about food assistance program participation and other characteristics relevant to the study of food choices and health outcomes. Not only was content unique, the survey contractor⁶ incorporated novel design and collection procedures. For instance, administrative data from the Supplemental Nutrition Assistance Program (SNAP) were used to create a sampling frame of SNAP households and to later confirm survey households' participation in the program. For the first time ever in a national government

* Corresponding author at: USDA Economic Research Service, 1400 Independence Avenue, SW, Mail Stop 1800, Washington, DC 20250-1800, United States.

E-mail addresses: jkirlin@ers.usda.gov (J.A. Kirlin), mdenbaly@ers.usda.gov (M. Denbaly).

¹ USDA Economic Research Service, 1400 Independence Avenue, SW, Mail Stop 1800, Washington, DC 20250-1800, United States.

² Both authors are employees of the U.S. Department of Agriculture (USDA), Economic Research Service, and USDA provided funding for the survey. Both authors have been working on this survey since its inception. The views expressed are those of the authors, however, and should not be attributed to the Economic Research Service or the U.S. Department of Agriculture.

³ The Economic Research Service (ERS) and the Food and Nutrition Service (FNS), both agencies within the U.S. Department of Agriculture, funded the survey.

⁴ Previously referred to as 2012 FoodAPS or simply FoodAPS, ERS now uses "FoodAPS-1" to refer to the survey conducted primarily in 2012. ERS is currently planning a second FoodAPS survey (FoodAPS-2).

⁵ "Food-at-home" generally refers to food purchased at grocery stores and later used at home to prepare meals and snacks. In contrast, "food-away-from-home" covers meals at restaurants, snacks from vending machines, meals at work or school, and other free or purchased acquisitions generally of already-prepared food. The distinction between the two categories of food is discussed in Section 4.1.

⁶ FoodAPS-1 was designed and implemented by Mathematica Policy Research, under a contract with ERS.

survey, households used handheld scanners to record information about their purchases. In addition, a variety of outside data sources were merged to the survey, such as information about local food environments and State-level SNAP administrative policies. Nearly 5,000 households participated in the study between April 2012 and January 2013, with an oversampling of low-income households participating and not participating in SNAP.

The objective of this paper is to share with the research community and survey designers what ERS has learned from FoodAPS-1. In particular, given the unique aspects of this survey and its importance to understanding household demand for food, many features of its instrumentation, sample design, interviewer and respondent training, data collection protocols, and use of extant data may serve as models for future data collections with similar goals to understand household food demand, both in the U.S. and abroad. But we can and should learn from our mistakes as well as our successes. Many challenges were faced while designing and implementing FoodAPS-1. In most instances these challenges were overcome, and the value and quality of the FoodAPS-1 data are being revealed by the research currently being done with them. In other instances, however, the challenges were overwhelming, and we did not achieve all our goals. The USDA is planning a FoodAPS-2 data collection, and we are examining all facets of the FoodAPS-1 experience looking for areas where we might improve the next data collection. That improvement could be in any combination of lower overall cost, improved response rates, better ways of identifying when household members did not report all food acquisitions, lower item non-response, lower respondent burden, and more efficient and timely processing of the data into analysis files.

We first discuss why FoodAPS-1 was needed. Then, we describe the survey in detail, focusing on the sampling design, the in-person interviews, the reporting of food acquisitions, and other instruments. This detail is needed for two reasons. First, some of the lessons we have learned pertain to specific details about the survey. Second, for readers to most effectively benefit from ERS' experience with FoodAPS-1, they need to know how FoodAPS-1 is similar to or different from their own planned surveys. The various extant data sources that were used and/or appended to the FoodAPS-1 data are then described. Along with the description of each component of the survey, we provide commentary about what we have learned so far about what worked well and what could be improved upon in future surveys of similar nature.

2. Why invest in a survey like FoodAPS?

Primary data on the food choices of American consumers are critical for understanding dietary patterns. In addition, detailed information about participants in the USDA food assistance programs and other vulnerable populations is essential to increasing the effectiveness and efficiency of Federal programs that address food insecurity, nutritional deficiencies, and public health issues such as obesity, diabetes, and the metabolic syndrome. Despite these research needs, the United States has been among a handful of developed countries that does not systematically and regularly gather data on expenditures, prices, and quantities of food bought by its populace.

Big questions about food assistance programs remain unanswered, especially for the \$74 billion dollar program called SNAP (previously the Food Stamp Program) (Oliveira, 2016). These questions include:

- How does program participation affect household food choices, expenditures, and consumption?
- Does the food environment around a participant's home affect access to the types of retailers from which food is acquired, the foods that are purchased and the prices that are paid?
- What is the relationship between program participation decisions and food security?

To address these and other research questions, an "ideal" dataset

would include information on food expenditures, where food is acquired, what food items are acquired and their unit price, and nutritional content. Household characteristics and eligibility for and participation in food assistance programs also are essential for understanding food demand. Information such as individuals' knowledge about nutrition and safe food preparation and handling practices, dietary restrictions and health conditions, and length of program participation would enhance research.

A number of existing data sources contain some, but not all, of these features for the United States, including the Consumer Expenditure Survey (CES), the Current Population Survey (CPS), and the National Health and Nutrition Examination Survey (NHANES). However, no single existing data source provides all of the information needed to answer the wide-ranging research questions associated with diet, health, and food assistance programs. FoodAPS-1 was designed to help fill the gaps in data needed to address many questions related to nutrition assistance and diet quality. In particular, and unlike many earlier surveys, FoodAPS-1 pays equal attention to FAH and FAFH food acquisitions, recognizing that FAFH is playing an ever-greater role in Americans' food choices. In addition, the FoodAPS-1 sample design oversampled households with SNAP participants and low-income households not participating in SNAP so that the role of Federal nutrition assistance programs on food demand and consequent nutrition, health, and food security outcomes could be better understood.

3. Sampling design

The survey employed a complex, multi-stage sample design with a goal of collecting data from 5000 households representative of the contiguous United States and of four target groups: households receiving SNAP benefits; non-SNAP households with income less than the poverty threshold; non-SNAP households with income between 100 and 184 percent of the poverty threshold; and non-SNAP households with income equal to or greater than 185 percent of the poverty threshold. The final sample size was 4826 households containing 14,317 individuals. FoodAPS-1 was unable to meet targeted sample sizes for low-income, non-SNAP households in part because screener respondents often under-reported household income compared to information provided in the final interview (see section 4.3).

FoodAPS-1 employed a unique strategy to more efficiently sample SNAP and non-SNAP residential addresses. SNAP agencies in the 27 States with one or more of the survey's 50 selected primary sampling units (PSUs) were asked to provide addresses for all SNAP units enrolled in the program in February 2012. These lists were merged with an Address-Based Sampling (ABS) list obtained from the United States Postal Service Delivery Sequence File for each of the eight secondary sampling units (SSUs) selected per PSU. Addresses that appeared on the SNAP list were identified as SNAP addresses and all other as non-SNAP addresses, resulting in two separate sample frames from which addresses could be selected at different rates.

Although the sampling frames were designed to sample SNAP and non-SNAP households more efficiently, it was recognized that the SNAP address lists would become less useful over time as SNAP households moved or left the program. The FoodAPS-1 team considered asking State agencies to provide updated lists throughout the field effort, but decided that such a request would be too burdensome to the agencies. As it was, four State agencies did not provide a list of SNAP addresses, and a fifth agency provided its list too late to be incorporated into the sampling process.

Finding and recruiting non-SNAP households with incomes below 185 percent of the poverty level, and especially those below the poverty line, was particularly challenging. Increasing the likelihood of selecting areas with higher percentages of lower-income households was one way to increase the sample size of these households. In addition, the screener was designed to determine a household's target group by directly asking about household size and total income (the determinants

of a household's income-to-poverty ratio, or POV) and SNAP participation. However, when the more detailed income data from the final interview were reviewed, the contractor discovered that about half of the non-SNAP households that reported income below the 100 and 185 percent of poverty thresholds later reported higher income levels. Midway through fielding, the contractor modified the screener to ask about sources of income to prompt respondents to report income from all sources. Analysis indicates that the rate of income mismatches between screener and final interview did not change with the modifications to the screener (Westat, 2016).

Response rates for FoodAPS-1 were not as high as hoped. The weighted screener response rate was 70.9 percent, and the initial agreement rate amongst those households eligible for the survey was 78.1 percent. Only 74.8 percent of those agreeing to participate, however, completed the data collection, with much of the falloff occurring when interviewers trained the primary respondent on data collection procedures. The overall survey response rate (the product of the first three rates) was 41.5 percent. One apparent way to increase the survey response rate would be to simplify data collection procedures to reduce attrition at the beginning (although the survey contractor had made substantial effort to reduce the burden of data collection and provide good training on procedures). There are inevitable trade-offs in survey design between collecting "needed" data while keeping respondent burden within acceptable bounds. With ambitious data goals, future FoodAPS-like surveys will need to focus on making data collection easier for respondents.

4. Lessons about data collection

In order to better understand the challenges faced by the FoodAPS-1 data collection, it is necessary to briefly review how the data were collected.

4.1. Overview

Once a household was selected for the study, the main food shopper or meal planner in the household became the household's primary respondent (PR). A household was defined as "all persons who live together and share food and who expect to be present at the sampled address during at least part of the data collection week." Plans to travel during the week did not preclude a household member from participating as they were asked to fill out their food books and keep food receipts while on the road. Family members not at home during the data collection week (e.g., students away at school, military personnel stationed elsewhere) were not included as household members. The goal was to match food acquisitions as closely as possible with the people at the sampled residence during the week.

FoodAPS-1 wanted respondents to report all food acquisitions during the week regardless of source (e.g., grocery store, restaurant, grandma's house, or vending machine). Researchers often differentiate these sources into food-at-home (FAH) and food-away-from-home (FAFH), although consensus has not been reached as to exact definitions. FoodAPS-1 avoided using either term and instead asked household members to separately record information for "food and drinks brought into the home" and "meals, snacks, and drinks you got outside the home". Their food books provided examples of each (Fig. 1).

Fig. 2 outlines a typical survey week for a participating household. At the initial household visit (day 0), the PR completed the CAPI-based⁷ Initial Interview and was trained on how to fill out the food books. The training was conducted using a video played on the laptop used to record the responses to the survey.⁸ In addition, prior to their being trained as FoodAPS-1 interviewers, all field and telephone interviewers

hired for the survey were themselves asked to collect food acquisition data for one week using the same tools and techniques as the survey itself, thereby giving them a better idea as to what questions respondents might have. Although the effects of the hands-on practice and use of videos during training were never quantified by an experimental test, they appeared to be successful as 84 percent of all household members provided at least some food acquisition data during the week, and another 10 percent confirmed no acquisitions on at least some days.

During each day of the food-reporting week (days 1 to 7), all household members were asked to record food acquisitions in their food books⁹ and to fill out the Meals and Snacks form. On days 2, 5, and 7, the PR was asked to gather information from all household members about their food acquisitions since the last contact and call the Survey Operations Center (SOC). Telephone interviewers then asked the PR about all FAH and FAFH acquisitions by each member on each day in terms of when and where they occurred. Details about FAFH events (i.e., items acquired and their cost, meal or snack indicator, and types of tender used) were captured as well. At the end of the week, and after completing the final interview with the PR, the field interviewer collected the food books and scanner, reviewed the food books for completeness, and issued all incentives. The PR was then asked to complete a Respondent Feedback Form.¹⁰

4.2. Incentives

All households contacted for screening were given an unconditional \$5 incentive. Once found eligible, respondents were informed of additional incentives that were designed to encourage both initial agreement to participate in the study and continued participation throughout the food reporting week. These incentives included a base incentive of \$100 for the PR,¹¹ a \$10 gift card for each phone call to the SOC initiated by the PR, and for filling out the Food Books, each child (age 11–14) was given a \$10 gift card and those age 15 and older were each given a \$20 gift card. Although we cannot report on actual incentive amounts paid, the potential *maximum* amount that could be received varied from \$135 for single-person households that initiated all three food reporting calls (i.e., \$5 + \$100 + \$10 + \$10 + \$10) to over \$300 for the largest household in the sample. The unweighted mean of these potential amounts was \$161.03, with median and modal maximum values of \$155.

4.3. Interviews

The initial and final interviews collected household- and individual-level information including demographics, education level, body heights and weights, individual income, non-food household expenditures, participation in Federal nutrition programs, dietary restrictions, school attendance, food security, guests at meals during the survey week, and information about the household's main and alternate food stores. There are a number of ways in which the interview instruments could be improved.

Questions about food assistance programs need to account for the planned research goals and the complexities of the program(s). We wanted to identify current (i.e., active) SNAP participants, but our question about SNAP receipt was not specific enough to lead

⁹ FoodAPS-1 used three different food books. The PR used the *Primary Respondent Book*; other adults in the household each used an *Adult Food Book*; and children ages 11–17 each used a *Youth Food Book*. The PR was instructed to record foods acquired by all children under 11 years old in their *Primary Respondent Book*.

¹⁰ Copies of all data collection instruments are posted on the FoodAPS website at <http://www.ers.usda.gov/data-products/foodaps-national-household-food-acquisition-and-purchase-survey.aspx>.

¹¹ The amount of the base incentive was selected after testing both a \$50 and a \$100 incentive during a Field Test of the survey.

⁷ CAPI stands for Computer-Aided Personal Interviewing.

⁸ The PR was responsible for training other household members, as needed.



Fig. 1. Differentiating places to get food.

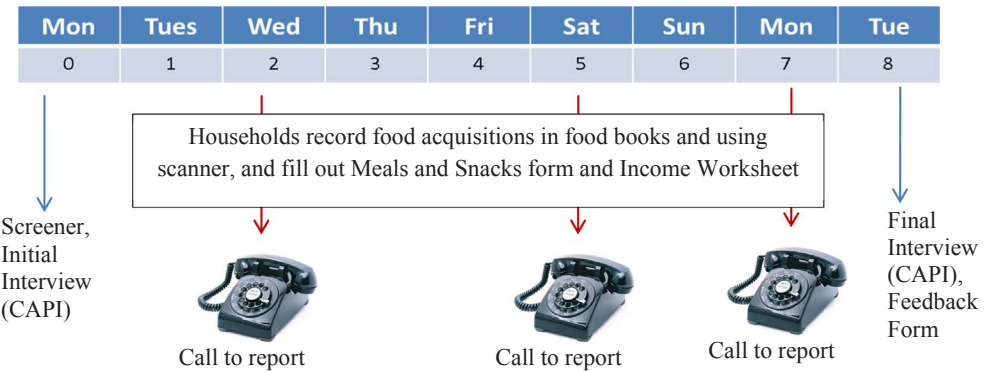


Fig. 2. Overview of data collection week.

respondents to refer to participation in just the previous month. (About 4.5 percent of the respondents reporting that their household was receiving SNAP provided a date of last SNAP receipt that was more than 31 days prior to the initial interview.¹²) Revising these questions to be more specific about the reference period would likely improve the data

¹² In contrast, very few (less than 0.5 percent) respondents reporting that their household was not receiving SNAP then provided a date of last SNAP receipt that was within the 31 days prior to the interview.

collected. Another challenge was the identification of “SNAP units.”¹³ Although FoodAPS-1 almost certainly identifies households with SNAP participants more accurately than other surveys because of post-survey data matching with State participant files (see Section 5.1), the survey did not include questions that identified the size of the SNAP unit or households with multiple SNAP units. It did not ask about SNAP

¹³ SNAP separates individuals into beneficiary units (SNAP units), and these units may or may not be same as a household unit defined by FoodAPS-1 or other surveys.

participation for each household member because of concerns about interview length and respondent burden.

Collecting income data posed many challenges. At the initial interview, households were given an Income Worksheet, which was modeled after the National School Lunch Program income application, to help them assemble information about income prior to the final interview. When they called the SOC during the week to report acquisitions, PRs were reminded to fill out the worksheet.

The final interview included a series of questions that closely followed the structure of the Income Worksheet and asked for the monthly dollar amount and frequency of receipt for six types of income: earnings from work, before deductions; unemployment compensation; welfare, child support, and alimony; retirement and disability income; investment income, and all other income. Overall, we had complete reports of income for 88.2 percent of all individuals that were asked about income. At the household-level, however, this translates into 16 percent of the sample that had at least one individual with income information partially or totally missing. Our research indicates that significantly fewer households that filled out the Income Worksheet had at least some missing income data (10 percent) compared to other households (25 percent). Any differences in the frequency of missing data between the two groups, however, cannot be directly attributable to use of the worksheet because that decision was endogenous.

Some of the strategies to collect income in FoodAPS-1 provided information not available in other surveys. For instance, even though the worksheet and survey question asked for earnings before deductions (i.e., gross earnings), we also included the question, “Is that take-home pay or the amount before taxes are taken out?” Among the nearly 5000 individuals for whom earnings were reported, net earnings were reported for 48 percent, despite the request for gross earnings. Other surveys collecting earnings data may want to use a similar question to confirm whether respondents are providing the requested information. We use the additional information to impute gross earnings when net earnings were reported.

One clear improvement to make with respect to income is to ask about Temporary Assistance for Needy Families (TANF) income separately, or to at least to identify whether TANF is included in income reported in the Welfare, Child Support and Alimony category. Knowing whether TANF was being received would help in estimating SNAP eligibility and benefit amounts among low-income households not receiving SNAP, and it could have clarified the source of funding for some of the 79 FAH transactions which used an electronic benefit transfer (EBT) card as tender but did not specify whether SNAP or TANF benefits were accessed.¹⁴

In determining who would be included on the household roster, the survey focused on who would be at the residence during the survey week, not necessarily who made up the household in terms of providing income or were sources of expenditures. But, since the income questions were based on the roster of individuals present in the household, we may have missed income of household members that travel for extensive periods of time, such as deployed members of the armed forces or business travelers. In addition, we did not identify students away at school as members of the household, even though they may require large expenditures from the household budget which may influence household spending on food.¹⁵

Some of the body measures in FoodAPS-1 align with those found in comparable NHANES data (Clay et al., 2016). In NHANES, body measures are clinically measured by trained staff, while in FoodAPS-1 the primary respondent was asked to report the height and weight of all

individuals in the household. Looking only at individuals age 2 and older, the weighted mean of weight is not statistically significantly different from that estimated in the 2011–12 NHANES. However, the mean height in FoodAPS-1 is 0.4 inches greater than in NHANES (significant at the 10-percent level) and the mean body mass index (BMI) is about 0.6 units less than that in NHANES (significant at the 1-percent level). Interestingly, the share of individuals that are overweight is nearly 5 percentage points higher in FoodAPS-1 as compared to NHANES, and although not statistically significant, the share that is obese is also higher in FoodAPS-1.¹⁶ Missing body measure data appear in both the FoodAPS-1 and NHANES data, and the comparisons made above do not include missing measures or any measures identified as clearly being erroneous. However, the full distributions have not been compared, and we know that the data could have been improved by preprogramming the CAPI system with upper and lower limits for reasonable values by age and gender. Then, any values entered that were outside of these limits could signal the interviewer to verify the reported values. We think that this pre-survey preparation is important in surveys where respondents are reporting these measures instead of trained survey staff actually taking measurements.

The food insecurity information in FoodAPS-1 has already spurred many research questions. The data estimate that 16.0 percent of households were food insecure in the 30 days before the final interview (Clay et al., 2016). This is significantly higher than both the 8.2 percent published by USDA for 2012 using Current Population Survey data (Coleman-Jensen et al., 2013) and the 11.7 percent found using data from the 2012 National Health Interview Survey (Ver Ploeg et al., 2015). These differences could be due to a number of differences between the various surveys and warrant further research. One possible explanation is that the food security questions were asked in FoodAPS-1 after the household was asked to track each and every item of food acquired as well as which meals and snacks each individual in the household consumed for an entire week. This data collection may have made any experience of food insecurity much more salient at the time of the final interview. ERS will be investigating this and other issues in the future.

In retrospect, there are a few things that were not collected that we wish we had. Having an inventory of food already in the house at the initial interview would have been helpful in understanding food acquisitions the following week, but adding a food inventory component was deemed too burdensome. In addition, in an acknowledgement that a one-week data collection period may be too short for households that make infrequent shopping trips, we could have asked when they last went shopping or how often they usually do their main grocery shopping. (A longer data collection period for each household also would be very useful, but this idea was rejected as too burdensome.) Previous research has found that shopping frequency is related to a household's ability to smooth food consumption over the course of a month (Wilde and Ranney, 2000). Having this information would help researchers to characterize or interpret the acquisitions that are reported during the FoodAPS-1 week.

4.4. Food acquisitions

Data on food acquisitions were collected using a hand held scanner, food books, and three calls to the SOC. As previously noted, participants were asked to distinguish between “food and drinks brought into the home” (which we designate as FAH) and “meals, snacks, and drinks you got outside the home” (designated as FAFH). Daily List pages documented summary information for each acquisition, and more details

¹⁴ In the U.S., program benefits for SNAP and TANF are posted to electronic accounts that participants may access only with a personal identification number and an EBT card, which functions very much like a debit card.

¹⁵ To reduce respondent burden, FoodAPS-1 collected information only on expenditures that affect determination of SNAP eligibility and benefit amount so that the SNAP eligibility of non-participating households could be estimated.

¹⁶ For adults, overweight is defined as having BMI greater than or equal to 25 and less than 30, and obese as having BMI greater than or equal to 30. For children under age 18, overweight is defined as having BMI greater than or equal to the 85th percentile and less than the 95th percentile, and obese is defined as having BMI greater than or equal to the 95th percentile for sex and age.

were recorded in separate event pages that were color-coded (blue for FAH and red for FAFH) to help direct respondents to the appropriate page to report the details of the acquisition. The PR's food book included pages for both FAH and FAFH acquisitions, while those given to other adults and children age 11 to 17 included only FAFH pages. The PR was responsible for recording food acquisitions by those under age 11.

The intent of having two different types of pages to record acquisitions was to limit respondent burden by asking for information relative only to that acquisition. For example, one would not ask which meal(s) the acquisition was for when shopping at a grocery or other retail store, and you would not expect a household to be able to use SNAP when eating out. Respondents sometimes reported acquisitions on the wrong page, however, and it might be better to collect all acquisition and item information similarly for both FAH and FAFH events. ERS will be testing this approach in a pilot test of using a web-based approach to collect data on food acquisitions. This approach needs to recognize that the information needs for FAH and FAFH events may be different and design questions appropriately.

In addition to recording information in the food books, households were asked to scan food package barcodes (UPC codes), or a barcode in a survey-provided book of bulk and variable-weight items, and to save their receipts. The survey-provided book included barcodes for many types of fruits and vegetables, and a number of items commonly purchased from bulk bins and deli counters. Respondents could scan a code for such items, rather than write down the details in the food books.

Respondents scanned UPC barcodes for 57 percent of the 143,057 FAH items captured in FoodAPS-1. They scanned other food item barcodes for about two percent of the items and Food Book barcodes for another seven percent. They did not or could not scan barcodes for the remaining 34 percent of the items, although about one-third of these missing barcodes were recovered during post-processing.

While the use of the scanner was often successful and reduced respondent burden, there were still some glitches and unforeseen complications even when scanning was done. For instance, prior to scanning items, the household was asked to initialize the acquisition by scanning a 'begin' barcode and a barcode for the type of store. When the scanners were not initialized this way, it became laborious to link the scanned items to the respective event, and to differentiate unique events. This was particularly challenging if a household had multiple transactions at the same place on the same day. For example, a household may have visited a grocery store and redeemed a WIC voucher and bought items using another method of payment. The WIC transaction was likely to have been separate from the other transaction, but in reporting the acquisitions the respondent may not have initialized two different events on the scanner.

The FoodAPS-1 contractor planned to match scanned barcodes to a proprietary database to identify each food item and its size and packaging (see section 5.2). Many of the scanned package UPCs, especially those from specific stores that do not appear in the proprietary data, never matched a UPC code from the proprietary data, making it difficult to identify the items. Another problem was that the survey-provided book of barcodes did not include cuts of meat, which are generally purchased by weight. Instead, respondents had to write these items down on the page, and the quality of the data, particularly the amount and type of meat purchased, is often unclear. Finally, receipts were used to obtain item prices, yet item descriptions came from matching the scanned UPC codes to the proprietary item data. This information did not always match up, making it difficult to match an item to its cost.

During the calls to the SOC on days 2, 5, and 7, the interviewer would ask about both FAH and FAFH acquisitions. For FAH acquisitions, only the date and place were recorded, while for FAFH all details about the acquisition were recorded. The telephone interviewers had a list of the names and locations of SNAP-authorized food stores and nearby restaurants so that an exact location could be identified. Linking

directly to a known store or restaurant may have reduced the burden on respondents (they were not then asked about the address). The telephone interviewers also had the menus of the top 30 quick service and top 30 full service restaurant chains preloaded in their system to help in the reporting of FAFH item information.

The food acquisition collection methods resulted in duplicate information for many features of events and the items obtained. The idea was to obtain information from the best source available while also having ways to fill in missing information if respondents failed to report the information through one venue. Specific reporting methods were assumed to be the primary (best) source of information. For FAH acquisitions, the scanned UPC codes matched to proprietary item data were intended to be the primary source of item-level descriptions, while the receipts were intended to provide the price or expenditure information for each item. The Food Book pages would provide the rest of the information and saved receipts would be used to verify information and/or fill-in missing information for FAH acquisitions. For FAFH acquisitions, phone calls were intended to be the main source of all details, including location, item-descriptions, and price and expenditure information. The FAFH Food Book pages were then reviewed to identify and capture any information that had not been reported during a phone call. While the multiple sources of event- and item-level information were helpful in obtaining high quality data, sometimes the redundancies led to problems aligning the data. In addition, some respondents did not provide the duplicate information, making verification difficult. For example, a household may have attached a receipt to a food book page, but if the item-level information on the receipt was not specific, we had item-level expenditure data but no item-level descriptions.

Overall, the use of saved receipts to capture item expenditure information was quite successful—receipts were provided for about 80 percent of all FAH events. About two percent of these receipts, however, were either not itemized or not fully readable. Receipts for FAFH events were collected but generally not processed because information had already been reported by telephone. In some cases the receipts provided item descriptions when the main source was not available, but generally the descriptions obtained from receipts were heterogeneous and usually quite different from the descriptions obtained by matching barcodes to the proprietary data.

The survey did not have a good way to differentiate between failing to report an acquisition from simply not acquiring foods. We were successful at capturing a variety of free or no-cost events. These varied from acquisitions in food pantries to meals at family and friends' homes or from work. However, for many of these events, the event-level information does not allow us to distinguish meals where the family or friends prepared the foods from those that were ordered in to the homes, which are likely to vary nutritionally (e.g. did Grandma make the Sunday dinner, or did she bring in take out?) Only by looking at the item descriptions can some of the events be sorted, but even then it is not always possible.

The large number of food items reported was unexpected and led to delays and cost escalations. The contractor had assumed there would be 5000 unique food items each in the FAH and FAFH categories. Instead, the FAH acquisitions contained over 55,000 unique items (out of over 143,000 total reported items), of which only 61 percent had a barcode that was scanned by respondents, was extracted from receipts, or could be assigned based on the other information provided. For these bar-coded items, proprietary data bases and the food books for random-weight products were used to identify product descriptions and sizes. For the remaining 39 percent of unique items (those not barcoded), identification relied on item descriptions and other information written on survey book blue pages and printed on receipts. Similarly, there were over 22,000 unique FAFH items collected (over 115,000 total), of which only 14 percent were matched to an item on the pre-loaded drop down list or to an item in the MenuStat data, a proprietary database of restaurant menu items. The remaining 86 percent of item descriptions

were entered into the data as open-ended text either during the phone interview or on the survey book red pages, challenging the identification of products and their quantities.

The greater-than-expected number of unique items, the variation in how the items were reported, and the level of detail meant a considerable amount of effort was spent in post-processing activities to extract item-level details to identify the products. These efforts to prepare the final FoodAPS-1 data could contribute to the next round of collection, hopefully reducing the amount of post-processing work necessary.

Improvements can be made in the collection of payment, expenditure, and item-level price information. Households were asked to report the total cost of the acquisition including tax and tip, the types of tender used to pay for the purchase or whether the acquisition was free, and whether coupons or a store loyalty card was used. For FAH acquisitions, if SNAP EBT was a form of tender, the amount of SNAP benefits used was also requested. For FAFH events, households were also asked to report the amount of tip separately. In retrospect, we think it would have been helpful to collect separately the amounts of any tip and food taxes paid. In addition, it would have been helpful to record the amount of container deposit fees paid, which some states collect at the point of purchase. We have attempted to estimate these values for FoodAPS-1 based on our knowledge of tax rates and deposit fees across states, but this is time-consuming and subject to error. Given that this information was likely included on the receipts, it probably would have been better to capture the information directly.

Some uncertainty was introduced by the decision not to collect item-level information on non-food items, or even whether a purchase included non-food items. Often, the presence of non-food items may be inferred when the sum of item-level costs is less than the total amount paid (minus estimated taxes and deposit fees), but such inferences rely on the accuracy and completeness of the other data. In addition to non-food items, differences in these two values could be due to the fact that the estimated taxes and bottle fees are incorrect, that data were recorded with error, and/or some food items obtained were not recorded. Having the information on food taxes, deposit fees, and the presence of non-food items would help data processing and cleaning and open additional lines of possible research.

4.5. Meals and snacks form

The Meals and Snacks form was left at the house, to be filled out daily by household members, and the interviewer collected the form at the time of the final interview. For each day of the food reporting week, individuals were asked to indicate that they ate breakfast, lunch, dinner, and/or a morning, afternoon, and evening snack by checking the bubble next to the meal or snack for that day. However, there was no way for an individual to report *not* eating any meal other than to not check the bubble. Respondents were instructed to leave a meal (or snack) bubble blank if that meal or snack was not eaten that day, but this means that partial underreporting of meals or snacks consumed cannot be differentiated from actual nonconsumption.¹⁷

Over 90 percent of the households filled out the Meals and Snacks form. However, for about 10 percent of the individuals in these households, no meals or snacks were reported eaten the entire week, and another two to six percent of individual records have missing data for at least one day. This leaves open the question as to the extent of possible underreporting on days when at least one meal or snack was checked for an individual. It would have been better to provide a means for individuals to positively affirm that they did not eat a specific meal

or snack, although doing so would probably complicate the form and perhaps have created more nonresponse.

4.6. Feedback form

When designing FoodAPS-1, we were aware of several factors that could affect the ability to collect accurate and representative information about food acquisition patterns among American households and individuals. The possibility of non-response by some household members on either certain days or for the entire week was dealt with during each food-reporting call during the survey week. After PRs had reported all FAH and FAFH events for each day, the interviewer asked specifically about any individuals who had not been identified as acquiring any food or participating in any FAFH meals. The PRs were asked to confirm that those individuals had not made any acquisitions. This procedure was sometimes difficult to implement, especially if the PR had not collected members' food books prior to the call.

We also were concerned that the monetary incentives would affect food choices during the week by providing additional resources. To reduce this risk, all incentives, except the \$5 offered at screening, were provided at the end of the data collection week. The Office of Management and Budget (OMB) generally prefers that any incentives offered be provided at the beginning of data collection, as research indicates that this can be effective in eliciting participation (Mercer et al., 2015; Singer et al., 1999). OMB recognized, however, that the FoodAPS-1 incentives were large enough—because of the burden involved in participating—that it made more sense to provide the incentives after data were collected.

To identify possible observational effects and to better understand the risk of under-reporting, all FoodAPS-1 households were invited to fill out and mail a Respondent Feedback Form at the conclusion of the final interview. The response rate for the form was about 97 percent, and item non-response among returned forms was generally about one percent. Table 1 shows the weighted distributions of responses to questions related to survey participation. About 6.2 percent of respondents said that it was difficult or very difficult to get other members to participate in the study, and 4.0 percent said that it was difficult or very difficult to keep track of the foods they got.

The feedback form also asked a question aimed specifically at determining whether there was a “Hawthorne effect,”¹⁸ where households change their acquisition behavior because they know their acquisitions are being recorded. Table 2 summarizes the responses to the question, “During the past week, did you (or other household members) change the way you got food because you were taking part in the study?” Over 88 percent of the responding households said they did not change the way they got food. At first glance, these responses suggest that the survey was not too difficult and did not change food acquisition patterns; however, more analyses are needed. Indeed, one reviewer noted that the direct manner of the question may have led some respondents to believe that changing their behavior would have been wrong and to therefore answer the question in the negative. This leads to an interesting dilemma for FoodAPS-2 and, more generally, to other surveys; should ERS repeat the question as originally written to ensure comparability between the surveys, or should we consider and test alternative approaches to assessing a possible Hawthorne effect?

5. Extant data to enrich the survey

FoodAPS-1 was unique in that it utilized a number of existing datasets to improve data quality and reduce respondent burden. These extant data included: administrative caseload records; listings of SNAP-authorized stores; EBT transaction records; proprietary retail sales data

¹⁷ Although FoodAPS-1 focused on food acquisition rather than consumption, it collected data on meals and snacks eaten to enable more complete modeling of the determinants of food demand. For instance, if a household member consistently skipped meals, this would probably affect food acquisition decisions.

¹⁸ The term originates from a study of work productivity by Elton Mayo at the Hawthorne Works factory of Western Electric (Mayo, 1946).

Table 1
Responses to questions about ease of participating.

Question	Very easy	Easy	Neither easy nor difficult	Difficult	Very difficult	Not applicable or missing
<i>Percent selecting this response</i>						
How easy or difficult was it for you to get other household members to take part in the study?	35.0	26.0	12.2	4.0	2.2	20.5 ^a
How easy or difficult was it to keep track of the foods you got?	43.6	36.9	11.9	3.3	0.7	3.6

Notes: Results based on weighted data from FoodAPS-1 Respondent Feedback Form.

^a Includes one-person households.

Table 2
Responses to Question Regarding Changing the Way You Got Food.

Question	Checked (%)
Did not change	86.9
Ate out more often	1.6
Ate out less often	3.1
Did more food shopping	1.8
Did less food shopping	2.9
Bought a specific item(s) just to be able to scan it	0.7
Avoided specific items so that you wouldn't have to scan them	0.4
Other changes	3.1

Notes: Results based on weighted data from FoodAPS-1 respondent feedback form.

from Gladson, Nielsen, and IRI; restaurant listings from InfoUSA; and USDA nutrient data. These sources and challenges using them are described below.

5.1. SNAP administrative and ALERT data

Three different sets of data on SNAP households were obtained from FNS and state SNAP agencies. The first, an address listing of SNAP participants in February 2012, was used to help identify the residential addresses of SNAP households during sampling (see Section 3). Separating addresses with SNAP-participating households from those without SNAP households at one point in time made it easier to fill the four target groups, particularly the low-income, non-SNAP households. However, this did not guarantee that the address held the same type of household as indicated in the sampling frame by the time an address was screened.

While the initial interview asked each PR whether anyone in the household received SNAP, survey reports of program participation are known to fall short of administrative counts (Meyer et al., 2009). Two additional administrative datasets were employed to confirm the self-reported participation, and when possible to update these reports. These were purchase transaction data and caseload data. Households were asked during the initial interview if they would allow their information to be matched to administrative program records. The 172 households that did not initially give consent to matching were asked again during the final interview. Overall, only 122 households (2.5 percent) did not consent to data matching.

For households that consented to data matching, survey records were matched probabilistically to State participant files for SNAP using address, phone number, household members' names, and benefit amount and distribution date. The case numbers from matched records then were used to identify the household's EBT transaction records in the ALERT file. If a survey record did not match to a State participant file, an effort was made to match it to the ALERT data using probabilistic matching based on SNAP transactions reported in FoodAPS-1. The results of both sets of administrative data matches were used to confirm or update the household's self-reported SNAP participation status.

Some problems were encountered in the survey's efforts to use administrative data to improve sample frames and to confirm respondents'

self-reported SNAP participation status. First, four State agencies did not provide the requested address file for February 2012, and a fifth agency provided the file after the sample frames had been constructed. In these five states, no SNAP address frame was used and SNAP households were selected from the general address frame. Second, neither State agencies nor FNS could provide a SNAP unit's case identifier when the identifier was based in whole or in part on a participant's social security number (SSN). Without a unique identifier available to match participant files to the EBT transaction records, match procedures had to resort to probabilistic matching instead of deterministic matching. As the name implies, probabilistic matching yields matches with a high probability of being correct, but both false positive and false negative matches remain possible.

The FoodAPS-1 experience does suggest that, when planning to use program administrative data as part of any survey effort, it is very important to understand the environment in which State and Federal agencies in the U.S. operate. All program agencies work with relatively fixed short-term resources, and they typically do not budget for external requests for data. A seemingly simple request can impose demands on the agency that are totally unexpected by the researcher. Thus, the chances of obtaining requested data will be improved if the request is: (a) kept as simple and straightforward as possible given the research needs; (b) designed to minimize burden on the agency;¹⁹ and (c) made as early as possible to allow ample time for discussions to clarify the request and for the agency to act upon it. These suggestions would probably be useful in non-U.S. surveys contemplating matching to administrative files as well. Whether in the U.S. or not, researchers should have alternate plans in place in the event that their data matching requests cannot be met.

5.2. Proprietary retail data

Proprietary retail data were obtained to standardize descriptions and other item-level information for UPC-coded food items that could be scanned by the hand-held scanner. The primary source of UPC-level item information was from IRI, a private company that obtains, organizes, and sells scanner data. All of the UPCs scanned by FoodAPS-1 households were merged to IRI data to obtain a text/character item description and package size and type.²⁰ Once the items are matched to the USDA nutrient information, the description attached to each unique food with a nutrient profile will serve as the item's description. This avoids any conflicts with releasing proprietary information about food items. The IRI data were also used in the Geography Component of FoodAPS-1, described below.

¹⁹ As mentioned in the earlier section on sample design, a decision was made not to ask State agencies to provide updated address lists throughout the field period even though such lists would have improved the efficiency of finding SNAP households and low-income households not participating in SNAP. Asking for multiple files was deemed as too burdensome a request.

²⁰ The item-level attribute information is being used to match each food item to its nutrient and My Pyramid Equivalent data in a USDA nutrient database.

5.3. Store location data (STARS, InfoUSA, Google)

A primary goal of FoodAPS-1 was to provide data for the purposes of studying how the food environment influences food acquisitions. A key gap in such research, especially research on the national scale, has been the lack of data on how specific food shopping behaviors (retailer choice, travel mode and distance, food items acquired, and prices paid) respond to different food environments. FoodAPS-1 fills a data gap by collecting information on both household food shopping behaviors and on the available set of stores and restaurants that could have been used for food acquisitions.

USDA's Store Tracking and Redemption Subsystem (STARS) data, which contain information on stores authorized to accept SNAP benefits, were used in the survey and in post-survey data analysis. These data were used in the survey instrument when respondents identified their primary and alternative grocery shopping locations to geocode the store location and to measure the types of stores identified. These data also were used in post-survey analysis to measure distance from household residences to primary and alternative stores, stores from which foods were purchased during the reporting period, and the nearest SNAP-authorized store by store type (e.g. distance to the nearest SNAP-authorized supermarket or convenience store).

Using the STARS data aided in identifying important information about the stores respondents used or identified as their shopping places. However, the STARS list is not a complete list of stores, so that in a significant number of cases, the primary and alternative stores reported by respondents were filled in by the interviewer or respondent. This resulted in inconsistencies in store names, locations and types that required work to correct. One potential area for improvement is to combine the STARS data with data from other sources, such as TDLinx, and clean these two data sets prior to their use in the survey. Each store directory has weaknesses in coverage, and store type classifications between the two sources differ. However, ERS has merged these data sets before and is developing methods to improve these matches for future use.

InfoUSA, a proprietary data source that contains information on retail eating places, was used to identify eating places used by respondents. These data included all retail eating places (SIC = 5812) in 46 of the survey's 50 PSUs, plus retail eating places within a 5-mile radius of 32 SSUs in four areas with high population (and eating place) density. Also, like STARS, these data are not complete in their coverage so that post-survey cleaning of the names, locations, and types of places respondents reported visiting needed to be filled in or corrected.

Because not all acquisitions occurred at locations near the household, or at places included in these lists, Google searches supplemented these lists to obtain geographic information as well as characteristics of the places reported. SAS geocoding procedures were used to obtain straight-line distances from the residence to each geocoded place, while Google Maps was used to obtain driving and walking distances and times from the residence to the place. Inconsistencies in place information, such as name and the type of place, arose because of inconsistencies in the source data as well as variation in how the data were entered or obtained. Moreover, sometimes there was just not enough information provided to allow for proper identification of a place so that it could be classified and geocoded. Resolving all of these issues took considerable effort after the data were collected.

5.4. Geography component

A major innovation of FoodAPS-1 was its design, at the outset, to capture and append detailed information about the local food environment for each of the 400 SSUs in the sample. This information is being used to examine if lack of access to food stores with desirable distances, attractive prices, and variety in a competitive market affect food security of low-income households. This Geography Component merged TDLinx data on store locations to the SNAP STARS data to

obtain a broader list of stores to measure store access and store density within specified distance radii of the population-weighted centroid of the census block groups in which respondents live.

Similarly, InfoUSA data were used to measure distance from the respondent's home to the nearest fast food and full-service restaurants and to measure the density of fast food and full service restaurants within specified distances of the population-weighted block group centroid of the block group in which the respondent lives.

Part of the Geography Component analysis used the IRI retail scanner data to construct weekly store-level food basket prices for stores within each of the 50 PSUs and counties adjacent to the PSUs. These basket prices are based on weekly UPC-level purchases reported at the store level. Information about the store type (e.g. supermarket, convenience, pharmacy) also is provided. The purpose of these data is to provide a measure of food prices, across broad food categories, in the neighborhoods of FoodAPS-1 respondents. While these data provide valuable information for analysis of food and store choices, they come with some caveats. First, some IRI scanner data are available from only about 20 percent of the retailers across the country (compared with the list of retailers from TDLinx) and for some of the IRI data, purchase price information is available only at regional levels for some chain retailers. Second, many stores may not sell many items or any items in a basket category and thus, the estimates of store-week prices by category could be a poor representation of prices of these products in these areas.

6. Application to survey designs elsewhere and in the future

FoodAPS-1 introduced many innovations, including state-of-the-art collection methods and data linkages. The effort successfully produced never-before-available data and information on food purchase patterns of Americans, in particular of households participating in SNAP, other poor and low income households, and the factors that influence their choices. Since their release, the FoodAPS-1 data have fueled many studies on critical policy issues, including: (1) variation in household, particularly SNAP household, food behaviors, (2) impact of SNAP benefits on diet quality and food security of low-income households, (3) cost of healthy diets, and 4) the role of the local food environment and other geographic factors driving food purchase and acquisition decisions of SNAP and non-SNAP households. We expect that these data will support many more studies.

We hope that USDA's experience with FoodAPS-1 can assist other agencies and organizations seeking to collect data on not only food expenditures, but also on what foods are acquired (both for food-at-home and food-away-from-home acquisitions), in what quantities and at what unit prices, and in what local food environments. The main lessons that we at ERS have learned from FoodAPS-1 include:

- The great diversity in food products needs to be recognized and accounted for in how data are captured and recorded and then processed to create useful research files. FoodAPS-1's use of hand-held scanners was innovative and partially successful, but a great amount of work was needed to identify the thousands of unique food products acquired and categorize them in a useful manner.
- Despite procedural and technical difficulties, there are benefits of matching survey data to administrative sources, especially for confirming participation in programs which is often under-reported in surveys.
- A great amount of food in the U.S. is obtained for free, either through government programs like the school meals programs; at social events with family and friends; or at places like work, schools, fraternal organizations, and faith-based institutions. If a survey about food choice does not collect information on freely received food, it may be very difficult to use the survey data to understand the determinants of household demand for food that is purchased.
- Capturing information about the local food environment (like the number and types of food stores and restaurants, their relative

prices, and distances from respondent residences) can add substantial value to research attempting to understand observed patterns of food acquisitions—especially decisions about whether to purchase groceries for meals at home or go out to eat, and what stores or restaurants to then patronize.

- When the sample design is based in part on household income, a better method of collecting accurate income information during a screening interview needs to be identified and tested. Attention also needs to be paid to differentiating between gross and net earnings in the main interview.

As for next steps at USDA, ERS and FNS are moving forward with plans to collect a second round of FoodAPS data. In preparation, ERS has hired an outside contractor, Westat Inc., and teamed with a survey methodologist to evaluate in greater detail the strengths and limits of the existing FoodAPS-1 data and, in so doing, identify strategies for improving data collection instruments and procedures. The contractor will be preparing public-use files to facilitate access to the data. Finally, ERS has awarded a contract to Westat Inc. to develop and test a web-based approach for collecting FoodAPS data to see if it can improve the accuracy and completeness of collected food data, improve response rates, lower respondent burden, or lower overall data collection and processing costs.

Conflicts of interest

J.A. Kirlin and M. Denbaly have no conflicts of interest.

References

- Clay, D.M., Ver Ploeg, M., Coleman-Jensen, A., Elitzak, H., Gregory, C., Levin, D., Newman, C., Rabbitt, M.P., 2016. Comparing National Household Food Acquisition and Purchase Survey (FoodAPS) Data with Other National Food Surveys' Data. U.S. Dept. of Ag., Econ. Res. Serv. EIB-157.
- Coleman-Jensen, A., Nord, M., Singh, A., 2013. Household Food Security in the United States in 2012: Statistical Supplement. U.S. Dept. of Ag., Econ. Res. Serv. AP-061.
- Mayo, E., 1946. *The Human Problems of an Industrial Civilization*. Macmillan Co., New York.
- Mercer, A., Caporaso, A., Cantor, D., Townsend, R., 2015. How much gets you how much? Monetary incentives and response rates in household surveys. *Publ. Opin. Q.* 79, 105–129.
- Meyer, B.D., Mok, W.K.C., Sullivan, J.X., 2009. The Under-Reporting of Transfers in Household Surveys: Its Nature and Consequences. NBER Working Paper No. 15181, Natl. Bur. of Econ. Res.
- National Research Council, 2005. Improving Data to Analyze Food and Nutrition Policies. Panel on Enhancing the Data Infrastructure in Support of Food and Nutrition Programs, Research, and Decision Making. Committee on National Statistics, Division of Behavioral and Social Sciences and Education. The Nat. Acad. Press, Washington, DC.
- Oliveira, V., 2016. The Food Assistance Landscape: FY 2015 Annual Report. U.S. Dept. of Ag., Econ. Res. Serv. EIB-150.
- Singer, E., Gebler, N., Rhagunathan, T., Van Hoewyk, J., McGonagle, K., 1999. The effects of incentives on interviewer-mediated surveys. *J. Off. Stat.* 15, 217–230.
- Ver Ploeg, M., Mancino, L., Todd, J.E., Clay, D.M., Scharadin, B., 2015. Where Do Americans Usually Shop for Food and How Do They Travel To Get There? Initial Findings from the National Household Food Acquisition and Purchase Survey. U.S. Dept. of Ag., Econ. Res. Serv. EIB-138.
- Westat, "FoodAPS 2012 Evaluation: Report on Completeness and Accuracy of FoodAPS Data", Unpublished. May 2016.
- Wilde, P.E., Ranney, C.K., 2000. The monthly food stamp cycle: shopping frequency and food intake decisions in an endogenous switching regression framework. *Amn. J. Ag. Econ.* 82 (1), 200–213.