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# Statistical integration in designing Australian farm surveys

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## Abstract

*The agriculture sector plays an important role in the Australian economy, accounting for around 15 per cent of total value of merchandise exports, and is a major employer in rural and regional areas. Based on the 2005–06 Agricultural Census, there were an estimated 154 500 agricultural businesses in Australia, and the majority of these were family-owned and operated. Farm surveys conducted since the 1940s by the Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences (ABARE–BRS) play a key role in the analysis of the Australian agriculture sector.*

*ABARE–BRS farm surveys provide a broad range of statistics covering the physical characteristics and economic performance of farms as well as of management practices and socioeconomic variables. These surveys provide the Australian Government, industries, consultants and researchers with a comprehensive data set that can be used to analyse current policy issues and to monitor change in the productivity and profitability of agricultural industries in Australia.*

*In designing and conducting farm surveys, ABARE–BRS integrates statistics from a range of sources including data drawn from the Australian Bureau of Statistics (ABS) – Australia’s official statistical agency – as well as information from industry organisations.*

*This paper outlines how ABARE–BRS conducts its annual farm surveys and highlights the use of other statistical collections to develop population lists, design surveys and weight survey results. Improvements to surveys over the years are highlighted, and the manner in which ABARE–BRS has integrated different surveys and data sources in analysing and presenting survey results is outlined.*

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# Introduction

In Australia the official statistical collections for agriculture are undertaken by the Australian Bureau of Statistics (ABS). The ABS conducts an Agricultural Census every five years and an Agricultural Commodity Survey and other collections in each of the intervening years. These collections primarily cover production of most agricultural products, together with information on land and water use and natural resource management practices. Other economy-wide ABS collections, including the Census of Population and Housing, together with employment surveys, also provide important data on the agricultural sector.

Additional data collections specifically for the Australian agriculture sector are undertaken by a range of organisations. The most prominent of these is the annual farm surveys undertaken by the Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences (ABARE–BRS), known until recently as ABARE (Australian Bureau of Agricultural and Resource Economics) and before 1987 as BAE (Bureau of Agricultural Economics).

The ABARE–BRS farm surveys fill a significant gap in Australia’s official agricultural data collections. The surveys are the only source of farm financial data integrated with associated production information, farm management practices and farm households’ socioeconomic characteristics. Importantly, this comprehensive set of information is available for each surveyed farm in one data set, which enables detailed analysis of a large range of issues.

Data from the farm surveys are extensively used by government, industries, consultants and researchers to examine issues such as how farmers adapt to climate change, improve productivity, manage price and climate risk, maintain competitiveness, improve management practices, adopt new technologies and improve produce marketing. The surveys assist in determining target research and development initiatives.

Because these surveys play such an important role, ABARE–BRS receives financial support for its survey activities from the Australian Government and a range of industry organisations. This support has enabled surveys of the broadacre and dairy sectors to continue on an annual basis and with a large and consistent data set from 1977–78 to the present day.

In designing and conducting these farm surveys, reported statistics are integrated from a range of sources including data drawn from the official agricultural census and surveys conducted by the ABS, as well as information from industry organisations. Linking of unit level data collected by different agencies rarely happens due to strict confidentiality requirements by different agencies.

This paper provides a brief outline of Australian agriculture and highlights the dominant role of family farms. The methods ABARE–BRS uses, in cooperation with the ABS and other agencies, to design and weight farm surveys, and report survey results, as well as methods used to coordinate the collection of data are explained. The paper also discusses a specific example where the ABARE–BRS farm survey data were linked to the ABS Census of Population and Housing to examine the regional expenditure patterns of farmers. Finally, the main improvements made to the surveys over time and lessons learned are covered.

# Overview of the Australian agriculture sector

Agriculture plays a key role in Australia's economy, generating national and regional wealth. In 2008–09 (July–June year), agriculture directly contributed approximately 2 per cent to Australian gross domestic product (GDP) and employed around 318 000 people (3 per cent of the total workforce). The food manufacturing industry contributes a further 2 per cent of GDP and the industry employs an additional 224 000 people. Around 60 per cent of Australian agricultural production is exported. Exports of agricultural products accounted for 15 per cent of total Australian merchandise exports in 2008–09 (ABARE 2009).

Australia supports a wide range of agricultural activity, with around 60 per cent of the continent devoted to agriculture of one form or another. The types of agricultural pursuits are dictated largely by climate, soil type, water availability and proximity to markets. Major agricultural commodities produced in Australia include beef, wheat, wool, dairy, barley, cotton, sugar, canola, lamb, poultry, wine grapes and a wide range of fruits and vegetables. The major industry contributors to the gross value of agricultural production, exports and farm numbers in Australia are the grain, livestock (beef, sheep and wool) and dairy industries.

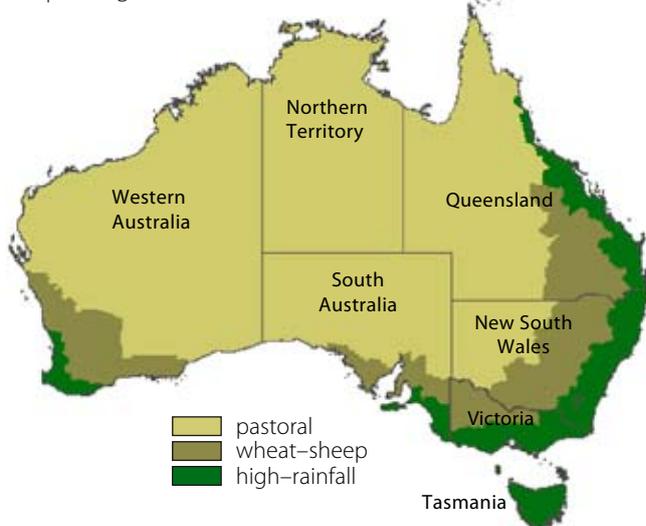
Annual farm surveys are undertaken in Australia because of the importance of agriculture to both the economy and rural employment and because of the volatility of farm incomes at the industry and regional level from year to year. The surveys are used to generate data on the projected incomes of farmers across industries and regions in the current financial year. The diverse nature of farm performance in Australia also presents a challenge in designing a sample survey that is representative of the industry.

The scale and production mix of agriculture varies considerably across three broad agricultural zones (map 1):

- **The pastoral zone** includes most of the northern tropical areas and the arid and semi-arid regions of Australia where agricultural land use is characterised by extensive grazing of native pastures. *There were around 6600 farms operating in the pastoral zone during 2005–06 with an average farm area of 47 400 hectares.*
- **The wheat–sheep zone** has a climate and topography that generally allows regular cropping of grains in addition to the grazing of sheep and beef cattle on a more intensive basis than in the pastoral zone. Rainfall is generally adequate for producing a variety of pasture species, usually as part of a crop grazing rotation. *In 2005–06 there were around 64 600 farms in the wheat sheep zone with an average area of 1400 hectares.*
- **The high rainfall zone** forms the greater part of the coastal belt and adjacent tablelands of the three eastern mainland states, small areas in south eastern South Australia and south western Western Australia, and the whole of Tasmania. The zone is more suitable for grazing and intensive crop growing. *In 2005–06 there were an estimated 83 500 farms in the high rainfall zone operating an average area of 397 hectares.*

In 2008–09 there were around 136 000 Australian farm businesses in these three zones with an estimated value of agricultural operations (EVAO) of \$A5000 (US\$3750) or more, the great majority of which are family owned and operated. EVAO is a standardised dollar measure of the level of agricultural activity. A detailed definition of the EVAO is given in *Agricultural Industries: Financial Statistics* (ABS 2001, Cat. no. 7506.0).

map 1 Agricultural zones in Australia



Businesses with an EVAO of \$A5000 (US\$3750) or above are classified by the ABS as commercial scale farms. As in many other countries there has been a steady decline in the number of commercial scale farms operating in Australia. Farm numbers have declined at a rate of slightly less than 1 per cent per year over the past 40 years. Farms with an EVAO of less than \$A5000 (US\$3750) are mostly rural residential holdings clustered around major regional centres that rely on income from other sources of employment.

A further feature of the Australian farm sector is that a relatively small percentage of farms produce the majority of industry output. For example, in the beef industry the largest 30 per cent of farms produced around half of all industry output in 2008–09, compared with 16 per cent of output from the smallest 30 per cent of farms. The degree of output concentration among larger farms has also increased over time.

In addition, larger farms typically report better financial performance than smaller farms. For example, the largest 30 per cent of farms (in terms of area operated) in the grain industry in 2008–09 achieved a rate of return to capital, excluding capital appreciation of 3.7 per cent compared with 1.8 per cent for the grain industry as a whole. In addition to earning higher incomes and generating greater returns on capital, these larger and better performing farms are typically characterised by better farm management planning, greater use of new technologies and higher levels of participation in a range of learning and training activities.

Despite the diversity of scale and production, most Australian farms can be categorised as family farms. ABARE–BRS survey data for the grain, livestock and dairy sectors indicate that around 99 per cent of farms are family owned. Across the whole of Australian agriculture, it is estimated that more than 98 per cent of farms are family farms. A high proportion of these farms are heavily reliant on family labour, with around 43 per cent of grain, livestock and dairy farms using family labour only (excluding shearers and contractors). Very large family farms and non-family farms account for a small share of farms but a large and growing share of the aggregate value of farm production.

Another feature of Australia agriculture is that farmers are ageing. The median age of farmers increased from 51 years in 2001 to 52 years in 2006. More importantly, the proportion of farmers older than 65 years of age increased to 18 per cent in 2006 from 15 per cent in 2001 and the proportion of farmers under 35 years of age decreased from 12 per cent in 2001 to 10 per cent in 2006 (ABS 2008, Cat 7104.0.55.001).

The volatility of farm income from year to year and the long-term downward trend in farmers' terms of trade are longstanding characteristics of Australian farming. The influence of weather and climate can have a substantial effect on farm sector earnings with, for example, 1982–83, 1994–95, 2002–03 and 2006–07 being years of substantial drought and low farm incomes (as measured by the net value of farm production). The annual farm surveys conducted by ABARE–BRS are the prime source of up-to-date information used to monitor changes in farm incomes at a regional and industry level.

# ABARE–BRS farm surveys

ABARE–BRS farm surveys are industry based and provide a broad range of information on the performance of farm business units in the rural sector. They provide a structural set of physical, financial and socioeconomic information for research and analysis that forms the basis of many publications, papers, briefing materials and industry reports.

ABARE–BRS industry surveys are based on the Australian and New Zealand Standard Industrial Classification (ANZSIC06). This enables comparability and linking with the ABS and other agricultural collections. This classification is consistent with an international standard applied comprehensively across Australian industries. Farms assigned to a particular ANZSIC have a high proportion of their total output characterised by that class. A detailed explanation of ANZSIC is in (ABS 2008, cat. no. 1292.0).

ABARE–BRS conducts two major annual farm surveys, the Australian Agricultural and Grazing Industries Survey (AAGIS) and the Australian Dairy Industry Survey (ADIS). These two surveys provide a unique database that integrates detailed financial and physical information representing around 70 per cent of Australian commercial farm business units. The industries covered in these surveys are wheat and other crops, mixed livestock–crops, sheep, beef cattle, sheep–beef (these five industries are commonly referred to as broadacre industries in Australia) and dairy. An explanation of each industry is set out in box 1 and the proportion of farms covered by these surveys is set out in table 1.

## 1 Businesses with agricultural activity, year ended 30 June 2009

Industry a	Number of farms no.	Percentage of farms %
Beef cattle farming	39 425	29
Grain–livestock farming	13 778	10
Other grain growing	13 215	10
Sheep farming	10 368	8
Dairy cattle farming	7 749	6
Sheep–beef cattle farming	6 690	5
Fruit and tree nut growing	6 333	5
Grape growing	5 926	4
Vegetable growing	4 489	3
Sugar cane growing	3 762	3
Horse farming	2 231	2
Other crop growing	2 197	2
Nursery floriculture and turf production	1 923	1
Other livestock farming	834	1
Poultry farming (meat)	765	1
Pig farming	682	1
Poultry farming (eggs)	309	0
Beekeeping	263	0
All other industries	15 055	11
Total all industries	135 996	100

Australian Agricultural and Grazing Industries Survey (AAGIS) and Australian Dairy Industry Survey (ADIS)

a The Australian and New Zealand Standard Industry Classification (ANZSIC) has been used to categorise businesses according to their main activity. Some categories have been combined in this table for presentation purposes. The table includes farms with an EVAO of \$5000 (US\$3750) or more.

Note: Percentages do not add up due to rounding.

Source: ABS 7121.0 Agriculture Commodities, Australia, 2008–09.

ABARE–BRS also conducts surveys of other industries (other than the five broadacre and dairy industries) subject to the availability of industry sourced funding. Recent surveys of other industries have included:

- the sugar cane industry in 2006–07 and 2007–08
- honeybee producers in 2007–08
- winegrape growers in the Barossa region 2007–08
- vegetable farms 2007–08 to 2009–10
- irrigated farms in the Murray Darling Basin from 2007–08 to 2009–10.

### **Box 1 Broadacre and dairy industries**

#### **Wheat and other crops industry** (ANZSIC06 Class 0146 and 0149)

- farms engaged mainly in growing rice, other cereal grains, coarse grains, oilseeds and/or pulses

#### **Mixed livestock-crops industry** (ANZSIC06 Class 0145)

- farms engaged mainly in running sheep or beef cattle, or both, and growing cereal grains, coarse grains, oilseeds and/or pulses

#### **Sheep industry** (ANZSIC06 Class 0141)

- farms engaged mainly in running sheep

#### **Beef industry** (ANZSIC06 Class 0142)

- farms engaged mainly in running beef cattle

#### **Sheep-beef industry** (ANZSIC06 Class 0144)

- farms engaged mainly in running both sheep and beef cattle

#### **Dairy industry** (ANZSIC06 Class 0160)

- farms engaged mainly in dairying

# Survey methodology

Farm surveys are conducted following systematic design, collection, estimation and analytical methodologies. They are conducted to a very tight schedule as shown by the schematic description of the timing and nature of the annual AAGIS data-collection process below.

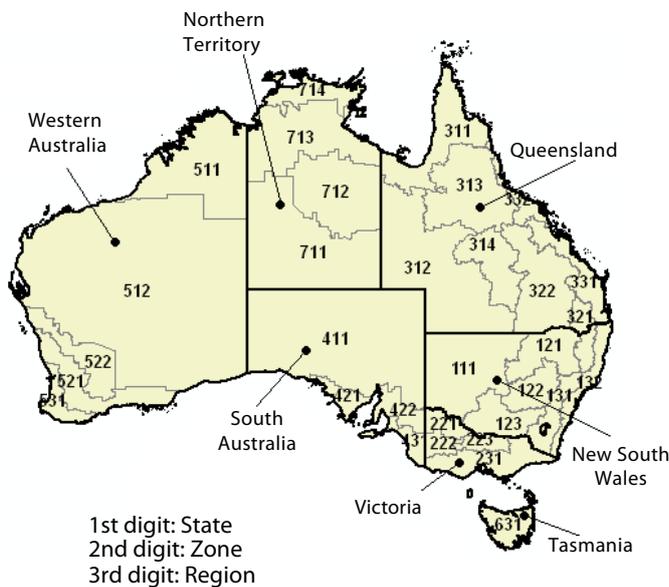
March to July	July to September	October	December to January	February to June
<p><b>Planning</b></p> <ul style="list-style-type: none"> <li>• Liaison with industries and ABS to obtain the population frame and to negotiate content of supplementary surveys.</li> <li>• Sample size confirmed.</li> <li>• Clearance of the surveys sought from the ABS' Statistical Clearing House.</li> <li>• Sample selected.</li> <li>• Questionnaire designed.</li> <li>• Training of survey officers.</li> </ul>	<p><b>Data collection</b></p> <ul style="list-style-type: none"> <li>• Letters sent to potential respondents.</li> <li>• Potential respondents contacted by phone to line up interviews.</li> <li>• Field interviews to collect data for the previous financial year.</li> <li>• Data editing and checking.</li> </ul>	<p><b>Phone update</b></p> <ul style="list-style-type: none"> <li>• Phone respondents for current production details and estimates for current financial year.</li> <li>• Editing and checking of phone survey data.</li> </ul>	<p><b>Data analysis</b></p> <ul style="list-style-type: none"> <li>• Review data and secondary source information, calculate sample weights.</li> <li>• Produce population estimates for the survey year and projections for the current year.</li> </ul>	<p><b>Data outputs</b></p> <ul style="list-style-type: none"> <li>• Respondents' benchmark reports.</li> <li>• Conference presentations and papers.</li> <li>• Online database.</li> <li>• Specific industry reports.</li> <li>• Data requests and research projects using AAGIS and ADIS data.</li> </ul>

All farm surveys conducted by ABARE–BRS are cleared by the Statistical Clearing House (SCH). The SCH, located within the Australian Bureau of Statistics, is the clearance point for business surveys that are run, funded or conducted on behalf of the Australian Government. The SCH assesses the proposed survey methods and questionnaire design to ensure that surveys follow best practice. It also assesses if there are any alternative sources of data to avoid duplication and excessive burden on respondents.

ABARE–BRS surveys target farming establishments that make a significant contribution to the total value of agricultural output, that is, commercial farms. The surveys exclude smaller farms, which in aggregate contribute less than 2 per cent to the total value of agricultural production.

The AAGIS is designed from a frame (a population list of agricultural businesses) drawn from the Australian Business Register (ABR) and maintained by the Australian Bureau of Statistics (ABS). The ABR comprises businesses registered with the Australian Taxation Office (ATO). The ABR–based frame provided to ABARE–BRS consists of agricultural establishments with their corresponding statistical local area, industry classification (ANZSIC), and a 'size of operation' variable, used as the design measure. The design measure used in ABARE–BRS farm survey designs is usually 'estimated value of agricultural operations' (EVAO).

map 2 Australian broadacre survey regions



The sample frame for the ADIS is a list of dairy farms that have paid levies based on their milk deliveries. This list is sourced from the Levies Revenue Service and provided to ABARE–BRS by Dairy Australia. The design measure for ADIS is total milk production.

ABARE–BRS farm surveys use a stratified random sample. For example, the target population for AAGIS is grouped into strata defined by ABARE–BRS region (map 2), ANZSIC and size of operation. The sample allocation is a compromise between allocating a higher proportion of the sample to strata with high variability in the design measure, and an allocation proportional to the population of the stratum. A similar method is used for ADIS but with dairy regions (ABARE 2010).

The sample chosen each financial year maintains a high proportion of repeat farms, that is, farms that participated in the survey in the previous year, to accurately measure change between years and to reduce respondent burden. It is slightly quicker and easier to collect data from repeat farms because the basic background information for these farms is already recorded and they have more understanding of the survey process and aims. A small proportion of new farms is included in the sample to reflect any changes in the target population.

The sample chosen each financial year maintains a high proportion of repeat farms,

## Data collection

The AAGIS/ADIS collections are based on a core questionnaire that seeks information on production, income, expenditure and capital as well as farm household data including socioeconomic variables (detailed explanation of variables collected is in appendix 1). Also, in order to provide extra information on specific issues in the agricultural sector, supplementary surveys are often added to the core questions. The size and number of supplementary surveys is constrained by the anticipated response burden. Examples of recently conducted supplementary surveys are in appendix 2.

The AAGIS and ADIS data are collected by face to face interviews with farmers. Respondents to the AAGIS and ADIS are also contacted by telephone in October and November each year to provide estimates of projected production and expected receipts and costs for the current financial year. Participation in ABARE–BRS farm surveys is voluntary. The success of the surveys depends on the cooperation of farmers in providing data and information on their farm operations. ABARE–BRS has over time built a good reputation with farmers, enabling them to provide financial and physical information confidently to field officers. The overall quality of the data stems from the accurate records farmers keep about each and every aspect of the farm business.

ABARE–BRS has moved to a model of using regionally based collectors. About thirty five field officers are contracted to collect data from around 1900 farms. These officers have an agricultural background and have a broad understanding of agricultural industries. This understanding of farming operations helps not only to build trust with farmers, but to conduct interviews quickly and effectively. It usually takes up to two hours to conduct an interview. All field officers are trained before each survey to ensure the accuracy of the data they collect. Regionally based field officers also help to cut down travel costs (more information about regionally based collectors is in appendix 3).

Data collections are usually scheduled to avoid major regional events and farmers' busy times. The data are mainly collected by computer assisted collection and capture methods. ABARE–BRS invests significant time and resources in software development for use by data collectors, incorporating edit checks, and programming to impute derived variables. This preliminary editing process improves the quality of the data. More thorough edit checks are also carried out prior to data analysis. The editing process also involves field officers checking each other's data.

## Sample weighting

Farm level estimates published by ABARE–BRS are calculated by appropriately weighting the data collected from each sample farm and then using the weighted data to calculate population estimates. Sample weights are calculated so that population estimates from the sample of the numbers of farms, areas of crops and numbers of livestock correspond as closely as possible to the most recently available ABS estimates from data collected from Agricultural Census and Surveys. The weighting methodology for AAGIS and ADIS uses a model-based approach, with a linear regression model linking the survey variables and the estimation benchmark variables. The details of this method are described in Bardsley and Chambers (1984) and a document titled '*ABARE Survey Methods and Definitions*' located at [http://www.abareconomics.com/publications\\_html/economy/economy\\_09/survey\\_methods.pdf](http://www.abareconomics.com/publications_html/economy/economy_09/survey_methods.pdf)

For AAGIS, the benchmark variables provided by the ABS include:

- total number of farms in scope
- area planted to wheat, rice, other cereals, grain legumes (pulses) and oilseeds
- closing numbers of beef and sheep.

For ADIS, the benchmark variables provided by Dairy Australia are:

- total number of in-scope dairy farms
- total milk production.

Generally, larger farms have smaller weights and smaller farms have larger weights, reflecting both the strategy of sampling a higher fraction of the large farms than small farms (the former having a wider range of variability of key characteristics and accounting for a much larger proportion of total output) and the relatively lower numbers of large farms.

The reliability of the estimates of population characteristics published by ABARE–BRS depends on the design of the sample and the accuracy of the measurement of characteristics for the individual sample farms. To give a guide to the reliability of the survey estimates, standard errors are calculated for all published estimates.

## Outputs

Data outputs include all variables collected from the survey plus major financial performance indicators derived from the collected variables (derived variables are described in box 2).

### Box 2 Major financial performance indicators

**Total cash receipts** = total revenues received by the business during the financial year

**Total cash costs** = payments made by the business for materials and services and for permanent and casual hired labour (excluding owner manager, partner and family labour)

**Farm cash income** = total cash receipts – total cash costs

**Farm business profit** = farm cash income + change in trading stocks – depreciation – imputed labour costs

**Profit at full equity** = farm business profit + rent + interest and finance lease payments – depreciation on leased items. (Return produced by all the resources used in the farm business)

**Rate of return** =  $100 * \text{profit at full equity} / \text{total opening capital}$   
(return to all capital used)

ABARE–BRS publications are made available to all users free of charge and can be accessed electronically from the ABARE–BRS website. They are widely promoted throughout the rural press when released and attract significant attention. The survey data are also included in papers presented at conferences which are held each year in every state in Australia.

Key annual publications include:

- *Australian farm survey results* that contain farm financial performance indicators at the national level and at the state and industry level (ABARE 2010)

Industry reports:

- *Australian grains* which contains farm financial performance indicators of the grain industry by cropping intensity.
- *Australian beef* contains farm physical characteristics of the beef industry by herd size, as well as financial performance indicators by region by herd size.
- *Australian lamb* contains farm physical characteristics of slaughter lamb industry by number of lambs sold for slaughter, as well as financial performance indicators by number of lambs sold for slaughter.
- *Australian dairy* contains estimates for the Australian dairy industry by region.
- Farm performance section in the national and regional conference papers.

Farm survey data are also presented in interactive electronic time series data packages available on the ABARE–BRS website:

– [www.abare-brs.gov.au/surveys](http://www.abare-brs.gov.au/surveys)

# Integration of ABARE–BRS farm surveys with other statistical collections

ABARE–BRS integrates reported data from other statistical collections in the design, weighting process and analysis of its farm surveys. Linking of data at a unit level mainly occurs in the design and weighting of farm survey data. The integration of ABARE–BRS farm survey data with other statistical collections at the analysis stage is usually at an aggregate level due to confidentiality issues and the lack of common linking variables. However, there have been incidences where linking has been done at the unit level for analysis purposes. Examples include the linking of farm survey data with wool sale data or with grain sale data (Gleeson et al. 1993 and Lubulwa et al. 1994).

The population list used to design the surveys is provided by the ABS under specific parliamentary legislation. This base list is drawn from the Australian Business Register. Considerable maintenance of this list by the ABS makes it suitable for ABARE–BRS's purposes. Maintenance includes integration with the Agricultural Census or Survey, efforts to delete duplicates and allocation of ANZSIC to each unit on the frame.

For most of its surveys ABS provides ABARE–BRS with 'benchmark variables', that is, estimates of populations and physical characteristics for specified groups of farms. For example, total area operated, area sown to specific crops, total sheep and beef numbers at 30 June are derived from ABS surveys or Census. From these variables ABARE–BRS is able to construct the sample weights, such that the weights sum to the 'known' population, and the weighted sums from the sample of the relevant physical characteristics match the 'known' totals for that group of farms.

It is because of the accurate frame and benchmark variables that are derived from the ABS agricultural census or large scale surveys that ABARE–BRS can employ relatively low sample sizes.

Integration of data from other non ABARE–BRS sources can either occur at aggregate level or unit level. The example below outlines the analysis of the impact of farmers' expenditure on employment in regional centres of Australia using data from ABARE–BRS farm surveys and surveys conducted by the ABS.

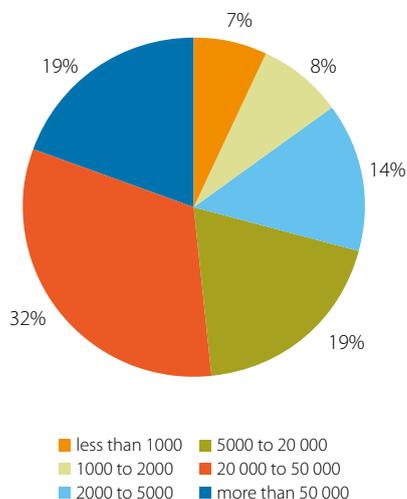
## An example

An analysis of the impact of farmers' expenditure on employment in regional centres was conducted in 2000 based on a supplementary survey to AAGIS conducted in 1999. The analysis drew on a number of statistical collections including:

- Information on the expenditure patterns collected as part of the 1999–2000 AAGIS
- Population data obtained from the 1996 ABS Census of Population and Housing
- National household expenditure data from the 1998–99 Household Expenditure Survey conducted by the ABS.

As part of the ABARE–BRS farm survey, farmers were asked to estimate the proportion of their expenditure on certain farm and household goods and services spent in their local town and regional centre. Farmers' expenditures in towns they identified as their places of expenditure were aggregated to represent expenditure patterns for the whole population of broadacre farmers.

## 1 Larger towns attract a higher proportion of total farm expenditure

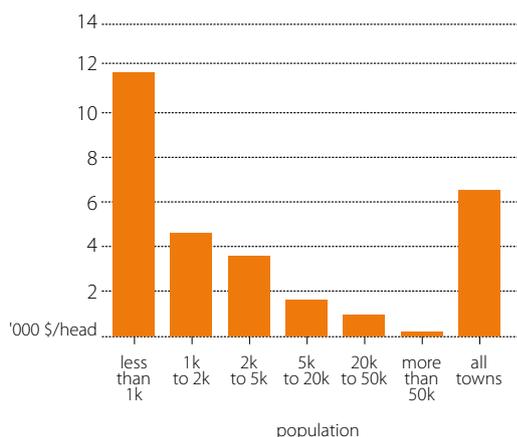


Population data obtained from the 1996 ABS Census of Population and Housing were used to divide the towns which were nominated by farmers into six size groups (based on the number of people in the town). A share of total expenditure by farmers, in each town size category, was estimated to establish where most farm expenditure occurred. Results from this analysis indicated that in aggregate most farm expenditure occurred in larger towns. Small towns with less than 1000 people and towns with between 1000 and 2000 people each attracted less than 10 per cent of total expenditure by broadacre farms (figure 1). Towns with between 5000 and 20 000 people attracted only about one fifth of expenditure. Centres with more than 20 000 people attracted over half of expenditure by broadacre farmers.

To analyse the importance of farm expenditure to country towns, aggregate farm expenditure for each town was divided by the total population of that town to derive expenditure per town resident. *[Expenditure per person in rural areas = weekly expenditure per rural household x number of rural households x 52 weeks / number of persons in rural areas.]*

Results showed that, although in aggregate most expenditure occurs in larger towns, the economies of small towns are highly dependent on expenditure by broadacre farmers. There was a strong inverse relationship between the size of a town and the level of expenditure by farmers in the town economy. The larger the town, the lower the farm expenditure per town resident (figure 2). Total expenditure by farmers ranged from around \$A200 (US\$126) per resident per year in large towns with more than 50 000 people to \$A12 000 (US\$7560) per resident per year in very small country towns with less than 1000 people (figure 2).

## 2 Total farm expenditure per town resident



Expenditure per town resident was then used to indicate the importance of farmers' expenditure in each town's economy. It could otherwise be interpreted as a proxy for farm share of total expenditure in each town. In turn, it provided an indication of the reliance of each town's employment on the farm sector.

Australia's GDP per person in 1998–99 of \$A31 400 (US\$19 782) was used to estimate the economic contribution of farmers' expenditure (ABS 2000). Assuming that, at best, economic activity per resident in small towns is as high as Australia's GDP per person, then farm expenditure in small towns was at least one third of the economies of small towns. That is, the economies of small towns, those having less than 1000 people, were the most highly dependent on farms, highlighting the importance of broadacre farming on employment in smaller towns. This analysis, including further analysis on the impact of farmers' expenditure on population growth, are detailed in Levantis (2001).

# Improvements and lessons learned

The success of ABARE–BRS farm surveys has depended on a number of elements in addition to the use of high quality population lists and integration of pre-existing data in sample weighting procedures. The most important of these have been:

## Access to reliable financial information for farm businesses

The collection methodology used in farm surveys needs to account for differences in the availability of records from survey cooperators without creating biases against farms with few records. Currently a high proportion of Australian farms maintain detailed financial records on-farm, most on computer based farm accounting systems. However, not all farmers maintain high quality records.

To overcome these difficulties, data collection methods used by ABARE–BRS surveys have historically incorporated records available on-farm and additional records held by accountants, marketing organisations and financial institutions. Historically, cooperating farmers were requested to sign documents authorising ABARE–BRS to access these records for survey purposes. Prior to 2000 access to detailed farm financial records was obtained via this authorisation process for the majority of farms. On-farm interviews collected mainly physical information, production, social and management data. Financial estimates were also obtained on-farm, but detailed financial data, sales data, debt and valuation data were mainly accessed via the authorisation process.

The introduction of a Goods and Services Tax (GST) to Australia in 2000 revolutionised on-farm record keeping as the majority of farm businesses moved to computer based accounting systems on-farm and most farms were required to report aggregate financial transactions on a quarterly basis. This has resulted in a high proportion of farmers having up to date financial records throughout the year and has greatly improved data collection via on-farm interview.

## Cooperation of farmers

Participation in all ABARE–BRS surveys is voluntary which can potentially result in response problems, particularly in relation to sensitive financial data. ABARE–BRS works closely with farmers and producer organisations and has built trust with the farmers through stringent adherence to maintaining the confidentiality of collected data. Confidentiality of the data is maintained by ABARE–BRS's policy of not releasing unit level data to external agencies or people, and being sensitive about the minimum sample size from which any published estimates are derived. Additionally, access within ABARE–BRS to the names and addresses of respondents and unit level data is restricted to those officers for whom access is an operational necessity. To further maintain the confidentiality of respondent information ABARE–BRS is required to return the frame population list and supporting information to the ABS as the surveys have been completed.

Maintenance of a high public profile by ABARE–BRS as a provider of high quality economic analysis, information and data for the rural sector has also greatly assisted survey cooperation. Providing a large volume of tabulated data and survey based analysis and publications free of charge, also assists in ensuring that collected data are widely used. Building trust in the ABARE–BRS surveys is a continuous process.

Respondents are not paid to participate in the ABARE–BRS farm surveys. Farmers cooperate mainly out of the desire to make available factual information to describe their circumstances and the circumstances of their industry and region for policy makers and the public more generally. To acknowledge the cooperation of farmers and, particularly the time given by farmers to providing data, ABARE–BRS provides each survey respondent with a detailed financial performance report for their farm business that includes benchmark data for their region. All survey respondents are also provided with major publications presenting the farm survey results.

ABARE–BRS is very conscious of the response burden. As a result the core questionnaire is revised annually to ensure only those data items that are essential are collected, and the package of supplementary surveys added to the main collection is constrained by the overall response time. This assessment is also guided by the Statistical Clearing House.

## Collection and analysis

The use of regionally based survey collectors employed on a contract basis has reduced collection costs, particularly in view of the large distances involved in rural Australia. This approach also assists in maintaining survey cooperation since most of the regional field officers are farmers themselves which helps them relate well to the respondents.

Computer assisted collection and capture methods have been adopted for all surveys since 2002–03. This collection methodology is particularly useful in enabling substantial data editing to occur at the collection stage when farmers are available to answer queries that may arise.

ABARE–BRS uses laptop computers to collect survey data from cooperators. These data are entered into a Microsoft Access program. The collected data are then compressed, encrypted and emailed back to central office for analysis.

Recent innovations to the collection programs have resulted in the ability to remotely load questions on the collector's laptop and store answers in a database. Some of the advantages include the ability to reuse questions, make changes to surveys, which requires a small data patch to be electronically sent out to collectors, automatically generate differences between surveys and modules from previous years or surveys, and automatically create a data dictionary.

SAS is the main statistical software used for processing and analysing survey data in ABARE–BRS. The advantages of using SAS are its power and versatility, its widespread use, and the resources available around the world and across the internet. It is widely used within ABARE–BRS and among other statistical agencies, and ABARE–BRS has built up a resource base and considerable expertise in SAS over many years.

# Conclusions

As in many other countries, agriculture plays a key role in Australia's economy by generating national and regional wealth. Annual farm surveys are undertaken in Australia to complement the official statistical collections for agriculture undertaken by the Australian Bureau of Statistics. The unique feature of the ABARE–BRS farm surveys is the collection of detailed farm financial data that can be integrated with associated production information, farm management practices and socioeconomic characteristics of the farm household.

The farm surveys are undertaken annually to generate data on the projected incomes of farmers across industries and regions in the current financial year. The data are also used to examine longer term issues affecting agriculture such as how farmers adapt to climate change, improve productivity and maintain competitiveness.

Other countries contemplating conducting farm surveys in a similar manner can draw on the lessons learned by ABARE–BRS. The success of the farm surveys has depended on a number of elements including: use of high quality population lists for its sample design, access to reliable financial information for farm businesses, use of computer assisted collection and capture methods, data collection primarily based on face to face interviews, the voluntary cooperation of respondents, integration of pre-existing data in sample weighting procedures and the use of skilled analysts. Coordination of data collections across government agencies via a survey clearing house has also been an important element in ensuring the quality of collections and minimising the burden on survey respondents.

Australia's experience in conducting farm surveys and estimating agricultural productivity trends has recently been shared with South Korea and Argentina. Improving agricultural statistical collections is an ongoing challenge for every country. For the ABARE–BRS farm surveys some of the challenges in the near future include further minimising response burden and achieving better integration of unit level data from various statistical collections while maintaining data confidentiality.

## Appendix 1

# Data collected from annual farm surveys

### Land

Area operated, types of tenure, additions and reductions to land area, opening and closing land values.

### Sharefarming

On and off farm sharefarming, by enterprises, crop areas and type, share proportion, quantity sold and payments received/made.

### Labour

Cooperator, managers and family labour by type, gender, age and weeks worked. Other members of the cooperators' household not working on the farm (family and non family) by type, gender and age. Permanent employees gender, weeks worked and wages paid. Wages paid to casuals and imputed cost of family labour.

### Farm family

For cooperator and spouse, educational level, percentage of farm assets owned, off-farm employment, weeks worked off farm, average hours per week, salaries/wages, other non farm income earned and social welfare payments.

### Capital

Capital inventory of plant, machinery, buildings, fences, yards etc by capital item group including leased items, age of, replacement cost and purchase price/sale price for items acquired/disposed. Estimated value of land and improvements, plant and equipment by major item groups, major types of livestock and stocks of wool and some crops. Capital appreciation is also estimated for these capital items together with the value of build-up in trading stocks of livestock, wool and some crops.

### Crops

By major crops for annual and perennial crops – areas planted, harvested, quantity produced/on hand/purchased/used or wasted/sold by type of outlet and cost of purchases and receipts from sale together with freight and other selling costs.

### Fertiliser

Fertiliser type applied, area fertilised and quantity applied by crop type or pasture.

### Irrigation

Area irrigated by crop type, pasture or lucerne, by method of irrigation and by major water source. Quantity of water used/resold and purchased.

## Livestock

For sheep, beef cattle and dairy cattle – opening and closing numbers, matings, natural increase, purchases (numbers and costs) sales (numbers, by type of sale, whether finished on grain, receipts and freight paid), deaths, losses, transfers, flock/herd composition at 30 June. Number agisted on and off farm, costs/receipts, reasons for off farm agistment and number of beef cattle feedlotted on farm/off farm. Branding and turnoff rates for beef cattle. Sheep shorn, wool produced and on hand. For other livestock (pigs, goats, horses, deer) income from sales and cost of purchases.

For dairy farms, milk sales (quantity, value and selling charges) by month for whole milk and manufacturing milk.

## Receipts

In addition to receipts from crops, livestock and wool and off-farm sharefarming, information is also collected on receipts from off-farm contracting, livestock compensation, insurance claims, other farm products, refunds from market support funds, royalties and other sources of income earned as a result of farm operations.

## Costs

Purchases of livestock, selling and marketing costs, freight, wages, sheep shearing, cost of inputs such as fertiliser, fodder, seed, sprays, fuel and oil and expenditure on contracts, repairs and maintenance, accountancy fees, rates, interest paid and other costs incurred in the operation of the farm. Depreciation of farm improvements, plant and equipment.

## Farm debt

Farm debts by loan purpose, loan type, lending source, loan term and amount outstanding at 1 July and 30 June.

## Liquid assets

Estimated value of liquid assets such as bank deposits, debentures and shares that are readily convertible to cash and are owned by or available to the farm business.

## Appendix 2

# Examples of supplementary surveys 2005-06 to 2008-09

### 2008-09

#### *Dairy technology survey*

Australian dairy farmers were surveyed with respect to their use of on-farm technologies and farm management practices. This information was collected to assist Dairy Australia to monitor industry developments and trends and to guide ongoing investments in research and development. This supplementary survey is bi-annual.

#### *GRDC cost of production survey*

The Grains Research and Development Corporation (GRDC) commissioned ABARE-BRS to collect specific unit cash costs of production data for grain crops. This cost information is critical in assessing the risks and challenges facing producers and is particularly important for the future development of research and development programs to improve the long run viability of the grain industry.

#### *GRDC farming practices survey*

ABARE-BRS was commissioned by GRDC to ask questions relating to farm management practices used by grain producers. Information was collected on management practices such as cultivation practices, stubble management, integrated management practices and use of GPS and controlled traffic farming.

### 2007-08

#### *Farm innovation survey*

Adoption of more efficient technologies and management practices is considered to be one of the key drivers in improving farm productivity and financial performance. The farm innovation survey was designed to collect data on the extent of innovative change on Australian broadacre and dairy farms over the two years ending 2007-08. Results from the innovation survey were linked to farm financial performance data with the aim to identify the characteristics of farms that made innovative changes over the period 2006-07 to 2007-08.

#### *MLA cost of production survey*

Meat and Livestock Australia (MLA) commissioned ABARE-BRS to conduct a survey of the beef cattle and the sheep industries to collect information on producers' costs of production per kilogram (live weight) of livestock produced. These data were used to calculate the unit cost of production for the sheep and beef cattle enterprise. This information is critical in assessing the risks and challenges facing producers and is beneficial in the future development of strategies and research and development programs to improve the long run viability of the red meat industry.

#### *MLA management practices survey*

As a follow up to a comprehensive survey of the adoption of management practices by sheep and beef cattle producers conducted in 2006, ABARE-BRS conducted a similar survey for Meat and Livestock Australia in 2008. Information was collected on the awareness of production costs, farm management and planning, livestock production, finishing and marketing, and the adoption of pasture and grazing management practices. The survey conducted in 2007-08 targeted broadacre producers with more than 300 sheep or 300 beef cattle. The results were beneficial in evaluating the effectiveness of a host of research and development activities implemented by MLA.

## 2006-07

### *Irrigation survey*

ABARE–BRS was commissioned to collect a range of physical and financial performance data for the 2006-07 financial year from irrigation farms in selected regions and industries within the Murray Darling Basin. The results of this economic survey were used to research various issues affecting irrigation industries, including water trading, pressures for structural adjustment, on-farm investment in irrigation infrastructure, land use returns, irrigation technology and farm productivity.

## 2005-06

### *Farm management deposits*

As part of the main 2005-06 survey ABARE–BRS collected information related to the awareness and use of Farm Management Deposits (FMD). The FMD scheme was established in April 1999 as a tax-linked, financial risk management tool for primary producers, to assist them to deal more effectively with fluctuations in their cash flow resulting from climate variations and changes in market prices. The FMD survey collected information on persons most influential on FMD decisions, patterns of deposits and withdrawals of FMDs and the importance of the FMD scheme to risk management strategies. Around 500 broadacre farms were targeted for this supplementary survey.

### *MLA management practices survey*

ABARE–BRS was commissioned by Meat and Livestock Australia (MLA) to undertake a supplementary survey of broadacre producers to gain insights into the awareness and adoption of a range of livestock management practices including: awareness of production costs, farm management and planning, pasture and grazing management practices, livestock production, finishing and marketing, and the use of transport handling guidelines. The survey targeted producers with more than 200 sheep or 50 beef cattle.

## Appendix 3

# Regionally based collectors

**Composition and make-up of collectors:** The selection criteria for recruiting field collectors include a proven knowledge and understanding of Australian agriculture, general understanding of simple agricultural financial principles (for example ability to read and understand a profit and loss statement), good organisation skills and importantly good work ethics (for example ability to work remotely unsupervised and follow defined guidelines).

**Supervision:** ABARE–BRS have field based (supervisors) called contact officers and their primary role is to provide a point of call for each of the collection officers. Each field officer is required to call his or her (supervisor) contact officer twice a week and provide regular updates on how the survey work is progressing. These updates are monitored closely to pick up any issues that may impact on a given block of work. The onus is on the individual officer to make sure the job is done as required as all future work is allocated based on work performance. Data quality issues are supervised through defined editing processes and are dealt with as they arise.

**Data entry:** ABARE–BRS interviews are conducted on farm with either the farm owner, or manager of the property (with the owner's approval). Data entry is primarily completed using an in-house developed software program called Farm Survey System (or FSS). The structure of the farming enterprises determines which questions are to be asked, for example beef only enterprises may not need the cropping module completed. Certain parts of the interview are completed on paper and then entered into the system at a later date (such as accounts information and crop details – especially if the farm is complex). This is to reduce the amount of time field collectors are on farm, and therefore reduce the response burden of the farmer.

**Data transmission:** Interviews are usually sent to the central office within 2-3 days of the physical interview. In some circumstances this may be extended if additional data are required to be collected that were not available at the original interview.

**Data entry:** A field collection officer who conducts the interview is required to enter all data relating to that farm in the Farm Survey System and then send information to the central database in Canberra.

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