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Australia Post's Corporate and Reserved Service Total Factor Productivity

(Public version)

Report prepared for Australia Post

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Contents

Executive Summary

Australia Post has requested Quantonomics to produce updated estimates of its total factor productivity (TFP) trends at the Corporate and Reserved Service levels. The analysis uses the same methodology as that previously used by Economic Insights (2019), and builds on the data used in that previous study with up-to-date data provided by Australia Post. This report updates the results of Quantonomics (2022b) using actual data for 2022 and forecast for 2023.

The Economic Insights (2019) report developed a framework for measuring Australia Post's output which included not only the billed services it provides but also the functional output of providing a postal delivery network. An output specification that includes only 'billed' outputs is suitable for productivity analysis applied to competitive markets but is unsuitable in a context where a network service provider is required to provide certain services universally, and not only services it can directly charge customers for. Hence, the output specification used in the 2019 study included the quantities of billed services and also, as a functional output, the number of delivery points, which is a proxy for the size of the postal delivery network made available. We have adopted the same methodology for this study. Whereas the earlier Economic Insights study made some comparisons between the productivity results when using the 'billed' outputs and 'functional' outputs specifications, this study presents results only for the preferred functional outputs approach from the Economic Insights (2019) study, which is consistent with Quantonomics (2022b).

Since around 2009, the throughput volumes of postal services have started to decline due to technological change and other factors. The fall in postal volumes accelerated with the number of reserved service postal articles falling by more than 10 per cent annually from 2015 to 2022. At the same time, Australia Post has been required to make its network available to an ever-increasing number of geographically dispersed customers which has increased broadly in line with population growth.

Productivity growth based on these frameworks (which include a functional output specification) is calculated for Australia Post Corporate over the period from 1992 to 2023 and for Reserved Services for the period from 1997 to 2023. At the Corporate level, we include three outputs: mail billed output, non-mail billed output and the number of delivery points. Mail billed output is formed by aggregating 15 separate mail article components using a Fisher Ideal quantity index. Non-mail billed output is formed by aggregating 5 separate components using a Fisher Ideal quantity index. Delivery points are included as the best available proxy measure for the network size Australia Post is required to maintain. The three functional outputs are aggregated into a total output measure using output cost shares derived from an estimated econometric cost function from Economic Insights (2019). The total input measure is formed from four components: labour, mail contractors, capital and other inputs.

Australia Post's Corporate TFP grew by an average of 1.4 per cent per annum over the last 31 years. Average annual TFP growth in the 16 years between 1992 and 2008 was 2.7 per cent. Average annual TFP growth was relatively flat, being slightly negative overall, in the period from 2008 to 2015 at –0.3 per cent per annum. This was a result of flat to slightly negative output growth, and flat input use. For the period from 2015 to 2023 average annual TFP growth was 0.2 per cent due to ongoing input reductions (–0.3 per cent per annum) despite the small *decrease* in total output in this period (–0.1 per cent per annum). The small *decrease* in total output was the net result of several divergent trends, including an average *decrease* in letters volumes of 10.0 per cent per year; average increases in both parcels and express post of 10.0 and 8.1 per cent per annum respectively; and *decreases* in billed non-mail services averaging 6.8 per cent annually over the 2015 to 2023 period.

At the Reserved Services level, we include two functional outputs: reserved service mail billed output and delivery points. Reserved service mail billed output is formed by aggregating five separate mail article components using a Fisher Ideal quantity index. Delivery points are again included as the best available proxy for the network Australia Post is required to maintain. In Figure A we plot the two reserved service functional outputs, total output, total input and TFP.

Figure A: Australia Post's Reserved Service Output and Input Quantity Indexes and TFP, 1992–2023
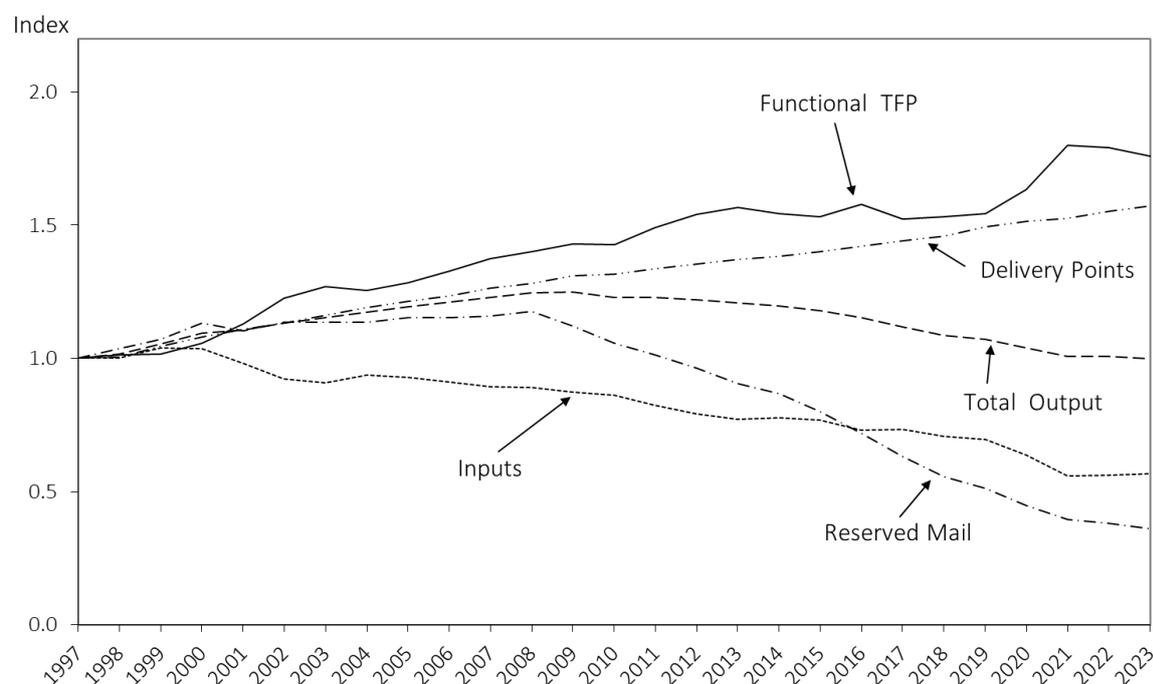
Reserved mail output increased from 1997 to 2008 averaging 1.5 per cent per year over that period. However, it subsequently decreased strongly over the period to 2015 (averaging –5.5 per cent per annum), and even more sharply in the period after 2015 (–10.0 per cent per annum). Delivery points, on the other hand, increased steadily over the whole period (averaging 1.7 per cent per annum), moderating the reduction in total output after 2008.

Total input use has trended down markedly since 2000. The rate of decrease in input use has been particularly strong in the period since 2015, during which input use has *declined* at an average rate of 3.8 per cent annually.

Reserved service functional TFP grew at a very strong average annual rate of 2.2 per cent over the 26-year period from 1997 to 2023. It grew at a high average annual rate of 3.1 per cent between 1997 and 2008 as output grew steadily at the same time as input use decreased. As output average annual growth became negative in the period from 2008 to 2015 (–0.8 per cent per annum), TFP average growth slowed to an average rate of 1.3 per cent per annum. The continued productivity growth in that period was due to a large reduction in input use (–2.1 per cent per annum). From 2015 to 2023, average annual TFP change was at a high average annual rate of 1.7 per cent. In this period, average annual functional output change of –2.1 per cent was considerably more than offset by an average annual input change of –3.8 per cent.

Australia Post's Reserved Services TFP growth of 2.2 per cent, on average from 1997 to 2023, has outperformed the ABS market sector productivity index which averaged an annual growth rate of 0.7 per cent for the period from 1997 to 2022.[1] Given that Australia Post's reserved services mail output has fallen substantially since 2008, being able to outperform the productivity performance of the economy as a whole has been an impressive achievement.

Australia Post's long-term Corporate TFP growth rate of 1.4 per cent per year also exceeds the long-term average rate of productivity growth for the market sector (noted above). Over the more recent period from 2015 to 2023, Australia Posts' Reserved TFP growth rate of 1.7 per cent remains well above the average TFP growth rate for the ABS market sector productivity index, which averaged an annual growth rate of 0.8 per cent over the period 2015 to 2022. The Corporate Services TFP growth rate of 0.2 per cent is below compared to the market sector as a whole over the most recent period since 2015.

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[1] ABS 5260.0.55.002 'Estimates of Industry Multifactor Productivity, Australia', Table 2: Hours worked basis.

1   Introduction

1.1   Scope and purpose

Australia Post has requested Quantonomics to produce updated estimates of its total factor productivity (TFP) trends at the enterprise and reserved service levels. The analysis uses the same methodology as that previously used by Economic Insights (2019) and builds on the data used in that previous study.

The Australian Competition and Consumer Commission (ACCC) currently has a price monitoring declaration covering certain core services of Australia Post, including reserved ordinary letters (eg, the basic postage rate) but not covering bulk business letter services. Although the ACCC does not have a role in approving price increases of reserved services, if Australia Post intends to increase the price of a covered letter service or introduce a new covered letter service, it must notify the ACCC in advance. The ACCC then indicates whether or not it objects to the proposed price increase. Australia Post intends to make a submission to the ACCC in 2023 for prices that would apply from January 2024. It has commissioned this study to provide information relevant to its planned submission.

1.2   Previous studies of Australia Post TFP

The approach taken in this report closely follows the Economic Insights (2019) and Quantonomics (2022b) studies of Australia Post's Corporate and Reserved Service TFP. The 2022 study followed a series of productivity studies of Australia Post carried out by Dr Denis Lawrence, previously Director of Economic Insights and formerly an Associate of Quantonomics. Those previous studies include: Lawrence (2002, 2007) and Economic Insights (2009, 2012, 2018b). Some of the main findings from previous relatively recent studies of Australia Post's productivity trends were:

- The 2019 study found Australia Post's corporate TFP grew by an average 1.7 per cent per annum over the 28-year period from 1992 to 2019. Average annual TFP growth in the 16 years to 2008 was estimated to be somewhat higher at 2.7 per cent. This is broadly consistent with the earlier studies. The growth rate of TFP subsequently slowed. Over the last four years of the sample period (ie, 2015 to 2019), average annual TFP growth was estimated to be 0.9 per cent.

- The 2019 study also found that reserved service TFP grew at average annual rate of 2.5 per cent over the 23-year period from 1997 to 2019. Over the four years from 2015 to 2019, reserved services average TFP growth was estimated to be 2.5 per cent per annum.

- The 2022 study estimated that Australia Post's Corporate TFP grew by an average of 1.5 per cent per annum over the 30-year period from 1992 to 2022. Average annual

TFP growth in the 16 years between 1992 and 2008 was 2.7 per cent. More recently, from 2015 to 2022 average annual TFP growth was estimated to be 0.7 per cent. Reserved services TFP increased at an average annual rate of 2.6 per cent over the 25-year period from 1997 to 2022, and at an average rate of 3.0 per cent from 2015 to 2022.

1.3   Outline

Section 2 describes the methodologies used in this study. It explains the concepts of TFP and partial factor productivity (PFP). It defines the individual inputs and outputs used in this study and explains the methods for aggregating them into total output and input indexes. It also documents data sources.

Section 3 presents productivity index results for Australia Post corporate-wide. These include output and input indexes, the TFP index, and PFP indexes for each input type. Section 4 presents analogous productivity index results for reserved services, which refers to the subset of services covered by the ACCC price monitoring declaration.

1.4   Quantonomics' experience

Quantonomics provides consulting services in the fields of economic and regulatory policy, quantitative economic analysis and pricing in infrastructure industries, especially the water, energy, telecommunications and transport industries, and quantitative analysis in competition law applications. Quantonomics was established in 2013 to provide high-quality and robust quantitative analysis to support decision-making by Australia's infrastructure regulators, regulated infrastructure businesses and competition authorities.

2   Methodology & Data Sources

This section explains the methods used to measure total factor productivity (TFP) in this report. Section 2.1 outlines the indexing method. Section 2.2 discusses the use of functional outputs and billed outputs. Sections 2.3 and 2.4 document the specification of the outputs and inputs respectively. Section 2.5 notes the data sources.

2.1   Total factor productivity indexes

Most firms have a diverse range of outputs and inputs. Australia Post provides many outputs including letter carriage, financial transaction processing, retail stationery sales, etc; and it uses many inputs including labour, capital, materials and fuel. TFP is a measure of the overall productivity of a business—the amount of production of all of its outputs in proportion to the amount of all inputs it uses to produce those outputs.

TFP growth is defined as the proportional change in total output divided by the proportional change in total inputs used between two periods. It is usually measured using index number methods. Productivity indexes are formed by aggregating individual output quantities into a measure of total output quantity and aggregating individual input quantities into a measure of total input quantity. The productivity index is then the ratio of the total output quantity to the total input quantity, as shown in equation (2.1).

$$TFP = Q/I \tag{2.1}$$

where TFP is the total factor productivity index, Q is the total output quantity index and I is the total input quantity index. The rate of productivity growth is the difference between the rates of growth of the aggregate output index and the aggregate input index, as shown in equation (2.2).

$$\dot{TFP} = \dot{Q} - \dot{I} \tag{2.2}$$

where the dot above a variable indicates the rate of change.

The total output quantity index, Q, and the total input quantity index, I, are calculated using the Fisher Ideal index method, which is explained in Appendix A. The individual outputs (which are aggregated in the total output index) will be denoted as Y_i, for the ith output. The individual inputs (aggregated in the total input index) are denoted as X_j for the jth output.

Partial factor productivity (PFP) indexes refer to the ratio of total output to a single input. Hence, the PFP of the jth input is defined as:

$$PFP_j = Q/X_j \tag{2.3}$$

2.2 Functional and billed outputs

Measuring the output of network businesses such as Australia Post presents a number of challenges, especially where charging formats may not well reflect the cost of producing the various services provided. One example is 'postage stamp' pricing whereby the cost to the consumer is unaffected by the distance over which mail is sent, although costs may be affected by distances. Outputs can be measured on an 'as billed' basis or a broader 'functional' basis. 'Billed' outputs are those outputs the network business explicitly charges users for. 'Functional' outputs, on the other hand, are outputs of value to the user – such as the availability of daily deliveries – but which are not explicitly charged for by the network business. This study uses the number of delivery points as a functional output representing the spatial and complexity characteristics of the postal service.

As explained in Appendix A, the construction of quantity indexes requires information on the prices as well as quantities of the constituent products. The rate of change in the aggregate quantity index (of outputs or inputs) is calculated as the average rate of change in expenditure when prices remain fixed and only the quantities vary. Hence, the fixed prices serve as the weights for averaging the changes in the quantities of the products comprising the index. Here prices should represent the market values of the products. For regulated natural monopolies, market values may be problematic if the prices of billed outputs are not proportionate to marginal costs, as would be the case in a competitive industry, or where there are functional outputs not directly charged for. In these circumstances, weights (ie, product values) may be developed based on an econometrically estimated cost function, the parameters of which reflect the marginal costs of the outputs.

Like all network infrastructure industries, a major part of Australia Post's output is providing a network with capacity, in this case for people to send and receive postal articles. The functional outputs Australia Post provides are directly related to its network availability as reflected by its number of delivery and collection points and its frequency and speed of service.

For practical and historical reasons, Australia Post levies a high proportion of charges on postal articles even though changes in the volume of postal articles now have a relatively small impact on the costs it faces (see the Economic Insights (2018a) and Quantonomics (2022a) studies of output cost elasticities) and dimensions that customers may value highly such as daily availability of delivery and universal coverage are not explicitly charged for at all.

Changes in the TFP index will more accurately measure technical change if the total output index includes relevant functional outputs irrespective of whether they are explicitly billed for or not. Billed outputs will then be a subset of functional outputs. The appropriate weights to apply to these outputs when forming the total output measure are the difference between price and marginal cost for each output (Economic Insights 2019:5). Since marginal costs are not readily observable, their estimation requires the use of econometric methods.

The inclusion of functional outputs is also especially important when there are diverging growth rates between billed and functional outputs. Postal articles throughput has declined steadily over the last two decades. For instance, reserved services letters are estimated to have declined at an average annual rate of –5.5 per cent over the 21 years between 2002 and 2023. On the other hand, the size of the network, as indicated by the number of delivery points, has steadily increased, on average at an annual rate of 1.6 per cent over the same period. Hence, the billed outputs alone do not adequately represent the supply obligations of Australia Post, as the network continues to grow. Consistent with Economic Insights (2019) and Quantonomics (2022b), an unbilled functional output is included in the analysis, the number of delivery points, which is closely related to the aggregated length of all routes served and captures the spatial dimension and complexity of the services provided.

2.3 Outputs

We use data for the 31 financial years (ending in June) from 1992 to 2023. Price and quantity data were assembled for 21 individual outputs which are divided into three broad functional categories—mail outputs, non-mail outputs and other functional outputs. Only six of these 21 outputs are relevant to Reserved Services—a subset of mail outputs and the other functional outputs. There are two stages in the aggregation process. Firstly, the individual outputs are aggregated into an output index corresponding to each of the three groups' outputs (or two for Reserved Services), and subsequently, the three outputs are aggregated into the total output index. Thus, for the Corporate TFP analysis the aggregate output index is made up of three constituent outputs:

(a) billed mail outputs,

(b) billed non-mail outputs, and

(c) other (functional) outputs.

For the Reserved Service TFP analysis there are just two component outputs:

(a) billed mail outputs (more narrowly defined than for Corporate), and

(b) other (functional) outputs.

The individual outputs included in these broad functional outputs are discussed in the following subsections. Individual mail and non-mail outputs are aggregated to the functional mail and non-mail output levels using average prices (as these are all billed outputs). The three functional outputs (or two for Reserved Services) are then aggregated into the total output index using output cost shares derived from the estimation of an econometric cost function.

2.3.1 Billed Mail Outputs

The specific mail outputs are shown in Table 2.1. There are 15 Corporate mail outputs, grouped under the headings of letters, parcels, express post, and international mail outwards

and inwards. Five of the outputs, comprising most types of domestic letters, are included in the Reserved Services mail output measure.

Each of these outputs is measured by the number of items handled. Revenues for each mail output type are used to calculate implicit average prices for each of the 15 outputs. The Fisher Ideal index (see Appendix A) is then used to aggregate the relevant outputs into a billed mail output index for each of the Corporate and Reserved Services.

Table 2.1   Mail outputs

Types	Corporate outputs	Reserved service outputs
1. Letters		
• Small full rate	✓	✓
• Small pre-sort	✓	✓
• Large full-rate	✓	✓
• Large pre-sort	✓	✓
• Print post	✓	✓
• Unaddressed	✓	
• Other letters	✓	
2. Parcels		
• Card rate	✓	
• Contract	✓	
3. Express		
• Letters	✓	
• Parcels	✓	
4. International outwards		
• Letters	✓	
• Parcels	✓	
5. International inwards		
• Letters	✓	
• Parcels	✓	

2.3.2   Billed Non-mail Outputs

Billed non-mail outputs are only included in the Corporate TFP analysis. These outputs and their quantity measurement are:

- BillPay (number of transactions)
- Banking (number of transactions)
- Identity services (number of identity verification services provided)
- Private boxes and bags (number), and

- Other billed outputs. These include envelope and stationary sales and redirection fees. Its quantity is measured by deflating this revenue by the CPI (excluding volatile items).[2]

Revenues for each mail output type are used to calculate implicit average prices. The Fisher Ideal index (see Appendix A) is then used to aggregate these outputs into a billed non-mail output index.

2.3.3 Other Functional Outputs

The 'other' functional output included in the analysis is the number of delivery points, which is closely related to the aggregated length of all routes served and captures the spatial dimension and complexity of the services provided.[3]

2.3.4 Total Output Index

The three preceding subsections explain the derivation of three output indexes: (a) billed mail outputs, (b) billed non-mail outputs, and (c) other (functional) outputs. For Reserved Services, there are two output indexes. These indexes a combined into a total output index using a fixed weighted index. The weights used are the same as those used in Economic Insights (2019) and Quantonomics (2022b) and are shown in Table 2.2.

Table 2.2   Output weights

Outputs	Corporate weight	Reserved service weight
Billed mail	33.3	30.8
Billed non-mail	11.1	--
Other Functional	55.6	69.2
Total	100.0	100.0

Source: Economic Insights (2019).

2.4   Inputs

Both the Corporate TFP and Reserved Services TFP analyses use four inputs:

(a) Labour,

(b) Mail contractors,

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[2] ABS, *6401.0 Consumer Price Index, Australia*, Table 8. CPI: Analytical Series, Weighted Average of Eight Capital Cities.

[3] Economic Insights (2019:14) adopted the number of delivery points as an indicator of (delivery) network size, in preference to route length, stating: "At this time limited reliable data are available on a consistent basis for postal network length as different state reporting systems have only been integrated into a national reporting system relatively recently. It is likely there will be a high degree of correlation between the number of delivery points that have to be served and network route length."

(c) Other non-capital inputs, and

(d) Capital inputs.

The inputs defined for the Reserved Services are, within each category, a subset of those used for Corporate Services.

2.4.1 Labour

Labour quantity is measured by full-time equivalent (FTE) employees. Three categories of labour are recognised: those employed directly by Australia Post; those employed on contract by Australia Post (excluding mail contractors); and staff employed by licensed post office (LPO) agents.

The quantities (FTE) of direct employees were provided by Australia Post for the years from 2008 onwards for both Corporate and Reserved Services. This data is spliced onto data for the period before 2008, as developed in Economic Insights (2009) and used in Economic Insights (2019). The FTE of those employed on a contract is available up to 2017 from the 2019 Economic Insights study and is estimated after that by deflating the cost of contractors using the implicit wage rate escalated at the rate of increase in the General Retail Industry Awards (GRIA) in the period after 2017. The cost of direct employee labour, and those employed on contract, is drawn from Australia Post's Corporate accounts and is equal to Australia Post's total Corporate wage and salary costs (including superannuation and other staff-associated costs) plus contract labour cost. The price of direct labour inputs is obtained by dividing the total cost by the FTE. The price of contract labour inputs is obtained in the same way up to 2017 and estimated as described above after 2017.

Estimating the number of LPO FTEs presents a number of challenges as from around 2012 onwards compensation to LPOs increased faster than the Australia Post wage rate to cover increased costs being incurred by LPOs to perform additional tasks. Australia Post holds no information on the number of staff employed by LPOs. Australia Post provided total LPO costs back to 1998. These were extended back to 1992 by splicing with the corresponding series from Economic Insights (2009a). Up until 2011 the number of LPO FTEs was estimated by dividing the cost of LPOs by the same composite wage series as used for contract labour. However, from 2012 to 2017 we assume that LPO FTEs increased by one per cent annually except for 2015 when LPO FTEs are assumed to increase by 5 per cent to allow for additional tasks such as carding allocated to the LPO level. The implicit wage rate for LPO staff during the same period is derived by dividing LPO costs by the estimated number of LPO FTEs. After 2017, the implicit wage rate for LPO staff is escalated at the rate of increase in the GRIA, and in the period after 2017, LPO FTEs are estimated by dividing the cost of LPOs by the LPO wage series so-derived.

2.4.2 Mail contractors

The delivery and cartage of mail by contractors is an important part of postal operations. For the period up 2017, Mail contractor quantity is measured by the number of contracts, and this data is provided by Australia Post. From 2017, Mail Contractors is measured using an index that considers the growth rate of Mail Contractors' hours and kilometres. This index takes into consideration the weight of each of these factors. The specific details regarding the construction of this index can be found in Appendix B.

The associated cost of mail delivery contracts is obtained from Australia Post's Corporate accounts. The implicit price is the ratio of cost to quantity. Mail contractor inputs used to provide Reserved Services are a subset of total mail contractor inputs. Australia Post provided data on the number of contracts back to 2008, and additionally provided data for the cost of mail contractors allocated to Reserved Services by type of mail contractor activity from 2018 to 2023. This data on the number of mail contracts and mail contractor cost was provided by Australia Post on a disaggregated basis, by type of mail contractor activity. Using this disaggregated data, the number of mail contracts allocated to Reserved Services from 2018 to 2023 is estimated using the other data for mail contracts. Mail contractor activities are categorised by Australia Post as:

- Roadside mail,
- Street mail,
- Shuttle contracts,
- Parcel service,
- Miscellaneous delivery services,
- Road intrastate,
- Road interstate,
- Street post box clearance.

The share of mail contractor cost attributed to Reserved Services differs between activities. Almost two-thirds of Corporate mail contractor costs for Roadside mail, Street mail and Street post box clearance, are attributable to Reserved Services. About 40 per cent of Miscellaneous delivery services relate to Reserved Services. None of the mail contractor costs for Parcel services, and only a small proportion of the remaining cost categories are attributable to Reserved Services.

The implicit price of mail contractor services for each activity is the ratio of cost to quantity in that category at the Corporate level. These implicit prices differ considerably between the activities listed above. For the period before 2017, the number of mail contractors attributed to Reserved Services is drawn from the Economic Insights data. Similarly mail contractor

costs up to 2009 are drawn from Economic Insights data.[4] Since the ratio of reserved services to corporate mail contractor costs has declined steadily with changes in the mix of mail types, interpolation of this share is used between 2009 and 2018. For the period after 2017, Mail Contractors quantity is measured by the Hours and Kilometres index.

2.4.3   Other non-capital inputs

Other Non-capital inputs cover a wide range of materials and services used by Australia Post. The quantity of Other Non-capital inputs is measured by the deflated cost of those inputs. The cost of these inputs is obtained by deducting the costs of Labour and Mail Contractors from total non-capital costs (not including voluntary redundancy package costs, depreciation, interest and tax, notional expenses and abnormal items). The deflator is based on a combination of producer price indexes (PPIs). Consistently with Economic Insights (2019) and Quantonomics (2022b), we form the composite PPI where:

- 20 per cent weight is given to the ABS PPI for 'Non–residential property operators' (to proxy the price index for accommodation costs),[5] and

- 80 per cent weight is given to the ABS's 'Final total (source)' PPI (to proxy the price of the diverse and changing balance of other costs).[6]

2.4.4   Capital

Capital inputs are different to other inputs in that they are not fully consumed in the year of purchase. Rather, they provide a flow of services over their lives. The quantity and cost of using capital must take this phenomenon into account. The flow of services provided by capital employed by Australia Post is assumed to be a fixed proportion of the capital stock used. The capital stock is estimated using data on yearly investment, asset retirements, assumed depreciation rates and a point estimate of the market value of the capital stock. The method is the same as that used previously by Economic Insights (2019) and Quantonomics (2022b).

Capital stock estimates are formed for four asset classes: land, buildings, motor vehicles, and plant and equipment and software ('plant'). Real investment and retirement series were obtained by deflating the current price data using the National Accounts implicit price deflator for relevant components of net capital stock. For land and buildings, the deflator for Non-

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[4] Economic Insights' data from 2010 onwards are based on assuming the cost per mail contract for reserved services is equal to that for corporate services, indicating that these are estimates. However, the actual data provided for 2018 to 2022 shows that the resulting reserved services mail contractor costs do not accurately reflect the trend in reserved services mail contractor costs over the relevant period.

[5] ABS (Dec 2021) '6427.0 Producer Price Indexes, Australia', Table 23. Output of the Rental, hiring and real estate services industries, subdivision, group and class index numbers.

[6] ABS (Dec 2021) '6427.0 Producer Price Indexes, Australia', Table 1. Final demand, Index Numbers and Percentage Changes.

dwelling Construction was used. For the other two asset classes (plant and motor vehicles), the deflator for Machinery and Equipment was used.

The real stock of capital for each of the four asset classes is calculated using the declining balance method:

$$S_{jt} = S_{j,t-1}(1 - d_j) + I_{jt} - R_{jt} \qquad (2.3)$$

where j refers to the asset class and t to the period, S_{jt} is the period-end real capital stock of asset class j in period t, d_j is the declining balance annual rate of economic depreciation, I_{jt} is real investment, and R_{jt} is real retirements. The point estimates of market value used as starting points are the same as those used in Lawrence (2002). The real stock of capital employed by Australia Post in years other than 1990 was calculated using the equation (2.3). Following Economic Insights (2009), the assumed annual depreciation rates are: (i) zero for land, (ii) 6 per cent for buildings, (iii) 14 per cent for motor vehicles, and (iv) 15 per cent for plant.

The Fisher ideal index is used to combine the quantities of the four asset classes into a single capital input quantity index. This indexing method uses both the quantities and prices for each asset class. The capital price indexes used in calculating the capital input index are the same as those used to deflate nominal capital expenditure (noted above).

The annual user cost of capital inputs of each asset class is calculated using the formula:

$$AUC_{jt} = \left(d_j + r_t - \frac{\Delta p_{jt}}{p_{jt}} \right) p_{jt} S_{jt} \qquad (2.4)$$

where AUC_{jt} is the annual user cost of asset class j in period t, d_j is the declining balance annual rate of economic depreciation, r_t is the nominal rate of return in period t, and p_{jt} is the price deflator of asset class j in period t. The terms inside the brackets are effectively the economic depreciation rate plus the real rate of return, and the terms to the right of the brackets are the nominal value of the capital. These annual user costs by asset class are then summed over the asset classes to obtain the total annual user cost of capital. When it comes to aggregating inputs into a total input index, the price series for the capital input is the total annual user cost of capital divided by the total capital quantity index.

2.4.5   Total input index

The Fisher Ideal index is used to combine the quantities of the four inputs into the total input quantity index.

2.5   Data Sources

Most of the data used in this study are sourced from Australian Post. Data for various price indexes were obtained from the Australian Bureau of Statistics (ABS). The data provided by Australia Post includes the following two data sources:

- Data provided by Australia Post in 2023 for: (a) quantities of letters and parcels by category and for each of the unbilled outputs, (b) for revenues by service type, (c) for quantities of inputs such as labour full-time equivalents (FTE) and the number of mail contractors, (d) for contractors hours and kilometres, (e) for expenses by cost category, (f) for expenses allocated to reserved services, and (g) for capital expenditure and disposals by asset class and the allocation of these items to reserved services.

- Data was collected for previous productivity studies by Economic Insights, which was derived from earlier data provided by Australia Post.

The data for the Corporate business excludes subsidiaries. This means the StarTrack courier business is not included.

3 Corporate Output, Input & Productivity Trends

This section discusses the trends in outputs, inputs and productivity for Australia Post Corporate. Section 3.1 discusses output trends for five groups of mail outputs, five groups of non-mail outputs and the other functional output. Section 3.2 discusses the trends in the aggregated output categories (mail, non-mail and other functional). Trends in inputs are discussed in section 3.3. Productivity trends are examined in section 3.4.

3.1 Trends in Corporate Outputs – Detail

Trends in output indexes for mail outputs are depicted in Figure 3.1. Trends in billed non-mail output indexes are depicted in Figure 3.2.

3.1.1 Letters

Seven categories of letters are included in the letters group, as shown in Table 2.1. The quantity index for the letters group of outputs *increased* at an average annual rate of 2.4 per cent between 1992 and 2008. Since 2008, letters growth has been strongly negative with an average annual growth rate of –5.3 per cent between 2008 and 2015, and at –10.0 per cent between 2015 and 2023. By 2023, the letters quantity index was 55 per cent below its 1992 level. This rapid turnaround in letter volumes has been due to the impact of technological change with the mass migration of both private and business communication from hard copy to electronic means.

The share of the letters output group in Australia Post's total corporate revenue has fallen from 64.5 per cent in 1992 to 23.0 per cent in 2022.

3.1.2 Parcels

Two parcel categories are included in the parcels group (card rate and contract). The parcels group quantity index increased by 1.6 per cent on average between 1992 and 2008. It increased at a higher annual rate of 2.9 per cent between 2008 and 2015, and much more rapidly at an annual average rate of 10.0 per cent between 2015 and 2023.

The increase in the quantity index for this group, which averaged 4.1 per cent per year over the 31-year period from 1992 to 2023, has been driven by contract parcels which have increased at an average annual rate of 7.4 per cent over the same period. Deliveries of card rate parcels, on the other hand, have trended downwards since 1992, with an average annual growth rate of –0.6 per cent over the same period.

The share of the parcels output group in Australia Post's total corporate revenue has increased from 13.4 per cent in 1992 to 46.7 per cent in 2023.

Figure 3.1:   Corporate Mail Output Group Quantity Indexes, 1992–2023
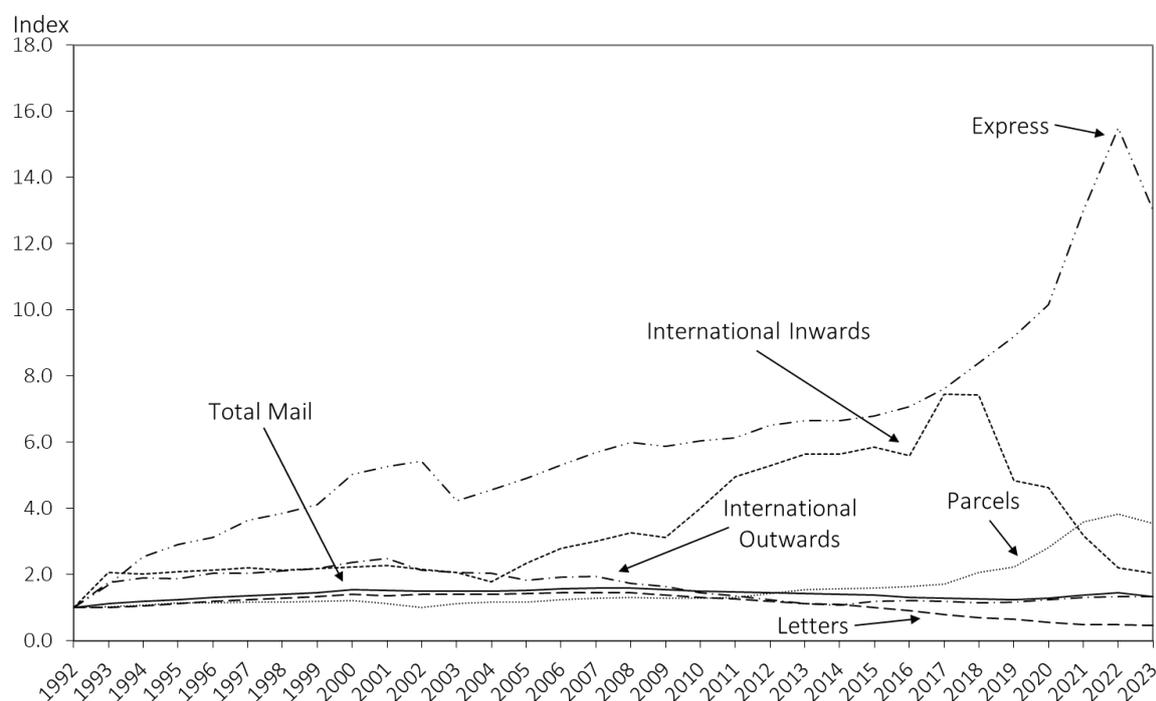
3.1.3   Express

Two express outputs are included in the express group; letters and parcels. The express group quantity index increased strongly between 1992 and 2008, at an average annual rate of 11.2 per cent. Express output increased more slowly at 1.8 per cent between 2008 and 2015, but more strongly from 2015 to 2023, at an annual average rate of 8.1 per cent. It reached a peak in 2022, but in 2023 decreased to about the same level as in 2021. In 2023, the quantity of express services was 13 times higher than in 1992.

In the period from 1992 to 2008 there was strong growth in both express letters and express parcels. After 2008, express letters declined steadily, averaging an annual rate of –5.7 per cent from 2008 to 2015, and –7.6 per cent from 2015 to 2023. On the other hand, there has continued to be strong growth in express parcels, increasing on average by 5.0 per cent from 2008 to 2015, and 11.0 per cent from 2015 to 2023.

The share of the express output group in Australia Post's total corporate revenue has increased from 0.8 per cent in 1992 to 11.7 per cent in 2023.

3.1.4   International outward

International outward outputs comprise letters and parcels. The international outward group quantity index grew over the 16 years from 1992 to 2008 at an average rate of 3.5 per cent. It then decreased, at an average annual rate of –5.3 per cent from 2008 to 2015. This output

increased at an average rate of 1.4 per cent per year from 2015 to 2023. The recent increase has been driven by a reversal in the trend decline in the parcels component which saw an average annual *decrease* of 2.0 per cent during the period 2008 to 2015, followed by a substantial increase of 5.9 per annum during the period 2015 to 2023, likely reflecting increasing activity by Australian online sellers supplying overseas customers. The outward letters component, on the other hand, has trended downwards since 2001. Over the 31-year period, this component experienced a total decline of 87.8 per cent.

The share of the international outward output group in Australia Post's total corporate revenue was 9.6 per cent in 1992 but had fallen to 5.1 per cent by 2023.

3.1.5   International inwards

International inwards outputs also comprise letters and parcels. The international inwards group quantity index increased from 1992 to 2008 at an average annual rate of 7.4 per cent, and from 2008 to 2015 at 8.4 per cent per year. However, from 2015 to 2023, international inwards mail decreased, averaging –13.2 per cent per annum. The latter trend is surprising given the expected strong growth in inwards parcels due to the strong growth in overseas online shopping purchases by Australian consumers. There have been strong downturns in 2019, 2021 and 2022, which may be partly due to supply constraints in the COVID period. By 2023, the quantity of international inwards mail was 2.0 times the quantity in 1992.

The share of the international inwards output group in Australia Post's total corporate revenue declined from 3.3 per cent in 1992 to 2.7 per cent in 2023, after peaking at 6.4 per cent in 2015.

3.1.6   BillPay

The quantity of BillPay transactions is measured by the number of transactions. The quantity of BillPay services increased by 8.2 per cent per annum on average between 1992 and 2008. It has decreased steadily thereafter, at an average rate of –7.2 per cent from 2008 to 2015, and a rate of –11.6 per cent from 2015 to 2023. By 2023, BillPay transactions were 11.9 per cent below the level in 1992.

The share of BillPay transactions in Australia Post's total corporate revenue was 3.0 per cent in 1992 and reduced to 1.4 per cent in 2023, after peaking at 6.4 per cent in 1997.

3.1.7   Identity services

The number of identity verification services provided by Australia Post grew rapidly over the period from 1992 to 2008, averaging growth of 15.9 per cent per annum, and from 2008 to 2015, averaging 11.8 per cent. From 2015 to 2023, the quantity increased, averaging 2.5 per cent per year. The rapid increase over most of the period reflects increased security requirements associated with issuing passports and minimising fraud risks in financial transactions, among other things. In 2020 and 2021 there were substantial declines, possibly

due to restrictions on international travel. However, in 2022 and 2023, it recovered and reached the same level as in 2018. In 2023, ID services were 36 times their level in 1992. The share of identity services in Australia Post's total corporate revenue has increased from 0.3 per cent in 1992 to 2.1 per cent in 2023.

Figure 3.2: Corporate Non-mail Output Group Quantity Indexes, 1992–2023
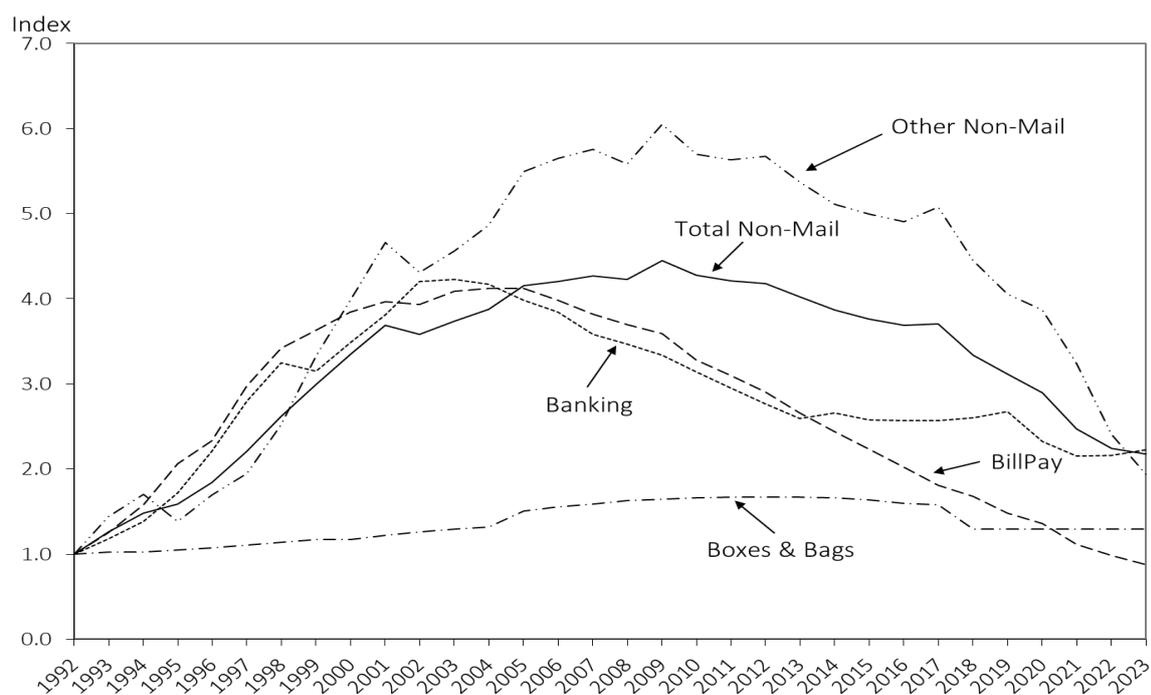
Note: ID services not shown due to the scale of increase since 1992.

3.1.8 Banking

The quantity of banking services is measured by the number of transactions. The number of banking transactions increased at an average rate of 7.8 per cent between 1992 and 2008. This rapid increase reflected Australia Post's success in becoming a centre for financial transactions. Subsequently, banking services have declined, between 2008 and 2015 it averaged –4.2 per cent per annum, and between 2015 to 2023 by –1.9 per cent. By 2023 the quantity of banking services was more than double its 1992 level.

The share of banking services in Australia Post's total corporate revenue increased from 1.0 per cent in 1992 to 1.3 per cent in 2023.

3.1.9 Private boxes and bags

The quantity of private post box and bag rentals is measured by their number. The quantity of private boxes and bags increased steadily in the period from 1992 to 2008, at an average annual rate of 3.0 per cent, before levelling off at an annual growth rate of 0.1 per cent per annum

from 2008 to 2015. From 2015 to 2023, the quantity of private boxes and bags declined, averaging an annual rate of –2.9 per cent. In 2023 the quantity of private boxes and bags was 30 per cent higher than it was in 1992.

The share of private boxes and bags in Australia Post's total corporate revenue has increased from 1.4 per cent in 1992 to 2.4 per cent in 2023.

3.1.10 Other billed outputs

The other billed outputs category comprises a range of revenue sources for Australia Post including envelope and stationery sales, philatelic sales and redirection fees. The quantity of other outputs is measured by deflating the relevant revenue received by the consumer price index excluding volatile items. The quantity of other billed outputs grew strongly between 1992 and 2008, increasing by 10.8 per cent per year. It has since decreased; from 2008 to 2015, at the rate of –1.6 per cent, and from 2015 to 2023 at an average rate of –11.8 per cent.

The share of other billed outputs in Australia Post's total corporate revenue increased from 2.6 per cent in 1992 to around 3.6 per cent in 2023, after peaking at 11.9 per cent in 2009.

3.1.11 Functional output

To take account of the spatial dimensions of the mail delivery task, the number of delivery points is included as a non-billed functional output. The number of delivery points increased at an average annual rate of 2.4 per cent over the 16 years from 1992 to 2008. Over the period 2008 to 2015, the average rate of growth of delivery points was 1.3 per cent per annum; and from 2015 to 2023, the average rate of growth of delivery points was 1.5 per cent per annum. By 2023, the total number of delivery points was 79 per cent higher than in 1992.

3.1.12 Summary conclusion

This section has demonstrated that since around 2008 the volumes of letters, and most non-mail services, have been in decline in the face of accelerating technological change and competition from electronic forms of communication and payments. The key growth areas have been parcels and express post. These two groups of output together accounted for 58.4 per cent of Australia Post's revenue in 2023 (compared to 14.2 per cent in 1992). Letters accounted for 23.0 per cent of revenue (compared to 64.5 per cent in 1992). While increased online shopping using electronic platforms has facilitated growth in some of Australia Post's billed outputs such as parcel delivery, the growth in these items has not been sufficient to offset the decline in major billed outputs such as letters. At the same time, however, Australia Post has been required to make its collection and delivery networks available to an ever-increasing number of geographically dispersed customers.

3.2   Trends in Corporate Outputs –Aggregates

The TFP analysis presented in this report uses three functional outputs: mail billed outputs, non-mail billed outputs and the number of delivery points. Individual mail outputs, discussed in the preceding section under the headings Letters, Parcels, Express, International outward, and International inward, are aggregated into a single mail output using the Fisher Ideal index (see Appendix A). Individual billed non-mail outputs, BillPay, Banking, Identity services, Private boxes and bags, and Other billed outputs, are aggregated into a single billed non-mail output, again using the Fisher Ideal index. The third (unbilled) functional output is the number of delivery points.

To aggregate these three functional output indexes, weights are needed representing output cost shares. These shares have to be estimated using econometric cost functions given information constraints. Economic Insights (2019) estimated an econometric cost function using a Leontief cost function specification (documented in Appendix B of that report), as described more fully in Lawrence and Diewert (2006). The resulting output weights are presented in Table 2.2 above.

The three broad output quantity indexes and the total output index are graphed in Figure 3.3. The index numbers are presented in Table 3.1.

Figure 3.3:   Corporate Output Indexes, 1992–2023
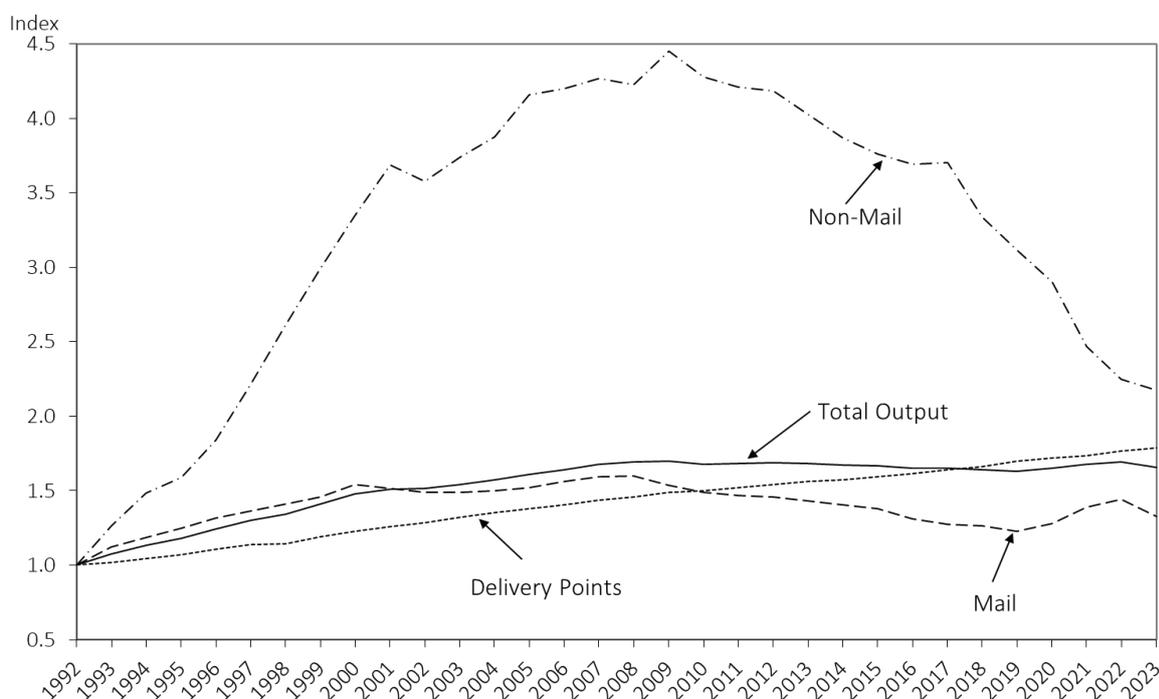
The mail billed output and non-mail billed output indexes shown in Figure 3.3 are the same as presented in Figures 3.1 and 3.2 respectively. Mail output increased at an average rate of 2.9 per cent per annum from 1992 to 2008, subsequently declining. Over the period from 2008 to 2015, the average annual rate change in mail output was –2.1 per cent. Over the period 2015 to 2023 the average rate of change was –0.5 per cent. Over the whole period from 1992 to 2023, the average annual rate of change was 0.9 per cent. By 2023, the level of mail output was 33 per cent higher than in 1992.

Non-mail output increased more rapidly compared to mail output up until 2008 but declined more strongly after 2015 compared to mail output. Non-mail output increased at an average rate of 9.0 per cent per annum from 1992 to 2008, and declined thereafter, averaging –1.7 per cent from 2008 to 2015, and –6.8 per cent from 2015 to 2023. Delivery points, on the other hand, showed slower but steady growth over the whole period, with an average annual growth rate of 1.9 per cent for the whole period 1992 to 2023.

Total output increased over the whole 31-year period from 1992 to 2023, at an average annual output growth rate of 1.6 per cent. This growth was concentrated in the first half of that period. From 1992 to 2008, the average annual growth rate was 3.3 per cent. However, after 2008 total output was flat overall. Despite the higher weight given to delivery points in forming the total output index, the ongoing increases in the number of delivery points were offset by the reductions in mail and non-mail billed outputs after 2008. The average rate of total output change was –0.2 per cent over the seven years 2008 to 2015, and –0.1 per cent over the eight years 2015 to 2023.

3.3 Trends in Corporate Inputs

Table 3.1 also shows quantity indexes for the four inputs, labour, mail contractors, other non-capital inputs, and capital inputs, as well as the total input index. The quantity indexes for each of the four input groups and for total inputs are graphed in Figure 3.4.

3.3.1 Labour

Labour usage increased from 1992 to 1999, but thereafter decreased, so that over the period from 1992 to 2008 the average annual growth rate was –0.4 per cent. Between 2008 to 2015 the average rate of change was –0.1 per cent, and between 2015 and 2023 there was a small decrease averaging an annual rate of change of –0.4 per cent. Labour usage declined over the 31-year period, averaging an annual rate of –0.3 per cent. Total labour costs averaged 58.3 per cent of Australia Post's corporate non-capital costs over the 31-year period, declining from 67.8 per cent in 1992 to 53.7 per cent in 2023.

Table 3.1:   Corporate Outputs & Inputs, 1992–2023

	Outputs				Inputs				
	Mail	Billed Non-mail	Delivery Points	Total	Labour	Mail contractors	Other Non-capital	Capital	Total
1992	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1993	1.12	1.26	1.02	1.08	0.97	1.03	1.00	1.02	0.99
1994	1.18	1.48	1.05	1.13	0.98	1.05	1.04	1.04	1.00
1995	1.25	1.59	1.07	1.18	1.02	1.04	1.17	1.11	1.06
1996	1.32	1.84	1.11	1.24	1.05	1.13	1.20	1.20	1.10
1997	1.37	2.21	1.14	1.30	1.04	1.25	1.31	1.19	1.11
1998	1.41	2.62	1.14	1.34	1.03	1.30	1.38	1.23	1.13
1999	1.46	2.99	1.19	1.41	1.06	1.37	1.43	1.31	1.16
2000	1.54	3.35	1.23	1.48	1.03	1.39	1.68	1.35	1.19
2001	1.51	3.69	1.26	1.51	0.96	1.47	1.75	1.35	1.16
2002	1.49	3.58	1.29	1.51	0.94	1.49	1.73	1.31	1.14
2003	1.49	3.74	1.32	1.54	0.93	1.45	1.73	1.30	1.13
2004	1.50	3.87	1.35	1.57	0.94	1.45	1.81	1.30	1.15
2005	1.52	4.16	1.38	1.61	0.93	1.43	1.74	1.26	1.12
2006	1.56	4.20	1.41	1.64	0.93	1.42	1.71	1.26	1.12
2007	1.59	4.27	1.44	1.68	0.93	1.40	1.69	1.28	1.12
2008	1.60	4.22	1.46	1.69	0.94	1.37	1.57	1.29	1.10
2009	1.53	4.45	1.49	1.70	0.93	1.39	1.55	1.26	1.09
2010	1.49	4.28	1.50	1.68	0.90	1.35	1.50	1.24	1.06
2011	1.47	4.21	1.52	1.68	0.88	1.37	1.41	1.22	1.03
2012	1.46	4.18	1.54	1.69	0.88	1.36	1.45	1.19	1.03
2013	1.43	4.03	1.56	1.68	0.88	1.36	1.44	1.28	1.04
2014	1.41	3.87	1.57	1.67	0.88	1.34	1.53	1.25	1.05
2015	1.38	3.76	1.59	1.67	0.93	1.34	1.73	1.23	1.11
2016	1.31	3.69	1.62	1.65	0.87	1.31	1.68	1.24	1.06

Table 3.1:   (cont.)

	Outputs				Inputs				
	Mail	Billed Non-mail	Delivery Points	Total	Labour	Mail contractors	Other Non-capital	Capital	Total
2017	1.27	3.70	1.64	1.65	0.88	1.27	1.54	1.27	1.05
2018	1.27	3.34	1.66	1.64	0.88	1.28	1.58	1.27	1.06
2019	1.23	3.12	1.70	1.63	0.88	1.32	1.42	1.24	1.03
2020	1.28	2.90	1.72	1.65	0.89	1.35	1.40	1.27	1.04
2021	1.39	2.47	1.74	1.68	0.91	1.37	1.70	1.17	1.09
2022	1.44	2.25	1.77	1.70	0.95	1.40	1.83	1.08	1.12
2023	1.33	2.18	1.79	1.66	0.90	1.68	1.40	1.13	1.08
Growth rates:									
1992–2023	0.9%	2.5%	1.9%	1.6%	-0.3%	1.7%	1.1%	0.4%	0.2%
1992–2008	2.9%	9.0%	2.4%	3.3%	-0.4%	2.0%	2.8%	1.6%	0.6%
2008–2015	-2.1%	-1.7%	1.3%	-0.2%	-0.1%	-0.4%	1.4%	-0.6%	0.1%
2015–2023	-0.5%	-6.8%	1.5%	-0.1%	-0.4%	2.9%	-2.6%	-1.1%	-0.3%

Figure 3.4:   Corporate Input Indexes, 1992–2023
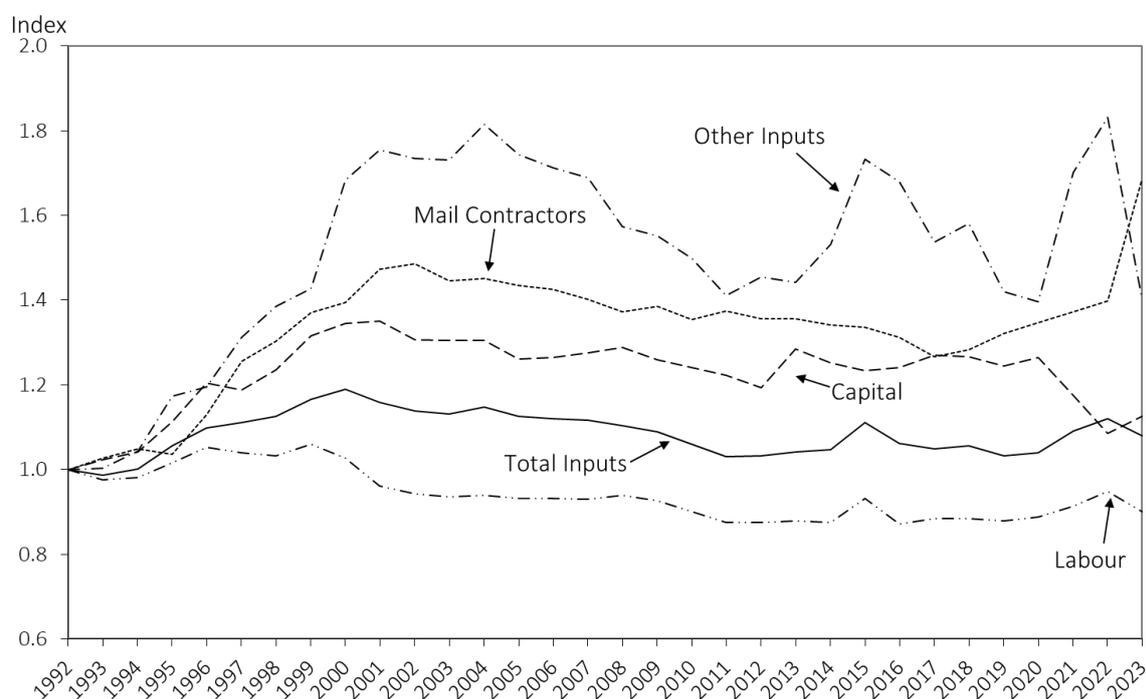
3.3.2   Mail contractors

The number of contracts used increased at an annual rate of 2.0 per cent between 1992 and 2008, before flattening out—the average rate of change from 2008 to 2015 was –0.4 per cent per annum. Between 2015 and 2023, the number of contracts increased, with an average rate of change of 2.9 per cent. Over the 31-year period from 1992 to 2023, the average rate of change in mail contractor inputs was 1.7 per cent. Mail contractor costs averaged 8.1 per cent of Australia Post's corporate non-capital costs over the 31-year period, increasing from 3.4 per cent in 1992 to 18.0 per cent in 2023.

3.3.3   Other non-capital inputs

The quantity of 'other non-capital' inputs initially increased faster than the other three input categories—over the period from 1992 to 2008 the average annual growth rate was 2.8 per cent and from 2008 to 2015 it averaged 1.4 per cent per annum. However, from 2015 to 2023 the average rate of change was –2.6 per cent per year, driven by a *decrease* of 30.7 per cent in the last year. Overall, other inputs increased by 40 per cent in total between 1992 and 2023, equivalent to an average annual rate of 1.1 per cent.

The share of other inputs in total costs averaged 20.8 per cent over the 31-year period from 1992 to 2023. It decreased from 17.8 per cent in 1992 to 15.8 per cent in 2023, although it peaked at 25.6 per cent in 2002.

3.3.4 Capital

Capital inputs are different to other inputs in that they are not fully consumed in the year of purchase. Rather, they provide a flow of services over their lives. The quantity and cost of using capital must take this phenomenon into account. The calculation of the quantity and cost of services provided by capital employed by Australia Post is explained in section 2.4.4.

The quantity of capital inputs increased over the 31-year period from 1992 to 2023 at an average annual rate of 0.4 per cent. Over the period from 1992 to 2008, capital inputs increased by 1.6 per cent, and from 2008 to 2015 the average annual growth rate was –0.6 per cent. From 2015 to 2023, capital inputs had a considerable decline, *decreasing* at an average rate of 1.1 per cent per year. The share of capital inputs in total costs averaged 12.8 per cent over the 31-year period from 1992 to 2023. It increased from 11.0 per cent in 1992 to 12.5 per cent in 2023.

3.3.5 Total input

Figure 3.4 shows that the total input quantity index follows a similar pattern to the labour quantity index but lies above it since the other three inputs all increased more than labour did over the period. The trend in total input use for the period as a whole has been relatively flat, increasing at an average rate of 0.2 per cent per annum from 1992 to 2023. Total input use increased at an average annual rate of 0.6 per cent between 1992 and 2008, and at 0.1 per cent from 2008 to 2015. But it has fallen since then, averaging –0.3 per cent per annum from 2015 to 2023.

3.4 Productivity

This section discusses the trends in Corporate TFP and partial factor productivity (PFP) indexes.

3.4.1 Total Factor Productivity (TFP) Trends

Australia Post's Corporate output quantity, input quantity and TFP indexes and their average growth rates for a number of periods are presented in Table 3.2 and Figure 3.5. TFP growth is the net effect of output and input growth.

Total output quantity grew strongly from 1992 up to 2008, at an average annual rate of 3.3 per cent. It then levelled out over the period from 2008 to 2023, averaging –0.2 per cent per year from 2008 to 2015 and –0.1 per cent from 2015 to 2023. The flat output index is due to the offsetting effects of reductions in both the mail and non-mail billed outputs and the growth in delivery points. The average annual growth rate of total output was 1.6 per cent between 1992 and 2023.

Table 3.2: Corporate Output, Input, TFP and PFP Indexes, 1992–2023

	Output Quantity Index	Input Quantity Index	TFP Index	Partial productivity index of:			
				Labour	Contractors	Other Costs	Capital
1992	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1993	1.08	0.99	1.09	1.11	1.05	1.07	1.05
1994	1.13	1.00	1.13	1.16	1.08	1.09	1.09
1995	1.18	1.06	1.12	1.16	1.14	1.01	1.06
1996	1.24	1.10	1.13	1.18	1.10	1.04	1.03
1997	1.30	1.11	1.17	1.25	1.04	0.99	1.10
1998	1.34	1.13	1.19	1.30	1.03	0.97	1.09
1999	1.41	1.16	1.21	1.33	1.03	0.99	1.07
2000	1.48	1.19	1.24	1.44	1.06	0.88	1.10
2001	1.51	1.16	1.30	1.57	1.02	0.86	1.12
2002	1.51	1.14	1.33	1.61	1.02	0.87	1.16
2003	1.54	1.13	1.36	1.65	1.07	0.89	1.18
2004	1.57	1.15	1.37	1.68	1.09	0.87	1.21
2005	1.61	1.12	1.43	1.73	1.12	0.92	1.28
2006	1.64	1.12	1.47	1.76	1.15	0.96	1.30
2007	1.68	1.12	1.50	1.80	1.20	0.99	1.31
2008	1.69	1.10	1.53	1.80	1.23	1.08	1.31
2009	1.70	1.09	1.56	1.84	1.23	1.10	1.35
2010	1.68	1.06	1.58	1.86	1.24	1.12	1.35
2011	1.68	1.03	1.63	1.92	1.23	1.19	1.38
2012	1.69	1.03	1.64	1.93	1.25	1.16	1.42
2013	1.68	1.04	1.62	1.92	1.24	1.17	1.31
2014	1.67	1.05	1.60	1.91	1.25	1.09	1.34
2015	1.67	1.11	1.50	1.79	1.25	0.96	1.35
2016	1.65	1.06	1.56	1.90	1.26	0.98	1.33
2017	1.65	1.05	1.57	1.87	1.30	1.07	1.30
2018	1.64	1.06	1.55	1.85	1.28	1.04	1.29
2019	1.63	1.03	1.58	1.86	1.23	1.15	1.31
2020	1.65	1.04	1.59	1.86	1.23	1.18	1.31
2021	1.68	1.09	1.54	1.83	1.22	0.99	1.43
2022	1.70	1.12	1.51	1.79	1.21	0.93	1.56
2023	1.66	1.08	1.53	1.84	0.98	1.18	1.47
Growth rates:							
1992–2023	1.6%	0.2%	1.4%	2.0%	-0.1%	0.5%	1.2%
1992–2008	3.3%	0.6%	2.7%	3.7%	1.3%	0.5%	1.7%
2008–2015	-0.2%	0.1%	-0.3%	-0.1%	0.2%	-1.6%	0.4%
2015–2023	-0.1%	-0.3%	0.2%	0.3%	-3.0%	2.5%	1.0%

Corporate total input quantity increased at an average annual rate of 0.2 per cent over the 31-year period to 2023. The growth rate for the first 16 years up to 2008 was higher, averaging 0.6 per cent per annum. From 2008 to 2015, inputs were stable, averaging an annual growth

rate of 0.1 per cent. Since 2015, total input use has had an average annual change of –0.3 per cent.

Australia Post's TFP growth (which is the difference between the growth rates of output and input quantity indexes) averaged 1.4 per cent per annum over the 31 years from 1992 to 2023. Average annual TFP growth in the 16 years from 1992 to 2008 was somewhat higher at 2.7 per cent. There was further TFP growth up to 2012, but then a decline in TFP up to 2015. On balance, TFP reduced slightly in the period 2008 to 2015, averaging an annual rate of –0.3 per cent. For the period from 2015 to 2023, average annual TFP growth was 0.2 per cent as total output was relatively flat while input use decreased. Whilst this is a positiive rate of TFP growth, the challenges of maintaining TFP growth in the face of declining mail volumes are evident, especially during the COVID-19 period.

Figure 3.5:   Corporate TFP Index, 1992–2023
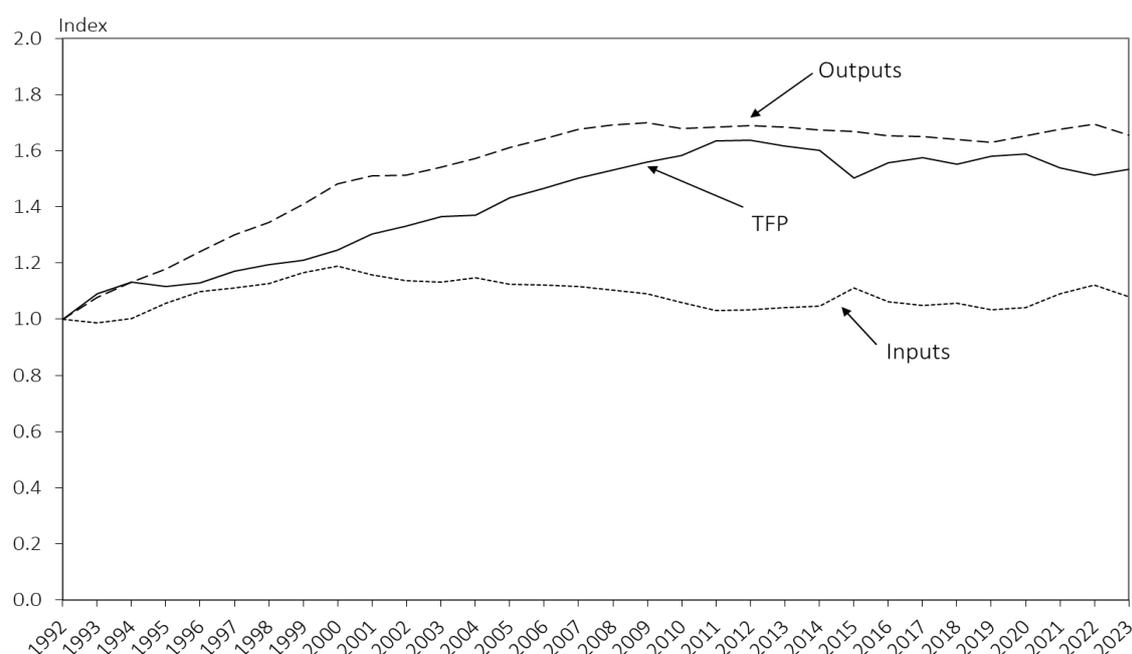
3.4.2   Partial Factor Productivity (PFP) Indexes

The partial productivities of the four inputs are presented in Figure 3.6 along with the TFP index. The PFP indexes and their average annual growth rates are also presented in Table 3.2. The TFP index is effectively a weighted average of the partial productivity indexes where the weights are complex terms involving the cost shares of the four inputs.

From Figure 3.6 we see that in the early part of the period, especially up to 2001, labour PFP increased faster than TFP, but since that time labour PFP has been flat. Over the full 31-year period, the average annual growth rate of labour PFP was 2.0 per cent. In the sub-periods,

labour PFP increased at an average rate of 3.7 per cent from 1992 to 2008, –0.1 per cent from 2008 to 2015, and 0.3 per cent from 2015 to 2023.

Mail contractor PFP growth averaged –0.1 per cent per year from 1992 to 2023. In the early period from 1992 to 2008, mail contractor PFP growth averaged 1.3 per cent, which is lower than the rate of growth of TFP during the same period. Like labour PFP, mail contractor PFP was relatively flat in the period 2008 to 2015, with 0.2 per cent annual growth in this period. From 2015 to 2023, mail contractor PFP decreased particularly strongly, averaging –3.0 per cent per year.

Other non-capital inputs' partial productivity has shown some growth over the 31-year period, averaging 0.5 per cent per year. This reflects the divergent trends of deterioration in the period 2008 to 2015 (at 1.6 per cent per year), and growth in the period 2015 to 2023, where other non-capital PFP increased at an average annual rate of 2.5 per cent. The latter was strongly influenced by a recovery of 24.3 per cent in 2023.

Capital PFP growth over the 31-year period from 1992 to 2023 averaged 1.2 per cent per annum. This is a quite strong result, in which significant gains in capital PFP were made in the period up to 2012, with relative stability from 2012 to 2020, and subsequently a substantial increase in the years from 2021 to 2023. The Capital PFP growth averaged 1.7 per cent per year from 1992 to 2008, 0.4 per cent from 2008 to 2015 and 1.0 per cent from 2015 to 2023.

Figure 3.6:   Corporate PFP Indexes, 1992–2023
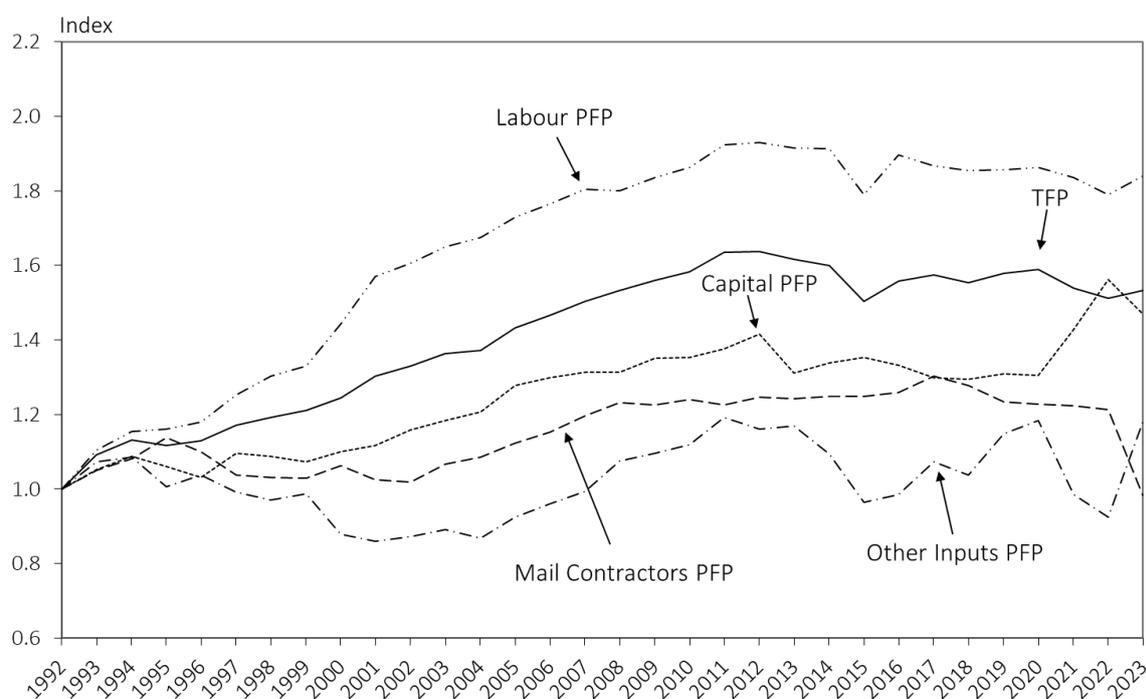
4   Reserved Service Productivity Indexes

This section discusses the trends in outputs inputs and productivity for Australia Post reserved services. Section 4.1 discusses output trends for five groups of mail outputs, and in total output of reserved services. Section 4.2 discusses the trends in inputs, and section 4.3 addresses productivity trends.

4.1   Trends in Reserved Services Outputs – Detail

4.1.1   Letters

Reserved letters output is a subset of the corporate letters group output, which was discussed in section 3.1.1, and the trends are similar. The quantity index for reserved letters service outputs increased at an average annual rate of 1.5 per cent between 1997 and 2008. Since 2008, letters growth has been strongly negative with an average annual growth rate of –5.5 per cent between 2008 and 2015, and at –10.0 per cent between 2015 and 2023. By 2023, the letters quantity index was 64 per cent below its 1997 level. This rapid turnaround in letter volumes has been due to the impact of technological change with the mass migration of both private and business communication from hard copy to electronic means.

Figure 4.1 shows the trends in the five types of reserved services letters outputs. These indexes and their growth rates over selected periods are shown in Table 4.1.

Figure 4.1:   Reserved Services Letters Output Quantity Indexes, 1997–2022
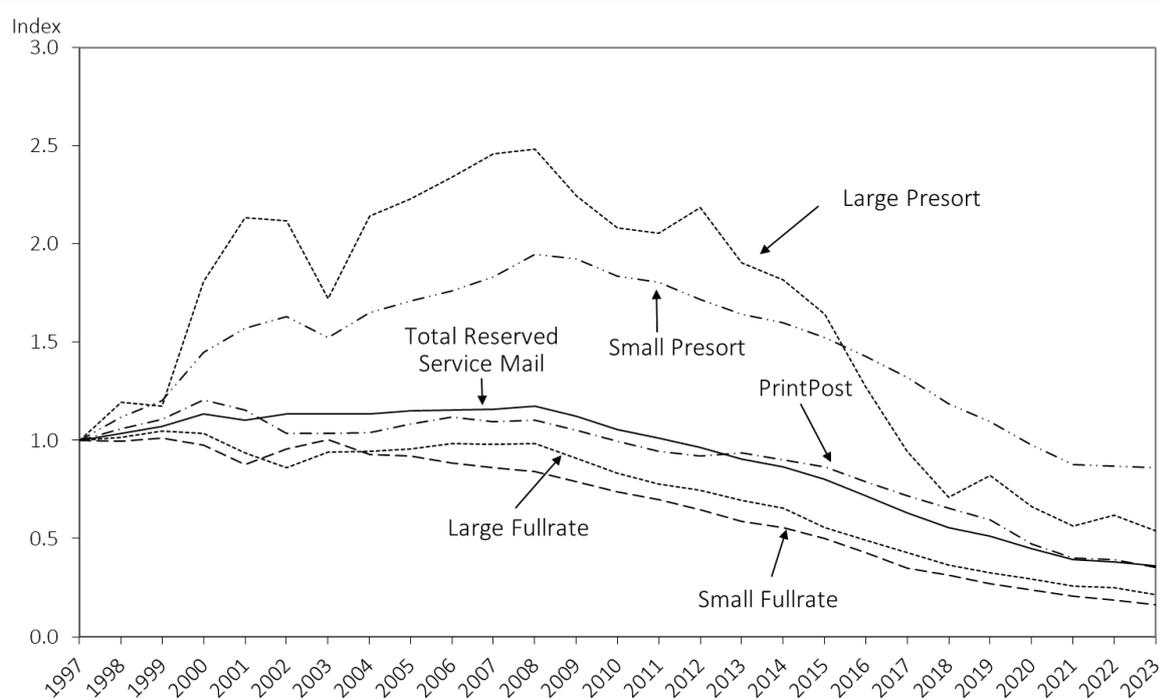
Table 4.1:   Reserved Services Mail Outputs 1997–2023

	Small full-rate	Small pre-sort	Large full-rate	Large pre-sort	Print post	Total Mail
1997	1.00	1.00	1.00	1.00	1.00	1.00
1998	0.99	1.12	1.02	1.19	1.06	1.04
1999	1.01	1.20	1.05	1.17	1.11	1.07
2000	0.97	1.45	1.04	1.81	1.20	1.13
2001	0.88	1.57	0.94	2.13	1.15	1.10
2002	0.96	1.63	0.86	2.12	1.04	1.13
2003	1.00	1.52	0.94	1.72	1.04	1.14
2004	0.93	1.65	0.95	2.14	1.04	1.14
2005	0.92	1.71	0.96	2.23	1.08	1.15
2006	0.88	1.76	0.98	2.34	1.12	1.15
2007	0.86	1.83	0.98	2.46	1.09	1.16
2008	0.84	1.95	0.99	2.48	1.10	1.17
2009	0.79	1.93	0.91	2.24	1.05	1.12
2010	0.74	1.84	0.83	2.08	1.00	1.06
2011	0.70	1.81	0.78	2.06	0.94	1.01
2012	0.65	1.72	0.74	2.19	0.92	0.96
2013	0.59	1.64	0.69	1.90	0.94	0.90
2014	0.55	1.60	0.65	1.82	0.90	0.87
2015	0.50	1.52	0.55	1.64	0.87	0.80
2016	0.43	1.43	0.49	1.27	0.79	0.72
2017	0.35	1.32	0.43	0.95	0.72	0.63
2018	0.31	1.19	0.36	0.71	0.66	0.56
2019	0.27	1.10	0.33	0.82	0.59	0.51
2020	0.24	0.97	0.29	0.66	0.47	0.45
2021	0.21	0.88	0.26	0.56	0.40	0.39
2022	0.19	0.87	0.25	0.62	0.39	0.38
2023	0.16	0.86	0.22	0.54	0.35	0.36
Growth rates:						
1997–2023	-7.0%	-0.6%	-5.9%	-2.4%	-4.0%	-3.9%
1997–2008	-1.6%	6.1%	-0.1%	8.3%	0.9%	1.5%
2008–2015	-7.5%	-3.5%	-8.2%	-5.9%	-3.4%	-5.5%
2015–2023	-13.9%	-7.1%	-11.8%	-13.9%	-11.3%	-10.0%

Figure 4.1 shows that the five reserved services mail categories have shown similar trends after 2008. In the period from 2008 to 2015, the average rates of change varied between −3.4 per cent (print-post) and −3.5 per cent (small pre-sort) to −8.2 per cent (large full-rate) per annum. In the period from 2015 to 2023, the average annual rates of change varied between −7.1 per cent (small pre-sort), −11.3 per cent (print post) and −11.8 (large full-rate) to −13.9 per cent (small full-rate and large pre-sort).

4.1.2   Other functional outputs

Trends in the number of delivery points are discussed in section 3.1.8.

4.2 Trends in Reserved Services Outputs – Aggregates

The TFP analysis of reserved services has two broad output quantity indexes, mail and delivery points. Mail here refers to the aggregate index for the five categories of reserved services letters as discussed in the previous section, which are aggregated using the Fisher Ideal index method (see Appendix A). The two broad outputs, reserved services mail and delivery points are then aggregated into a total output index using the fixed marginal cost weights presented in section 2.3.4.

The two broad output indexes are plotted alongside the total output index in Figure 4.2, and the corresponding index numbers are presented in Table 4.2. It is apparent from Figure 4.2 that the reserved services mail output index increased up to 2008, but then entered into a steep decline. As previously noted, reserved services mail outputs increased at an average annual rate of 1.5 per cent between 1997 and 2008, whereas the average annual rates for change were −5.5 per cent between 2008 and 2015, and −10.0 per cent between 2015 and 2023. In contrast to reserved letters, delivery points increased steadily over the whole 26-year period—at an average annual rate of 2.3 per cent between 1997 and 2008 and 1.3 per cent between 2008 and 2015. From 2015 to 2023, delivery points grew at an average rate of 1.5 per cent per annum.

Over the whole 26 years from 1997 to 2023, the annual rate of change in reserved services mail averaged −3.9 per cent. By 2023, the letters quantity index was 64 per cent below its 1997 level. Over the same period, the number of delivery points increased at an average rate of 1.7 per cent per year. By 2023, the delivery points output index was 57 per cent above its 1997 level.

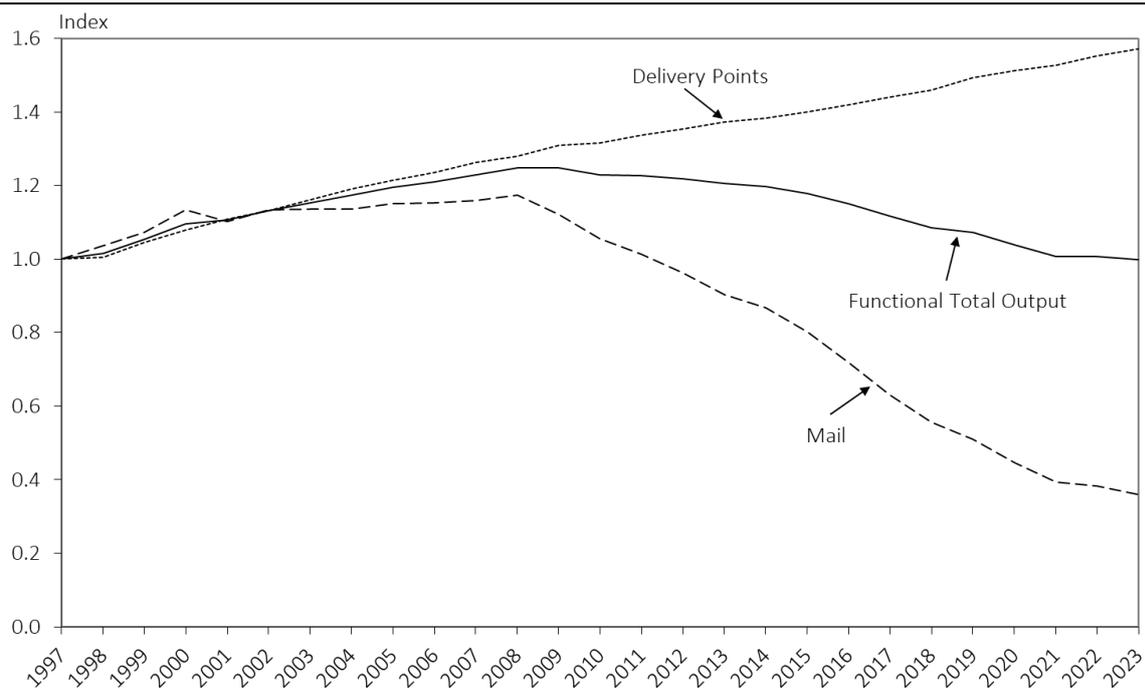### Figure 4.2: Reserved Services Output Indexes, 1997–2023

Table 4.2:   Reserved Services Outputs & Inputs, 1997–2023

	Outputs			Inputs				
	Mail	Delivery Points	Total	Labour	Mail contractors	Other Non-capital	Capital	Total
1997	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1998	1.04	1.00	1.01	0.98	1.04	1.06	1.01	1.00
1999	1.07	1.05	1.05	0.96	1.09	1.27	1.05	1.04
2000	1.13	1.08	1.10	0.94	1.11	1.32	1.05	1.04
2001	1.10	1.11	1.11	0.93	1.17	1.01	1.06	0.98
2002	1.13	1.13	1.13	0.89	1.21	0.85	1.02	0.92
2003	1.14	1.16	1.15	0.89	1.17	0.80	1.02	0.91
2004	1.14	1.19	1.17	0.88	1.14	0.99	1.02	0.94
2005	1.15	1.21	1.19	0.87	1.08	1.07	0.96	0.93
2006	1.15	1.24	1.21	0.86	1.08	0.99	0.96	0.91
2007	1.16	1.26	1.23	0.85	1.04	0.96	0.94	0.89
2008	1.17	1.28	1.25	0.86	1.00	0.93	0.94	0.89
2009	1.12	1.31	1.25	0.84	1.06	0.87	0.92	0.87
2010	1.06	1.32	1.23	0.81	1.04	0.95	0.91	0.86
2011	1.01	1.34	1.23	0.78	1.01	0.83	0.90	0.82
2012	0.96	1.35	1.22	0.76	0.96	0.77	0.86	0.79
2013	0.90	1.37	1.21	0.75	0.94	0.70	0.84	0.77
2014	0.87	1.38	1.20	0.74	0.97	0.80	0.82	0.78
2015	0.80	1.40	1.18	0.74	0.97	0.79	0.77	0.77
2016	0.72	1.42	1.15	0.72	0.95	0.64	0.75	0.73
2017	0.63	1.44	1.12	0.72	0.98	0.65	0.76	0.73
2018	0.56	1.46	1.08	0.70	0.99	0.57	0.75	0.71
2019	0.51	1.49	1.07	0.69	1.02	0.53	0.72	0.70
2020	0.45	1.51	1.04	0.65	1.04	0.37	0.70	0.64
2021	0.39	1.53	1.01	0.54	1.06	0.35	0.66	0.56
2022	0.38	1.55	1.01	0.55	1.08	0.36	0.62	0.56
2023	0.36	1.57	1.00	0.54	1.30	0.38	0.62	0.57
Growth rates:								
1997–2023	-3.9%	1.7%	0.0%	-2.4%	1.0%	-3.8%	-1.9%	-2.2%
1997–2008	1.5%	2.3%	2.0%	-1.4%	0.0%	-0.6%	-0.6%	-1.1%
2008–2015	-5.5%	1.3%	-0.8%	-2.2%	-0.4%	-2.4%	-2.8%	-2.1%
2015–2023	-10.0%	1.5%	-2.1%	-3.9%	3.6%	-9.2%	-2.8%	-3.8%

4.2.1   Total output

The movement of the total output index for reserved services reflects the net effect of the divergent trends of its two components. Figure 4.2 shows that in the period up to 2008, the total output index increased, whereas after 2008 it decreased. The average rate of change in total output from 1997 to 2008 was 2.0 per cent per annum. On the other hand, from 2008 to 2015, the average annual rate of change in Reserved Services' total output was –0.8 per cent; and from 2015 to 2023 the average annual rate of change was –2.1 per cent. The net effect of the increase prior to 2008 and the decrease since then, is that the total output index in 2023

was the same as its 1997 level. The annual average growth of Reserved Services total output over the 26-year period from 1997 to 2023 was zero.

4.3 Trends in Reserved Services Inputs

Table 4.2 also shows quantity indexes for the four inputs, labour, mail contractors, other non-capital inputs, and capital inputs, as well as the total input index for reserved services. The quantity indexes for each of the four input groups and total inputs are graphed in Figure 4.3.

4.3.1 Labour

Labour usage decreased almost continuously over the 26-year period to 2023. From 1997 to 2008, the average annual growth rate was –1.4 per cent. Between 2008 to 2015 the average rate of change was –2.2 per cent, and between 2015 and 2023 the average rate of change was –3.9 per cent. Labour usage declined over the 26-year period, averaging an annual rate of –2.4 per cent. By 2023, labour inputs for reserved services were 46 per cent below the level in 1997.

Figure 4.3:   Reserved Services Input Indexes, 1997–2023
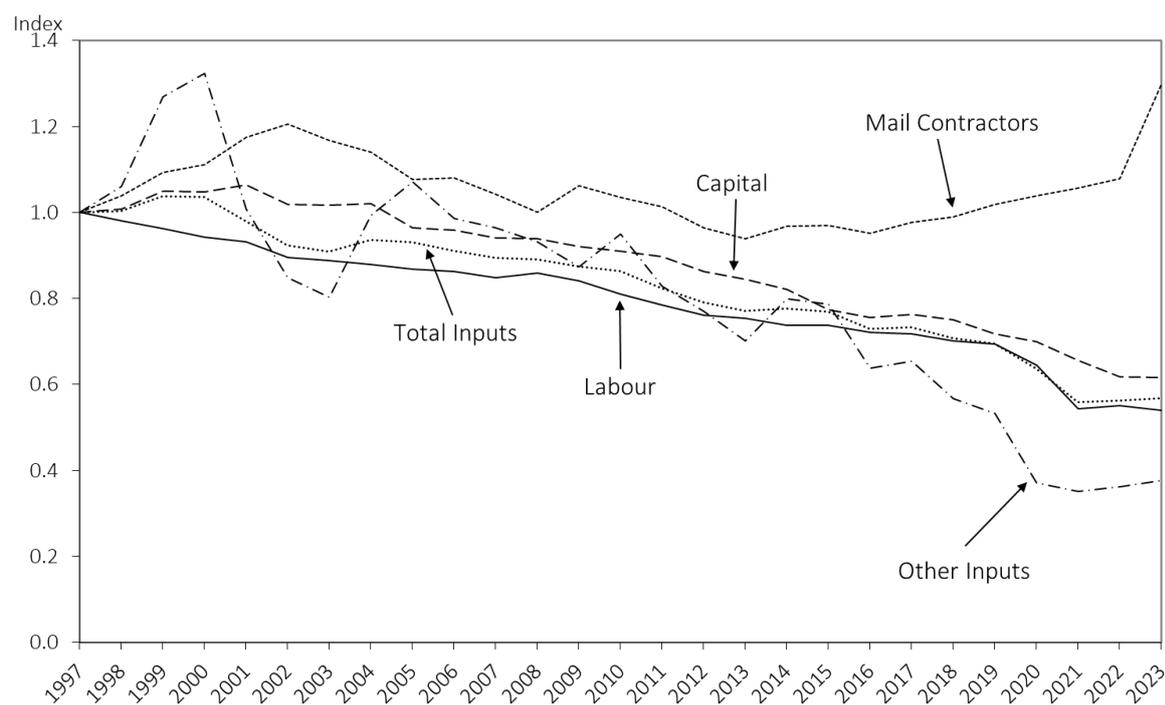
4.3.2 Mail contractors

The number of mail contracts used increased up to 2002, but thereafter decreased almost continuously up to 2016 and increased up to 2023. In the period up to 2008, the net effect was an average annual rate of increase of mail contractor input of zero per cent. From 2008 to

2015, the annual average rate of change in mail contractor input was –0.4 per cent, and from 2015 to 2023 it was 3.6 per cent. Over the 26-year period from 1997 to 2023, the average rate of change in mail contractor inputs was 1.0 per cent per year.

4.3.3 Other non-capital inputs

The quantity of 'other non-capital' inputs decreased considerably over the period 1997 to 2023. Other inputs are residual items calculated from the difference between the total cost allocated to reserved services and the costs of labour and mail contractor inputs associated with reserved services activities. Over the 26-year period, other non-capital inputs decreased rapidly, averaging an average annual rate of –3.8 per cent. This has accelerated over the period, and by 2023, other non-capital inputs were only 38 per cent of their level in 1997.

4.3.4 Capital

Capital inputs increased up to about 2001 but have decreased continuously since that time. Over the period 26-year period from 1997 to 2026 capital inputs declined at an average annual rate of –1.9 per cent. The rate of decline increased over this period; from –0.6 per cent from 1997 to 2008; to –2.8 per cent from 2008 to 2015; to –2.8 per cent from 2015 to 2023. By 2023, capital inputs were 38 per cent below the level in 1997.

4.3.5 Total input

Figure 4.3 also shows the total input quantity index. The rate of change in the total input index averaged –1.1 per cent between 1997 to 2008, and –2.1 per cent from 2008 to 2015. In the most recent period from 2015 to 2023, the total input index for reserved services decreased more strongly, averaging an annual rate of –3.8 per cent per annum. Over the whole period from 1997 to 2023, the total input index for reserved services changed at an average rate of –2.2 per cent per year.

4.4 Productivity

This section discusses the trends in reserved services TFP and PFP indexes. These indexes are shown in Table 4.3.

4.4.1 Total Factor Productivity (TFP) Trends

Australia Post's reserved services output quantity, input quantity and TFP indexes, and their average growth rates for a few periods, are presented in Table 4.3 and Figure 4.4.

Table 4.3: Reserved Services Output, Input, TFP and PFP Indexes, 1997–2023

|	*Output Quantity Index*	*Input Quantity Index*	*TFP Index*	*Partial productivity index of:*			
				Labour	*Mail Contractors*	*Other cost*	*Capital*
1997	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1998	1.01	1.00	1.01	1.03	0.98	0.96	1.01
1999	1.05	1.04	1.02	1.10	0.97	0.83	1.01
2000	1.10	1.04	1.06	1.16	0.99	0.83	1.05
2001	1.11	0.98	1.13	1.19	0.94	1.10	1.04
2002	1.13	0.92	1.23	1.27	0.94	1.34	1.11
2003	1.15	0.91	1.27	1.30	0.99	1.44	1.13
2004	1.17	0.94	1.25	1.33	1.03	1.18	1.15
2005	1.19	0.93	1.28	1.38	1.11	1.11	1.24
2006	1.21	0.91	1.33	1.40	1.12	1.23	1.26
2007	1.23	0.89	1.37	1.45	1.18	1.27	1.31
2008	1.25	0.89	1.40	1.45	1.25	1.34	1.33
2009	1.25	0.87	1.43	1.48	1.18	1.43	1.36
2010	1.23	0.86	1.43	1.52	1.19	1.30	1.35
2011	1.23	0.82	1.49	1.56	1.21	1.48	1.37
2012	1.22	0.79	1.54	1.60	1.26	1.58	1.41
2013	1.21	0.77	1.57	1.60	1.28	1.72	1.43
2014	1.20	0.78	1.54	1.62	1.24	1.50	1.46
2015	1.18	0.77	1.53	1.60	1.22	1.50	1.52
2016	1.15	0.73	1.58	1.60	1.21	1.81	1.53
2017	1.12	0.73	1.52	1.56	1.14	1.71	1.46
2018	1.08	0.71	1.53	1.55	1.10	1.91	1.44
2019	1.07	0.70	1.54	1.55	1.05	2.02	1.49
2020	1.04	0.64	1.63	1.61	1.00	2.80	1.49
2021	1.01	0.56	1.80	1.85	0.95	2.87	1.54
2022	1.01	0.56	1.79	1.83	0.94	2.78	1.63
2023	1.00	0.57	1.76	1.85	0.77	2.66	1.62
Growth rates:							
1997–2023	0.0%	-2.2%	2.2%	2.4%	-1.0%	3.8%	1.9%
1997–2008	2.0%	-1.1%	3.1%	3.4%	2.0%	2.7%	2.6%
2008–2015	-0.8%	-2.1%	1.3%	1.3%	-0.4%	1.6%	2.0%
2015–2023	-2.1%	-3.8%	1.7%	1.8%	-5.7%	7.2%	0.7%

As previously noted, reserved services total output quantity grew from 1997 up to about 2008, and then declined over the period from 2008 to 2023, such that the output level in 2023 was the same as that in 1998. Input use in Reserved Services generally declined over the period 1997 to 2023 and decreased most strongly in the period from 2015 to 2023. The net effect of these trends is seen in movements of the TFP index.

Reserved Services TFP growth averaged 3.1 per cent per annum from 1997 to 2008, influenced by reasonably strong output growth (averaging 2.0 per cent per annum) in combination with reduced input use (–1.1 per cent per annum).

Between 2008 and 2015, reserved services TFP increased more slowly at an average rate of 1.3 per cent per annum. This is the net effect of declining output (–0.8 per cent per annum), and a larger decline in inputs (averaging –2.1 per cent per annum).

From 2015 to 2023, reserved services TFP growth was strong, averaging 1.7 per cent per year. Although output declined strongly in this period (–2.1 per cent per annum), it was outpaced by the rate of decline in input use (averaging –3.8 per cent per annum).

Figure 4.4:   Reserved Services TFP Index, 1997–2023
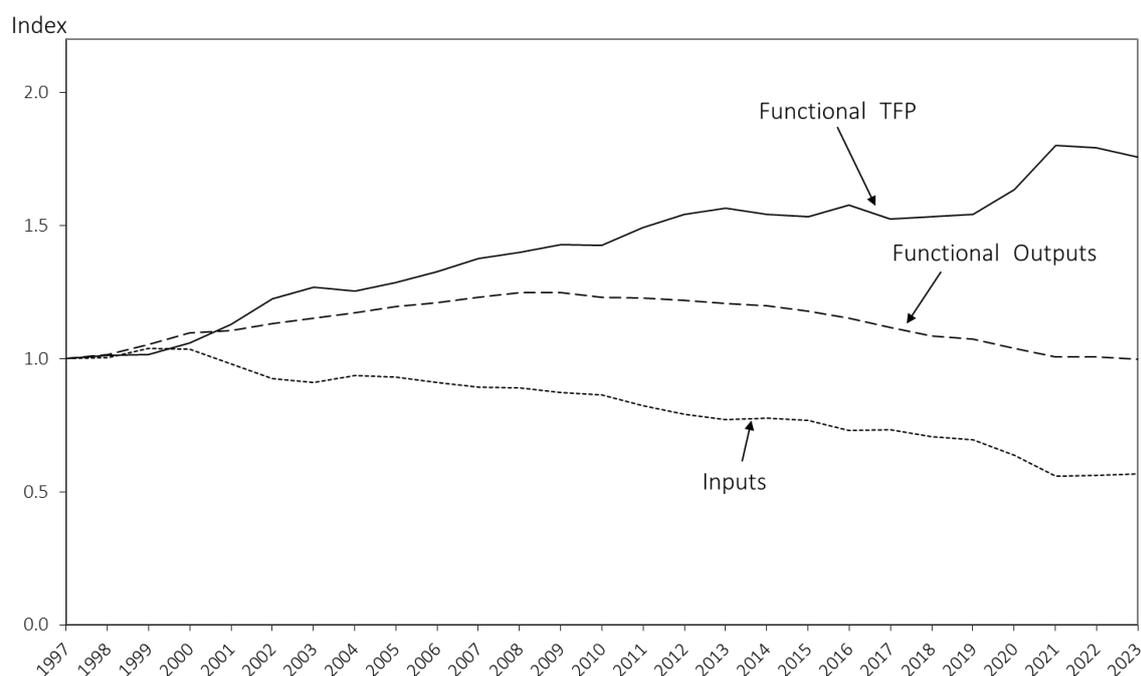
4.4.2   Partial Factor Productivity (PFP) Indexes

The partial productivity indexes of the four inputs for reserved services, and their average annual growth rates, are presented in Table 4.3. They are also plotted in Figure 4.5 alongside the TFP index.

From Figure 4.5 we see that labour PFP increased at a reasonably steady rate over the 26-year period from 1997 to 2023, with the exception of some weakening in the period between 2014 and 2017, and a particularly strong improvement in 2021. Over this whole period, the average annual growth rate of labour PFP was 2.4 per cent. In the sub-periods, labour PFP increased at an average rate of 3.4 per cent from 1997 to 2008, 1.3 per cent from 2008 to 2015 and 1.8 per cent from 2015 to 2023.

Figure 4.5: Reserved Services PFP Indexes, 1997–2023
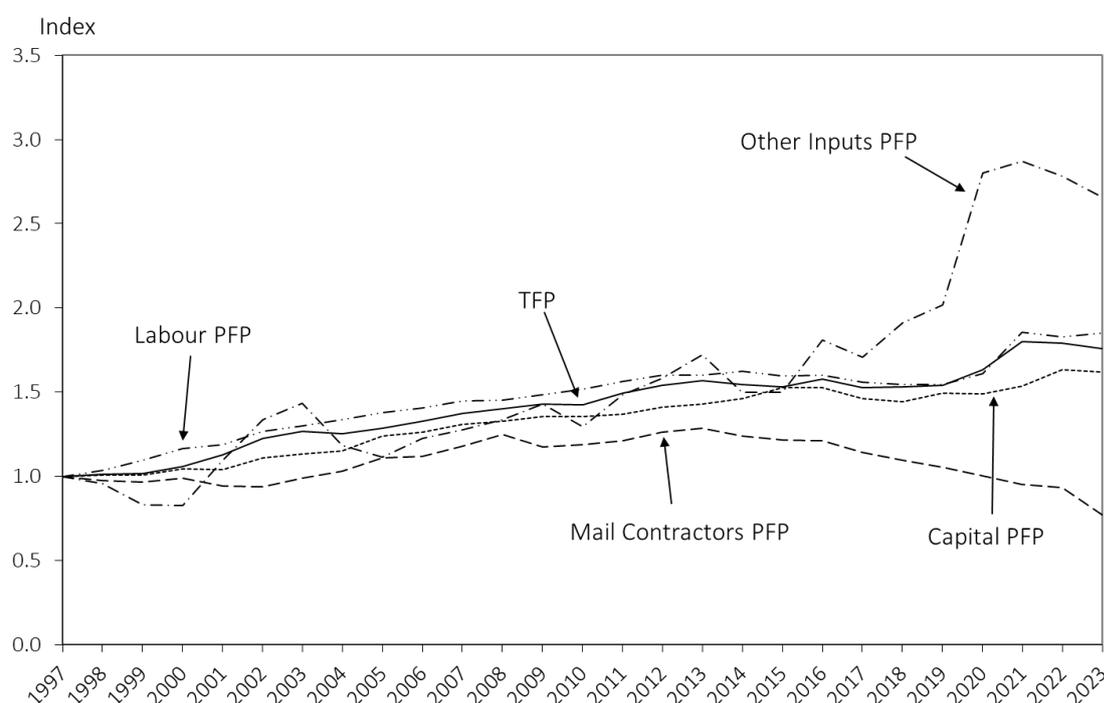
Mail contractor PFP in reserved services increased up to 2013, but declined over the remaining period to 2023, and in that year, the level of contractor PFP was 23 per cent lower than in 1997. Its growth averaged 2.0 per cent per year from 1997 to 2008. It declined slowly in the period 2008 to 2015, averaging –0.4 per cent per year; and decreased particularly strongly in the period from 2015 to 2023, averaging –5.7 per cent per year. Other non-capital inputs PFP increased steadily up to 2015, averaging 2.7 per cent growth per annum from 1997 to 2008, and 1.6 per cent per year from 2008 to 2015. There was a particularly strong increase in Other non-capital PFP in the period from 2015 to 2023 of 7.2 per cent. Over the whole period from 1997 to 2023, Other non-capital input PFP increased at an average annual rate of 3.8 per cent.

Capital PFP growth for reserved services over the 26-year period from 1997 to 2023 averaged 1.9 per cent per annum. This is a stronger result than for Corporate. Much of the gains in reserved services capital PFP were made in the period up to 2015, with its growth rate averaging 2.6 per cent per year from 1997 to 2008 and 2.0 per cent per year from 2008 to 2015. Since 2015, capital PFP has continued to grow at lower rate, averaging 0.7 per cent annual growth in the period 2015 to 2023.

Appendix A: Fisher Ideal TFP Index

Mathematically, the Fisher ideal output index is given by:

$$Q_{t|b} = \left[\left(\frac{\sum_{i=1}^{m} P_{ib} Y_{it}}{\sum_{i=1}^{m} P_{ib} Y_{ib}} \right) \left(\frac{\sum_{i=1}^{m} P_{it} Y_{it}}{\sum_{i=1}^{m} P_{it} Y_{ib}} \right) \right]^{0.5} \tag{A.1}$$

where subscript i refers to the ith output, t refers to period t and b refers to the base period; and

- $Q_{t|b}$ is the Fisher ideal output index for period t relative to base period b

- P_{ib} and P_{it} is the price of the ith output for the base period and period t respectively

- Y_{ib} and Y_{it} is the quantity of the ith output for the base period and period t respectively.

The Fisher ideal index is the geometric mean of: (a) an index in which outputs in each period are weighted by prices of the base period, and (b) an index in which outputs in each period are weighted by prices of in period t.

Similarly, the Fisher ideal input index is given by:

$$I_{t|b} = \left[\left(\frac{\sum_{j=1}^{n} W_{jb} X_{jt}}{\sum_{j=1}^{n} W_{jb} X_{jb}} \right) \left(\frac{\sum_{j=1}^{m} W_{jt} X_{jt}}{\sum_{j=1}^{m} W_{jt} X_{jb}} \right) \right]^{0.5} \tag{A.2}$$

where subscript j refers to the jth input, t again refers to period t and b refers to the base period; and

- $I_{t|b}$ is the Fisher ideal input index for period t relative to base period b

- W_{ib} and W_{it} is the price of the jth input for the base period and period t respectively

- X_{ib} and X_{it} is the quantity of the jth input for the base period and period t respectively.

The Fisher ideal TFP index is then given by:

$$TFP_{t|b} = \frac{Q_{t|b}}{I_{t|b}} \tag{A.3}$$

The Fisher index can be used in either the unchained form as shown above, where it is defined between any base period b and period t, or in the chained form which is used in this study. The chained form is defined for the output index in equation A.4. For each period, the base period is the previous period and the indexes are multiplied by the preceding value to produce a sequence.

$$Q_t^{Ch} = 1 \times Q_{2|1} \times Q_{3|2} \dots \times Q_{t|t-1} \tag{A.4}$$

Appendix B: Mail Contractor Input Index

In its assessment of Australia Post's 2022 draft price notification, the ACCC indicated that the measurement of mail contractor input needs further consideration. In the 2022 analysis of TFP (Quantonomics 2022b), and earlier studies carried out by Economic Insights, mail contractor input has been measured by the number of contracts. The ACCC noted that mail contractor input had a declining trend over more than a decade, and said that "using number of contracts as a measure fails to control for changes in size or composition of mail contracts over time" (ACCC 2022:27). This may result in underestimation of mail contractor input, and over-estimation of TFP growth. However, "given the relatively small cost share of the mail contractors input", the ACCC concluded that "the extent of over-estimating TFP growth may be limited" (ACCC 2022:27).

In this report, we have formulated a different measure of mail contractor input from 2018 to 2022 and spliced this onto the previous measure of mail contractor input up to 2017. Australia Post has provided data from 2017 to 2022 for:

- Mail contractor hours worked by type of mail service and activity;[7] and

- Estimated mail contractor annual kilometres by type of mail service.

We have used the total mail contractor hours and total annual kilometres over all activities and have combined the growth rates of these two measures into an index of mail contractor input. A fixed-weighted index formula is used, as follows:

$$\dot{M}_t = \alpha . \dot{H}_t + (1 - \alpha) . \dot{D}_t \qquad \text{(B.1)}$$

where *M* refers to the quantity of mail contractors, *H* refers to the hours worked, *D* refers to the estimated distance travelled, and a dot above a variable refers to the rate of change between period *t* and the previous period, measured by the difference in log values.

To develop the weights we have drawn on a report prepared for the Independent Pricing and Regulatory Tribunal (IPART) by the Centre for International Economics (CIE 2012) on the cost structure of taxi cabs. We have excluded cost items that are specific to taxi cabs, including plate lease costs, network fees and operator administration. Further, we have assumed that maintenance and insurance costs for vehicles used by mail contractors are only half of those for taxi cabs. Cleaning costs are assumed to be only a quarter of those of taxi cabs, which have special cleaning requirements. These data and assumptions result in the cost breakdown shown in Table B.1.

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[7] The mail service types are: Roadside Delivery, Intrastate Transport, Interstate Transport, Street Mail Delivery, Miscellaneous Delivery, Parcel Delivery, SPB Clearances, Depot/Dump Bags, and Combination Service. The activity types are Sorting, Setup and Delivery. This breakdown is not used in our analysis.

Table B.1: Estimated mail contractor cost structure

Cost item	% of mail contractor's costs
Driver labour	65.3
Fuel	15.5
Maintenance cost	4.2
Insurance	5.6
Vehicle lease payments	5.5
Cleaning	3.9
Total	100.0

Source: The cost components are based on the average of urban and rural taxis in (CIE 2012), subject to the assumptions stated.

The weight attributed to kilometres is based on the combined costs of fuel, maintenance and insurance, which together amount to approximately 25 per cent. The other costs are allocated to driver hours and together amount to 75 per cent. These are our adopted weights for calculating the mail contractor input quantity index.

References

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