Appendix C Measuring the output of service industries

This appendix summarises the methods that Statistics New Zealand uses to measure the output (value-added) of service industries. It describes the challenges and complexities involved in this measurement.

C.1   Service industries' value-added

An industry's productivity is calculated by dividing its value-added by its inputs.[1] Value-added is the value of an industry's gross output minus the cost of inputs provided to it by other industries. [2] National accounts refer to these inputs as intermediate consumption, in opposed to final consumption of goods and services by consumers.

There are formidable challenges in measuring industry productivity. The difficulties in measuring labour and capital inputs are similar for service and other industries and are not covered in this appendix. Instead, the focus is on the measurement of output, which is generally more difficult for service industries than for goods industries (Djellal & Fallouj, 2008).

The measurement of services output presents a number of challenges:

- Output can be difficult to define. Service outputs are often intangible and can vary between customers as the service is adapted to meet their specific needs. For instance, the number of haircuts may not be a good indicator of a hairdresser's output, as each haircut is different.

- The quality of service outputs such as financial advice may be difficult to specify.

- Services vary significantly in quality and other dimensions, making measurement and aggregation of data difficult. For example, there is not standard legal advice that can be quantified and aggregated.

- Ill-defined outputs mean that it is difficult to measure innovations and quality improvements. This is a particularly significant issue in rapidly innovating service industries, such as information media and telecommunications.

- The effects of service outputs can be felt over time. For instance, the immediate service output of a garage mechanic is the tasks they perform on a vehicle, but the longer term output is the consequence of those tasks for vehicle functioning. This adds to the challenge of measuring quality.

- Output can be co-produced by consumers of services. Customers can contribute to the output of services such as by giving guidance and feedback to service providers and through providing some self-service.

- Industry diversity. There are numerous service sub-industries and they vary substantially (Djellal & Fallouj, 2008). Average measures for an industry may give a misleading of its characteristics, for example reporting an average level of value added for an industry made up of sub-industries with very high and very low value added.

C.2   International standards

International statistical bodies provide standards for output and productivity measurement. In particular, the United Nation's Statistics Division's *Fundamental Principles of Official Statistics* provides the basic framework for official statistics in member countries, including New Zealand (Statistics New Zealand, n.d.

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[1] Industry value-added rather than industry gross output is used to estimate industry output. This avoids wrongly capturing the outputs of other industries that are used as inputs into that industry's production.

[2] Output is valued at producers' prices. The producer's price is the value of the goods and services sold at the producer's door. It excludes GST. The valuation of intermediate consumption is the price paid by the purchaser. This is the cost up to the point of delivery, inclusive of any distribution and transport margins and taxes on commodities such as sales tax and excise duties or import duties. GST is included in cases where the tax is non-deductible (Statistics New Zealand, 2008).

(a)). The Division also produces the *Handbook of Statistical Organization* and the *System of National Accounts*. The OECD Statistics Directorate is another important standard-setting body. These agencies regularly review their recommended methods and standards.

Statistics New Zealand seeks to use international best practice and continuously to improve its statistics[3]. It generally develops its standards and classifications in line with international norms. It is a member of many international statistical agencies and organisations, including the United Nations Statistics Division and the OECD, and works closely with the Australian Bureau of Statistics to develop harmonised standard classifications, such as ANZSIC06.[4] Statistics New Zealand departs from international standards where there are concepts or items that are not suitable for New Zealand's needs or where New Zealand's laws require different treatment. It has a programme of work to keep up with changes in international standards. For example, it is working on implementing the recommendations from the 2008 review of the UN's System of National Accounts (Statistics New Zealand, 2013a). There are generally lags between new recommendations and when they are implemented by Statistics New Zealand, owing to the time and cost involved in implementation.

C.3   Methods to calculate market services value-added

National and international statistical agencies typically measure industry productivity and value-added growth over time using an index series[5]. The use of indices reflects that it is generally easier to measure *changes* in outputs and inputs over time than to measure their *levels* at specific points in time.

Productivity is a ratio of two volume measures; for example, the number of widgets produced per labour hour. However, measurement in monetary units is required to aggregate the many different products that most industries produce (Djellal & Fallouj, 2008).

To measure changes in an industry's output in volume terms, the first step is generally to measure changes in industry value-added (or output and intermediate consumption separately) in current prices. The second step is to remove the effect of pure price changes over time (inflation); that is, price changes not related to changes in the quantity, quality or the mix of services sold. Price changes are removed by deflating industry value-added in current prices (ie, dividing it by the increase in prices) to get a (constant-price) volume series (Djellal & Fallouj, 2008).

Statistics New Zealand calculates the constant-price value-added series for service industries using different methods.

- Deflation of an industry's value-added series to get a constant-price, value-added series:

    - *Single price deflation*: The value-added series is deflated using a price index for the output series. This method assumes that the price movements of output and intermediate consumption are similar for an industry; that is, the relationship between the output price and intermediate prices remains the same. This may not be a correct assumption. To avoid this problem, a more complex method known as double-price deflation can be used (Statistics New Zealand, 2013a).

    - *Double price deflation*: The current-price series for output and intermediate consumption are each deflated by separate price indices. The output series is deflated by a price index measuring the change in output prices, while a price index for the price of inputs is used to deflate the intermediate consumption series. Once the two series are deflated, the constant-price value-added series is calculated from output less intermediate consumption (Statistics New Zealand, 2013a).

- Extrapolation of a constant-price, value-added figure using a single volume indicator to get a constant-price value-added series. Three types of indicators for an industry can be used: its output, an

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[3] Sourced from Statistics New Zealand in a customised information request.

[4] Australian and New Zealand Standard Industrial Classification, 2006 edition. The ANZSIC06 provides a standardised framework for grouping businesses into industries, allowing the OECD collection, analysis and dissemination of economic data on an industry basis for Australia and New Zealand.

[5] An index is a 'unitless' measure – a single index number provides no information. As an example, a productivity index begins with a reference number, such as 1000, that represents an estimated productivity level at a particular date. The number for another other date in the index, such as 1025, shows the productivity level for that date relative to the reference level. Change between the index numbers is generally measured in percentage terms.

intermediate good or service used in its production, or a factor of production (such as the amount of labour or capital used).

This method assumes that the true constant-price value-added for an industry has similar movements to, or varies in the same proportion to, changes in whichever indicator is used. This assumption is unlikely to be exactly correct. Statistics New Zealand generally prefers to use an indicator of output, but if one is not available, it uses the best available intermediate input indicator[6].

It is also very difficult to get an indicator that properly captures the output of services. For instance, retail industry value-added is calculated from retail sales, but the value-added of the retail industry is really its service to customers through providing information, customer service and accessibility to a range of products (Djellal & Fallouj, 2008).

While double deflation is a superior approach to calculating volume measures of value added (because it accounts for changes in the volumes of both inputs and outputs during the production period), it cannot be used in all situations. For instance, the data may not be available or meet the required standards. All of the methods listed above are internationally accepted[7].

C.4   Methods and data sources by industry

This section summarises the methods used by Statistics New Zealand to calculate industry value-added for specific service industries. It sets out first, in Table C.1, the approach used in all industries other than information, media and telecommunications. Table C.2 then gives a more detailed and disaggregated description for the information media and telecommunications industry.

Table C.1   Statistics New Zealand value-added methodology for individual industries

Industry	Data source
Wholesale trade	Extrapolation by an output volume index. The index is based on the quarterly sales from the Wholesale Trade Survey, deflated by sub-indices of the PPI.
	Wholesale Trade Survey: 650 firms in a postal sample. Data for approximately 35,000 firms is modelled from tax data (GST and employer monthly schedule), sourced from the Inland Revenue (Statistics New Zealand, 2013b).
Retail trade	Extrapolation by an output volume index. The index is based on quarterly sales data from the Retail Trade Survey.
	Retail Trade Survey: 2,500 enterprises in a postal sample. Data for approximately 26,400 firms is modelled from GST data, sourced from the Inland Revenue (Statistics New Zealand, 2013c).
Accommodation and food services	Extrapolation by an output volume index. The index is based on quarterly sales data from the Retail Trade Survey.
Transport, postal and warehousing	Single deflation by the PPI for the sub-industry is used for road transport, warehousing and storage services.
	Double deflation by the PPI for the sub-industry is used for other water transport, other transport and transport support services.
	Extrapolation based on volume indices is used for rail transport (freight volumes and passenger revenue), ferry transport (passengers, cars, commercial vehicles and freight) and scenic and sightseeing transport (total visitor arrivals).
	Extrapolation based on output volume indices is used for postal and courier delivery (the number of posted items) and air transport (domestic and international air passenger and freight revenue).
Information media and	See Table C.1

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[6] Sourced from Statistics New Zealand in a customised information request.

[7] Sourced from Statistics New Zealand in a customised information request.

Industry	Data source
telecommunications	
Financial and insurance services	Extrapolation of the base year value-added using output volume indices is used for the following sub-industries: • Reserve Bank. Output volume – full-time equivalent employees. • Other banking and financing. Output volume- financial intermediation services indirectly measured indicator (FISIM), deflated by sub-indices of the producers price index and the consumers price index, and bank transactions data. • Financial asset investing and auxiliary finance. Output volume- constant-price value-added for the banking and financing industry. • Auxiliary finance and insurance. Output volume – combined constant-price value-added for all finance and insurance industries. Double deflation, using annualised versions of the PPI for each sub-industry, is used for the other sub-industries. The experience of the Global Financial Crises has raised the question of whether FISIM is a good measure of value-added. Some argue that it overestimates value-added by including the risk margin in addition to risk-management and other services. This is examined in Burgess (2011) and Haldane (2010).
Rental, hiring and real estate services	Double deflation, by annualised versions of the PPI for each sub-industry, is used for rental and hiring services and non-financial asset leasing. Extrapolation of the base year constant-price value-added by output volume indices is used for non-residential property operators (using deflated annual output) and real estate operators (using the number of property sales).
Professional, scientific and technical services	Extrapolation by a factor-of-production indicator is used for non-market output. The indicator is compiled in two parts. The first part is based on salary and wages sourced from the Central Government Enterprise Survey and the Crown Financial Information System, deflated by a sub-index of the labour cost index. The second part uses constant-price consumption of fixed capital. Double deflation, deflated by annualised versions of the PPI for each sub-industry, is used for market output.
Administrative and support services	Double deflation, deflated by annualised versions of the PPI, is used for each sub-industry.
Arts and recreation services	Double deflation, deflated by annualised versions of the PPI, is used for the market output of sports and recreation activities and for gambling activities. Extrapolation by a factor-of-production indicator is used for non-market output. The indicator is compiled in two parts. The first part is based on compensation of employees sourced from the national accounts, deflated by a sub-index of the labour cost index. The second part uses quarterly constant-price consumption of fixed capital.
Other services	Double deflation, by annualised versions of the PPI for each sub-industry, is used for repair and maintenance; personal, care and other personal services; and the market output of civil, professional and other interest groups. Extrapolation by a factor-of-production indicator is used for religious services and the non-market output of civil, professional and other interest groups. The indicator is compiled in two parts. The first part is based on compensation of employees sourced from the national accounts, deflated by a sub-index of the labour cost index. The second part uses quarterly constant-price consumption of fixed capital.

Source: Productivity Commission; Statistics New Zealand (2013d).

Information media and telecommunications

The measurement of value added in the information media and telecommunications industry is described in more detail to illustrate the complexity involved in practice. The industry is split in to six sub-industries, with a mixture of methods used to estimate value-added in volume terms (Table C.2). Statistics New Zealand calculates the constant-price, value-added series for motion picture and sound recording activities, internet service providers, telecommunications services, and library and other information services sub-industries. The department does this by extrapolating a base year constant-price, value-added figure, using output volume indices as indicators. It estimates the constant-price, value-added for the remaining sub-industries – publishing and broadcasting – using double deflation (Statistics New Zealand, 2013a).

Table C.2   Detailed Statistics New Zealand's value-added methodology for information media and telecommunications

Sub-industry	Value-added methodology
JJ111 – Publishing (except internet and music publishing)	Double deflation. The current-price intermediate consumption and output series from the national accounts are deflated by an annualised producers price index (PPI) for the sub-industry.
JJ112 – Motion picture and sound recording activities	Extrapolation by an output volume index. The index is based on output deflated by an annualised version of the PPI for the sub-industry.
JJ113 – Broadcasting and Internet publishing	Double deflation. The current-price intermediate consumption and output from the national accounts are deflated by annualised versions of the quarterly PPI for the sub-industry.
JJ122 – Internet service providers, web search portals, and data processing services	Extrapolation by an output volume index. The index is based on volume data collected from key companies, which are weighted together based on annual, current-price, gross output and sales data.
JJ121 – Telecommunications services	Extrapolation by an output volume index. The index is based on volume data collected from key companies, which are weighted together based on annual current price output and sales data.
JJ123 – Library and other information services	Extrapolation by an output volume index. The index is compiled from two components added together. The first component is annual constant-price consumption of fixed capital. The second component is annual salaries and wages of employees in the sub-industry from the national accounts, deflated by annualised versions of the relevant part of the quarterly labour cost index.

Source: Productivity Commission; Statistics New Zealand (2013a).

C.5   Quality changes

As stated previously, it is difficult to measure changes in the quality of outputs and innovations in service industries. Similar challenges, perhaps less severe, exist in measuring the quality of goods outputs.

Statistics New Zealand captures quality changes in industries' value-added by deflating industries' value-added in current prices by price indices that *exclude* any observed quality change. This is appropriate since quality improvements are part of value added and should not be removed through price deflation. The effect of quality change is then captured in the resulting measure of value-added[8].

To get price indices that exclude observed quality change, the price effects of quality change need to be calculated. Statistics New Zealand estimates the price effects of quality changes of services in its producer price index (PPI) data by adding new or improved services to its sample, changing the weights of different

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[8] Sourced from Statistics New Zealand in a customised information request.

services to reflect the new mix, and then observing the effect on prices in a single period. This effect of improved quality on prices is then removed from the raw price indices[9].

The information media and telecommunications industry is particularly affected by quality change. Its products often change rapidly and have large price falls. A common problem is that price falls reflect both cost reductions and quality changes and it is difficult to disentangle them (Djellal & Fallouj, 2008).

C.6   Sources of price data

Most prices used to calculate Statistics New Zealand's PPIs come from price quotes collected in its Commodity Price Survey, a quarterly postal survey. Statistics New Zealand surveys approximately 13,000 individual commodity items from about 3,000 respondents. Some commodities are not directly priced but are derived from other data sources. For example, revenue and volume data is sometimes used to calculate unit prices. Other sources of price data used in the PPI include prices collected for the consumer price index, the labour cost index and overseas trade indices. Publicly available data is also used, including prices published in regular publications (Statistics New Zealand, n. d. (b)).

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