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NON-MARKET OUTPUT - RECENT WORK BY THE AUSTRALIAN BUREAU OF STATISTICS

Agenda item 8

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NON-MARKET OUTPUT RECENT WORK BY THE AUSTRALIAN BUREAU OF STATISTICS

National Accounts Branch, Australian Bureau of Statistics

Introduction

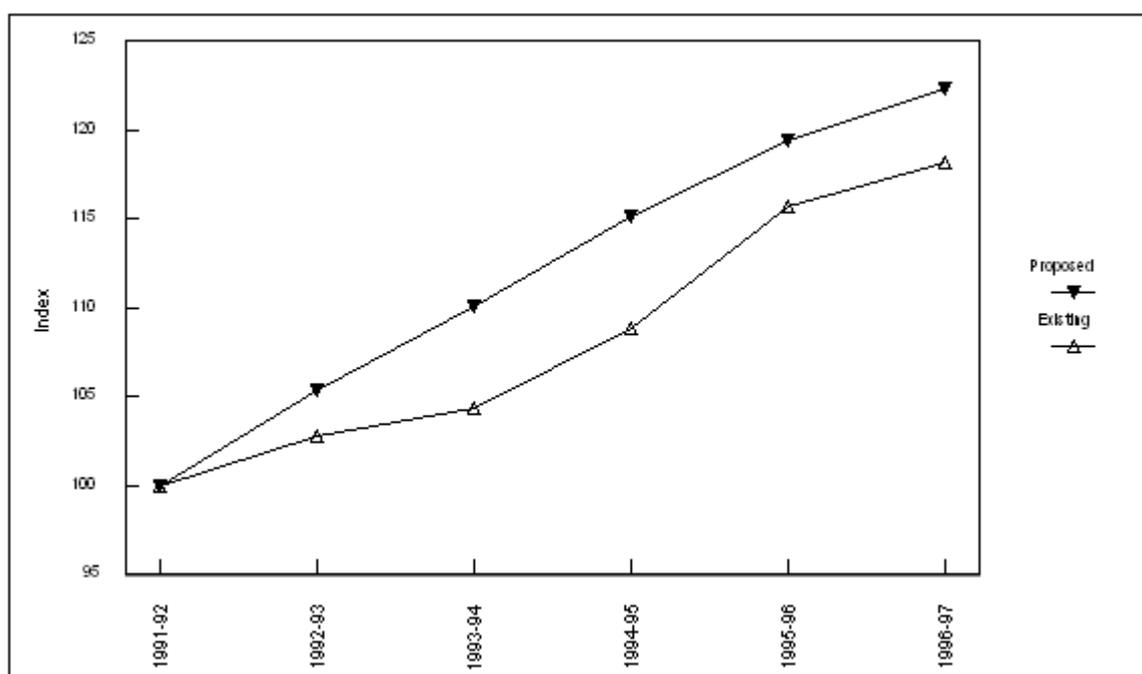
1. In 1997, the Australian Bureau of Statistics [ABS] began a research program aimed at constructing better measures of output for non-market service industries. This paper updates the report we presented at the September 1998 OECD meeting.
2. At present in the Australian system of national accounts [ASNA], the output of non-market services is generally measured by reference to the inputs used. For example, estimates of the output of government health services are derived by summing deflated estimates of the compensation of employees, intermediate consumption and consumption of fixed capital. The ABS is now trying to develop output measures that are independent of input measures for the most significant non-market services. Each investigation has three phases:
 - a) first, we construct the best measure of output volume that the available data will support;
 - b) second, we bring the output volume measure into the current- and constant-price supply-use framework that the ABS now uses to compile its national income, expenditure and product accounts;
 - c) third, we evaluate the new estimates to ascertain whether they are trustworthy enough to be introduced into the ASNA.
3. During 1997, an experimental output measure was developed for health services; recently, the new measure was brought into the supply-use system and evaluated. The project team has recommended that it be introduced into the ASNA from mid-2000. During 1998, an experimental measure was developed for government education; it is being evaluated now. During 1999, experimental measures are being developed for police services, correctional centres and the justice system; they will be evaluated early next year.
4. Although there are some outstanding issues (regarding quality change, in particular), the ABS is confident that many of the new output measures can be introduced into the ASNA next year and that they will lead to an improved understanding of aggregate economic activity and productivity.

New Output Measures for Health Services

5. In the main, the new measures for health relate to just the first half of the 1990s. The data and methods are summarised below and are discussed in greater detail in Attachment 1.

- a) The estimates of output volume for inpatient care in public acute hospitals and private hospitals have been estimated by applying cost weights to casemix data.
 - b) The estimates of output volume for psychiatric hospitals and nursing homes are based on cost-weighted patient-days.
 - c) The estimate of output volume for medical services is based on the number of “attendances” (or services) weighted by average fees charged.
 - d) The estimates of output volume for most other components (which account for around one-fifth of health services) continue to be based on input costs deflated by price indexes that are in the main output-based.
6. An annual chain weighted Laspeyres volume index was constructed from the segment output volume measures to arrive at an output volume measure for the Health services industry. (See Figure 1.)

Figure 1: Output Volume Measure - Health Services

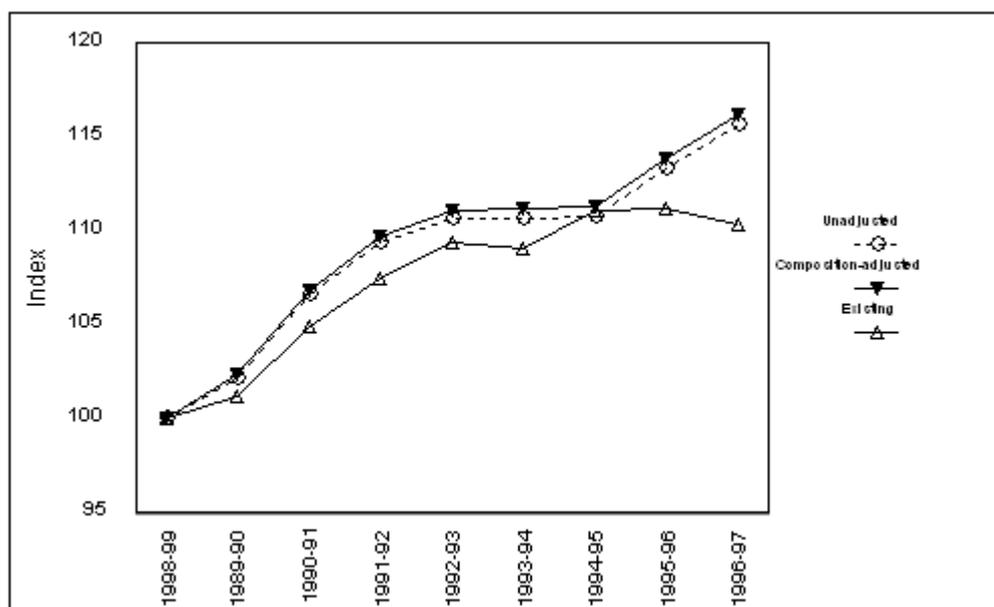


7. Because the data (especially the casemix data for acute care hospitals) are dissected fairly finely, the ABS believes that the new aggregate output measure captures an appreciable amount of quality change. But it could be failing to detect some quality change occurring *within* Diagnosis-Related Groups, and there may be some undetected quality change in the non-hospital segments of the industry. There are prospects for assessing quality change more thoroughly in the future, and perhaps for introducing quality adjustments into our output measures. For example, the *First National Report on Health Sector Performance Indicators* foreshadowed the development of quality-of-care and patient-satisfaction indicators as part of the National Hospitals Outcome Program -- this is a “top-down” approach. Also, Jack Triplett of the Brookings Institution has been researching the measurement of quality change in health care. He is taking a “bottom-up” approach, examining in detail the changing effectiveness of treatments for particular conditions, such as cardiovascular disease.

New Output Measures for Government Education

8. The ABS has developed experimental output measures for most major segments of education, including primary and secondary schools, universities and vocational training institutions. The data and methods are discussed in Attachment 2.
9. An annual chain Laspeyres volume index has been constructed from these to arrive at an output measure for government education. (See Figure 2.) The output index for schools is based on the number of students. The higher education output index has been compiled in two ways -- an "unadjusted index" based on the number of students and an "adjusted index" which weights student numbers according to the costs of the courses in which they are enrolled. The vocational education index has also been compiled in two ways -- the number of student-hours, and student-hours weighted by an academic progress rate.

Figure 2: Experimental Output Volume Measures - Government Education



Data for the "existing" series have been approximated by deflating expenditures.

At present, the output estimate for higher education does not include research output, although the ABS has experimented with some methods for doing so.

New Output Measures for Police, Corrections and Justice

10. The ABS has been developing new output measures for police services, correctional institutions and the justice system. Although the work has not yet been completed, there appear to be prospects of obtaining usable measures of volume for the major activities of the major institutions. Attachment 3 provides more details of the work done so far.

Output Measures for the Remaining Non-Market Services

11. When the data construction and evaluation for health, education, police, corrections and justice are complete, the ABS will turn its attention to the remaining non-market services, such as welfare, public administration and defence. Together, these account for roughly one-third of total non-market output.

12. There is some prospect of measuring output volume for services that are consumed by individuals. Caseload counts, possibly weighted according to differential servicing costs, may be a good starting point for services such as the administration of social security payments, the processing of taxation returns, and the like. There is less prospect of constructing output measures for services such as defence and policy advising that are collectively consumed. Even for these, however, we acknowledge that some statistical agencies have found proxy measures that they judge to be usable.
13. There are several options for dealing with services for which we cannot obtain a new measure of output volume. We might continue the traditional method of input deflation, or we might impute to the remaining services the same productivity growth as is observed in health, education and the like.

Issues for Discussion

- a) What progress have countries made in developing output-based volume measures for non-market services?
- b) How much of this work has actually been reflected in changes to methods used to compile the national accounts?
- c) What techniques, if any, are being considered for measuring quality change? In what areas is it seen as particularly important to reflect quality change in the output measures?

ATTACHMENT 1 OUTPUT VOLUME MEASURES FOR THE HEALTH SERVICES INDUSTRY

Institutional arrangements

Health services in Australia are financed mainly by government, although the services are delivered by both general government and private sector units. Medical practitioner, paramedical and dental services are in the main provided by the private sector, although the government exercises a substantial degree of control over fees charged by medical practitioners because it determines the level of refund or “benefit” paid under the universal Medicare scheme.

Hospital services are provided under more complicated arrangements. Around 80 per cent of hospital services are delivered by government hospitals, the remainder being delivered by the private hospital system. The government system provides services to both full fee paying (“private”) patients and non fee paying (“public”) patients, the latter predominating. Fee paying patients have certain advantages such as right of choice of medical practitioner. The private hospital system only provides services to full fee paying patients.

Nursing homes for the long term ill and infirm are a significant sector of the Australian health system and are institutionally separate from hospitals.

Existing approach to volume estimation

Volume estimates for the output and final consumption of health services have been derived by deflating the current price estimates using a combination of input and output price indexes. The predominant hospitals and nursing home component is deflated using a fixed weighted composite index of wage rates, professional fee rates and price indexes for pharmaceuticals and other intermediate inputs plus consumption of fixed capital.

The remaining health services components – medical practitioner, dental, optometry, paramedical and veterinary services – are deflated using related consumer price indexes and government administrative data.

Proposed new volume estimates

The ABS proposes to adopt new volume estimates based on output indicators for hospital and nursing home services, medical services and ambulance services. These components together comprise around four-fifths of the output of the Health services industry. The remainder – dental services, optometry and optical dispensing, paramedical services and veterinary services – will continue to be derived using deflated inputs because the price indexes used for deflation are generally output-based. No further comment will be made on these estimates in this paper. All estimates have been prepared in a supply-use framework.

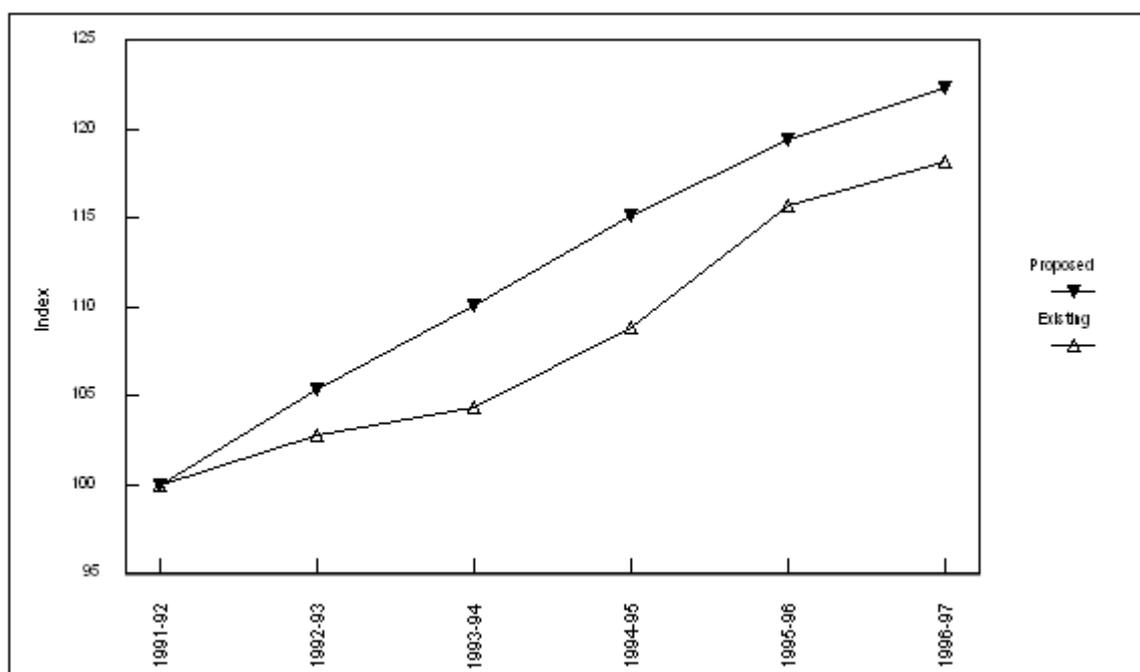
Volume estimates using the output indicator approach were derived using administrative by-product data from the Medicare system. A brief overview of the data and methodology, together with a comparison of results with existing input based estimates, is presented below.

These data are not without some shortcomings. In particular, it has not been possible to capture quality change, except to the extent that the switch to new improved procedures is reflected in the detailed source data. Nevertheless, the ABS is confident that the new methodology represents a substantial improvement over the existing estimates. They provide a basis for further development as techniques for quality adjustment become available in the future. Also, the usual amount of care has to be taken with the use of administrative by-product data because it is often collected with a different purpose in mind than time series analysis. A number of adjustments were required to put the data on a consistent basis. Where data are used for funding purposes there is a recognised tendency for “gaming” by service providers, particularly in the initial years of a program - some of the gaming may result in increased output; some may result merely in changes to the reported performance indicators. However, the ABS expects that any upward bias resulting from this effect would be outweighed by the downward bias from the failure to fully capture quality change.

Total health services industry output

An annual chain weighted Laspeyres volume index was constructed from the following components - Hospital and nursing home services, medical services, Dental services, Optometry and optical dispensing; health services nec, ambulance services, veterinary services and consumption of fixed capital by general government.

Figure 1.1: Output Volume Measure - Health Services



Hospital and nursing home services

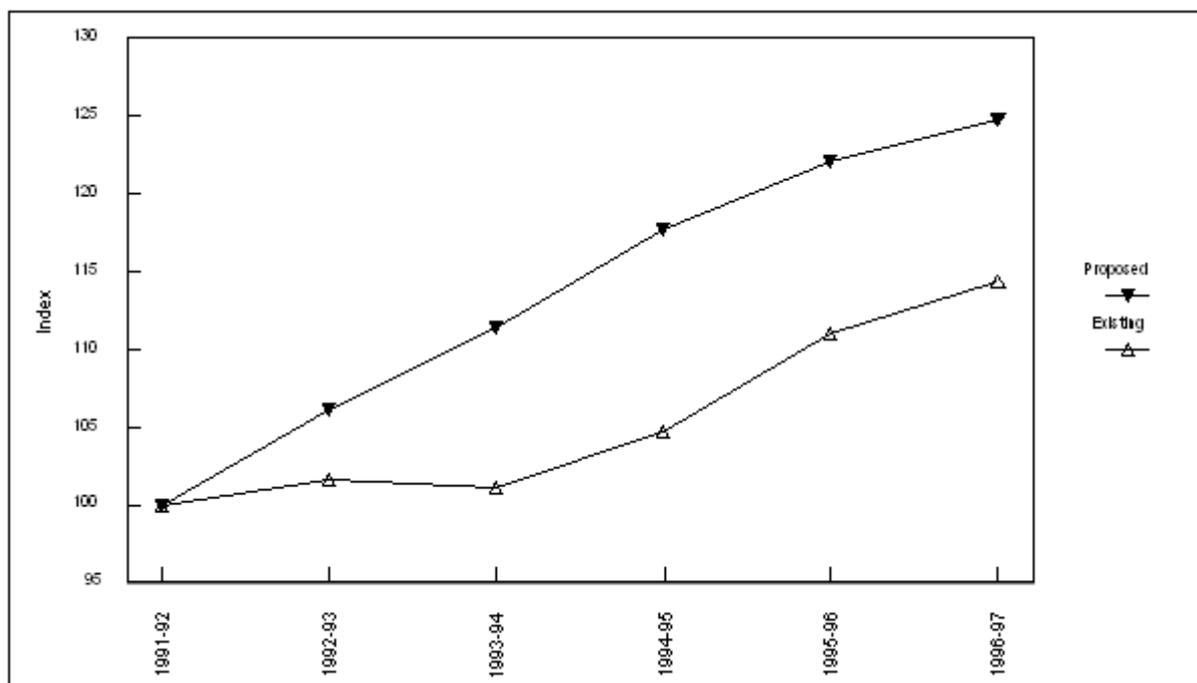
The Department of Health and Aged Care collects detailed case data from all government and private “acute care” hospitals in accordance with the Australian National Diagnostic Related Groups Classification (AN-DRGs). These data are used for funding the government hospital sector. The current version of the classification consists of 667 separate diagnostic related groups. Volume is represented by the number of episodes (separations) for each group. Data are available annually from 1991-92 for government hospitals and from 1994-95 for private hospitals. (Satisfactory separations data were available from other sources to extend the private hospitals series back to 1991-92.)

Detailed cost studies have also been undertaken by the Department of Health and Aged Care for 1994-95 and 1996-97. These were used to construct average cost weights per separation for each diagnostic related group. Because of changes in the methodology used to derive the costs data between the two studies, a fixed weighted Laspeyres type volume index with base year 1996-97 was constructed back to 1991-92. It is expected that annual chain weighting of AN-DRGs will be possible in the near future when consistent costs data become available on an annual basis.

Outpatient episodes provided by hospitals remain a problem. Because data of satisfactory quality are not available, outpatient episodes are currently excluded from the index. This is not expected to have an appreciable impact on the quality of the overall estimates.

Nursing home patient days are classified under a Resident Classification Instrument (RCI) - a five category rating system which measures the level of care required by a patient. Patient days are considered by the ABS to be an appropriate output volume indicator for this sector because the emphasis is on long term care, not cure or rehabilitation. Data is also available on the cost per patient per day for each of the five RCI categories (this cost is based on a care component and an infrastructure component). An annual chain weighted volume index was constructed using these cost weights.

Figure 1.2: Output Volume Measure - Hospitals and Nursing Homes

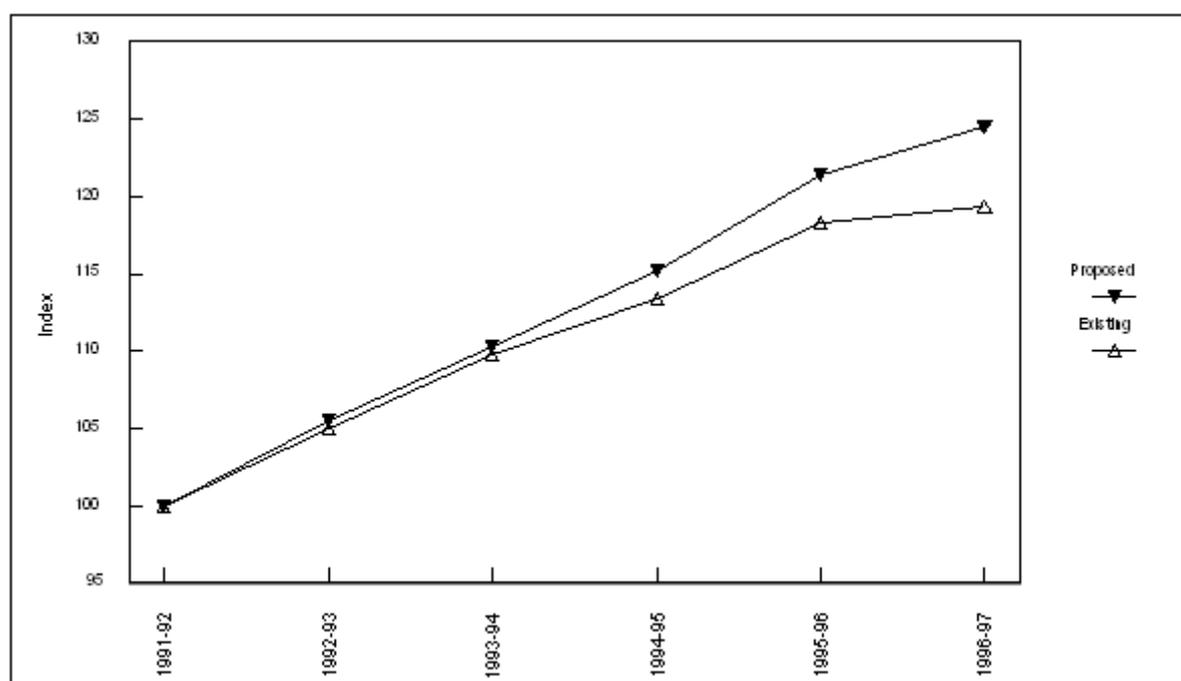


Medical services

Detailed quarterly data are available on the operation of Medicare Australia's universal health insurance system. The indicator used to construct the volume index is "attendances" or "number of services", weighted by average fees charged. As the Medicare schedule used to determine claims runs to many thousands of different medical services, the challenge was to choose a sufficient level of detail that was operationally feasible but also adequately captured the effect of product substitution over time. Some analysis of compositional change is presented later in this attachment.

A chain volume index of medical service was constructed back to 1984-85, although estimates will only be published from 1991-92, consistent with data available for hospitals.

Figure 1.3: Output Volume Measure - Medical Services



Ambulance services

The output indicator used was total number of ambulance call outs. (A chart has not been provided because existing estimates are not separable from a much larger aggregate.)

The impact of compositional change

The medical services industry has been characterised by significant improvement over time in technology and medical techniques. The take-up of these improvements is hastened by the supply driven nature of the industry - a high level of health care is considered a right of all citizens and is funded by social insurance schemes.

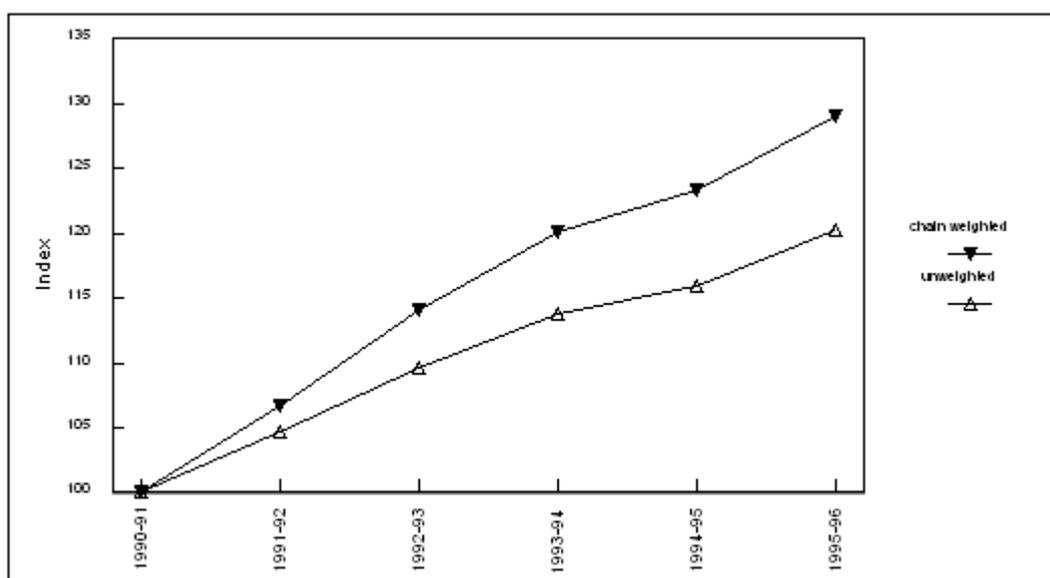
An analysis of detailed Australian data for medical services shows that the level at which chain indexes are constructed can have a significant impact on output volumes for the industry. Chain weighting at the more detailed level captures more substitution between medical services products over time. Normally it could be expected that chain weighting would result in a lower growth in volumes than base period weighting as consumers substitute lower priced products for higher priced products. However the reverse can be true for medical services where health needs rather than price can be the major determinant of demand.

The commonwealth government provides a prescribed Medicare benefit for services listed in the Medicare Benefits Schedule. This schedule contains around 5000 separate items and is reviewed constantly to reflect current medical practice. For statistical purposes these items are also aggregated to higher level groups reflecting the major segments of the industry - general practitioners and nine separate specialty services.

General practitioner (GP) services

There are currently around 100 separate service items in the Medicare Benefits Schedule for general practitioners. Chart 1.4 plots an index derived as the aggregate number of attendances and an index where the number of attendances for each of the 100 items are chain weighted by fees charged for each of the items.

Figure 1.4: Output Volume Measures - General Practitioners



The divergence between the chain weighted and unweighted index could reflect both differential growth in differently priced services and changes in the prices of services. In this instance, the major factor is relatively stronger growth in the number of higher priced services. In particular:

In September 1989, the government introduced vocational registration for GPs, whereby GPs who continued their medical education could claim at a higher rebate level. It takes three years for a GP to gain this extra status, and to maintain it they need to participate in ongoing training equivalent to about 60 hours per year. Hence, over time there has been a drift to the higher price service as more GPs have become vocationally registered. There has been some drift towards longer (higher priced) consultation times.

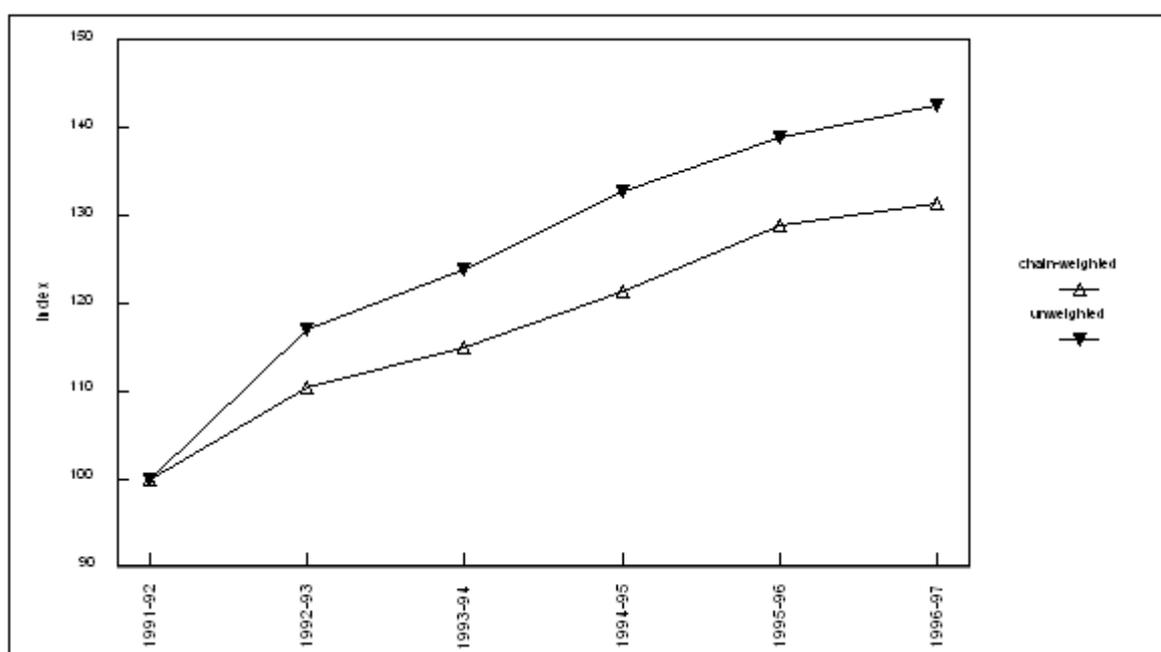
The ABS has interpreted the drift to these higher priced attendances as a quality improvement, and therefore a legitimate volume change rather than a price change, although we have no way of measuring whether the quality of output has actually improved. The impact of the first effect is particularly apparent in the series shown above because of the timing of the introduction of the new scheme. It only has a minor impact on the growth of the index after 1993-94.

Medical specialty services

This category includes the various branches of specialist medicine such as obstetrics, anaesthetics, pathology, diagnostic imaging and surgical operations. "Number of services" indexes for nine separate categories have been chain weighted using fees charged. Some further important compositional effects are evident from the pathology services industry in particular.

Pathology services have undergone substantial technological and price change in recent years and are characterised by falling unit prices and a rapid growth in the number of services provided. This affects the chain weighted index for specialist medical services in the opposite way to that described for general practitioners above, i.e., it shows slower growth than the unweighted index.

Figure 1.5: Output Volume Measure - Medical Specialty Services



Most of the observed divergence in Figure 1.5 results from pathology services. It is clear from this that a certain level of disaggregation is necessary to capture the main effects of product substitution in the volume index. The ABS has recently obtained more detailed time series data for each of the broad specialty categories. Further analysis will be required before it can be determined if it is worthwhile chaining at a more detailed level than the existing nine categories.

Other health services

Significant compositional effects have also been observed in the estimation of nursing home output volumes. The unweighted index (based on total number of patients) grew only 2.6 per cent between 1991-92 and 1996-97 whereas the chain weighted index (based on number of patients in five different cost categories) grew 12.6 per cent over the same period. This difference is largely attributable to changes in the institutional structure of the industry - changes in government funding arrangements resulted in patients requiring minimal care being shifted to aged care hostels, leaving the higher care (higher cost) patients behind.

No analysis has yet been done on the impact of compositional change in hospital services as a consistent time series of cost weights are not yet available.

ATTACHMENT 2

OUTPUT VOLUME MEASURES FOR GOVERNMENT EDUCATION

Institutional arrangements

Education in Australia is financed mainly by government; over 80 per cent is financed by direct government outlays or government grants. School education is provided by a mixture of government and non-government institutions; about one-quarter of primary school pupils and one-third of secondary school pupils attend non-government schools. Higher education and vocational education are provided almost exclusively by government institutions.

New volume estimates

At present, volume estimates for the output and final consumption of education are derived by deflating the current price estimates using a combination of input and output price indexes.

The ABS is assessing experimental estimates of output volume for government primary and secondary schools, higher education, and vocational education. These segments together comprise more than 90 per cent of the output of government education services. Output estimates for the remainder including such services as pre-schools and "other education" may continue to be derived using price deflators. As has already been done for health services, the estimates of education output will be brought into the ABS's supply-use framework.

The experimental volume estimates have been derived using administrative by-product data (chiefly relating to the number and mix of students). A brief discussion of the data and methodology is presented below.

The most serious shortcoming of the administrative data is that they largely fail to capture changes in the quality of education (except to the extent that it is reflected in changes in the mix of students and courses in higher education). However, there are prospects for better measuring quality change in the future, using the results of standard testing regimes.

Primary and secondary schools

The output measure for school education is based on a data collection conducted by the ABS. Student numbers have been converted to an EFTSU (equivalent full-time student unit) basis.

Figure 2.1: Experimental Output Measures - Government Primary Schools

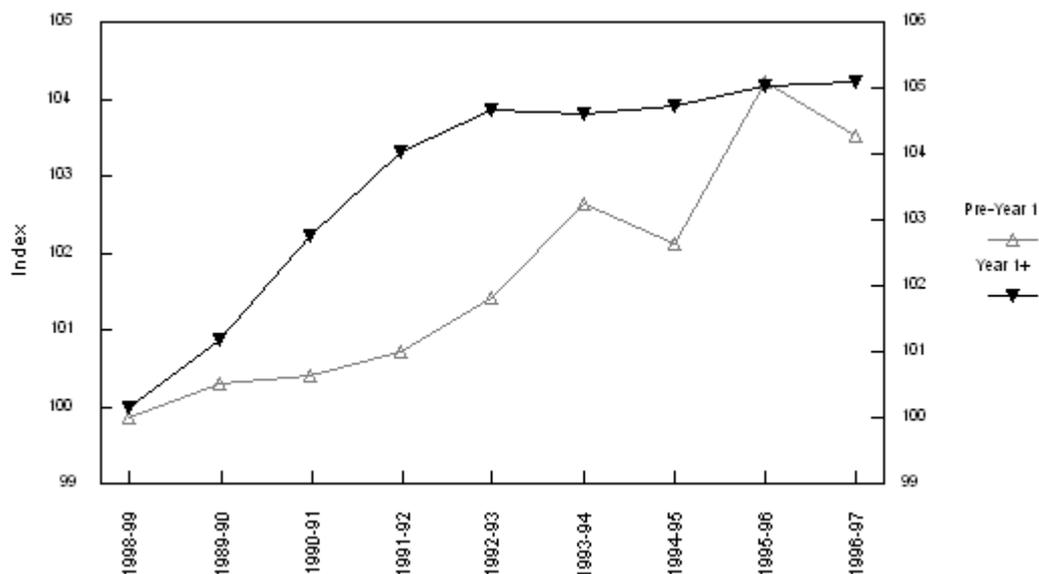
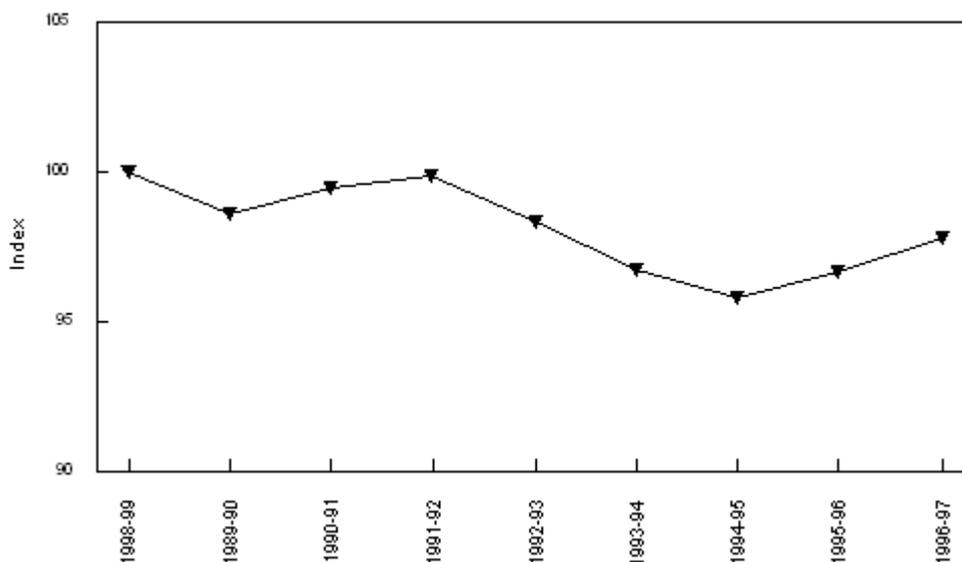


Figure 2.2: Experimental Output Measures - Government Secondary Schools

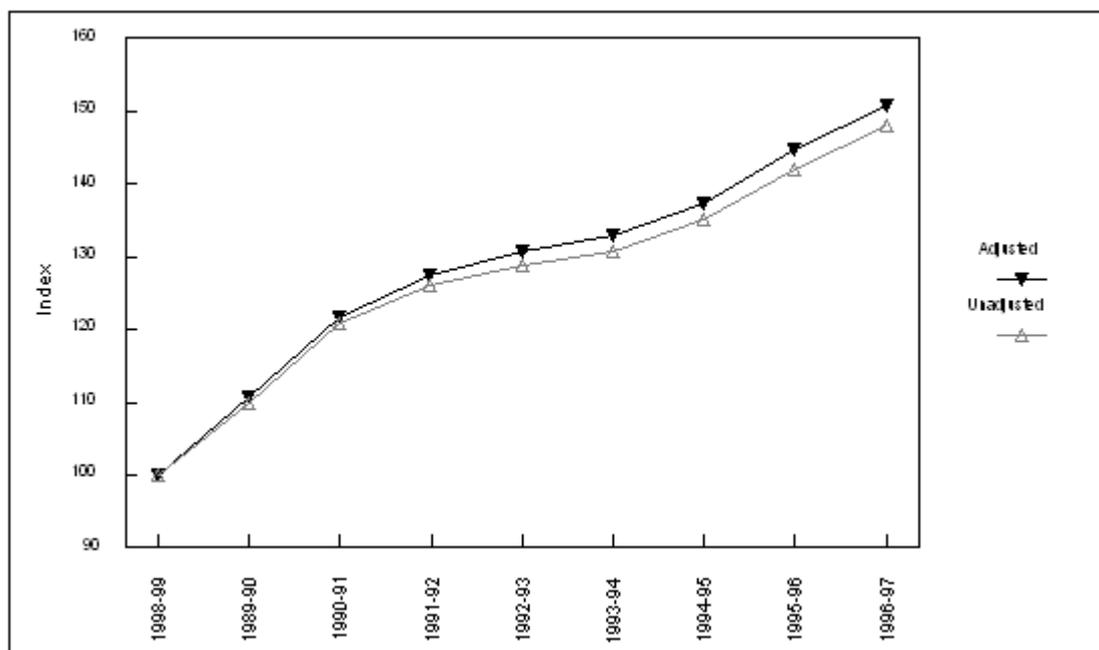


Higher education

The output measure for higher education is based on a data collection conducted by the responsible government department. For the unadjusted output index, student numbers have been converted to an EFTSU basis. For the composition-adjusted index, student numbers have been weighted according to the Higher Education Contribution Scheme charges levied on students. HECS is a three-tiered charging scheme: the lowest charge is paid by students in courses such as humanities and social science; and the highest charge is paid by students in courses such as medicine, dentistry and law. This three-way

dissection is fairly coarse, but the adjusted index does capture some compositional change. (See Figure 2.3.) The ABS is also examining other possible weighting methods, including one based on a matrix of relative teaching costs.

Figure 2.3: Experimental Output Measures - University Teaching Services

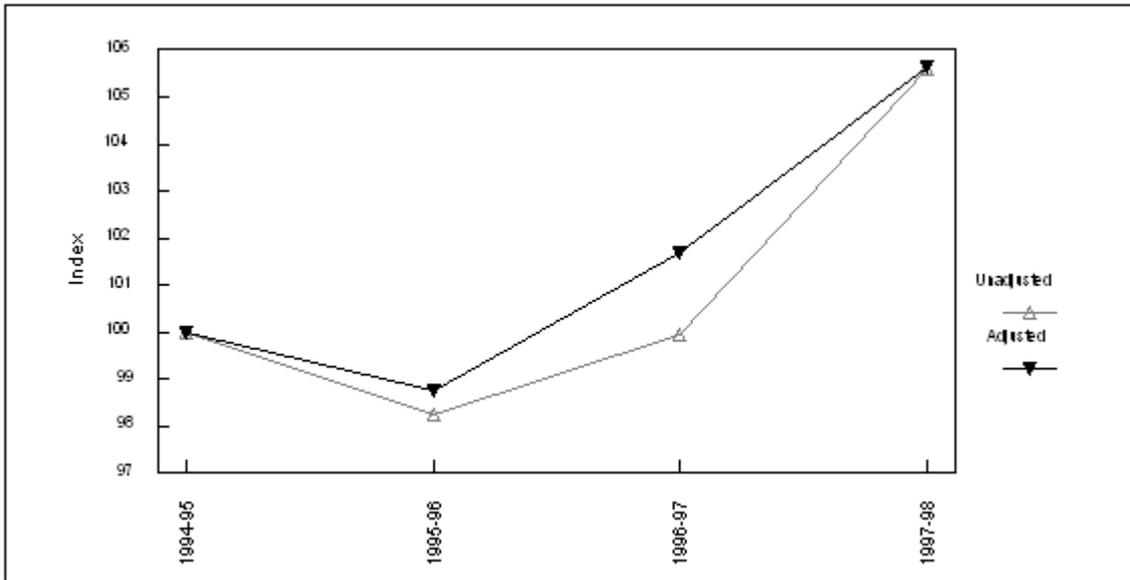


At present, the output measure for higher education does not include research. The ABS has experimented with using a weighted number of publications (such as books and journal articles) as a research output measure; but we are concerned about the omission of some outputs (such as patents, software and designs) and the absence of an adjustment for the quality of publications. More investigation is needed.

Vocational education

The output measure for vocational education is based on a data collection conducted by the responsible government department. The unadjusted output index is based on the total number of student-hours; this measure is superior to the number of students, because the workload and cost vary greatly from course to course. For the quality-adjusted index, student-hours have been weighted according to the “module progression rate”; this is a measure of the rate of successful completion of study units. Owing to a fairly high rate of failure and late withdrawal (counting as failure), the adjusted number of student-hours is lower than the unadjusted number, but movements in the two series are similar. (See Figure 2.4.)

Figure 2.4: Experimental Output Measures - Vocational Education



Quality Adjustment

The major shortcoming of the experimental output measure for government education is its failure to reflect changes in the quality of school education. The ABS has examined the literature relating to the effect of staff-student ratios on quality, but is not persuaded that this provides a defensible basis for constructing a quality-adjusted output estimate. Recent developments in standardised testing of school student competencies (such as the Scholastic Aptitude Test and the OECD Student Achievement Indicators) offer some prospect for future work on this problem, but the time series will be too short for statistical work till some years hence.

ATTACHMENT 3

OUTPUT VOLUME MEASURES FOR THE POLICE, CORRECTIONS AND JUSTICE

Institutional arrangements

In Australia, these services are both financed and provided mainly by general government. The first segment includes police and security services. Correctional centres are provided by government, except for a few privately run prisons established in recent years. The justice system is financed and provided by government.

Developing new volume estimates

Volume estimates for the output and final consumption of these services have been derived by deflating the current price estimates using input price indexes.

The ABS is developing experimental output volume estimates for each of the three segments. Although the work is well advanced, final choices of the preferred output indicators have not yet been made.

Police services

This segment includes the Federal and State police services and specialised agencies such as the National Crime Authority and Bureau of Criminal Intelligence.

Administrative by-product data on major police activities include the number of cases (initiated, in process and completed during the reference period), the amount of time spent on traffic and road safety duties, time and distances travelled for road patrols and so on. The preferred approach to output measurement may be to calculate a chain expenditure-weighted index of caseloads across the range of activities. Several States have undertaken detailed surveys of police activity, and these are providing valuable guidance to our output estimation; similar surveys are planned by other States.

Data on other police activities and on the specialised agencies are more sparse. Thus it may be necessary to retain the input-deflation approach for some parts of this segment.

Corrective centres

This segment includes high- and low-security prisons, remand centres, periodic detention centres and non-custodial corrections such as home detention and community service orders.

Administrative by-product data are available on the number of prisoner-days for eight categories of corrections. The preferred output measure may be the number of prisoner-day chain weighted according to expenditures.

Justice system

This segment includes the civil and criminal courts, the High Court (which resolves constitutional matters), the Family Court, other tribunals, dispute resolution agencies and special commissions.

For the civil and criminal courts, administrative by-product data are available on the number of cases (and, for some jurisdictions, the number of sitting hours). Even within courts at the same level in the hierarchy, the cases can be very heterogeneous, and the ABS is considering a two-stage chain weighting procedure (perhaps weighting the types of cases within a court according to average time taken per case or according to some other indicator of case complexity, then weighting the output indexes across courts according to expenditures).

Data for the High Court and other specialist agencies is much more sparse, and it may be necessary to retain the input-deflation approach for them.