Methodology Advisory Committee
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ABS Analysis Program : Bounds and Focus

Ken Tallis, Analysis Branch

email ken.tallis@abs.gov.au
phone (02) 6252 7290
fax (02) 6252 8015

PART I — EXECUTIVE SUMMARY AND QUESTIONS FOR MAC

Since early 2000, the ABS has expanded significantly the resources it devotes to analytical work. The main aims of this increased investment are to :

- fill gaps in our suite of statistical products — say, by constructing measures of socioeconomic concepts that cannot be delivered directly from our censuses and surveys, or generating estimates for smaller domains (smaller areas or subpopulations, etc.) than can be supported by our direct collections;
- enhance the quality of our statistical products.

And recently the economic and social subject matter divisions of the ABS were re-organised, partly with a view to freeing resources for additional analytical work. So it is timely for the ABS to consider what kinds of analyses it should undertake and how their relevance and quality can be assured. Two issues are prominent in our thinking :

- *The "bounds" of the ABS analysis program.* What varieties of analyses are legitimate for a national statistical agency to undertake?
- *The "focus" of the ABS analysis program.* What varieties of analyses would it be most fruitful for a national statistical agency to undertake?

➲ **In this paper, we seek MAC members' views on methodological considerations that affect the bounds and focus of the ABS analysis program.**

We would welcome members' comments on any aspect of this issue, and in particular on the following questions :

1. Are there any kinds of analytical work that would be unsuitable for the ABS to undertake? If so, how would such work be characterised?
    - o by technique? — difficult to master; novel, embryonic or still controversial; not yet implemented in standard computing packages; etc.
    - o by subject matter or underlying socioeconomic theory?
2. What kinds of analytical work would be it be most fruitful for the ABS to undertake?
3. How can we ensure that the analyses we undertake are professionally defensible — including ways of :
    - o defining the quality of our analytical products and advice?
    - o obtaining peer review and other quality assurance?
    - o making the quality characteristics of our analytical products visible?

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PART II — BODY TEXT

A. ABS Thinking about the Bounds and Focus Its Analysis Program

1 In a 1993 speech, Ivan Fellegi (head of Statistics Canada) listed eight reasons for a statistical agency's undertaking analysis :

- Some forms of analysis needed by the user community can be undertaken only within the statistical agency, because they require access to the full microdata.
- Some important, mainstream statistical products are inherently analytical constructs and cannot be delivered by classical estimation from censuses or surveys.
- Analysis can bring to light quality concerns with statistical products — and can suggest ways of addressing those concerns.
- Analysis can bring to light gaps in the information available to decision-makers — and can construct products that fill those gaps.
- Analysis can extend estimates to domains (say, geographic areas or subpopulations or subindustries or time periods) which classical survey-based methods cannot (or at least do not) support.
- Analysis can help build bridges between the statistical agency and its user community (especially sophisticated or high-end users in policy departments and the universities).
- Analysis can engender a deeper understanding of socioeconomic subject matter within the agency, and can enhance the ways in which traditional survey processes, development of classifications and frameworks and other tasks are undertaken.
- Analysis can bring to light key features of the agency's datasets and can help the agency highlight and promulgate the results of its major data collections.

2 During the past three years, the ABS has expanded significantly the resources it devotes to analytical work. We condense Fellegi's eight points into two — the ABS' expanded analytical program fills gaps in our statistical product mix and enhances and extends our existing products.

3 During their first three years, the ABS analytical groups have been working through a menu of analytical problems devised by senior managers in late 1999. We believe that we have delivered some valuable new analytical products, and have helped improve other parts of ABS outputs and processes. We have largely exhausted the 1999 menu.

4 It is a good time to take stock of whether the analytical program has been doing the right things, and whether we have been doing things right. Such a stocktake has many dimensions, and we are adopting a variety of approaches to our evaluation. For example, a project team of participants in our premier leadership program is addressing such issues as :

- The risks that an analytical program may pose to the reputation of the ABS. The status and marque that should be accorded to research papers. Clearance procedures.
- How the quality of analytical work should be managed. The role of external advisors, reference groups and peer reviewers.

See Attachment 1 for the project team's terms of reference.

5 Two issues have arisen prominently in our stocktake, and we want to obtain MAC members' views on them :

- *The "bounds" of the ABS analysis program.* What varieties of analyses are legitimate for a national statistical agency to undertake?
- *The "focus" of the ABS analysis program.* What varieties of analyses would it be most fruitful for a national statistical agency to undertake?

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6 Section (B) of the paper describes some major styles of analytical projects. A list of our past and present projects is in Attachment 2, and some of these are discussed in greater detail in Attachment 3. (We have provided this material so that MAC members can consider the issues in the light of concrete examples of work we have undertaken.) Attachment 4 outlines the ways in which the ABS decides what analytical projects to pursue.

7 Section (C) lists some analytical methodologies that we think will be prominent in our work during the next couple of years.

8 Section (D) suggests some methodological considerations relevant to defining the bounds and choosing the focus of ABS analytical work. Most prominent of these considerations is whether we have (or can acquire or co-opt) the technical capacity to deliver good quality, professionally defensible work of such-and-such a style. Attachment 5 provides examples of the peer review and advisory panels we have used to check the direction of our analytical projects and the quality of our outputs.

B. Some Styles of ABS Analytical Work

9 The discussion is grouped under four analysis themes. Attachment 2 lists some other styles of work and provides case studies.

(a) Exploiting By-product Datasets

10 Traditionally, national statistical agencies have relied largely on their own censuses and sample surveys when compiling economic and social statistics. Such direct collections will remain a major element of ABS operations. But government departments and businesses are accumulating large databanks that potentially have considerable value for statistical purposes. Their main purpose is to assist management of the department's own business operations, although some departments are now extracting performance information and other statistics. The ABS is exploring possibilities for using administrative by-product data to enhance the national statistical service.

(b) Exploiting Melded and Multiple Datasets

11 To answer some analytical questions, we must use multiple datasets. This is especially true when the question spans multiple domains (having, say, both social and economic aspects) or when we wish to develop estimates for smaller domains than a single collection will support. Statistics compiled at the whole-of-Australia level satisfy the needs of many decision-makers and researchers. But other users need data dissected by geographic areas (say, States or regions), by subpopulations (say, age-sex groups or household types) or by industries or other dimensions. It is not possible to run a census for all socioeconomic topics, owing to the prohibitive financial cost and the load on households and businesses that provide the data. And while ABS sample surveys can deliver somewhat disaggregated estimates, there is an ever-growing user demand for more and finer dissections.

(c) Model-based Data Construction

12 Policy-makers and researchers appeal to a wide variety of socioeconomic concepts, not all of which can be measured directly in statistical surveys; in many cases, the survey data must be transformed or modelled to meet users' needs. The ABS already publishes statistical measures for many concepts that arise in economic or social theory and underlie policy design — these include aggregate economic activity, productivity, inflation, income distribution, life expectancy, the energy intensity of production and so on.

(d) Analytical Products that Cut Across the Economic/Social/Environmental Domains

13 The ABS publishes a rich suite of statistical products describing major aspects of Australian life — the economy, society and environment. There is a growing demand for statistical products that draw information together, regardless of source. Such 'integrating' statistical products help decision-makers and the community form a more comprehensive view of some aspect of life; they also help researchers analyse the interactions between key variables.

Topics and Styles of Analysis — Have We Overstepped the Bounds?

14 In our opinion, none of these styles of analysis is inappropriate *per se* for the ABS. But particular projects of each style might sail close to the wind or pose a hazard to the ABS reputation for objectivity :

- When we are analysing administrative by-product datasets, our clients are often most interested in analyses that will guide the design or evaluation of policy. We want our analyses to be relevant to these important applications. We must ensure that the ABS informs policy — but does not become entangled in it. For example, our analyses of FaCS-Centrelink data carried implications regarding the efficacy of the "activity testing" of welfare beneficiaries, but our research report had to adhere to a strictly objective analysis of patterns in the data.

- When we are analysing melded and multiple datasets, we must ensure that our linking across databanks does not violate (or create the impression that we are violating) confidentiality undertakings. For example, our analyses of linked hospital-Medicare-Pharmaceutical Benefits data could not commence till they were checked for consistency with the Privacy Commissioner's guidelines.

- When we are constructing data based on a socioeconomic theory or model, we must ensure that there is broad consensus support for the model we have adopted — or at the least ensure that the dependence of our estimates on certain assumptions is completely transparent. For example, our work on human capital has adopted a very particular approach (namely, basing the value of human capital on its economic benefits) which not all commentators would accept.

- When we are doing cross-cutting analyses to inform community discussion of important socioeconomic questions, we must ensure that the ABS does not appear to have taken sides on contestable issues. For example, a few commentators have said that the term "progress" is irreducibly value-laden and that —even by providing a suite of progress indicators from which readers can choose— the ABS has taken sides.

➲ We would welcome MAC members' advice on whether there are any broad topics or styles of analysis that we should steer clear of.

C. Some Emerging Technical Themes for ABS Analytical Work

15 Much of the ABS analysis program relies on traditional techniques from mathematical statistics, econometrics, time series analysis and other disciplines. But some of the technical matters arising in the program are novel (not having been addressed until fairly recently in the literature) or at least new to the ABS (not yet having been applied to the development of the bureau's statistical products).

Multilevel analyses

16 Some of our projects are trying to construct socioeconomic measures or analyse data patterns at multiple geographic levels (say, both States and Statistical Local Areas) or for multiple units (say, both persons and households). The relationships between variables can be quite complex. For example, the probability of falling victim to a crime may be influenced both by the characteristics of individual people and by the characteristics of the areas in which they live. Moreover, the strength of the various influences may rise or fall as one changes the unit of analysis from individuals to households or as one moves from coarse to fine geography.

Longitudinal analyses (of longitudinal and quasi-longitudinal datasets)

17 Some of the socioeconomic questions we are asked to address (say, about labour market experience or the rise and fall of businesses) are analysed most naturally from a longitudinal perspective. During the past decade, the ABS has run two major longitudinal surveys — the Survey of Employment and Unemployment Patterns and the Growth and Performance Survey (also called the Business Longitudinal Survey). We continue to base some analyses on these — most recently in a joint ABS-Productivity Commission project about the influence of information technology on business performance. We also have (or may obtain) access to other databanks such as the Longitudinal Dataset of FaCS-Centrelink customers and the Household, Income and Labour Dynamics in Australia Survey. Equally, we are interested in whether it is possible to exploit data other than those gathered from a truly longitudinal survey to answer questions of a broadly longitudinal character.

Estimating for small domains

18 There is a large and growing demand for estimates that relate to smaller domains (chiefly small geographic areas, but also subpopulations and subindustries) than can be supported by ABS surveys. During the past few years, the ABS has done a good deal of work of this kind — MAC members may recall the Bell/Pfeffermann work on labour force trends and the Tanton/Jones work on crime rates for small areas.

19 We are not satisfied that we have an adequate understanding of the estimation methods that should be preferred in given circumstances. State-of-the-art methods can be complex and too expensive to apply to more than a small number of the demands that we must satisfy. So we must achieve a better understanding of how we might use to generate defensible or usable estimates in production mode — that is, whether we can achieve approximately-right answers using simpler methods. We intend to make a serious assault on these questions during the coming year, and shall submit work-in-progress papers for MAC members' comments.

Analysing by-product datasets

20 As mentioned earlier, exploiting administrative and business by-product datasets for statistical purposes is a major theme in our work program. Over the years, the ABS has developed a large array of tools (mathematics, procedures and software) to analyse datasets collected through the bureau's own censuses and sample surveys. The question arises, however, whether those tools remain appropriate when we must deal with very large by-product datasets :

- How might traditional models and methods have to change to deal with datasets that have not been assembled using ABS classifications, definitions and collection methods?

- What methods are needed to assess the quality of the datasets (and especially to detect any drift in quality as time passes)?
- How can our analyses deal with the fact that the data may be partial (because the databank covers only the customers of a department, not the whole population)
- How might traditional research strategies have to change? For example, might the bulk of the exploratory analyses be done on sampled datasets, and the preferred or final model be validated against the full dataset?

Analysing huge datasets

21 The datasets being used in some analytical projects —especially the transactional and customer databanks— can very large. Exploiting the statistical potential of such datasets may prompt some reconsideration of ABS research strategies, analytical techniques and software tools.

Analyses that take account of complex survey design

22 The sampling designs for some ABS surveys can be quite complex. When it later comes to analysis, however, many standard techniques for fitting and testing models ignore the complex sample design — in effect, it is assumed that the data have been drawn by simple random sampling. This expedient can lead to invalid inferences about the explanatory power of one's models; it may even lead us to choose the wrong model.

Advice from MAC and other experts regarding analytical technique

23 During the past year or two, we have been scouring the literature, evaluating software and running pilot projects to acquaint us with these issues. We have been building our knowledge, but do not yet have a solid or confident grounding. In some cases, the issues are still being developed or debated in the literature, and software packages do not yet embody all the preferred techniques. We shall bring papers on our research strategies and pilot projects to MAC during the coming year.

Analytical Techniques — Have We Overstepped the Bounds?

24 In our opinion, none of the techiques listed above is inappropriate *per se* for the ABS. Some other techniques that we have been asked to adopt may be sailing close to the wind — for example, applying data envelopment analysis or stochastic frontier modelling to assess the performance of government service providers. Our rule is that we will provide technical advice and will undertake objective components of the analyses, but drawing the policy implications is the responsibility of our clients.

➲ We would welcome MAC members' advice on whether any analytical techiques are so complex (or consensus on preferred technique is still so far away) that we should steer clear of them.

In our opinion, small area estimation and analysing complex surveys may fall into this category at present. But we face strong and growing demand for analyses of these kinds, so must find a way of delivering professionally defensible work.

D. (How) Can We Assure the Methodological Quality of Our Analytical Work?

25 For us, a key consideration is whether we have (or can acquire or co-opt) the technical capacity to deliver good quality, professionally defensible work of such-and-such a style or using such-and-such a technique.

26 When we prototype any new analytical product, we have three responsibilities:

- defining and assessing the quality attributes of our product
- managing our production process to assure quality
- making the quality attributes visible, so our product can be used intelligently.

Defining quality for analytical products

27 The ABS has now agreed on a standard array of quality attributes — relevance, coherence, accessibility, interpretability, timeliness and accuracy. (See Geoff Lee's paper "Making Data Quality Visible", May 2002.) During recent months, we have been reworking our guidance documents on the quality of analytical products to align with the ABS standard. This alignment is an essential but not an elementary task :

- The quality of analytical products is affected both by classical statistical processes (such as sampling) and by novel or complex transformations (such as multilevel modelling). So we must be concerned with the ways in which errors in our raw input data translate into errors in our analytical outputs. We must also be concerned with model error (choosing the wrong data transformation).

- Many of our analytical projects draw on multiple or melded datasets. Others draw on administrative or transactional databanks. The ABS is gradually building up its understanding of the statistical and business processes that generate those databanks.

Assuring quality

28 Our key strategy for assuring the quality of our analytical products has been peer review. Quality flaws may arise in analytical products for many reasons — we may use an inappropriate raw dataset or misunderstand its content or limitations; we may be ignorant of key subject matter concepts; we may choose an inappropriate analytical technique or apply it wrongly; we may misinterpret our results; and so on. It is seldom the case that a single quality advisor can steer us clear of all these hazards. So we insist that —for almost every analysis project that is prototyping a new product, and occasionally for our other projects as well— we recruit a panel of advisers and reviewers inside and outside the ABS.

29 Members of each "peer review panel" are asked to critique our plan of attack, our work-in-progress and/or our draft project report. For larger projects, we may convene a workshop or a walk-through session. It is impossible to exaggerate the value of peer review to us. The rigour of our analyses and the clarity of our interpretations have benefited greatly from comments by our internal and external reviewers. For lists of recent and current peer review panels, see Attachment 5.

30 Setting up a peer review process so we get best value from it (and distilling the key messages from a round of peer review) is an art that we are still learning. Our experience is that we derive best value from the process when the reviewer reads our project reports and the project team undertakes a structured walk through its data, methods and findings with the reviewer.

31 We have recently reconsidered somewhat our approach to recruiting external reviewers, particularly academics. Some university staff have been very generous with their time, especially if one of our projects has piqued their imagination or promises to deliver statistics that will advance their own research. We shall continue to rely on such good will and energy. But for some key analytical prototypes or for projects that involve complex modelling, we are willing to pay an academic researcher to spend, say, several days doing a thorough critique of our methods and findings.

32 A kindred scheme that we are working toward is engaging some academic experts to sit in our branch as "non-ongoing ABS employees" — each expert interacts intensively with one or two of our project teams and conducts a problem clinic for our other projects.

Making quality visible

33 Ideally, we wish all of our analytical products to be accompanied by a quality declaration and a suite of quality indicators. This would encourage intelligent use. So far, we have relied largely on making our analyses transparent — we explain clearly the input datasets that we have used, the transformations we have applied, and the assumptions on which our data treatments and transformations have relied. Where possible, we make both the datasets and algorithms available to users, but this is sometimes constrained by our need to protect confidentiality.

34 Some of our recent products have been accompanied by more thorough quality declarations. For example :

- The papers on the experimental indexes of socioeconomic status for Indigenous areas include long discussions of the attributes of the input data and an extensive analysis of sensitivity of the indexes to our methodological choices (such as choice of index components, unit of analysis, level of geography, and so on).

- The papers on household wealth include long discussions of the attributes of the input data and indicators of quality for each asset and liability class (based on a mix of hard data and judgments by ABS subject matter experts).