Australia Post
Letter Volume Demand Update

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Note

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Overview

The sustainability issue facing Australia Post's letters business reflects a situation whereby the migration towards digital communication platforms (e-substitution) is eroding volume despite a growth in delivery points.[1] This is a global trend as postal authorities worldwide have increased their Basic Postage Rate (BPR) in response to severe volume erosion. By comparison, Australia Post's BPR has remained comparatively low given the lack of significant rate increases over the past five years. This update examines the impact of a proposed January 2024 increase in Australia Post's letter rates, headlined by a 25% rise in the BPR. The research uses econometric techniques to explain historical volume fluctuations for Australia Post's key domestic letter segments whilst also projecting baseline volume forecasts to 2025/26.

Historical trends

Letter volume reductions differ across each segment because the impact of the key volume driver, e-substitution, differs depending upon the unique communication and content characteristics of each letter service. Total letter volume declines in 2021/22 were softer than usual due to transitory demand stimulus flowing through the PreSort small letter service, see Table 1. Additional mail was attributable to factors including the federal election and increases in the Reserve Bank of Australia's official cash rate which triggered lending institutions into alerting customers of changes to their mortgage commitments. Often the letter was used to convey these communications.

Table 1 Total addressed domestic letter volumes

	Percentage change (%)				Share of total letters
Segment	**2019/20**	**2020/21**	**2021/22**	**2007/08 to 2021/22**	**2021/22**
Other small	-12.5	-13.6	-9.6	-78.0	25%
PreSort small	-11.0	-10.1	-1.0	-55.4	62%
Other large	-10.5	-12.4	-2.9	-74.7	4%
PreSort large	-20.1	-15.2	8.7*	-76.0	3%
Print Post	-21.3	-12.9	-1.9	-66.2	6%
Total letters	**-12.3**	**-11.4**	**-3.2**	-66.5	**100%**

**figure impacted by the August 2021 Australian census*

Price elasticities and volume projections

All estimated price elasticities are inelastic, with several statistically insignificant, see Table 2. This conforms with previous updates in this series, as volume erosion is largely driven by accelerated e-substitution and a relative stable letter rate. The econometric baseline projections emphasise minimal long term demand effects resulting from the proposed January 2024 rate rises. Instead, total letter volume erosion is expected to be primarily driven by e-substitutive pressures by 2025/26 irrespective of any rate increases, see Table 3.

[1] Since 2007/08, Australia Post has experienced a 66.5% reduction in total domestic letter volume, however Australia's population has grown by 22.3%.

Table 2 Price elasticity of demand

		2022 Update	2023 Update
Small letter	Ordinary / Other	-.15	-.38*
	PreSort	-.55*	-.45*
Large letter	Ordinary / Other	-.18	-.38
	PreSort	-.47*	-.65
Print Post		-.06*	-.65

** denotes statistically insignificant*

Table 3 Percentage changes in total letter volume inclusive of proposed rate rises

(Projections without proposed rate rises presented in parentheses)

	Pre COVID-19	COVID-19		Post COVID-19				
	2018/19*(a)*	**2019/20*(a)***	**2020/21*(a)***	**2021/22*(a)***	**2022/23*(a & p)*[2]**	**2023/24*(p)***	**2024/25*(p)***	**2025/26*(p)***
Small								
Ordinary/Other	-13.9	-12.5	-13.6	-9.6	-12.1	-12.3 *(-12.1)*	-13.0 *(-12.0)*	-13.1 *(-12.1)*
PreSort	-7.7	-11.0	-10.1	-1.0	-2.0	-14.3 *(-8.9)*	-10.1 *(-6.5)*	-6.3 *(-6.3)*
Large								
Ordinary/Other	-10.6	-10.5	-12.4	-2.9	-10.2	-9.7 *(-9.6)*	-10.0 *(-8.8)*	-9.3 *(-8.1)*
PreSort	16.6	-20.1	-15.2	8.7	-15.0	-10.0 *(-8.7)*	-13.0 *(-6.5)*	-10.5 *(-7.6)*
Print Post	-9.1	-21.3	-12.9	-1.9	-12.5	-21.1 *(-16.9)*	-22.1 *(-12.7)*	-12.3 *(-12.3)*
Total letters	**-9.2**	**-12.3**	**-11.4**	**-3.2**	**-5.8**	**-13.9 *(-10.1)***	**-11.5 *(-8.1)***	**-8.4 *(-8.0)***

actual *(a)* & projected *(p)* baseline

For further detail please consult the source documentation.

[2] The 2022/23 projections are constructed by using nine months of actual values and three months of econometric projected values.

INTRODUCTION

1.1 OVERVIEW

For more than two decades, Diversified Specifics' product-segmented econometric models have been instrumental in analysing and projecting variations in domestic letter volumes for Australia Post.[3] During this period, the Australian postal industry has undergone substantial change as letter volumes have eroded significantly, primarily due to the forces of e-substitution.[4] This has created a significant challenge for Australia Post, as the volume declines have been accompanied by increased delivery points. Being the national carrier of standard letters under its reserved service obligations, Australia Post is therefore confronted with a fundamental problem of sustainability – a rapidly diminishing demand for letters that must fund the increasing costs associated with an ever-expanding delivery footprint.

Complicating matters further, the corporatised framework of Australia Post requires the business to aim to deliver a profit to its key shareholder, the Australian Government.[5] The options available to Australia Post, if it is to work towards this aim, are quite limited. In the absence of meaningful legislative change to its universal service and reserved service obligations, the only real levers of change Australia Post can pull are alterations to the delivery timetable and/or price change.[6] Australia Post has enacted a series of initiatives in recent years aimed at streamlining its cost base, such as offering a dual speed letter. However, there are limitations on the extent to which the delivery window can be widened before the transportation of a physical letter item becomes completely redundant, especially when competing against the immediacy of an electronic alternative. A complete elimination of the letters business has consequences for those in society who

[3] The econometric methods deployed throughout the study vary. Vector error correction modelling (VECM) and dynamic ordinary least squares (DOLS) represent the primary modelling techniques. The VECM framework nests the structural and cyclical components of letter volume trends into a methodology that allows an examination of short and long-run fluctuations of letter volumes and their relevant drivers. DOLS techniques are also employed to improve the precision of the long-run parameter estimates for some letter segments because of data availability or the presence of structural breaks.

[4] In this context the term 'erosion' primarily refers to a shift towards digital modes of communication and away from a physical letter item. Although these switching characteristics are commonly termed 'e-substitution', the term 'substitution' for the purposes of this study also extends to other forms of erosion such as letter volume consolidation and the rationalisation of mailing cycles.

[5] Commonwealth of Australia (1989), see bibliography. As a government business enterprise, Australia Post operates under the Australian Postal Corporation Act 1989. This Act outlines the objectives and functions of the organisation, which include the requirement to operate efficiently and profitably while also fulfilling its community service obligations. The Act mandates Australia Post to balance its commercial objectives with its responsibility to provide accessible and reliable postal services to the Australian public. Section 27 of the Australian Postal Corporation Act 1989 specifically addresses the need for Australia Post to pursue profitability. The Act states that the organisation must "perform its functions in such a manner as to maximise its profits unless, and to the extent that, it is inconsistent with the performance of its community service obligations or with the exercise of its powers under this Act". Thus, the corporatised framework of Australia Post ensures that the business focuses on delivering a profit while also maintaining its obligation to serve the community.

[6] In this context, the term 'price' is defined as the rate charged for a given postal item.

still place a high value on Australia Post's letters service, such as the elderly and those demographics without access to alternative, technology-based communicative platforms.

In this document, scenarios on letter volumes and revenue projections are developed according to Australia Post's intent to use a rate rise in January 2024 to assist in coping with its sustainability challenges. This proposed rate rise will attempt to realign the basic postage rate (BPR) to one that more accurately reflects the prices charged by other Westernised countries offering a similar set of products in their letters portfolio.

As this documentation is an update of the 2022 Diversified Specifics research, it is important to address a key unanticipated change in the set of drivers that has substantially affected Australia Post's letter volumes over the past 18 months – the cost-of-living crisis. Inflationary pressures have led to rising interest rates as the Reserve Bank of Australia (RBA) adjusts the cash rate to maintain price stability and sustainable economic growth. This influences commercial banks to raise their interest rates on loans and mortgages.[7] Because of these interest rate movements, Australian mortgage holders have been notified by financial institutions about increases in their loan repayments. These notifications have typically been delivered using letters, leading to a surge in transactional mail sent to Australian households.

While this cost-of-living crisis has temporarily increased the number of transactional mail items, the concern for Australia Post is that once the interest rate rises cease, letter volumes will likely revert to their longer-term decline as dictated by the forces of e-substitution. Therefore, this update seeks to quantify the cost-of-living effects on letter volumes, while accounting for the cumulative impact of typical drivers. These include e-substitution, letter pricing, economic growth, delivery service performance, the pandemic and the 2021 census. Examining the effect of the cost-of-living crisis also highlights a recent trend in the research effort, as letter volumes reduce unique events are becoming more visible and distortive to time series analysis.

This report summarises the research process, which involves estimating an updated set of econometric models designed to explain recent volume movements across Australia Post's five key domestic letter segments. Baseline projections of segmented letter volumes are developed for the 2022/23 to 2025/26 period using the estimated models in conjunction with forecasted demand driver values. Given the econometric nature of this study, each model is based on empirical associations. Therefore, it is essential to augment the projections generated by the econometric

[7] Taylor, J. B. (1993) and Mishkin, F. S. (2007) provide an explanation of the underlying economic theories. See bibliography.

models with additional intelligence about future events or emerging trends not adequately observed in the historical data. Continuous consideration of further amendments based on sound institutional knowledge and emerging trends is imperative.[8]

The report is structured as follows:

- Section 1 details the research objectives and project scope.
- Section 2 showcases trends in Australia Post's reserved letter segments, highlighting recent letter volume erosion, and presents the demand hypotheses/driver proxies used in the econometric analysis.
- Sections 3 to 7 provide individual summaries of the descriptive statistics, elasticities and projections for the five key reserved letter segments comprising total domestic addressed letters at Australia Post.
- Section 8 summarises the key findings at a total letter level, presents simulated variations on the projections and offers concluding remarks.
- The appendices include a technical summary of statistical outputs, data descriptions, and a discussion on the caveats associated with interpreting the outcomes of this econometric process.

[8] See Appendix C for a list of qualifications relating to baseline econometric projections.

1.2 OBJECTIVES

1.2.1 Primary objective

Econometrically estimate a set of segmented domestic addressed letter volume models on behalf of Australia Post to:

1) *Identify the key letter volume demand drivers.*
2) *Estimate a robust set of econometric models with own-price elasticity estimates.*
3) *Assist with the generation of volume projections to 2025/26.*

1.2.2 Objective set

This research project aims to:

- Use Australia Post's revenue-based volumes (RBV) data to identify a comprehensive, five-segment, product-delineated view of Australia Post's domestic addressed letters business.
- Present a numerical, tabular and graphical descriptive summary of the trends pertaining to letter volume demand movements at a segmented level.[9]
- Specify hypotheses about the drivers of letter volume demand at a product-segmented level and obtain tractable data proxies.[10]
- Use dynamic econometric techniques to model letter volume fluctuations at a product segment level (where data permits) and estimate parameters, known as elasticities, on the statistically significant volume drivers. [11]
- Explain the transitory nature of recent PreSort small letter volume stabilisations via quantifications on the impact of the cost-of-living crisis, Australian company privacy breaches and the post-pandemic recovery of Promo Post. [12]
- Deploy the segmented models, combined with forecasted future values on the drivers, to project letter volumes for each of the five segments across the 2022/23 to 2025/26 period. [13]
- Acknowledge a requirement to segment baseline econometric projections with further intelligence on emerging trends and material off-model future events.[14]
- Aggregate the segmented projections to obtain projections on total letter volume and dissect the projections into components explained by price and non-price effects. [15]
- Conduct a series of simulations on PreSort small letter volumes that illustrate how sensitive total letter volumes are to interest rate rises in 2023/24.[16]

[9] See Section 2.1 for a total letter volume trend summary and Section 2.2 for a discussion of historical volume fluctuations per segment.

[10] See Section 1.6 for the list of hypotheses tested and Appendix B for extensions beyond previous documentation in this series.

[11] See Appendix D for information on the econometric processes and Appendix E for test results and preferred models.

[12] See Section 2.3.

[13] See Sections 3 to 5 for the generation of segment-specific letter volume projections.

[14] See Appendix C for qualifications on the use of econometric models for forecasting purposes.

[15] See Section 6 for a summary of projections and implications at a total letter volume level. Appendix F contains a listing of Australia Post's proposed postal rate changes to 2025/26.

[16] See Section 6.3.

1.3 PROJECT SCOPE

The scope of this project focuses on Australia Post's addressed domestic letter service, which includes letter products used for sending personal messages, business correspondence, public notices, documents, magazines and catalogues within Australia. These items may consist of letters, cards, postcards, self-mailers, annual reports, financial documents, government notifications, and other mail meeting size and weight requirements. This characteristics-based demand study identifies letter volume drivers through a series of discriminant statistical tests that establish linkages to each of the in-scope service offerings. As highlighted in Table 1.3.1, the letter service offerings appeal to different types of customers depending on their ability to meet Australia Post's minimum lodgement requirements.

Table 1.3.1 In-scope Australia Post domestic letter product segment definitions

Letter service	Definition
Other (Ordinary) small	The Other (Ordinary) small letter segment category consists of full-rate business mail and other consumer correspondence that satisfy the relevant small letter category size and weight requirements as set by Australia Post. The Other (Ordinary) letter classifications consist of non-bulk business-to-business and business-to-household mailings and individual mailings from household-to-business and household-to-household.
PreSort small	The PreSort small segment consists of bulk (300+) lodgements that satisfy the relevant small letter category size and weight requirements: 1) Business transactional presentment letter volumes such as bills, statements, share notices and letters advising customers of price increases, policy changes, etc.; 2) Public sector notifications and correspondence related to welfare, elections, etc.; 3) Promotional mail including direct mail, brochures and other addressed advertising material; and 4) Charity mail aimed at fundraising and increasing awareness of charitable institutions/causes.
Other (Ordinary) large	The Other (Ordinary) large segment consists of full rate large letters up to a maximum size, weight and thickness of 360x260mm, 500g and 20mm, respectively. Other (Ordinary) large letter content skews towards ad-hoc non-standard-size documents, including legal contracts and reports sent by individuals and commercial entities.
PreSort large	The PreSort large segment consists of bulk (300+) lodgements that satisfy the relevant large letter category size and weight requirements. It includes items sent by business and the public sectors such as prospectuses, annual reports, outbound census forms and promotional material.
Print Post	This segment consists of lodgements that satisfy the relevant Print Post category size and weight requirements. Volumes consist of publications such as magazines, periodicals and catalogues.

1.4 PRICING

1.4.1 International comparisons

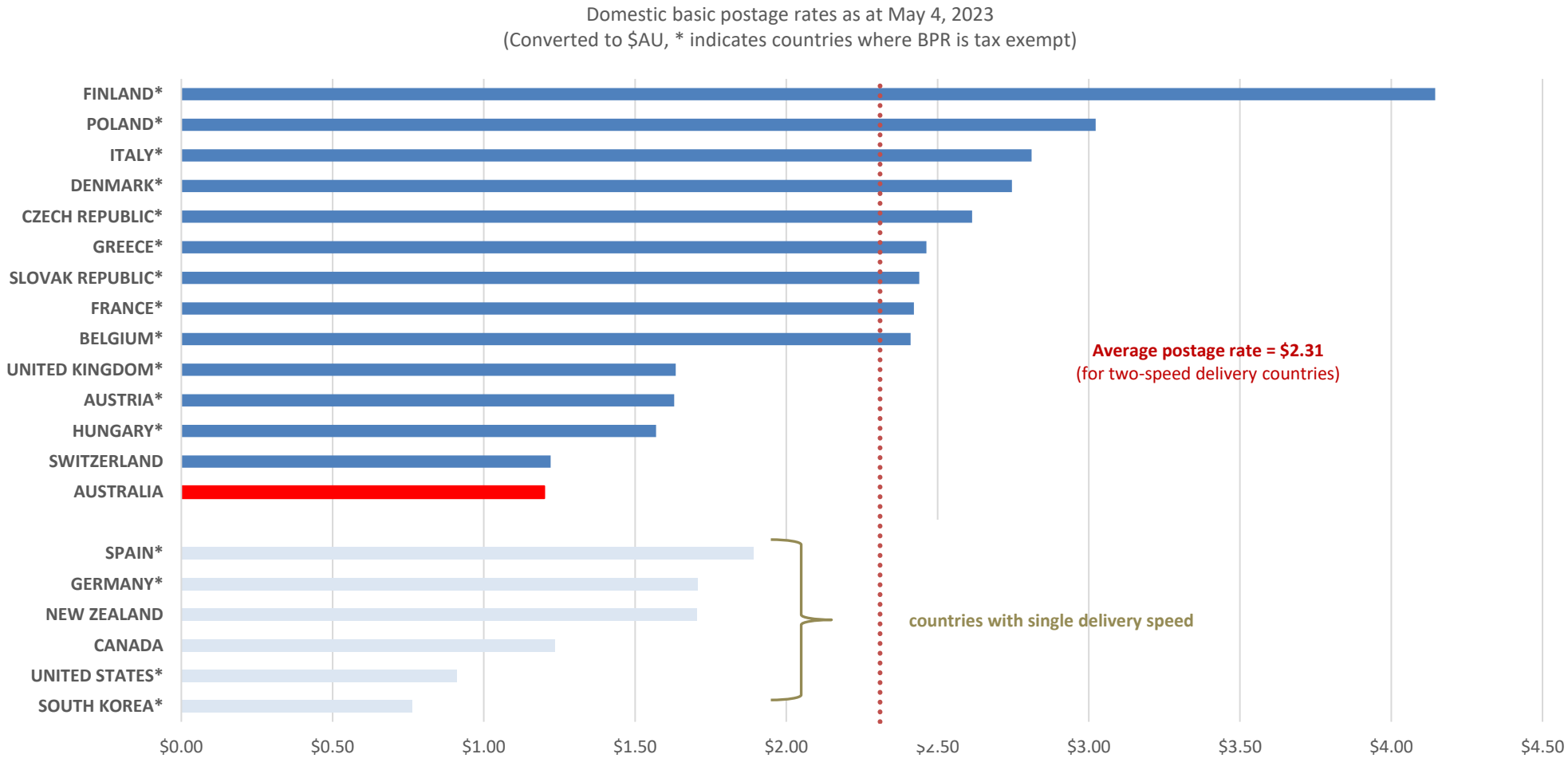
The primary goal of this project is to evaluate the consequences of Australia Post's proposed increase in letter rates. To provide wider context, an examination of the relative basic postage rates (BPR) across various nations highlights a general trend for large increases as each postal authority grapples with sustainability issues within their letters business similar to those confronted by Australia Post. As highlighted in Table 1.4.1.1, Australia's BPR has not increased dramatically when compared with many of its international counterparts. When comparing the affordability of standard letters for countries offering a dual speed service, Australia ranks as the most affordable across the selected regions considered; see Chart 1.4.1.1.

Table 1.4.1.1 Ranking the growth in basic postage rates from 2018 to 2023 (converted to $AU, descending order)[17]

Country	2018	2023	Growth
Slovak Republic	$1.36	$2.44	80%
Finland	$2.52	$4.15	64%
Poland	$2.01	$3.02	50%
Hungary	$1.08	$1.57	46%
France	$1.67	$2.42	45%
Spain	$1.33	$1.89	42%
New Zealand	$1.20	$1.70	42%
Greece	$1.78	$2.46	38%
Belgium	$1.76	$2.41	37%
Denmark	$2.06	$2.75	33%
South Korea	$0.59	$0.76	30%
United Kingdom	$1.26	$1.63	29%
Italy	$2.23	$2.81	26%
United States	$0.72	$0.91	26%
Germany	$1.41	$1.71	21%
Czech Republic	$2.16	$2.61	21%
Australia	$1.00	$1.20	20%
Austria	$1.37	$1.63	19%
Canada	$1.15	$1.23	7%
Switzerland	$1.15	$1.22	6%

[17] To ensure a valid comparison, Table 1.4.1.1 and Chart 1.4.1.1 convert the local stamp prices as of May 4, 2023, into Australian dollars using the OECD generated purchasing power parities. This conversion to $AU is calculated using purchasing power parities. Source: www.OECD.org. Additionally, basic postage rates were sourced by Australia Post and Diversified Specifics based on information available on each of the postal authority websites. Note that standard letter product and lodgement characteristics such as weights and speeds may differ across countries; therefore, the chart and table presented should be treated as an indicative guide only.

Chart 1.4.1.1 Domestic basic postage rates as at May 4, 2023 (converted to $AU, * indicates countries where BPR is tax exempt)[18]



[18] See previous footnote for caveats applicable to Chart 1.4.1.1.

1.4.2 Defining a price elasticity

Quantifying the impact of proposed changes to postage rates via econometric techniques requires an estimate of statistically robust price elasticities across each of Australia Post's letter segments.[19] An essential input into the demand modelling is therefore the domestic letter price variables that account for empirical movements in postage rates. To obtain a comprehensive measure of the unit price according to an individual transaction, Australia Post's revenue-based volume data is used as the basis for determining an average revenue factor. This enables the construction of a price proxy to associate with each observation and facilitate econometric testing.[20] The advantage of using this method is it provides an automatic measurement mechanism for quantifying price points irrespective of the delineation required or customer discount applied.

More formally, a '*price elasticity*' measures the change in Australia Post's domestic letter volume in response to a given change in postage rates, assuming all other factors are held constant. For the purposes of this research, a price elasticity may be derived from the following equation:

$$VOL_{t,m} = VOL_{t,m}(1+\varphi)^{\beta}$$

where $VOL_{t,m}$ is volume at time *t* for letter segment *m*, φ is the price increase of an Australia Post letter, and β is the price elasticity. When interpreting the numerical value of a price elasticity, if an estimate is:

- **>|1| it is referred to as '*price elastic*'.** That is, the rate of change in volume is greater than the rate of change in the price variable. Price reductions are therefore prescribed to increase total revenue.
- **=|1| it is referred to as '*unitary elastic*'.** That is, the rate of change in volume mirrors the rate of change in the price variable. Price changes are therefore assumed to have no impact on altering total revenue.
- **<|1| it is referred to as '*price inelastic*'.** That is, the rate of change in volume is less than the rate of change in the price variable. Price increases are therefore prescribed to increase total revenue.

[19] All elasticities are estimated at their mean and are applicable only to the time frame over which the econometric models have been developed.

[20] These price variables are therefore expected to yield an approximate yet indicative view on price changes over the relevant time frame. For the purposes of econometric testing, all price variables were deflated by the headline Australian consumer price index (CPI) to ensure the specification of real, rather than nominal, price movements. CPI source: Australian Bureau of Statistics; see bibliography.

- **=0 it is referred to as '*perfectly price inelastic*'.** That is, the rate of change in volume is unrelated to the rate of change in the price variable. Price increases are therefore prescribed to increase total revenue because, in this case, there will be no associated volume response.

The price elasticities estimated within this project can be '*own*' price or '*cross*' price. Own-price effects reflect the percentage change in the quantity demanded of Australia Post's domestic letter volume divided by the percentage change in Australia Post's prices for those same letters. Cross-price effects represent the percentage change in the quantity demanded of Australia Post's domestic letter volume divided by the percentage change in competitors' prices.

As Australia Post is granted reserved service of a standard letter, competitors are defined as entities offering substitutive platforms for communication. These alternatives tend to be digital; their influence has been facilitated by recent growth in the speed, capacity and penetration of online mediums. The primary platforms for e-substitution emanate from the telecommunications industry in the form of smartphones and internet connectivity. Therefore, the price of a basket of prices governing a range of services within the telecommunications industry was used to proxy these cross-price effects.[21] An extensive summary on the technical aspects of the model and outputs containing the various price elasticity estimations are contained in Appendix E.[22]

[21] All cross-price variables were deflated by the headline Australian consumer price index (CPI) to ensure real rather than nominal price movements were incorporated into the analysis. The CPI sources for deflation and telecommunications-specific pricing characteristics can be found at the Australian Bureau of Statistics website: www.abs.gov.au.

[22] For further information about the hypotheses and data underpinning own-price and cross-price effects see Diversified Specifics (2022) Section B.1.1 and Section B.1.9 respectively.

1.5 METHODOLOGY AND ENHANCEMENTS

1.5.1 Overview

This report presents the latest findings on the demand for Australia Post's domestic addressed letter items and is the latest in a long series conducted by Diversified Specifics. For a comprehensive discussion of historical segmented letter volume trends it is recommended that readers refer to the previous updates' source documentation.[23] While the core methodology remains consistent, constant refinements in approach aim to ensure the analytical framework adapts to the changing dynamics of the Australian postal industry and reflects advances in econometric techniques.[24] Appendix D provides a technical summary of the econometric process and methodological aspects implemented in this study, which are based on best practice statistical methods and internationally accepted approaches to generating letter volume projections.[25]

It is important to note that while historical data can provide valuable insights into likely letter volume fluctuations in response to key demand drivers, there is no guarantee that future associations will precisely replicate those observed in the past. To ensure the projections are as accurate and reliable as possible, a list of caveats pertaining to the empirical analysis that generates the econometric projections is provided in Appendix C. This approach is motivated by a desire to empower internal and external stakeholders in the Australian letters business to make more informed decisions via a more sophisticated understanding of the underlying assumptions and limitations of the core models.

[23] Diversified Specifics (2013), (2015), (2019) and (2022); see bibliography.

[24] For more insight into these principles consult Martin VL, Hurn S. & Harris D (2013); see bibliography.

[25] Boldron, François, Catherine Cazals, Jean-Pierre Florens and Sebastien Lécou (2010); see bibliography.

1.5.2 Enhancements

The econometric approach adopted in 2022 has been extended in 2023 through the consideration of three main factors.

1. The need to embed a provision for cost-of-living increases into the PreSort small letter volume model. A rise in the general level of inflation has led to a number of interest rate increases by the Reserve Bank of Australia (RBA). When this occurs, letter volumes emanating from the financial sector increase as banking customers are individually notified by mail when their mortgage repayments rise. To contend with this, an additional hypothesis/driver has been added to the PreSort small volume model. This variable reflects positive quarterly movements in the cash rate as measured by the RBA.

2. Given the magnitude of Australia Post's proposed January 2024 rate rises are much larger than the past two letter rate rises, there is a need to acknowledge the possibility that the prevailing price elasticity of demand may alter from the value estimated previously. That is, price sensitivities may differ for the proposed new rises compared with the past rate rises given the differing magnitudes.

3. Adjustments to the econometric approach are based on a process of continual improvement and recognise comments made by the Australian Competition and Consumer Commission (ACCC) in the previous decision document.[26] The primary issue raised by the ACCC suggested Diversified Specifics consider a change in the source of the Australian consumer price index (CPI) from the Australian Bureau of Statistics (ABS) to the RBA. The ACCC made this suggestion based on the following rationale:

   > *"It would also have been preferable for Australia Post and Diversified Specifics to base their CPI forecasts on the estimates provided by the Reserve Bank of Australia … (and later) … The ACCC considers that the RBA forecasts … represent the best estimates."*[27]

[26] The Australian Competition and Consumer Commission (2022), pp. 18-22; see bibliography.

[27] The Australian Competition and Consumer Commission (2022), pp. 19; see bibliography.

Diversified Specifics is reticent to alter the measure of CPI within the analytical framework due to consistency concerns. A change in source choice would result in two measures of the CPI, the headline rate and the proxy for cross-price evaluation, the telecommunications CPI, derived from two different forecasting institutions. Instead, Diversified Specifics has elected to retain the ABS measure of CPI based on this consistency requirement; however, also because the RBA CPI figures are identical to those provided by the ABS. Indeed, the source of the RBA CPI figures is the ABS; see Section B.1.1. Either way, as acknowledged by the ACCC, this is a low-level issue and Diversified Specifics agrees with the 2022 ACCC decision finding:

> *"given the inelastic price elasticity estimates and relatively small impact of the proposed rate increases found, the impact of changing the CPI measure on forecast letter volumes is immaterial".* [28]

[28] The Australian Competition and Consumer Commission (2022), pp. 19; see bibliography.

1.5.3 Projection adjustments

The econometric models used in this study have generated logical and statistically valid projections that represent significant improvements on previous efforts. However, it is important to note that e-substitution pressures are affecting the various letter segments in ever-evolving waves of technological development, each at a different stage of maturity and penetration. This unpredictability implies the econometric process can only provide baseline projections, which must be supplemented with recent market and institutional intelligence to ensure that the final forecasts are as practically relevant as possible.

While the overlay of additional off-model intelligence is necessary for the overall forecasting task, it is beyond the scope of this study. It should also be noted that the econometric process does not fully incorporate the impact of emergent trends; nor does it have the capability to embed the potential impact of unforeseen future events into the baseline where there is no empirical evidence available from the sampled time series. For example, the significant increase in PreSort small letter volumes that has taken place since the last update was not captured by the econometric process as there was no prior evidence linking interest rate rises to surges in transactional letter volumes; see Table 1.5.3.1. However, in this update, the impact has been integrated into the baseline projections due to the availability of data underlining this recent phenomenon.

Table 1.5.3.1 Total domestic letter volumes by segment (annual percentage changes)

	2022/23 projections (from 2022 update)	Year to date (actuals) July 2022 to March 2023
Other small	-10.1	-11.1
PreSort small	-8.4	1.7
Other large	-10.7	-15.4
PreSort large	-13.8	-18.9
Print Post	-11.6	-9.9
Total letters	**-9.3**	**-3.6**

In cases where segmented letter volumes are likely to be affected beyond the model's empirical capabilities, Diversified Specifics recommends that Australia Post adjust the baseline projections via institutional and market intelligence to account for off-model impacts. This additional intelligence, combined with continual econometric refinements, will ensure that the final letter volume forecasts are as current and precise as possible.

1.6 DEMAND DRIVER HYPOTHESES

Working with Australia Post since 1997, Diversified Specifics has been at the forefront of identifying and empirically testing the relevance of potential demand drivers for domestic letter volume via econometric modelling techniques. Crucial to the modelling process is the formulation of hypotheses that link fluctuations in prospective demand drivers to movements in domestic letter volume demand. To do so, each hypothesis must be accompanied by information on a primary data source or proxy that adequately reflects historical trends, market dynamics and patterns in customer behaviour. The aim is to provide Australia Post with the most accurate and reliable set of letter volume demand drivers. This facilitates the construction of models suited to generating reliable baseline projections, assisting in strategic planning initiatives and resource allocation decisions at Australia Post.

Table 1.6.1 provides a summary of the key hypotheses that have been tested within this project to associate letter volume fluctuations with movements in potential demand drivers.[29] These hypotheses cover a wide range of factors, including changes in:

a) Product attributes such as price and delivery service performance.

b) Macroeconomic indicators including GDP and inflation.

c) Shifts in consumer behaviour that impact certain segments, such as the advertising sector.

d) Advancements in technology resulting in e-substitutive alternatives to the traditional letter item.

e) Delivery point proxies such as population that highlight the scale effects of Australia Post's delivery footprint.

f) Socio-economic shocks and events that structurally alter the demand characteristics for mail, with examples being elections, the census, the global financial crisis of 2007/08 and the recent COVID-19 pandemic.

[29] A more detailed explanation of the hypotheses listed in Table 1.6.1 can be found in Appendix B of Diversified Specifics (2022); see bibliography. Key additions and alterations to this set of hypothetical associations are presented in Appendix B of this document. This additional information is essential for understanding the econometric modelling process and for interpreting the results of the analysis that constitute the core of this research. It is important to note that the econometric modelling process is ongoing and constantly evolves to incorporate new data sources, methodologies and techniques. This continual refinement ensures that the models remain relevant and accurate in the face of changing market conditions and emerging trends that tend to characterise the typical modern-day postal industry.

Table 1.6.1 Key letter volume demand hypotheses tested in this project

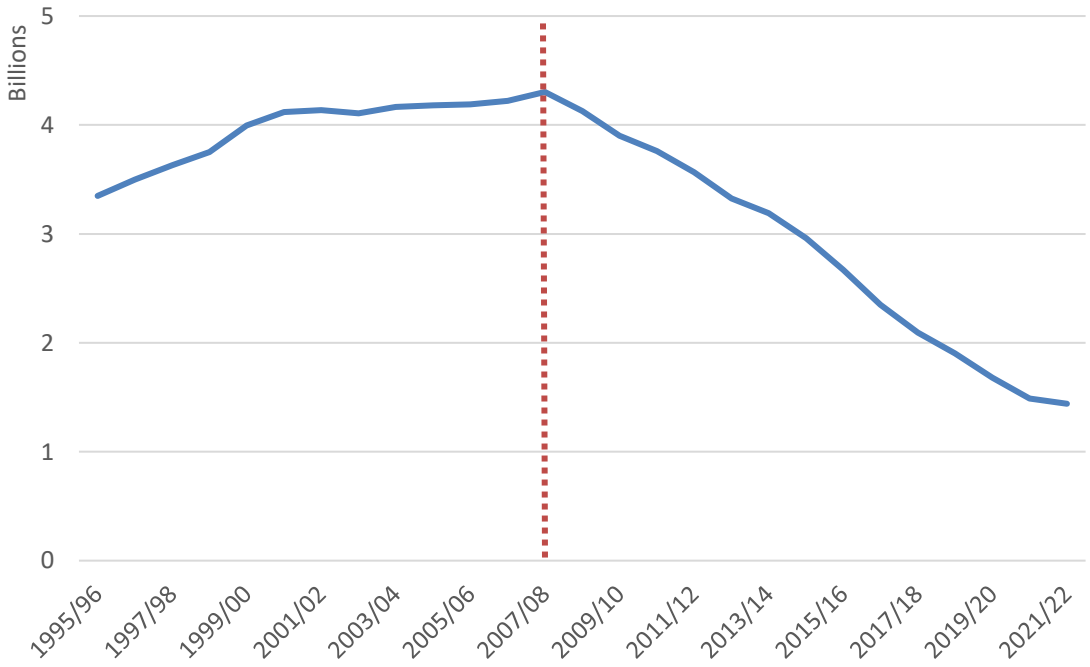
Hypothesis 1: *See Section B.1.1 in Appendix B of Diversified Specifics (2022)* *According to the fundamental principles of economics, increases in the own price of a letter is inversely associated with movements in letter volume.*
Hypothesis 2: *See Section B.1.2 in Appendix B of Diversified Specifics (2022)* *Fluctuations in the level of e-substitution are inversely associated with movements in letter volume.*
Hypothesis 3: *See Section B.1.3 in Appendix B of Diversified Specifics (2022)* *Changes in the size of the Australian population or a change in the number of delivery points across the Australia Post network are positively associated with movements in letter volume.*
Hypothesis 4: *See Section B.1.4 in Appendix B of Diversified Specifics (2022)* *Movements in the level of Australian economic activity (or GDP segments such as retail trade) are positively associated with movements in letter volume.*
Hypothesis 5: *See Section B.1.5 in Appendix B of Diversified Specifics (2022)* *Certain individual events (COVID-19, elections, referendums, census, etc.) may either increase or decrease letter demand depending on the nature of that occurrence.*
Hypothesis 6: *See Section B.1.6 in Appendix B of Diversified Specifics (2022)* *Fluctuations in the level of Australian business confidence are positively associated with movements in letter volume.*
Hypothesis 7: *See Appendix B and Section B.1.7 in Appendix B of Diversified Specifics (2022)* *Letter volumes are prone to inherent seasonal effects that highlight regular demand movements throughout any given year.*
Hypothesis 8: *See Section B.1.8 of Diversified Specifics (2022)* *Fluctuations in the level of Australia Post's delivery service performance are positively associated with movements in letter volume.*
Hypothesis 9: *See Section B.1.9 in Appendix B of Diversified Specifics (2022)* *Fluctuations in the price of technologies that are regarded as a substitute to mail are positively associated with movements in letter volume.*
Hypothesis 10: *See Section B.1.10 in Appendix B of Diversified Specifics (2022)* *Increases in the number of public offerings on the Australian share market are positively associated with movements in letter volume.*
Hypothesis 11: *See Section B.1.11 in Appendix B of Diversified Specifics (2022)* *Fluctuations in the health of the Australian advertising industry are positively associated with movements in letter volume.*
Hypothesis 12: *See Section B.1.12 in Appendix B of Diversified Specifics (2022)* *Fluctuations in the price of paper are inversely associated with movements in letter volume.*
Hypothesis 13: *See Section 2.3.3 and Section 6.3* *Positive fluctuations in the Australian cash rate are positively associated with movements in letter volume.*

1.1 TOTAL DOMESTIC ADDRESSED LETTERS

Prior to the new millennium, total letter volumes at Australia Post were predominantly driven by the expansion of the Australian economy. However, with the turn of the century, pressures from e-substitution began to surface.[30] The decline of Australia Post's letter volumes mirrors sweeping trends observable in postal industries across the globe. This downturn is largely attributable to the shift towards digital alternatives, a movement that gained significant momentum in the wake of the 2007/08 global financial crisis. As illustrated in Chart 2.1.1, Australia Post's total domestic addressed letter volumes eroded by 66% from 2006/07 to 2021/22. This seismic shift, driven by technological advancements and a behavioural pivot towards online communication, has fuelled a mass migration in communication that once resided in the domain of a physical letter. E-substitution has become the predominant force influencing letter volume demand in recent years, despite the continued importance of other factors such as fluctuations in the level of economic activity, population, delivery service performance and the real cost of postage. These dynamics underscore the shifting postal landscape for Australia Post, a trend common across most Westernised postal authorities.[31]

Chart 2.1.1 Total letter volumes at Australia Post (annual)[32]

- - - - Denotes the onset of the GFC



[30] This 'technology wedge' phenomenon, focusing on a long-run divergence between letter volumes and the GDP trend, is explored in Section 2.1 of Diversified Specifics (2022)'; see bibliography.

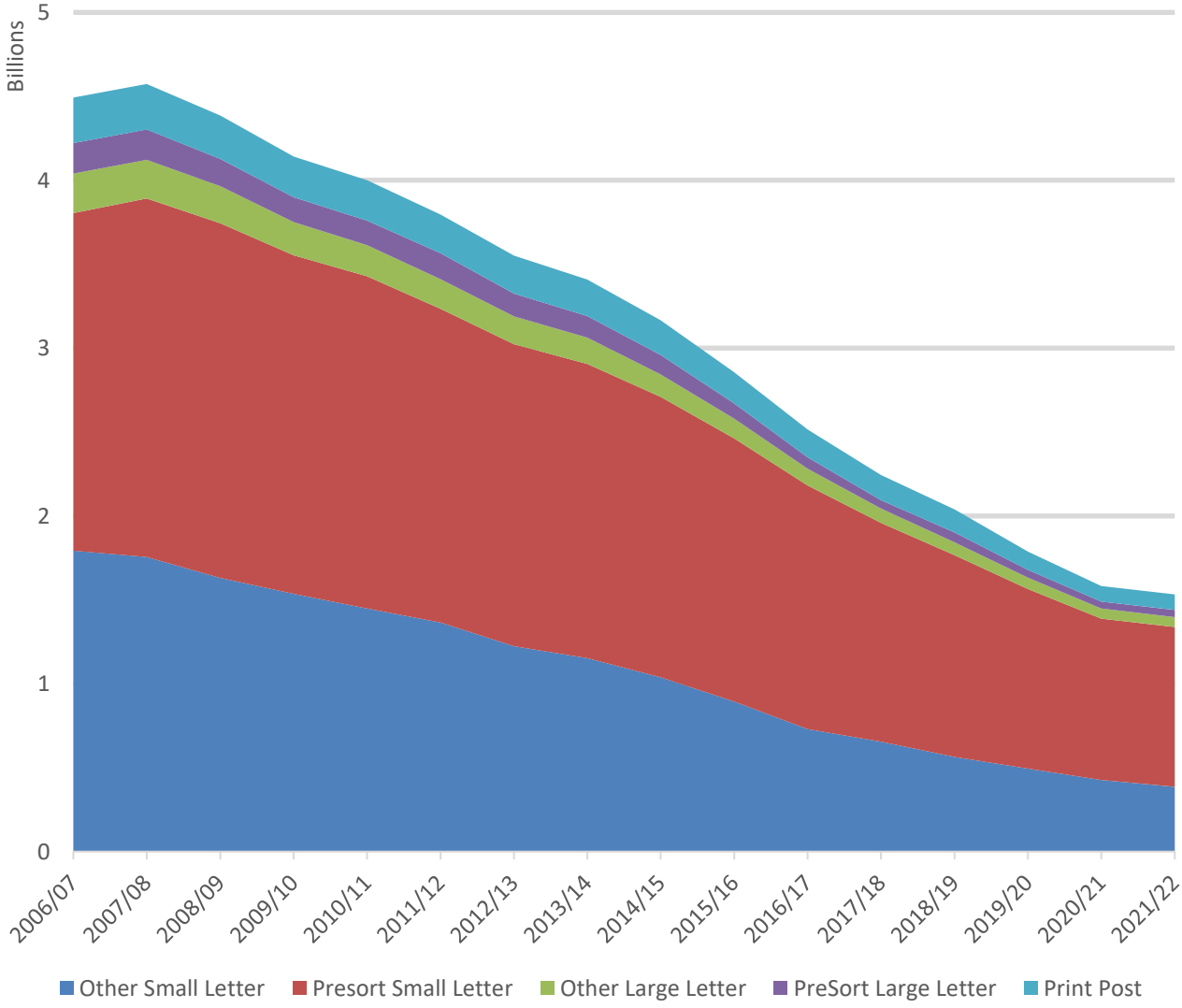
[31] Universal Postal Union (2020); see bibliography.

[32] Print Post volumes have been excluded from Chart 2.1 due to a lack of available data prior to 2006/07.

1.2 PRODUCT SEGMENTS

The accelerating pace of volume decline has been marked by successive waves of technological advancements and e-substitution pressures, which have affected different letter segments at various intensity rates (see Chart 2.2.1).[33] Consequently, the volume composition of Australia Post's domestic letter service has undergone significant transformations since 2006/07. These changes in the underlying demand mix are outlined in Chart 2.2.2 and Table 2.2.1 and further underscore the dynamism of Australia's postal industry in the face of digital disruption.

Chart 2.2.1. Australia Post domestic addressed letter volumes (annual, millions)



[33] While price rises have contributed to the volume decline, e-substitution has consistently emerged as the key statistical driver of total letter volume trends. Strategies embracing rate rises, such as the 43% increase in the basic postage rate in January 2016, largely represent Australia Post's attempts to recoup revenue aimed at assisting the funding of its community service obligations amid eroding letter volume demand due to e-substitution. These obligations are legislative commitments ensuring a minimum service offering to all prospective customers, regardless of their geographical location.

Chart 2.2.2. Proportionate share of total domestic letter volumes by segment (annual, %)

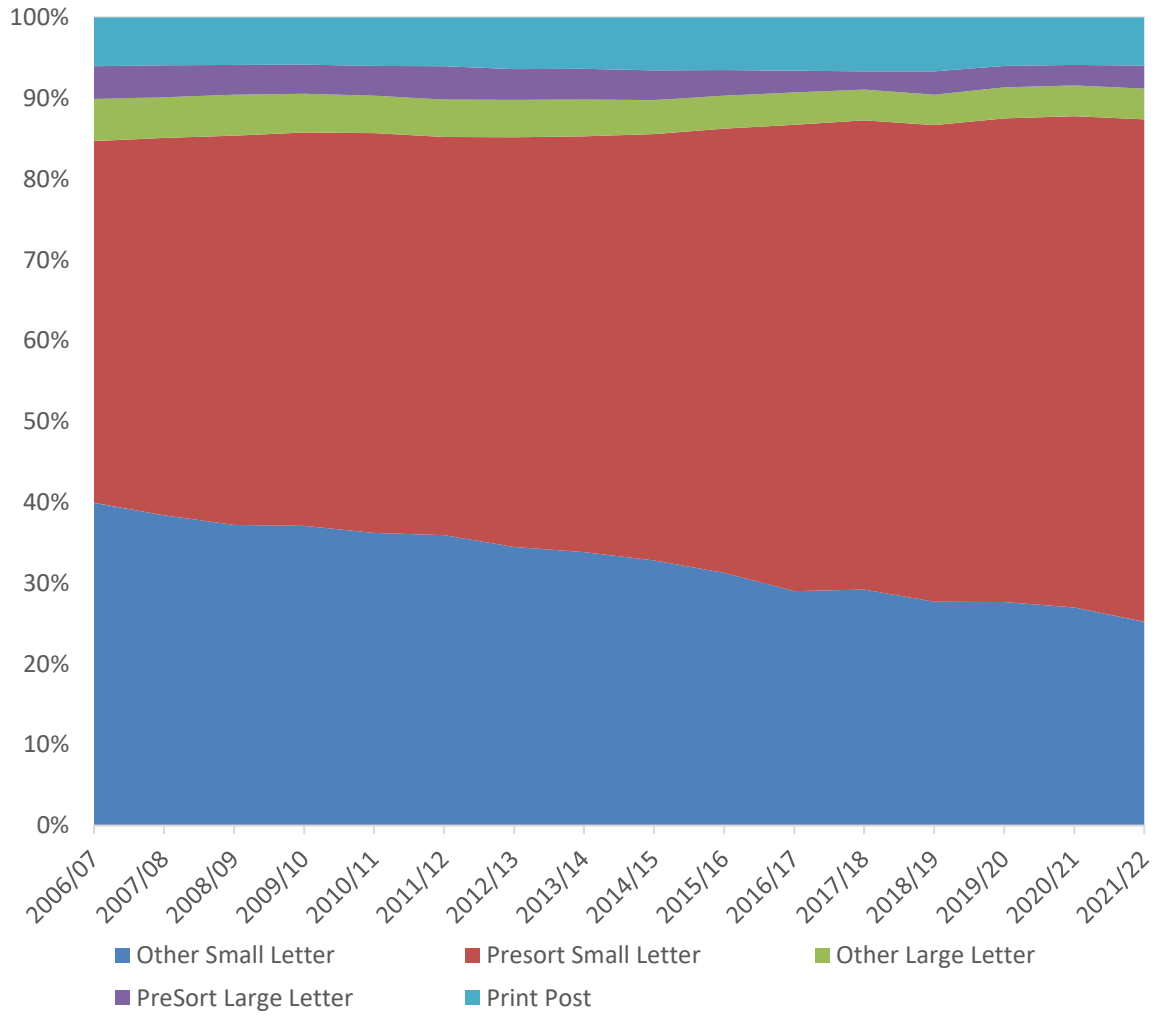


Table 2.2.1 Percentage share of addressed domestic letter volumes by segment (annual)

Parcel segment	2006/07	2020/21	2021/22	Volume (mil) 2021/22
Other small	40%	27%	25%	386
PreSort small	45%	61%	62%	952
Other large	5%	4%	4%	58
PreSort large	4%	3%	3%	43
Print Post	6%	6%	6%	92
Total letters	**100%**	**100%**	**100%**	**1,532**

Most of Australia Post's domestic letters volume is now lodged within the PreSort small letter service (see Table 2.2.1). A substantial portion of these letters typically relate to commercial transactions driven by business processes, largely consisting of bulk lodged bill presentations/statements. In the aftermath of the global financial crisis (GFC), a notable acceleration in the decline of these volumes was observed. This reduction was primarily attributed to a sharp rise in the e-substitution of bill presentments, explicitly through online channels but also implicitly via the growth in direct debit arrangements.

1.3 RECENT STABILISATION IN PRESORT SMALL LETTER VOLUME

2.3.1 Overview

Over the past decade, fluctuations in total domestic letter volume at Australia Post largely echo the changes in PreSort small volumes (see Table 2.3.1). Even when considering this structural shift, a persistent decline in letter volumes is evident across all segments, albeit at differing intensity rates. The volume reductions presented in Table 2.3.1 largely demonstrate that different segments are affected by various types of e-substitution. This variation is predominantly due to distinct communication and content traits that shape the demand for each letter service. Consequently, these differences necessitate a unique econometric modelling approach for each letter segment. This approach is superior to estimating a single total letter model as it enables a more effective capturing of the heterogeneity in e-substitution, the key driver of eroding letter volume. The disaggregated approach contributes to a more comprehensive set of insights, assisting to ensure the resiliency of all price/e-substitution elasticities estimated.

Table 2.3.1 Total addressed domestic letter volumes

	Percentage change (%)				Share of total letters
Segment	**2019/20**	**2020/21**	**2021/22**	**2006/07 to 2020/21**	**2021/22**
Other small	-12.5	-13.6	-9.6	-76.2	25%
PreSort small	-11.0	-10.1	-1.0	-52.2	62%
Other large	-10.5	-12.4	-2.9	-74.4	4%
PreSort large	-20.1	-15.2	8.7*	-78.0	3%
Print Post	-21.3	-12.9	-1.9	-65.5	6%
Total letters	**-12.3**	**-11.4**	**-3.2**	**-64.8**	**100%**

**figure impacted by the August 2021 Australian census*

2.3.2 2021/22 federal election impact

In every letter volume demand update in this series, Diversified Specifics has stressed the importance of augmenting projections generated from empirical models due to the difficulty of isolating and quantifying all possible contingencies.[34] As an example, the May 21, 2022, federal election was flagged as a key off-model event, responsible for 21 million additional PreSort small letter items. Table 2.3.1 is highlighted by a distinct departure in the PreSort small letter volume trend because of factors including this occasional event. Given PreSort small letter volumes constitute a majority share of total letters, this also illustrates how a softening of the long-term volume erosion, to -3.2%, in 2021/22, can be largely attributed to the influx of mail associated with a surge of volume within this segment. Accelerated volume declines in the preceding years were also explained by the socio-economic factors related to limiting the spread of COVID-19. These COVID-19-related impacts are explained and quantified in Section 2.3. of Diversified Specifics (2022) letter volume demand update.[35]

[34] For an extended discussion see Appendix C.

[35] For an extended discussion see Section 2.3 of Diversified Specifics (2022); see bibliography.

2.3.3 Explaining 2022/23 PreSort small letter volume trend discrepancies

The recent 2022/23 PreSort small letter volume increase cannot simply be attributed to the stimulus provided by the 2022 federal election and a post-pandemic rebound. This unanticipated surge has resulted in previous econometric projections for 2022/23 underestimating actual volumes and relates to the impossibility of foreseeing this pivot (see Table 2.3.3.1).

Table 2.3.3.1 Total domestic letter volumes annual percentage changes

	2022/23 econometric projections (from 2022 update)	July 2022 to March 2023 year to date (actuals)
PreSort small	-8.4	1.7
Total letters	**-9.3**	**-3.6**

The econometric process cannot fully incorporate the impact of emergent or unforeseen future events into the baseline where there is no empirical evidence available from the sampled time series. In this case, there are three unforeseen impacts that are likely to drive a wedge between the actuals and any projections that do not incorporate their full effects:

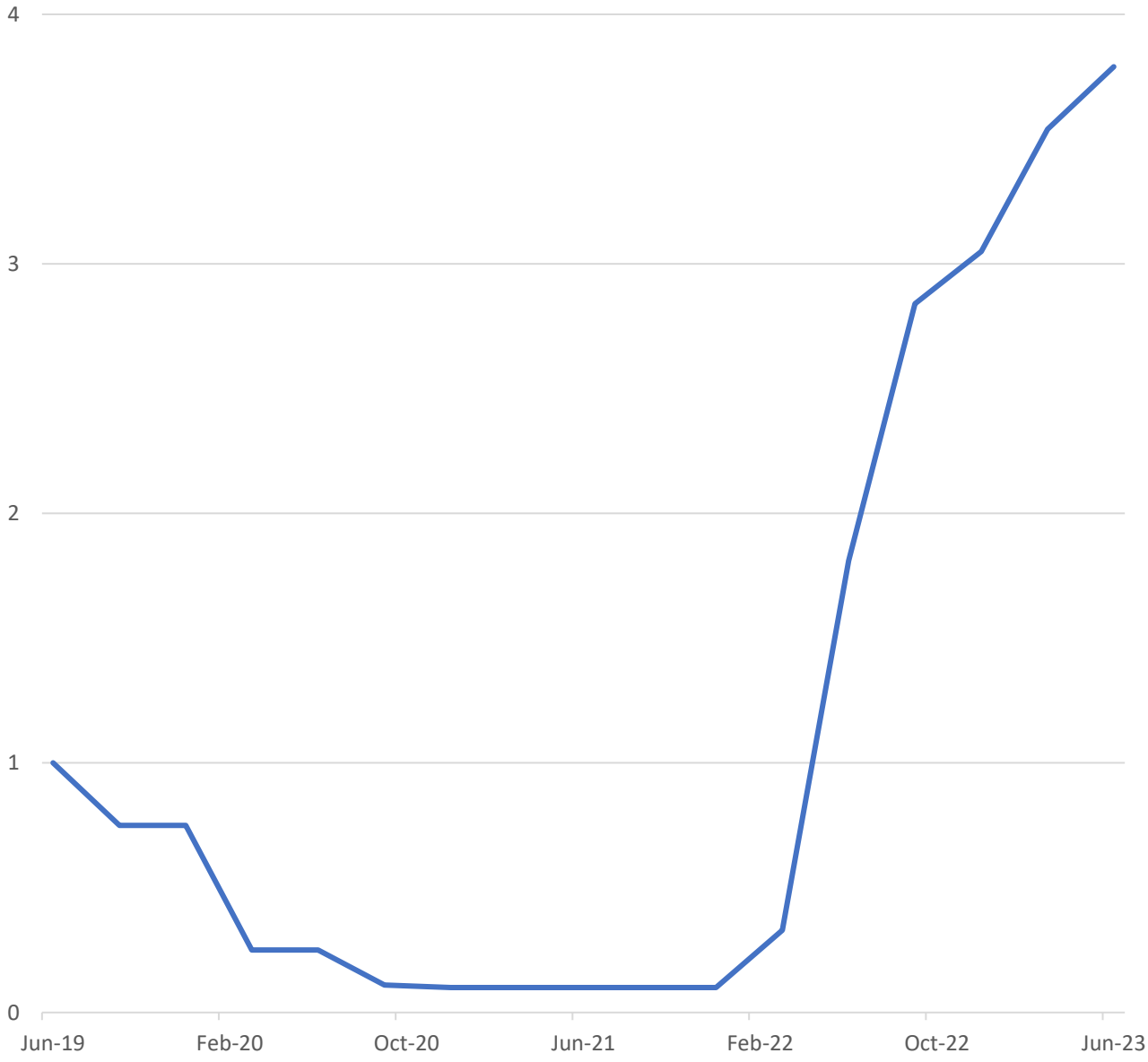
1) The cost-of-living crisis.
2) Australian company privacy breaches.
3) Promo Post.

Of these three impacts, the first is now embedded within the projections generated for this demand update because of the availability of tractable data and adjustments to the econometric models. For the remaining two, which are based on unpredictable events that have no available data, the projections should be augmented with additional information, where available, to account for forecasting discrepancies. This supports Diversified Specifics' philosophy to forecasting of overlaying additional intelligence onto an econometric baseline and retaining a 'finger on the pulse' approach to detect any emergent trends or distorting one-off effects more readily.

1) The cost-of-living crisis

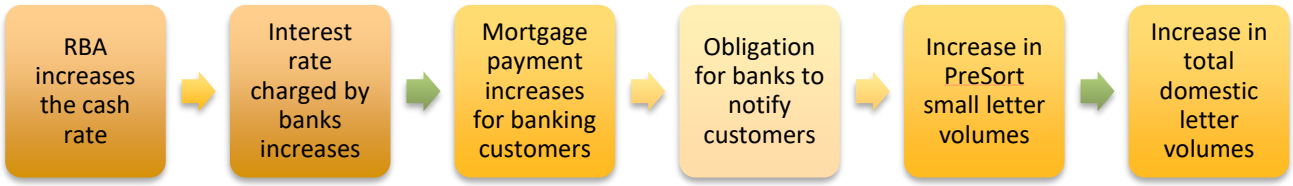
Emerging from the pandemic and the 2022 federal election, Australia has been characterised by increasing rates of inflation that are unprecedented in recent times. To contain the general rise in prices, monetary policy enacted by the RBA has been underlined by a series of frequent increases in the headline cash rate (see Chart 2.3.3.1). As lending institutions tend to pass on cash rate increases to their mortgage customers, this is accompanied by communications, often via letter, as to how repayments will alter. For Australia Post's letters business, this change in the macro environment has resulted in an unexpected boost to mail sent via the PreSort small letter service. Chart 2.3.3.2 illustrates, conceptually, how this cost-of-living crisis has affected Australia Post's addressed letter volumes.

Chart 2.3.3.1 Reserve Bank of Australia – cash rate target on date (%)



Source: Reserve Bank of Australia (2023)

Chart 2.3.3.2 Impact of cost-of-living crisis on total domestic letter volumes



In this study, given the availability of tractable data supporting the above hypothesis, the impact can now be integrated into the baseline projections. This also permits a re-engineering of what 2022/23 volumes could have been expected to be by switching off the interest rate effect. Table 2.3.3.2 undertakes this counterfactual reconstruction to illustrate how PreSort small letter volumes converge to the actuals when the interest rate effect is assumed to have not taken place.

Table 2.3.3.2 Total domestic letter volumes annual percentage changes

	2022/23 econometric projections (as per 2022 update)[36]	**July 2022 to March 2023 year to date (actuals)**	**Counterfactual scenario: switching off recent increases in the cash rate** **Year to date 2022/23 econometric projections***
PreSort small	-8.4	1.7	-0.2
Total letters	**-9.3**	**-3.6**	**-5.5**

* The counterfactual scenario assumes zero increases in the cash rate from July 2022 to March 2023.

At the time of writing, uncertainty remains high around future increases in the cash rate. Therefore, Section 6.3 outlines estimated changes to projected letter volumes by simulating future movements in the cash rate under two scenarios:

- Option 1: An increase of 0.25 base points for the September quarter in 2023.
- Option 2: An increase of 0.25 base points for all quarters of 2023/24.

In doing so, the sensitivities to future changes in RBA monetary policy on total letter volumes can be observed and quantified.

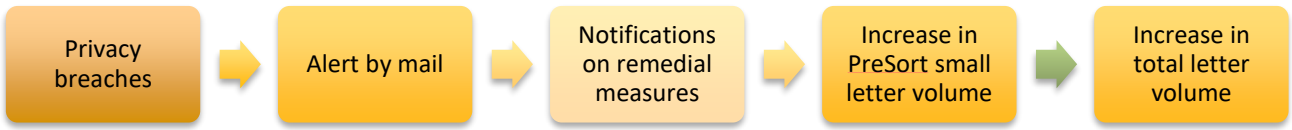
[36] Taken from Diversified Specifics (2022); see bibliography.

2) Australian company privacy breaches

In the second half of 2022, there were several online security breaches of confidential customer information held by a small number of large Australian firms that affected millions of Australian citizens.[37] The affected companies subsequently announced the breaches to their customer base, followed by a series of remedial advisements. Often, these communications were sent as a physical letter, unexpectedly increasing the use of the PreSort small letter service. Chart 2.3.3.3 illustrates, conceptually, how the data breaches affected Australia Post's addressed letter volumes.

The Office of the Australian Information Commissioner (OAIC) reports the metrics surrounding the 'Notifiable Data Breaches' (NDB) scheme to gauge the frequency and voracity of detectible privacy risks. In the second half of 2022, the OAIC reported a "41% increase in data breaches resulting from malicious or criminal attacks" in Australia.[38] Such unforeseen events were impossible to predict at the time of the last iteration of baseline projections. However, the extent of the additional mail associated with the breaches in information/data security add to the explanation for any discrepancies between actual 2022/23 letter volume movements and the baseline projections.

Chart 2.3.3.3 Impact on total domestic letter volumes of privacy breaches by Australian firms



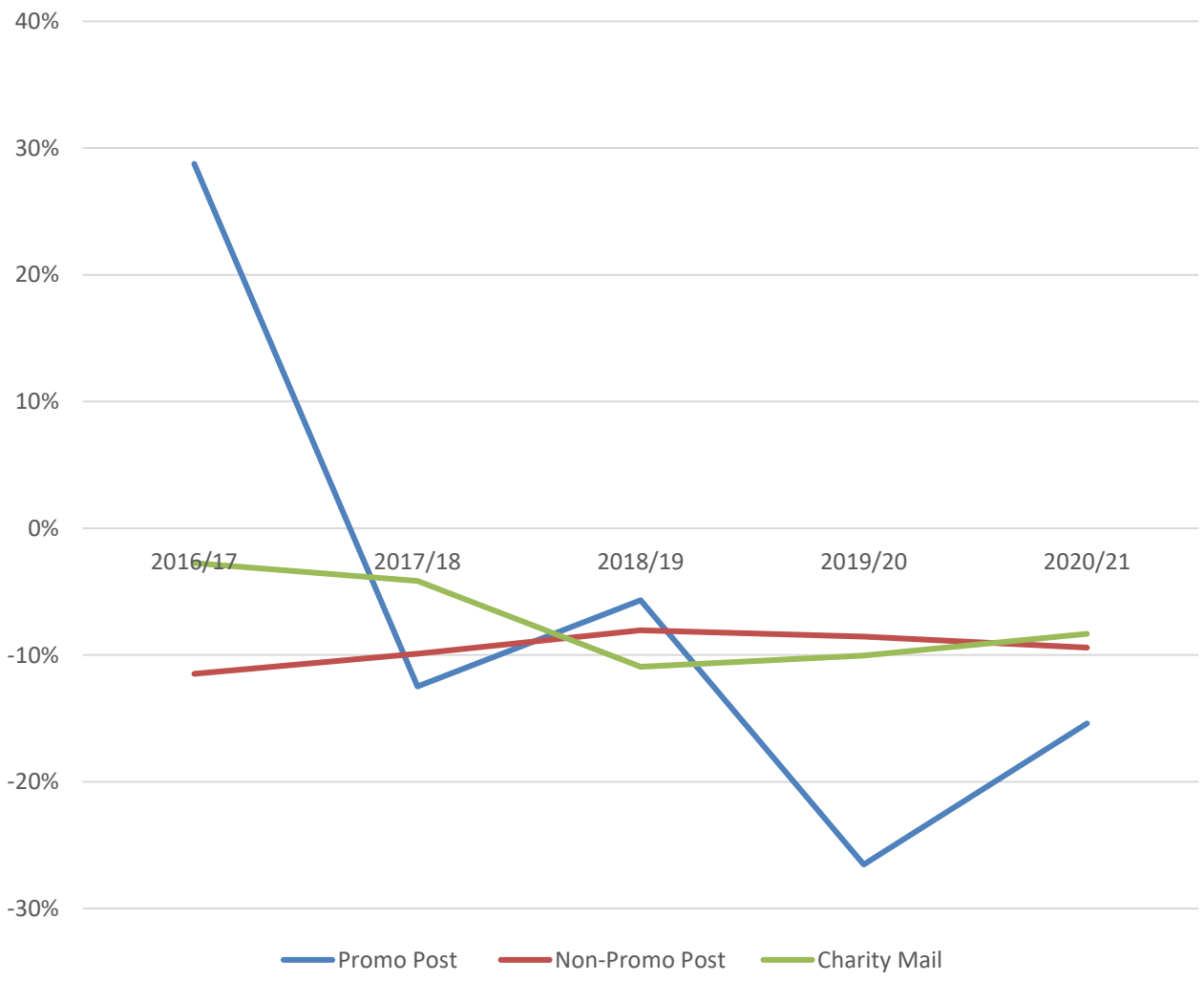
[37] All company names and specific events relating to each individual privacy breach are de-identified in this report.

[38] The Office of the Australian Information Commissioner (OAIC) (2023), see bibliography.

3) Promo Post

The promotional component of PreSort small letters, Promo Post, has experienced large, unanticipated growth of 20.9% following a period where the segment was severely impacted by the closures of non-essential retail during the pandemic.[39] The volatility of volumes within the Promo Post letter service, relative to the transactional (non-Promo Post) and charity mail sub-segments, is emphasised in Chart 2.3.3.4. To capture the differences in volatility and mitigate projection errors, Diversified Specifics is contemplating developing multiple models for the PreSort small service as part of future letter volume demand updates. An important consideration when doing this is the trade-off in accepting a smaller sample size given Promo Post data is only available from 2015/16.

Chart 2.3.3.4 Growth rates in PreSort small letter volumes by sub-segment (annual % change)



[39] Based on year-to-date figures provided by Australia Post contrasting the July 2022 to March 2023 period with volumes from the same months in the preceding year.

1.1 OVERVIEW

Australia Post's Other (Ordinary) letter service offers the delivery of full-rate mail for the weight and size specifications outlined in Table 3.1.1. These items are lodged either via a street posting box or over the counter at an Australia Post registered post office. The key lodgement characteristics of the Other (Ordinary) letter segment are minimal and include no requirement for barcoding or sorting.

Table 3.1.1 Other (Ordinary) service qualification requirements

Size details	Small	Large
Maximum weight	250g	500g
Minimum size	88 x 138mm	N/A
Maximum size	130 x 240mm	260 x 360mm
Maximum thickness	5mm	20mm

Source: www.auspost.com.au

The Other (Ordinary) letter classifications consists of non-bulk business-to-business and business-to-household mailings, and individual mailings from household-to-business and household-to-household. Generally, the Other (Ordinary) letter service is characterised by:

- Communication produced or mailed on an ad hoc or daily basis.
- Mailings in response to a one-to-one interaction.
- Lodgement sizes that are well below the threshold required to access the PreSort small letter service.

This has resulted in greater e-substitutive pressures – relative to bulk-lodged mail – for the Other (Ordinary) letter segments over a longer period as individuals tended to be early adopters of digital communication solutions.

1.2 OTHER (ORDINARY) SMALL

3.2.1 Service scope

The Other (Ordinary) small letters segment consists of full-rate business mail, cheque payments and other consumer correspondence that satisfies the relevant small letter category size and weight requirements. In terms of volume, [c-i-c] [redacted] [c-i-c], as illustrated in Table 3.2.1.1.

For more than three decades there has been a marked shift towards electronic alternatives to mail delivery, particularly for transaction settlements. This trend reflects an increasing desire from individual consumers and small-to-medium enterprises (SMEs) to engage in online transactions with their respective billers. This type of digital migration is emphasised by the dwindling use of cheques, the traditional mode of postal bill payments. Cheque usage has plummeted by 95% since 2002/03, encapsulating the decline in traditional letter-based bill payments.

In parallel, the use of direct debit payments within Australia has surged by 171% since 2002/03.[40] This trend underscores the accelerating transition towards non-letter-based alternatives for bill payments. Consequentially, the composition of the Other (Ordinary) small letters segment holds a higher proportion of SME bill presentment type mail, a category that has predominantly characterised the PreSort small letter service. Therefore, the Other (Ordinary) small letter segment is now also increasingly susceptible to pressures stemming from e-substitution, consolidation and rationalisation. These dynamics are primarily driven by senders' motivation to curtail transaction costs, prompting a reduction in their reliance on physical mail items.

[40] The direct debit growth rate should be treated as indicative due to an RBA measurement change occurring in May 2018.

Table 3.2.1.1: Other (Ordinary) small letter service sub-segments[41]

Small letter services classified into the Other small segment	2021/22 Volume (millions)		Percentage of total Other small volumes	
Ordinary Stamped Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Stamped Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Local Rate Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Local Rate Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Metered Imprint Charge Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Metered Imprint Charge Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Clean Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Clean Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Reply Paid Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Reply Paid Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Imprint Cash Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Imprint Cash Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Seasonal Greeting Cards	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Concession Stamps	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Prepaid Envelope Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Sample Post	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

[41] Sub-segment listing as per 2021/22. On occasions merged and revised/new product codes alter the historical data, which may lead to data omissions beyond the control of Diversified Specifics.

3.2.2 Elasticity estimates

In estimating an econometric model for Other (Ordinary) small letter volume, a preliminary assessment was performed involving a sequence of discriminatory tests for variable selection. Detailed information about key structural breaks and lag specification tests used in the creation of the chosen Other (Ordinary) small letter volume vector error correction model (VECM) is outlined in Appendix E.1, referenced in Table E.1.3.1. [42] The model explains 99.73% of the total quarterly fluctuations in Other (Ordinary) small letter volumes during the period from June 2002 through to December 2022. [43] Key factors influencing historical demand for Other (Ordinary) small letter volumes, as well as the corresponding estimated demand elasticities, are discussed below.[44]

1. **E-substitution.**

The combination of technological progress and an increased penetration of online platforms, alongside a decline in conventional methods of bill payment such as cheques, collectively reflect a shift towards digital mediums. This transition consequently implies a decrease in Other (Ordinary) small letter volume.

Elasticity: A 1% increase in e-substitution as measured via principal component analysis was associated with a 0.18% decrease in Other (Ordinary) small letter volumes on average in the long run.

Recent trends: The use of cheques in Australia has declined by 95% since 2002/03 while direct debit payment numbers have grown by 171% over the same period.[45] The rollout of the Australian NBN service has been characterised by a 1,048% increase in the number of wholesale services in operation since December 2015. [46] Mobile phone subscriptions in Australia have increased by 113% since 2002/03. [47]

[42] Individual tests relating to each of the hypothesised tests are omitted from this document due to space considerations; however, they are available on request from Diversified Specifics.

[43] Based upon Adjusted R-squared calculations:

$\bar{R}^2 = 1 - (1 - R^2)\frac{T-1}{T-K-1}$ where $R^2 = \frac{\text{Explained sum of squares}}{\text{Total of sum of squares}} = 1 - \frac{\sum {e_t}^2}{\sum (Y_t - \bar{Y})^2}$

[44] All elasticities reported are estimated at their mean and are applicable only to the time frame over which the econometric models have been developed. In interpreting the elasticities within this report, it is assumed all other factors are held constant.

[45] Source data: Total number of cheques, cheques – original series – C5.1, Reserve Bank of Australia at www.rba.gov.au. This statistic is impacted by a change in the RBA data definition, occurring in May 2018, so interpretations should be treated with all due caution.

[46] Source data: Number of wholesale NBN services in operation (SIOs) by technology type, Australian Competition and Consumer Commission at www.accc.gov.au.

[47] Source data: Mobile-cellular telephone subscriptions by postpaid/prepaid, Australia, International Telecommunication Union at www.itu.int; and ACCC Internet activity RKR data as 30 June 2022, Australian Competition and Consumer Commission at www.accc.gov.au

2. Real price.

Rational economic theory suggests the real cost – that is nominal price adjusted for inflationary effects – of sending Other (Ordinary) small letter mail will be inversely related to demand. Price changes over the examined time frame have been significantly associated with demand responses in the opposite direction.

Elasticity: A 1% increase in the real price of sending Other (Ordinary) small letters was associated with a 0.38% decrease in Other (Ordinary) small letter volumes on average in the long run.

Recent trend: Nominal postage rates for the Other (Ordinary) small letter service have increased at an annual average rate of 4.4% from 2000/01 to 2021/22. However, this average is largely influenced by the 50% rate rise occurring in 2015/16. More recently, the nominal postage rates for the Other (Ordinary) small letter service have increased at an annual average rate of 2.2% from 2016/17 to 2021/22. By contrast, Australian CPI has increased at an average annual rate of 2.6% between 2000/01 to 2021/22. [48]

3. Cross price.

The price of alternative technologies in Australia is used to assess the cross-price impacts on letter volume demand. Decreases in Other (Ordinary) small letter volumes are associated with the declining price of telecommunications services.

Elasticity: A 1% decrease in the real price of services provided in the Australian telecommunications industry was associated with a 1.59% decrease in Other (Ordinary) small letter volumes on average in the long run.

Recent trend: The nominal price of services in the Australian telecommunications industry has decreased by 22% between 2002/03 and 2021/22, at an annual average rate of -1.2%. [49]

[48] Source data (prices): Australia Post and (CPI) the Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, Tables 1 and 2 at www.abs.gov.au.

[49] Source data: Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, Table 7, at www.abs.gov.au.

1.2.3 Driver projections used

A series of projected values on each of the drivers within the VECM framework is required. These include the following:

- E-substitution projections were derived via an endogenous process that involved forecasting the Other (Ordinary) small letter principal components from June 2022 to June 2024.[50]

- CPI projections from the International Monetary Fund (IMF) of 7.83% in 2022, 3.96% in 2023, 2.98% in 2024, 2.93% in 2025 and 2.52% in 2026 were delineated into quarterly averages to account for inflationary pressures.[51]

- Nominal increases in the price of each Other small letter service, listed in Table 3.2.1.1, were provided by Australia Post.[52] To derive a single tractable nominal price variable, the proposed individual price points were weighted based on 2021/22 volume proportions. For comparative purposes, an alternative price variable was constructed to model the scenario where letter prices do not increase over the projection period.

- Future values of the telecommunications CPI, used to proxy cross-price effects, were generated via an AR(1) process. This resulted in annual cross-price percentage changes of 0.53% for 2022/23, -3.14% for 2023/24, -3.30% for 2024/25 and -3.39% for 2025/26.

- Although most of the election-related mail resides in the PreSort small segment, Other small letter volume projections do not include the impact of future elections due to the impossibility of predicting poll dates. Estimated volumes associated with these off-model volume impacts should be added to the baseline projections when constructing the final forecasts.

- The error correction component of the VECM is augmented with two dichotomous variables to capture the effects of the relatively large increase in the BPR occurring in the March quarter of 2016 and a time-dependent variable from March 2020 denoting the COVID-19 pandemic. The structural changes to mail flow that have occurred since the arrival of COVID-19 in Australia are continued into the projection period as volumes losses are considered predominantly irreversible.

[50] The Other small letter principal components modelling follows previous methodological approaches in this series. For further information see Section B.1.2 of Diversified Specifics (2022).

[51] Source: International Monetary Fund (2023); see bibliography.

[52] A complete listing of proposed rate changes is provided in Table F.1.1 of Appendix F.

- During the pandemic, temporary regulatory relief (TRR) initiatives resulted in variations to Australia Post's required small letter delivery service standards and the cancellation of the Priority service. Due to identification issues associated with service-related demand effects and measuring the impact of the pandemic, any possible cross-segment volume migration could not be evaluated.

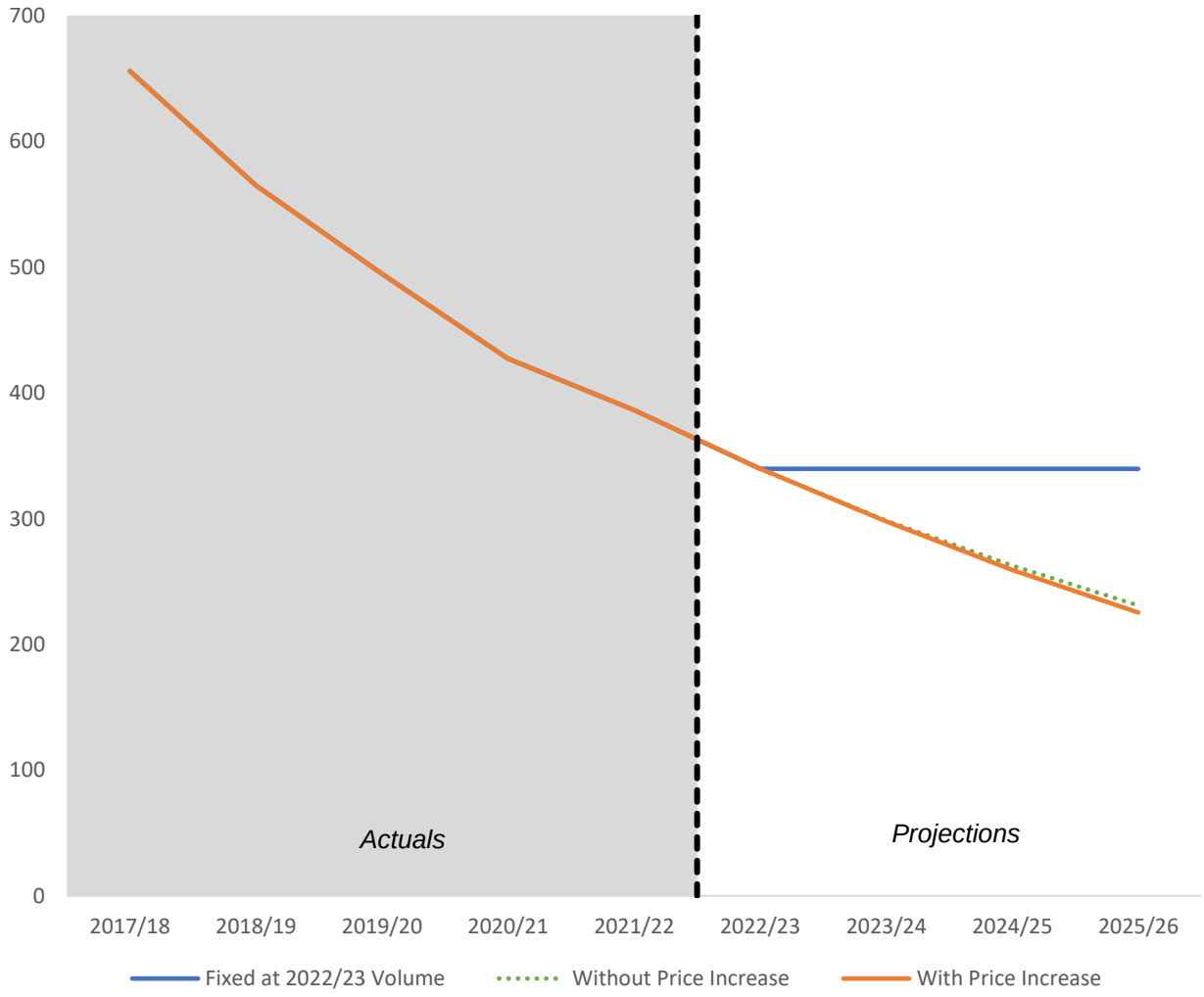
3.2.4 Econometric baseline volume projections

Other (Ordinary) small letter *ex-ante* baseline projections are presented in Table 3.2.4.1 and Chart 3.2.4.1. Minimum Other (Ordinary) small letter volume declines of 12% per annum are predicted over the projection horizon irrespective of a price change. Over the projection horizon the dominant driver of falling Other (Ordinary) small letter volumes is e-substitution as emphasised in Chart 3.2.4.1.

Table 3.2.4.1: Other (Ordinary) small letter volumes, econometric projected percentage changes

	Baseline projected volume change (%)	
	With price increases	Without price increases
2023/24	-12.3	-12.1
2024/25	-13.0	-12.0
2025/26	-13.1	-12.1

Chart 3.2.4.1: Other (Ordinary) small letter volumes (annual, millions), historical and projected



1.3 OTHER (ORDINARY) LARGE

3.3.1 Service scope

The Other (Ordinary) large letter segment consists of full-rate mail up to a maximum size, weight and thickness – 360x260mm, 500g and 20mm respectively.[53] Volumes are hypothesised to predominantly comprise individual non-standard-sized household-to-business, business-to-business and business-to-household mailings, with post traditionally considered an effective channel for larger document delivery. In 2021/22, [c-i-c] [redacted] [c-i-c], as highlighted in Table 3.3.1.1.

Other (Ordinary) large letter content tends to be dominated by non-standard-size documents, such as legal contracts and reports typically originating from individuals or commercial entities. Digital advancements have brought about a shift in this practice, with electronic correspondence representing the new norm. Initially, digital file transmission was restricted to email attachments with relatively small file sizes.

However, the heightened internet connectivity of Australian households and businesses has dramatically altered this scenario. The capacity to transfer large volumes of data electronically, encompassing a range of formats such as PDF, document and picture files via mediums other than email, is now commonplace. In recent times, the use of flash drives, cloud-based storage solutions, and file-sharing services such as Microsoft Teams, Dropbox, iCloud and OneDrive have gained considerable traction. They provide instant, cost-efficient alternatives for transmitting large-scale documents. Moreover, intricate legal contracts and insurance policies have now predominantly migrated to digital platforms. These take the form of websites and apps, significantly diminishing the necessity to circulate large physical documents through Australia Post's large letter service.

[53] Examples of which are the rectangular B4 and C4 envelope sizes.

Table 3.3.1.1: Other (Ordinary) large letter service sub-segments[54]

Large letter services classified into the Other large segment	2021/22 Volume (millions)		2021/22 Percentage of total Other large volumes	
Metered Imprint Charge 0-250g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Metered Imprint Charge 0-250g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Metered Imprint Charge 250-500g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Metered Imprint Charge 250-500g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Imprint Cash 0-250g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Imprint Cash 0-250g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Imprint Cash 250-500g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Imprint Cash 250-500g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Stamped 0-250g	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Stamped 0-250g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Stamped 250-500g	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Stamped 250-500g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Local Rate Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Local Rate Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Clean Small Plus Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Clean Small Plus Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Reply Paid Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Reply Paid Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Prepaid Envelope 0-250g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Ordinary Prepaid Envelope 250-500g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

[54] Sub-segment listing as per 2021/22. On occasions merged and revised/new product codes alter the historical data, which may lead to data omissions beyond the control of Diversified Specifics.

3.3.2 Elasticity estimates

Structural break, tests for cointegration and variable selection assessments resolved a preferred econometric Other (Ordinary) large letter volume model. Appendix E.2 contains the key structural break and lag specification tests applied when constructing the preferred Other (Ordinary) large letter volume vector error correction model (VECM) outlined in Table E.2.3.1.[55] The preferred model explains 97.71% of the total quarterly variation in Other (Ordinary) large letter volumes over the March 2009 to December 2022 time frame.

The historical demand drivers of Other (Ordinary) large letter volumes together with the estimated demand elasticities are presented below.

1. **E-substitution.**

The range of digital alternatives for this segment is vast, given the diverse nature of content travelling through the Other (Ordinary) large letter service. Behavioural adaptations in response to technological transformations have resulted in increasing penetration rates of email, internet, cloud and smartphone communication across Australia. These advancements have circumvented the need for substantial quantities of documentation to be transferred via the Other (Ordinary) large letter service. Shifts in the volumes are therefore characterised by an inverse relationship with the rate of increase in the e-substitution index. In other words, as digital alternatives become more prevalent, a statistically significant reduction in Other (Ordinary) large letter volumes is observed.

Elasticity: A 1% increase in e-substitution as measured via principal component analysis was associated with a 0.61% decrease in Other (Ordinary) large letter volumes on average in the long run.

Recent trends: The rollout of the Australian NBN service has been characterised by a 1,048% increase in the number of wholesale services in operation since December 2015.[56] Mobile phone subscriptions in Australia have increased by 113% since 2002/03.[57]

[55] Individual tests relating to each of the hypothesised tests are omitted from this document due to space considerations; however, they are available on request from Diversified Specifics.

[56] Source data: Number of wholesale NBN services in operation (SIOs) by technology type, Australian Competition and Consumer Commission at www.accc.gov.au.

[57] Source data: Mobile-cellular telephone subscriptions by postpaid/prepaid, Australia, International Telecommunication Union at www.itu.int; and ACCC Internet activity RKR data as 30 June 2022, Australian Competition and Consumer Commission at www.accc.gov.au.

2. Real price.

Rational economic theory suggests the real cost – that is nominal price adjusted for inflationary effects – of sending Other (Ordinary) large letter mail will be inversely related to volume demand. Price changes over the examined time frame have been significantly associated with demand responses in the opposite direction.

Elasticity: A 1% increase in the real price of sending Other (Ordinary) large letters was associated with a 0.38% decrease in Other (Ordinary) large letter volumes on average in the long run.

Recent trend: The nominal price of an Other (Ordinary) large letter item has increased at an annual average rate of 4.1% from 2000/01 to 2021/22. However, this average is largely influenced by the 2015/16 rate rise of 48.7%. Following that price increase, the nominal price of an Other (Ordinary) large letter item has increased at an annual average rate of 2.6% between 2016/17 and 2021/22. By contrast, Australian CPI has increased at an average annual rate of 2.6% between 2000/01 and 2021/22.[58]

[58] Source data (prices): Australia Post; and (CPI) the Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, Tables 1 and 2 at www.abs.gov.au.

3.3.3 Driver projections used

A series of projected values on each of the drivers within the VECM framework is required. These include the following.

- E-substitution projections were derived via an endogenous process that involved forecasting the principal components of numerous technology variables from June 2022 to June 2026.[59]

- CPI projections from the IMF of 7.83% in 2022, 3.96% in 2023, 2.98% in 2024, 2.93% in 2025 and 2.52% in 2026 were delineated into quarterly averages to account for inflationary pressures.[60]

- Nominal increases in the prices of each Other large letter sub-segments (identified in Table 3.3.1.1) were provided by Australia Post.[61] To derive a single tractable nominal price variable, the proposed individual price points were weighted based on 2021/22 volume proportions. For comparative purposes, an alternative price variable was constructed to model the scenario where letter prices do not increase over the projection period.

- Although the Other large letter model contains the census, volume projections do not include the impact of any future census or off-model drivers. Should any of these potential drivers possess economic significance and be anticipated into the projection period then adjustments to the econometric baseline should be undertaken.[62]

- Beyond the census, the error correction component of the Other Large Letter VECM incorporates an additional 4 dichotomous variables. One of these is used to evaluate the impact of the substantial rise in the BPR in January 2016. The other three variables have been designed to measure volume adjustments following March 2020, encapsulating pandemic impacts. The structural changes to the mail flow that have occurred since COVID-19 hit Australia are continued into the projection period as volumes losses are considered predominantly irreversible.

- During the pandemic, TRR initiatives resulted in variations to Australia Post's required large letter delivery service standards and the cancellation of the Priority service. Due to identification issues associated with service-related demand effects and measuring the impact of the pandemic, any possible cross-segment volume migration could not be evaluated.

[59] The technology-based (non-Other small) principal components model is constructed following previous methodological approaches in this series. For further information see Section B.1.2 of Diversified Specifics (2022).

[60] Source: International Monetary Fund (2023); see bibliography.

[61] A complete listing of proposed rate changes is provided in Table F.1.1 of Appendix F.

[62] The next Australian census is anticipated to occur in August 2026, which falls outside the projection horizon applicable to this study.

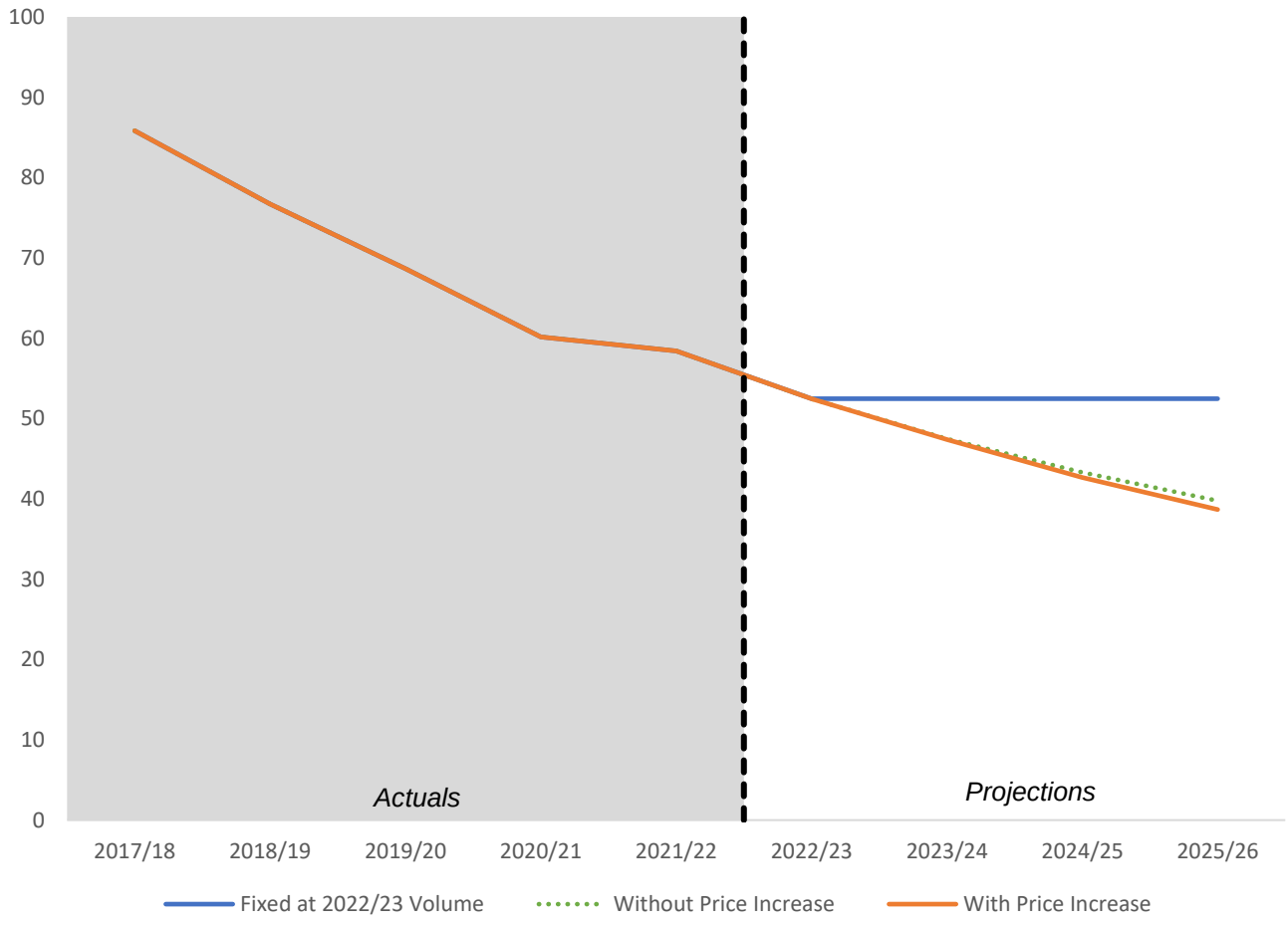
3.3.4 Econometric baseline volume projections

Table 3.3.4.1 and Chart 3.3.4.1 display the *ex-ante* baseline forecasts for Other (Ordinary) large letter volumes. These projections predict a reversion to the pre-2021/22 decline rates over the forecast period. As illustrated in Chart 3.3.4.1, the majority of the projected decrease in volume is attributable to the effects of e-substitution, with rate rise pressures playing a secondary role.

Table 3.3.4.1: Other (Ordinary) large letter volumes econometric projected percentage changes

	Baseline projected volume change (%)	
	With price increases	Without price increases
2023/24	-9.7	-9.6
2024/25	-10.0	-8.8
2025/26	-9.3	-8.1

Chart 3.3.4.1: Other (Ordinary) large letter volumes (annual, millions), historical and projected



PRESORT LETTERS

3.1 OVERVIEW

Australia Post's PreSort letter service enables customers to achieve cost savings through bulk mail lodgements according to a work-sharing arrangement. Typically, businesses and public sector entities use this service to dispatch bundles of letters that are addressed, barcoded and sorted, provided they meet the criteria specified in Table 4.1.1. Given the cost efficiencies realised in the processing stage from collection to delivery, Australia Post provides the PreSort service at a reduced rate when contrasted to the BPR. The PreSort letter service operates on a two-tier system, offering both Priority and Regular options. The Regular service delivers mail over an extended delivery window, catering to non-time-critical mail to be delivered at a lower cost. This service allows an extra two business days for delivery compared with Priority lodged mail.

Table 4.1.1 PreSort service qualification requirements

Size details	Small	Small Plus	Large
Maximum weight	125g	125g	500g
Minimum size	88 x 138mm	88 x 138mm	N/A
Maximum size	130 x 240mm	162 x 240mm	260 x 360mm
Maximum thickness	5mm	5mm	20mm

Further lodgement conditions are as follows:

- *Each lodgement must contain items in the same size and weight category.*
- *The minimum quantity is 300 barcoded articles per lodgement.*
- *The maximum weight for articles is 500g.*

Source: www.auspost.com.au

This segment is characterised by bulk lodgements exceeding 300 items, which typically fall into two primary categories. First, the commercial transactional letter volume component is predominantly produced by medium to large organisations and government entities that cater to extensive customer bases. These organisations use mail as an outcome of their operational processes that deliver their services to customers and constituents. This category of transactional mail often includes bills, statements and public notices. Such correspondence usually follows regular, predictable, structured cycles and recurring events. Second, the promotional or trans-promotional component encompasses brochures, catalogues or other addressed items that meet the size and weight prerequisites for this letter category.

3.2 PRESORT SMALL

4.2.1 Service scope

The PreSort small letter segment consists of bulk (300+) lodgements of:

- Business transactional letters such as bills, statements, share notices and letters advising customers of price increases, policy changes, etc.
- Public sector notifications and correspondence related to welfare, elections, etc., across all tiers of government.
- Charity mail aimed at fundraising and increasing awareness of charitable institutions/causes.
- Direct mail including promotional letters, brochures and other addressed promotional material that satisfies the relevant small letter category size and weight requirements.

Commercial transactional letters form most of the content flowing through the PreSort small letter service. These transactional volumes primarily originate from two sources: 1) fixed contractual arrangements with customers such as those for utility, phone and internet billing; and 2) recurring mailing cycles that include statements for bank accounts and credit cards. Before the global financial crisis (GFC) of 2007/08, fluctuations in PreSort small letter volumes were characterised by a positive association with indicators of Australian economic activity, such as gross domestic product (GDP). However, the economic downturn brought on by the GFC marked a turning point, as growth in retail sales stagnated and firms shifted their focus towards cost containment initiatives in a bid to preserve their profit margins. In this economic climate, companies began exploring methods to reduce their communication costs, including curbing mail expenditure. Bill presentment-type mail became increasingly vulnerable to the forces of rationalisation, consolidation and e-substitution. [63] Rationalisation reduces the frequency of invoice and statement deliveries to recipients, such as moving from monthly to quarterly billing cycles. Consolidation involves the integration of multiple messages, often transactional and promotional, into a single letter item. However, the dominant behavioural change is e-substitution, which expands through the increased proliferation and penetration of digital channels.

[63] Push and pull tactics were deployed involving the imposition of a surcharge for the provision of a paper-based bill or a compulsory use of direct debit arrangements as a condition of a new service agreement or product offering.

Post-GFC, PreSort small letter volumes tended to erode annually at an average of -6.3% from 2008/09 to 2018/19. This decline was exacerbated in 2020 and 2021 by the socio-economic impact of COVID-19, leading to a reduction in PreSort small letter volumes of -11.0% and -10.1% respectively in 2019/20 and 2020/21. When the pandemic struck, the transactional component of PreSort small letter volumes proved more resilient than the promotional component, Promo Post. For instance, Promo Post volumes were 58% lower in the June quarter of 2020 compared with the equivalent quarter in 2019. This significant volume decrease was primarily a result of the reduction in discretionary spending following the closure of non-essential retail and lockdown measures, which diminished the need for catalogues and in-store promotions.

However, as the 2007/08 GFC illustrated, the erosion of the transactional volume within the PreSort small letter segment during the pandemic may not manifest immediately. Economic shocks tend to drive a greater propensity for firms to concentrate on cost containment strategies, leading to an increased tendency to transition communication towards digital alternatives in the long run, eventually reducing transactional letter volumes. Implementing such strategies takes time to influence demand patterns, as fostering behavioural change in recipients often necessitates revised service terms and the acceptance of incentive schemes associated with the alternative platforms. Therefore, an ongoing impact of the pandemic on Australia Post's PreSort small letter volumes is anticipated, as businesses continue to transition an increasing number of communication items to digital alternatives.

In volume terms, the dominant product category within the PreSort small letter segment is business transactional letters, [c-i-c] [redacted] [c-i-c] as highlighted in Table 4.2.1.1.

Table 4.2.1.1: PreSort small letter service sub-segments[64]

Small letter services classified into the PreSort small segment	2021/22 Volume (millions)		2021/22 Percentage of total PreSort small volumes	
PreSort Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Charity Mail Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort Promo Mail Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Charity Mail Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort Promo Mail Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

[64] Sub-segment listing as per 2021/22. On occasions merged and revised/new product codes alter the historical data, which may lead to data omissions beyond the control of Diversified Specifics.

4.2.2 Elasticity estimates

The PreSort small letter volume model is based upon a DOLS (dynamic ordinary least squares) functional form. Tests for structural breaks, lag structures, cointegration and discussions regarding alternative specifications are outlined in Appendix E.3, with Table E.3.3.1 containing the preferred PreSort small letter volume model.[65] This model explains 98.43% of the total quarterly variation in PreSort small letter volumes between June 2016 and December 2022.

The historical demand drivers of PreSort small letter volumes together with the estimated demand elasticities are presented below.

1. **E-substitution.**

The increased popularity of smart devices such as mobile phones and tablets, combined with the widespread use of personal computers, has prompted a shift in how Australians receive information from billers, financial institutions, marketers and public agencies. There is a growing tendency for Australian firms to migrate away from the PreSort small letter service in line with these technological advancements.[66]

Elasticity: The e-substitution elasticity is dimensioned into COVID-19 and non-COVID-19 effects. A 1% increase in e-substitution as measured via principal component analysis was associated with a 0.51% decrease in PreSort small letter volumes on average in the non-COVID-19 period as compared with a 0.56% decrease following the pandemic.

Recent trends: The rollout of the Australian NBN service has been characterised by a 1,048% increase in the number of wholesale services in operation since December 2015. [67] Mobile phone subscriptions in Australia have increased by 113% since 2002/03.[68]

[65] Individual tests relating to each of the hypothesised tests regarding variable selection are omitted from this document due to space considerations; however, they are available on request from Diversified Specifics.

[66] Acknowledging the existence of consolidation and rationalisation pressures, Diversified Specifics has defined strategic structural reductions in bill presentment volume under the term 'e-substitution' for simplicity.

[67] Source data: Number of wholesale NBN services in operation (SIOs) by technology type, Australian Competition and Consumer Commission at www.accc.gov.au

[68] Source data: Mobile-cellular telephone subscriptions by postpaid/prepaid, Australia, International Telecommunication Union at www.itu.int; and ACCC Internet activity RKR data as 30 June 2022, Australian Competition and Consumer Commission at www.accc.gov.au

2. Real price.

Based on rational economic theory, there is generally an inverse relationship between the real cost – the nominal price adjusted for inflation – of sending a PreSort small letter item and its demand. This is a fundamental economic principle embodying the law of demand, which states that price and demand move in opposite directions, all else being equal. However, the dominant influence of e-substitution as a demand driver has crowded out the statistical influence of this traditional relationship. The real price variable is retained in the model due to its economic importance. Price remains a fundamental element in the economic structure of any market. It carries crucial information about supply and demand conditions and is a key determinant of the cost of production and profitability. Including price in the model thus allows for a more comprehensive and economically sound analysis of the factors affecting the demand for PreSort small letters.

Elasticity: A 1% increase in the real price of sending PreSort small letters was associated with a 0.45% decrease in PreSort small letter volumes on average in the long run.

Recent trend: Nominal postage rates for the PreSort small letter service has increased at an annual average rate of 4.7% between 2000/01 and 2021/22. A significant outlier was the 36.2% rate rise occurring in 2015/16. In the subsequent period, nominal postage rates for the PreSort small letter service have increased at an annual average rate of 3.0%.[69] By contrast, Australian CPI has increased at an average annual rate of 2.6% between 2000/01 to 2021/22.[70]

[69] The nominal postage rates for the Chaity component of the PreSort small letter service increased at an annual average rate of 0.8% between 2016/17 and 2021/22.

[70] Source data (prices): Australia Post; and (CPI) the Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, TABLES 1 and 2 at www.abs.gov.au.

3. COVID-19.

Policies and initiatives designed to stem the epidemiological and economic impacts of the pandemic had a statistically significant effect on the PreSort small letter service, resulting in a negative net volume outcome. This impact manifested in multiple forms as the transactional component of PreSort small letter volumes was initially more resilient than its promotional counterpart. Promo Post losses tended to be short run because of the COVID-19-led reduction in discretionary expenditure. Transactional letter volumes were not immediately impacted by the pandemic to the same degree due to a large component of PreSort small letter volumes generated either through fixed contractual arrangements with customers such as utility, phone and internet billing, or recurring mail-out cycles that include statements for bank accounts and credit cards. Given the importance of the pandemic, an interaction of the dichotomous COVID-19-related variables with the principal component measure of e-substitution are included in the model to capture the increased propensity to migrate out of the PreSort small letter service towards alternative communication platforms.

4. Cost-of-living crisis

Recently, Australia has been characterised by increasing rates of inflation leading to an unprecedented number of frequent increases in the cash rate. In response, as lenders increased their mortgage rates to customers, the associated notifications tended to be communicated via letter, increasing the usage of Australia Post's PreSort small letter service.[71]

Elasticity: A 1% increase in the official RBA cash rate was associated with a 0.08% increase in PreSort small letter volumes on average over the long run.

Recent trend: The RBA's official cash rate has risen frequently in recent times from 0.1 in December 2021 to 3.79 in June 2023.[72]

[71] See Section 2.3 for further detail.

[72] Source: Reserve Bank of Australia (2023); see bibliography.

3.2.1 Driver projections used

A series of projected values is required on each of the drivers within the DOLS framework. These include the following.

- E-substitution projections were derived via an endogenous process that involved forecasting the principal components of numerous technology variables from June 2022 to June 2026.[73]

- CPI projections from the IMF of 7.83% in 2022, 3.96% in 2023, 2.98% in 2024, 2.93% in 2025 and 2.52% in 2026 were delineated into quarterly averages to account for inflationary pressures.[74]

- Nominal increases in the price of each PreSort small letter service, listed in Table 4.2.1.1, were provided by Australia Post.[75] To derive a single tractable nominal price variable, the proposed individual price points were weighted based on 2021/22 volume proportions. For comparative purposes, an alternative price variable was constructed to model the scenario where PreSort small letter prices do not increase over the projection period.

- The majority of election-related mail travels through the PreSort small letter service. However, the PreSort small letter volume projections do not include the impact of future elections due to the impossibility of precisely predicting poll dates. Estimated volumes associated with these off-model volume impacts should be added to the baseline projections when constructing the final forecasts.

- The DOLS model is augmented with a series of dichotomous variables capturing the COVID-19 impact on e-substitution from March 2020. This structural change associated with the pandemic continues into the projection period. Future research should focus on investigating these ongoing structural change impacts further by isolating Promo Post from the transactional and charity components within the PreSort small letter segment.

- During the COVID-19 pandemic, TRR initiatives resulted in variations in Australia Post's required small letter delivery service standards and the cancellation of the Priority service. Due to identification issues associated with service-related demand effects and measuring the impact of the pandemic, any possible cross-segment volume migration could not be evaluated.

[73] The technology-based (non-Other small) principal components model is constructed following previous methodological approaches in this series. For further information see Section B.1.2 of Diversified Specifics (2022).

[74] Source: International Monetary Fund (2023); see bibliography.

[75] A complete listing of proposed rate changes is provided in Table F.1.1 of Appendix F.

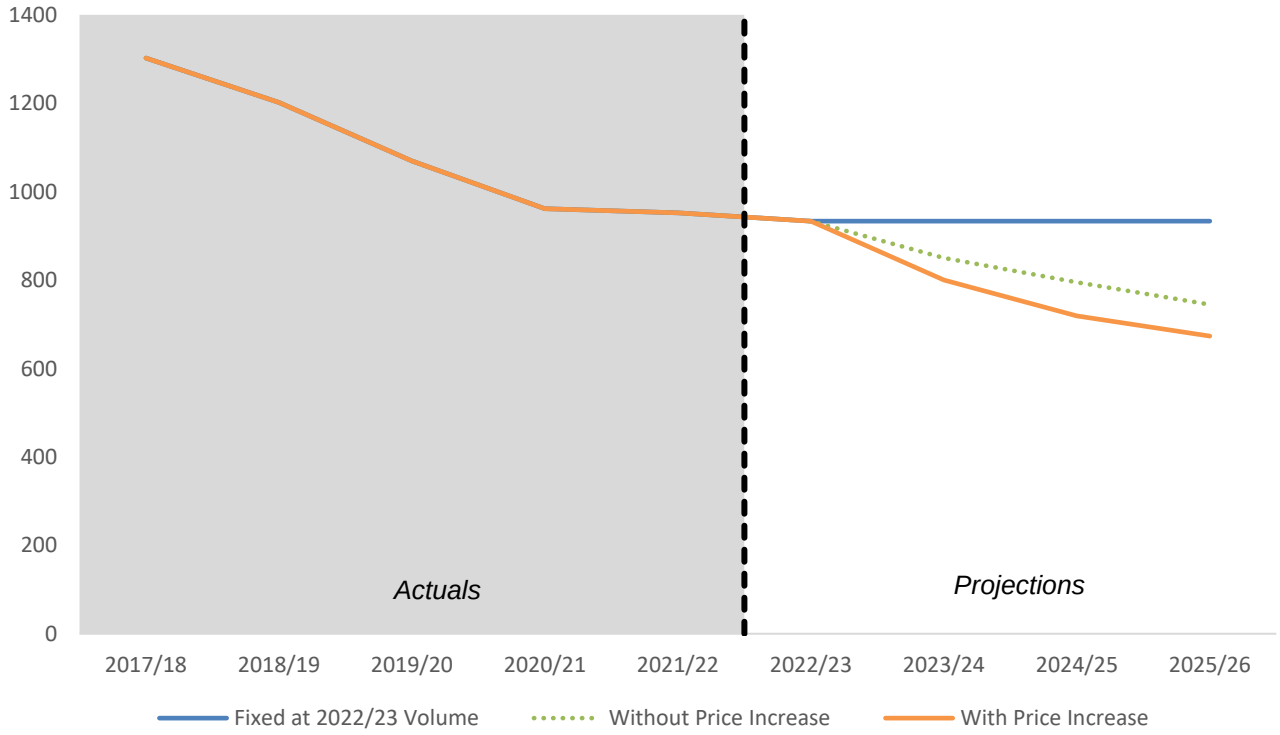
4.2.4 Econometric baseline volume projections

PreSort small letter *ex-ante* baseline projections are presented in Table 4.2.4.1 and Chart 4.2.4.1. The baseline declines are anticipated to return towards a more typical longer-run trend within this segment as the Australian economy continues to recover from the pandemic and an eventual easing of the cost-of-living crisis.[76] Chart 4.2.4.1 illustrates the anticipated outcome by 2025/26 is largely unaffected by the imposition of the proposed rate rises.

Table 4.2.4.1: PreSort small letter volumes econometric projected percentage changes

	Baseline projected volume change (%)	
	With price increases	Without price increases
2023/24	-14.3	-8.9
2024/25	-10.1	-6.5
2025/26	-6.3	-6.3

Chart 4.2.4.1: PreSort small letter volumes (annual, millions), historical and projected



[76] Alternative projections for PreSort small letter volumes based on differing scenarios for the cash rate are presented in Section 6.3.

3.3 PRESORT LARGE

4.3.1 Service scope

The PreSort large letter segment consists of bulk lodgements containing 300+ large letters, typically sent by business and the public sectors.[77] It includes non-standard-size items such as prospectuses, annual reports and outbound census forms. However, the segment also includes large promotional material as per the Promo Post service. [c-i-c] [redacted] [c-i-c], as highlighted in Table 4.3.1.1.

Before 2006/07, there was a positive correlation between PreSort large letter volumes and the level of Australian economic activity. However, legislative changes in 2007 instigated the shift of annual reports to digital platforms.[78] This development led to a decrease in the use of PreSort large letter service for correspondence to the stakeholders of Australian publicly listed companies. The timing of these changes coincided with the GFC, a period during which Australian firms generally curtailed bulk distributions of large publications in order to make cost savings. Most of this transition to electronic substitutes proved irreversible, causing PreSort large letter volumes to continue their decline at an accelerated pace since 2007/08. Recently, the decline has deepened due to the increasing penetration of digital communications, which can be provided at a lower relative cost to mail. The situation was exacerbated from March 2020 onwards as measures to curb the spread of COVID-19 led to further drops in bulk promotional activities due to the closure of non-essential retail. These combined factors have resulted in an annual average decline of 8.8% in PreSort large letter volumes between 2016/17 and 2020/21.

Table 4.3.1.1: PreSort large letter service sub-segments[79]

Large letter services classified into the PreSort large segment	2021/22 Volume (millions)		2021/22 Percentage of total PreSort large volumes	
PreSort medium Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort large 0-250g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort small Plus Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort large 250-500g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort small Plus Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort large 0-250g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort medium Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
PreSort large 250-500g Priority	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Charity Mail Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Promo Post Small Plus Large Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Promo Post 0-125g Regular	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

[77] Up to a maximum size, weight and thickness – 360x260mm, 500g and 20mm respectively.

[78] Parliament of Australia (2007); see bibliography.

[79] Sub-segment listing as per 2021/22. On occasions merged and revised/new product codes alter the historical data, which may lead to data omissions beyond the control of Diversified Specifics.

4.3.2 Elasticity estimates

In estimating an econometric model for PreSort large letter volume, a preliminary series of assessments and discriminative tests were carried to assist with variable selection.[80] Detailed information about key structural break and lag specification tests applied during the creation of the chosen PreSort large letter volume vector error correction model can be found in Appendix E.4 and the model itself is outlined in Table E.4.3.1. This selected model accounts for 98.42% of the total quarterly variation in PreSort large letter volumes over the period from June 2003 to December 2022.

The historical demand drivers of PreSort large letter volumes together with the estimated demand elasticities are presented below.

1. **E-substitution.**

The transition of PreSort large letters to digital alternatives mirrors the expanding potential for electronic communication in Australia, made possible by the growth in mobile phone ownership and internet connections across broadband, wireless and National Broadband Network (NBN) platforms. As these technologies have reached maturity, their widespread adoption across the business sector has empowered large corporations to swiftly distribute a single piece of digital information to a vast audience in a cost-effective manner. This type of e-substitution has been gaining pace, fuelled not just by technological advancements but also by evolving consumer preferences, immediacy and lower marginal costs associated with digital communications. Furthermore, digital alternatives allow businesses to leverage data analytics for targeted messaging, improving the effectiveness of their mass communication efforts. This transition is expected to continue as technologies continue to evolve and businesses seek more efficient, cost-effective ways to communicate with a large audience.

Elasticity: A 1% increase in e-substitution was associated with a 0.18% decrease in PreSort large letter volumes on average in the long run.

Recent trends: The rollout of the Australian NBN service has been characterised by a 1,048% increase in the number of wholesale services in operation since December 2015.[81] Mobile phone subscriptions in Australia have increased by 113% since 2002/03.[82]

[80] Individual tests relating to each of the hypothesised tests are omitted from this document due to space considerations; however; they are available on request from Diversified Specifics.

[81] Source data: Number of wholesale NBN services in operation (SIOs) by technology type, Australian Competition and Consumer Commission at www.accc.gov.au.

[82] Source data: Mobile-cellular telephone subscriptions by postpaid/prepaid, Australia, International Telecommunication Union at www.itu.int; and ACCC internet activity RKR data as 30 June 2022, Australian Competition and Consumer Commission at www.accc.gov.au.

2. **Real price.**

Economic theory suggests the demand for the PreSort large letter service is inversely associated with fluctuations in price, adjusted for inflation. Despite the growing influence of digital alternatives, price remains a statistically significant factor influencing demand in the PreSort large letter volume model.

Elasticity: A 1% increase in the real price of sending PreSort large letters was associated with a 0.65% decrease in PreSort large letter volumes on average in the long run.

Recent trend: Nominal postage rates for the PreSort large letter service have increased at an annual average rate of 4.2% from 2000/01 to 2021/22. Since 2016/17 this annual average rate change is 2.6% in the period following the 42.1% price increase that occurred in 2015/16. In contrast, the Australian CPI has increased at an average annual rate of 2.6% between 2000/01 to 2021/22.[83]

3. **Cross price.**

The price of telecommunications services in Australia is used to assess the cross-price impacts on letter volume demand. Decreases in PreSort large letter volumes are associated with the declining price of telecommunications services.

Elasticity: A 1% decrease in the real price of services provided in the Australian telecommunications industry was associated with a 1.4% decrease in PreSort large letter volumes on average in the long run.

Recent trend: The nominal price of services in the Australian telecommunications industry has decreased by 22% between 2002/03 and 2021/22, at an annual average rate of -1.2%.[84]

[83] Source data (prices): Australia Post; and (CPI) the Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, Table 1 and 2 at www.abs.gov.au.

[84] Source data: Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, Table 7, at www.abs.gov.au.

3.3.3 Driver projections used

A series of projected values is required on each of the drivers within the VECM framework. These include the following.

- E-substitution projections were derived via an endogenous process that involved forecasting the principal components of numerous technology variables from June 2022 to June 2026.[85]
- CPI projections from the IMF of 7.83% in 2022, 3.96% in 2023, 2.98% in 2024, 2.93% in 2025 and 2.52% in 2026 were delineated into quarterly averages to account for inflationary pressures.[86]
- Nominal increases in the price of each PreSort large letter service, listed in Table 4.3.1.1, were provided by Australia Post.[87] To derive a single tractable nominal price variable, the proposed individual price points were weighted based on 2021/22 volume proportions. For comparative purposes, an alternative price variable was constructed to model the scenario where letter prices do not increase over the projection period.
- Future values of the telecommunications CPI, used to proxy cross-price effects, were generated via an AR(1) process. This resulted in annual cross-price percentage changes of 0.53% for 2022/23, -3.14% for 2023/24, -3.30% for 2024/25 and -3.39% for 2025/26.
- PreSort large letter volume projections do not include the impact of any off-model drivers. If any of these potential drivers possess economic significance and can be anticipated into the projection period, then adjustments to the econometric baseline should be undertaken.
- The error correction component of the VECM is augmented with a series of dichotomous variables to capture the PreSort large letter demand effects of the relatively large increase in rates occurring in the March quarter of 2016; and targeted time-dependent variables from March 2020 capturing the transitory impacts from the COVID-19 pandemic.[88]
- During the COVID-19 pandemic, TRR initiatives resulted in variations in Australia Post's required large letter delivery service standards and the cancellation of the Priority service. Due to identification issues associated with service-related demand effects and measuring the impact of the pandemic, any possible cross-segment volume migration could not be evaluated.

[85] The technology-based (non-Other small) principal components model is constructed following previous methodological approaches in this series. For further information see Section B.1.2 of Diversified Specifics (2022).

[86] Source: International Monetary Fund (2023); see bibliography.

[87] A complete listing of proposed rate changes is provided in Table F.1.1 of Appendix F.

[88] The 2021 census was held on Tuesday 10 August 2021. See www.abs.gov.au.

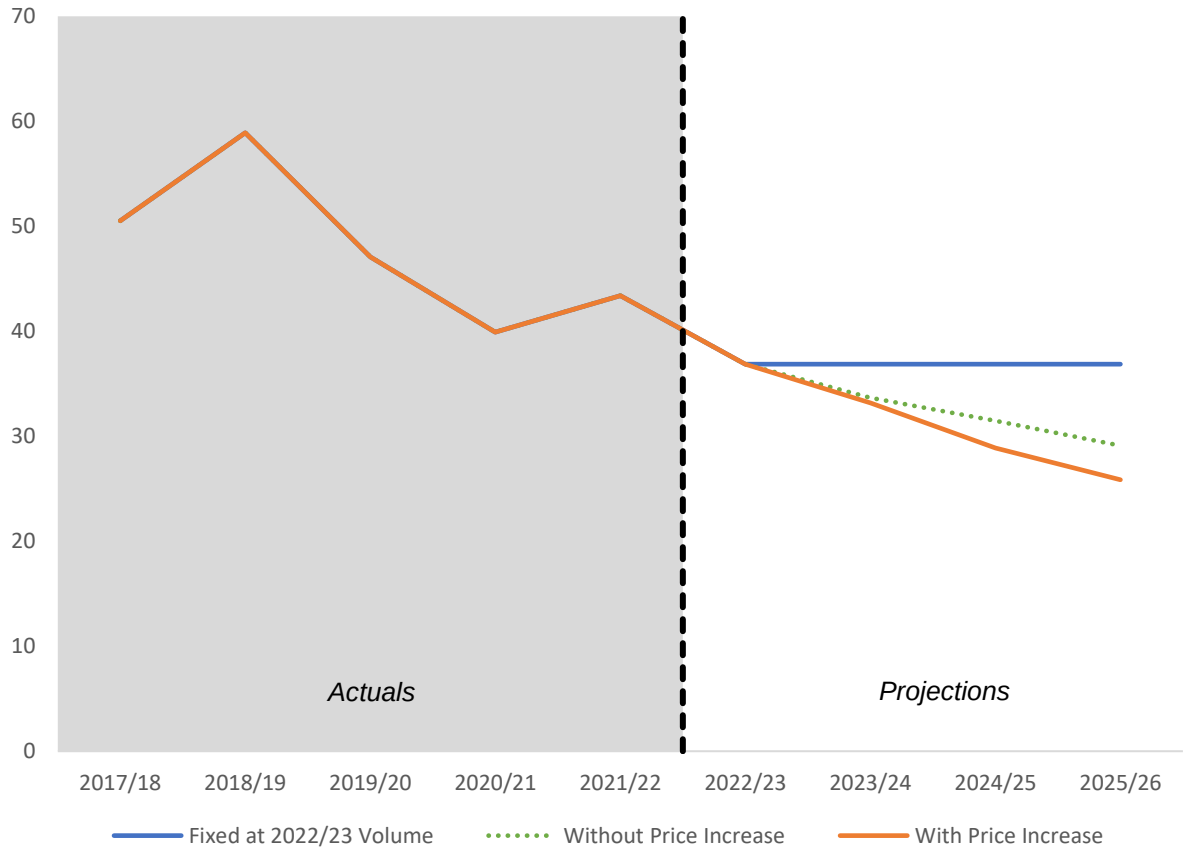
4.3.4 Econometric baseline volume projections

PreSort large letter volume *ex-ante* baseline projections are presented in Table 4.3.4.1 and Chart 4.3.4.1. PreSort large letter volume growth is anticipated to converge towards the long-run trend by 2025/26, largely driven by a continuing migration towards digital alternatives. The proportion of the projected volume declines explained by the proposed PreSort large letter rate rises is also illustrated in Table 4.3.4.1 and Chart 4.3.4.1.

Table 4.3.4.1: PreSort large letter volumes econometric projected percentage changes

	Baseline projected volume change (%)	
	With price increases	Without price increases
2023/24	-10.0	-8.7
2024/25	-13.0	-6.5
2025/26	-10.5	-7.6

Chart 4.3.4.1: PreSort large letter volumes (annual, millions), historical and projected



PRINT POST

3.1 OVERVIEW

Print Post consists of either small or large lodgements of 100 plus items that satisfy the relevant category content, size and weight requirements listed in Table 5.1.1.[89] Further conditions require the publication must be a continuing printed periodical with a fixed title and published at least twice a year. Australia Post pre-approval is essential to qualify for the service and accepted customers are issued with a unique Print Post publication number.

Table 5.1.1 Print Post service qualification requirements

Size details	Small	Large
Maximum weight	125g	1kg
Minimum size	88 x 138mm	88 x 138mm
Maximum size	130 x 240mm	260 x 360mm
Maximum thickness	5mm	20mm

Source: www.auspost.com.au

Australia Post's Print Post service is designed to provide numerous benefits to customers, aimed at delivering recurring publications via mail. The Print Post service grants work-shared discounts on mailing prices facilitated by the sorting and labelling requirements tailored for magazine distribution. To personalise publications and content, the service allows for tailored messages within each item. Additionally, Print Post offers the possibility of including a flysheet for the purpose of showcasing extra artwork or promoting specific activities. Packaging can also be customised, with options ranging from traditional envelopes to plastic-wrapped solutions. Print Post items are supplied within the regular mail flow, ensuring immediate access to Australia Post's comprehensive delivery network. Furthermore, for items that cannot be delivered, the service offers a return mechanism. Print Post items can be dispatched at either Regular or Priority speed, in line with the customer's needs. Australia Post does not monitor the delivery service performance for this particular segment, unlike the small and large letter services detailed in Sections 3 and 4.

[89] Large volume member magazines are excluded from this demand analysis.

3.2 PRINT POST

5.2.1 Service scope

The Print Post segment mainly caters to the delivery of bulk, recurring letter items emanating from business and the public sector. Primarily, the content ranges across magazines, periodicals and catalogues, etc. [c-i-c] [redacted] [c-i-c], as depicted in Table 5.2.1.1.

Table 5.2.1.1: Print Post service sub-segments[90]

Services classified into the Print Post segment	2020/21 Volume (millions)		Percentage of total Print Post volumes	
Print Post Standard Size	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Print Post < 500g	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Print Post > 500g	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

The accelerating erosion of Print Post volumes in Australia since 2007/08, as evidenced in Table 5.2.1.2, can be primarily attributed to the increasing consumption of digital content through social media, websites and digital publications. Magazine producers are also facing reduced incentives for publishing by traditional means due to the decline in print-based advertising revenue, which has been taken over by online mediums. [91] The magazine publishing business was also adversely affected by the COVID-19 pandemic. Various measures were implemented by all tiers of Australian government to contain the virus, including quarantines, shutdowns of non-essential retail, travel bans, mobility restrictions and work-from-home orders. Consequently, the pandemic and an economic recovery plagued by atypically large inflation rates have had a significant impact on magazine advertising expenditures. These trends align with the global deterioration of subscription and circulation rates in the magazine and publication industry over the long term.

Table 5.2.1.2: Print Post average annual volume percentage changes[92]

2007/08 – 2011/12	2012/13 – 2016/17	2017/18 – 2021/22
-4.0	-7.5	-11.6

[90] Sub-segment listing as per 2021/22. On occasions merged and revised/new product codes alter the historical data, which may lead to data omissions beyond the control of Diversified Specifics.

[91] Digital advertising expenditure worldwide is expected to increase from $US380.75 billion in 2020 to $US785.08 billion in 2025. These types of promotional activities include advertising on internet-enabled devices such as PCs, tablets and smartphones. See eMarketer, www.insiderintelligence.com

[92] Source: Australia Post.

5.2.2 Elasticity estimates

The Print Post volume model is based upon a VECM functional form. Tests for structural breaks, lag structures, cointegration and alternative specifications are outlined in Appendix E.5, with Table E.5.3.1 containing the preferred Print Post volume model.[93] This model explains 74.92% of the total quarterly variation in Print Post volumes between June 2019 and December 2022.

The historical demand drivers of Print Post volumes together with the estimated demand elasticities are presented below.

1. **E-substitution**

Australians now have simplified and inexpensive access to a wealth of information through digital channels such as social media, websites and digital publications. As a result, there has been a decline in Print Post volumes, mirroring a global trend in the magazine and publication industry where subscription and circulation rates have deteriorated. A large proportion of the Australian population has unprecedented access to mobile phones and high-speed internet connections that have significantly contributed to increased user engagement with online platforms. This shift towards digital mediums has also led to a redirection of promotional spending away from printed catalogues, which historically used Australia Post's Print Post service.

Elasticity: A 1% increase in e-substitution as measured via principal component analysis was associated with a 1% decrease in Print Post volumes on average in the long run.

Recent trends: The rollout of the Australian NBN service has been characterised by a 1,048% increase in the number of wholesale services in operation since December 2015. [94] Mobile phone subscriptions in Australia have increased by 113% since 2002/03.[95]

[93] Individual tests relating to each of the hypothesised tests regarding variable selection are omitted from this document due to space considerations; however, they are available on request from Diversified Specifics.

[94] Source data: Number of wholesale NBN services in operation (SIOs) by technology type, Australian Competition and Consumer Commission at www.accc.gov.au.

[95] Source data: Mobile-cellular telephone subscriptions by postpaid/prepaid, Australia, International Telecommunication Union at www.itu.int; and ACCC internet activity RKR data as 30 June 2022, Australian Competition and Consumer Commission at www.accc.gov.au.

2. Real price

Rational economic theory suggests the real cost, that is nominal price adjusted for inflationary effects, of sending a mail item via the Print Post service will be inversely related to demand.

Elasticity: A 1% increase in the real price of sending Print Post items was associated with a 0.65% decrease in Print Post volumes on average in the long run.

Recent trend: Nominal postage rates for the Print Post letter service have increased at an annual average rate of 4.1% between 2006/07 and 2021/22. Across this period the largest individual annual rate rise for the Print Post service was 29.5% in January 2016. [96]

3. Cross price

The price of telecommunications services in Australia is used to assess the cross-price impacts on letter volume demand. Decreases in Print Post volumes are associated with the declining price of telecommunications services.

Elasticity: A 1% decrease in the real price of services provided in the Australian telecommunications industry was associated with a 0.9% decrease in Print Post volumes on average in the long run.

Recent trend: The nominal price of services in the Australian telecommunications industry has decreased by 22% between 2002/03 and 2021/22, at an annual average rate of -1.2%. [97]

4. COVID-19.

Annual Print Post volume erosion experienced a significant acceleration through the COVID-19 pandemic, going from -9.1% in 2018/19 to -21.3% in 2019/20. This decline correlated highly with declines in Australian consumer discretionary expenditure and the reduction in catalogue volumes as non-essential retail closures rendered this type of advertising temporarily redundant. Within the modelling, this negative net volume impact on the Print Post service is captured by an overarching COVID-19 dichotomous variable.[98]

[96] Source: Australia Post.

[97] Source data: Australian Bureau of Statistics, Cat No. 6401.0 Consumer Price Index, Australia, Table 7, at www.abs.gov.au.

[98] For a visual summary of these effects consult Chart 5.2.2.1. of Diversified Specifics (2022); see bibliography.

3.2.3 Driver projections used

A series of projected values on each of the Print Post drivers within the VECM framework is required to generate the volume projections. These include the following.

- E-substitution projections were derived via an endogenous process that involved forecasting the principal components of numerous technology variables from June 2022 to June 2026.[99]
- CPI projections from the IMF of 7.83% in 2022, 3.96% in 2023, 2.98% in 2024, 2.93% in 2025 and 2.52% in 2026 were delineated into quarterly averages to account for inflationary pressures.[100]
- Nominal increases in the price of each Print Post sub-segment, listed in Table 5.2.1.1, were provided by Australia Post.[101] To derive a single tractable nominal price variable, the proposed individual price points were weighted based on 2021/22 volume proportions. For comparative purposes, an alternative price variable was constructed to model the scenario where Print Post prices do not increase over the projection period.
- Print Post volume projections do not include the impact of recently emerging trends or events of economic, rather than statistical, significance falling outside the sample data. Estimated volumes associated with these off-model impacts should be factored into any augmentations to the projections when constructing the final forecasts.
- The Print Post VECM model is augmented with an overarching dichotomous variable designed to capture structural demand changes associated with the impact of COVID-19 from March 2020.
- During the COVID-19 pandemic, TRR initiatives resulted in variations in Australia Post's delivery service standards in addition to the cancellation of the Priority service. As Print Post delivery service performance is not measured by Australia Post the associated demand effects could not be evaluated.[102]

[99] The technology-based (non-Other small) principal components model is constructed following previous methodological approaches in this series. For further information see Section B.1.2 of Diversified Specifics (2022).

[100] Source: International Monetary Fund (2023); see bibliography.

[101] A complete listing of proposed rate changes is provided in Table F.1.1 of Appendix F.

[102] Diversified Specifics recommends Australia Post commence measurement of Print Post delivery service performance, as preliminary testing using large letter proxies implied significant service-related demand impacts.

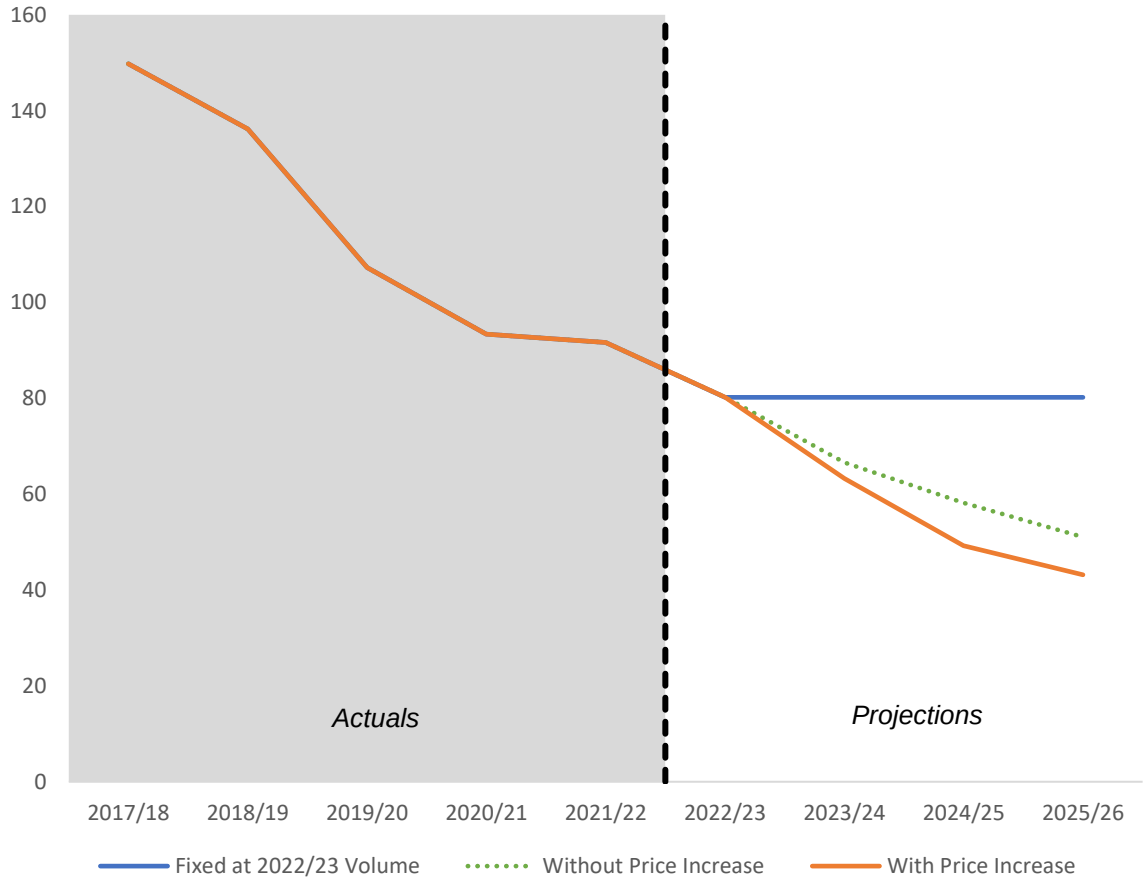
5.2.4 Econometric baseline volume projections

Print Post *ex-ante* baseline projections are presented in Table 5.2.4.1 and Chart 5.2.4.1. Proportionately, Print Post was one of the letter segments most impacted by COVID in 2020. This structural change in behaviour is anticipated to continue into the longer term, reflected in the substantial rates of volume erosion projected to 2025/26. By then, any impact from the proposed rate rises is likely to diminish as the rates of volume decline converge to the longer-term e-substitution-driven trend.

Table 5.2.4.1: Print Post volumes econometric projected percentage changes

	Baseline projected volume change (%)	
	With price increases	Without price increases
2023/24	-21.1	-16.9
2024/25	-22.1	-12.7
2025/26	-12.3	-12.3

Chart 5.2.4.1: Print Post volumes (annual, millions), historical and projected



CONCLUDING OBSERVATIONS

3.1 IMPLICATIONS FOR TOTAL LETTERS

The Australian economic landscape has faced several disruptions in recent years, each having an impact on letter volumes at Australia Post in a variety of ways. The socio-economic shock associated with responses to the COVID-19 pandemic has given way to a recovery period that has been punctuated by relatively high rates of inflation, escalating instances of data breaches at large corporations and a federal election.[103] In response to these significant changes, adjustments were made to the econometric models. Both the conceptual frameworks and the underlying data were updated, yielding a revised set of price elasticities. Despite these changes, the updated set of estimates continue to provide robust support for the long-standing assertion of letter price inelasticity. Changes in rates continue to play only a secondary role, if any, in driving volume for certain segments, as evidenced in Table 6.1.1.

Table 6.1.1 Price elasticity of demand

		2022 update	2023 update
Small letter	Ordinary / Other	-.15	-.38*
	PreSort	-.55*	-.45*
Large letter	Ordinary / Other	-.18	-.04*
	PreSort	-.47*	-.65
Print Post		-.06*	-.65

** denotes statistical insignificance*

As with previous updates in this series, the key conclusion is that e-substitution remains the principal statistical and economic driver influencing the total volume of letters at Australia Post, a trend expected to continue in the coming years. A consistent decline in letter volumes is projected annually through to 2025/26, observed in total and across all specific letter segments, as detailed in Table 6.1.2. The anticipated impact on letter volumes with and without the proposed rate rises is illustrated in Chart 6.1.1.

[103] A comprehensive discussion about the impact of the pandemic on Australia Post's letter volumes, along with the methodological approach to embedding these effects within the modelling process, are outlined in Diversified Specifics (2022), see bibliography.

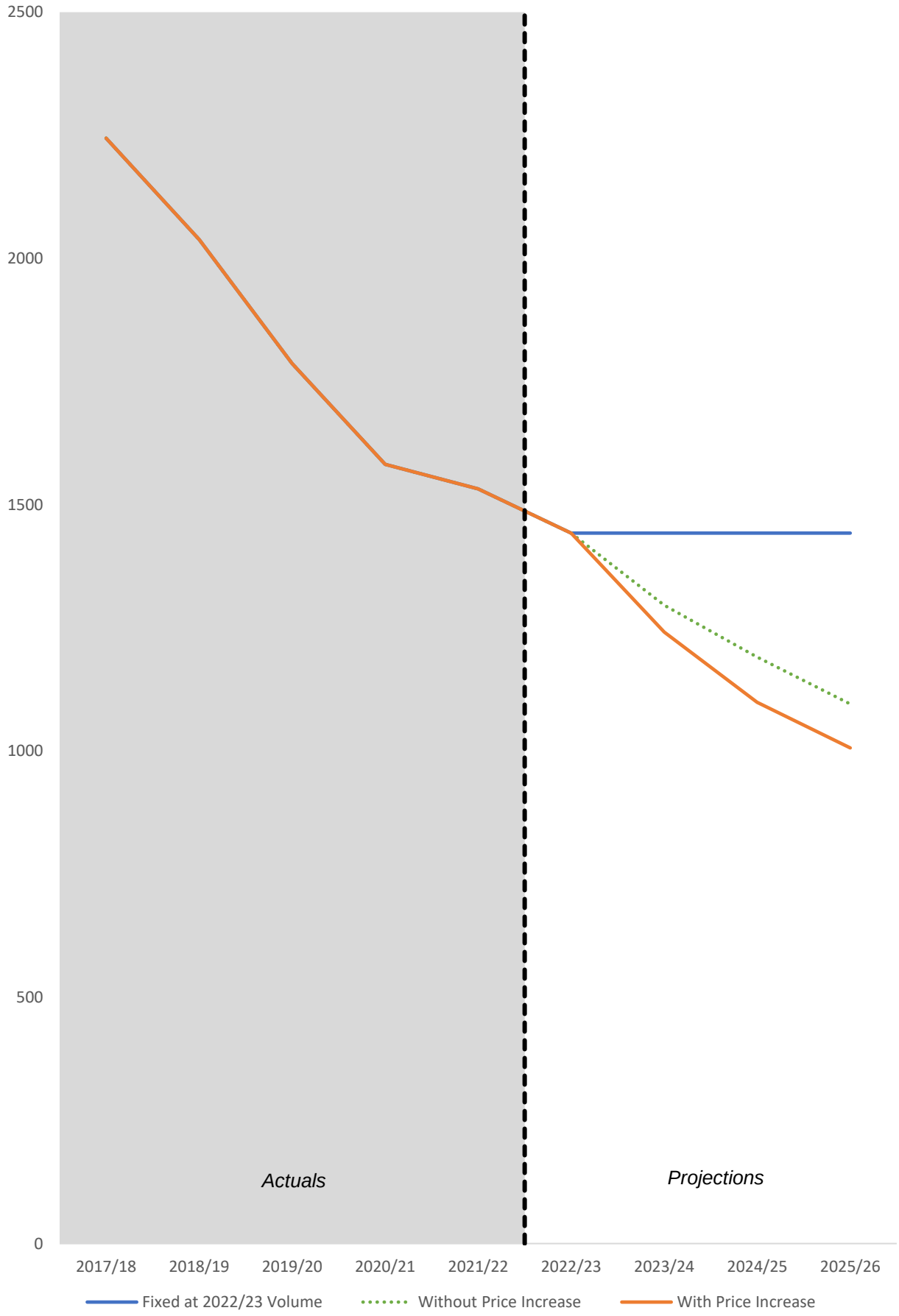
Table 6.1.2 Percentage changes in total letter volume inclusive of proposed rate rises
(Projections without proposed rate rises presented in parentheses)

	Pre COVID-19	COVID-19		Post COVID-19				
	2018/19*(a)*	**2019/20*(a)***	**2020/21*(a)***	**2021/22*(a)***	**2022/23*(a & p)*** [104]	**2023/24*(p)***	**2024/25*(p)***	**2025/26*(p)***
Small								
Ordinary/Other	-13.9	-12.5	-13.6	-9.6	-12.1	-12.3 *(-12.1)*	-13.0 *(-12.0)*	-13.1 *(-12.1)*
PreSort	-7.7	-11.0	-10.1	-1.0	-2.0	-14.3 *(-8.9)*	-10.1 *(-6.5)*	-6.3 *(-6.3)*
Large								
Ordinary/Other	-10.6	-10.5	-12.4	-2.9	-10.2	-9.7 *(-9.6)*	-10.0 *(-8.8)*	-9.3 *(-8.1)*
PreSort	16.6	-20.1	-15.2	8.7	-15.0	-10.0 *(-8.7)*	-13.0 *(-6.5)*	-10.5 *(-7.6)*
Print Post	-9.1	-21.3	-12.9	-1.9	-12.5	-21.1 *(-16.9)*	-22.1 *(-12.7)*	-12.3 *(-12.3)*
Total letters	**-9.2**	**-12.3**	**-11.4**	**-3.2**	**-5.8**	**-13.9 *(-10.1)***	**-11.5 *(-8.1)***	**-8.4 *(-8.0)***

Key: actual *(a)* and projected *(p)* baseline.

[104] The 2022/23 projections are constructed by using nine months of actual values and three months of econometric projected values.

Chart 6.1.1: Total domestic addressed letter volumes at Australia Post (annual, millions), historical and projected



3.2 HYPOTHESISED CONSEQUENCES OF ATYPICAL RATE RISES

In an era marked by declining letter volumes, Australia Post's proposed increases in letter rates represent the largest increase since January 2016. This has consequences for the precision of unfettered empirical baseline projections, which extrapolate future demand based upon generalised historical patterns. In cases where rates are increasing by amounts greater than previously observed, the models may underestimate the impending decrease in letter volumes. This is primarily due to a greater likelihood that customers will respond differently to steep price rises, in contrast to the typical, moderate increases in postal rates made in recent years.

There is a greater propensity for the price elasticity of demand to become more elastic (*or rather less inelastic*), leading to a greater-than-expected fall in volumes given the magnitude of the proposed rate increases. Although the increase proposed for January 2024 is atypical, should subsequent proposals include increases of similar magnitude that occur more regularly, the associated demand responses may vary from the historic indicators. In such cases, Australia Post's customers would be forming decisions based upon the totality of the successive rate rises rather than each individually and the elasticities reported are likely to be conservative estimates of the final demand response.

3.3 CASH RATE SIMULATIONS

A primary objective of the econometric analysis undertaken on Australia Post's letter volumes was to generate a set of empirical baseline projections. These numbers hinge on the critical assumption that the RBA's cash rate will remain stable, with no further increases across the projection period. However, the complexity of the prevailing inflationary economic climate means alternative scenarios must be explored. In this section, alternative sets of projections are generated under varied assumptions about potential marginal movements in the cash rate:

- Scenario 1: An increase of 0.25 base points in the September quarter in 2023.
- Scenario 2: An increase of 0.25 base points in each quarter of 2023/24.

These hypothetical scenarios are first applied to PreSort small letter volumes as this segment's volumes are significantly influenced by changes in the cash rate, according to the associative statistical modelling conducted (see Table 6.3.1).

Table 6.3.1 Projected PreSort small letter volumes (percentage changes)

	2023/24	*2024/25*	*2025/26*
Baseline – no future increases in the cash rate	-14.3	-10.1	-6.3
Scenario 1: Increase of 0.25 base points in the Sept. quarter of 2023	-13.8	-10.6	-6.3
Scenario 2: Increase of 0.25 base points in each quarter of 2023/24	-12.6	-11.9	-6.3

All scenarios assume the imposition of the proposed letter price increases.

Subsequently, the PreSort projections from Table 6.3.1 are incorporated into the baseline total letter volume projections so the sensitivity to shifting monetary policy by the RBA may be evaluated; see Table 6.3.2.

Table 6.3.2 Projected total letter volumes (percentage changes)

	2023/24	*2024/25*	*2025/26*
Baseline – no future increases in the cash rate	-13.9	-11.5	-8.4
Scenario 1: Increase of 0.25 base points in the Sept. quarter of 2023	-13.6	-11.8	-8.4
Scenario 2: Increase of 0.25 base points in each quarter of 2023/24	-12.8	-12.6	-8.4

All scenarios assume the imposition of the proposed letter price increases.

The experiments quantify the additional letter items generated because of financial institutions corresponding with their customer base following any decisions by the RBA to lift the cash rate.[105] The findings also illustrate the transitory nature of this effect as letter volumes in the following year return to the underlying trends in the absence of any further increases in the cash rate. In theory, a similar rationale can be applied to other off-model disruptions impacting PreSort small letter volumes including federal elections and the type of privacy breaches affecting Australian firms as described in Section 2.3.

[105] Future studies of this type should monitor how letter volumes respond to a decline in the official cash rate as recent data does not permit the examination of impacts in the reverse direction.

3.4 FINAL REMARKS

Moving into 2023/24, letter volumes at Australia Post are likely to be challenged by factors including inflation, restrictive monetary policy, a post-pandemic recovery, and issues relating to global instability. Despite these uncertainties, Diversified Specifics is unwavering in its assessment that e-substitution continues to be the primary threat to Australia Post's letter business over the next decade. This assessment is premised on modelling the influence of key demand drivers when generating volume projections. From this analysis, increasing postage rates becomes an effective instrument for Australia Post in ensuring the medium-term sustainability of its letters business, without substantially contributing to long-run volume losses.

As with all prior studies in this series, it is imperative the construction of econometric letter volume projections and price elasticity estimates are viewed as initial steps in the entire forecasting process. Crucially, the baseline should be supplemented with additional market intelligence about emerging trends and off-model effects to adequately forecast letter volume movements, building on the figures predicted via associative statistical methods. The evolving dynamics of e-substitution, socio-economic shocks and constant behavioural change in communications emphasise the need for ongoing model updates and trend reassessment. This will ensure that Australia Post's strategic decision-making continues to be based on a rigorous, structured and scientific methodology, essential during these challenging times.

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Australian Competition and Consumer Commission, www.accc.gov.au

Australian Electoral Commission, www.aec.gov.au

Australian Government Federal Register of Legislation, www.legislation.gov.au

Australian Stock Exchange, www2.asx.com.au

Australia Post, www.auspost.com.au

eMarketer, www.insiderintelligence.com

International Monetary Fund, www.imf.org

International Telecommunication Union, www.itu.int

National Australia Bank, www.business.nab.com.au

Organisation for Economic Co-operation and Development, www.OECD.org

The Office of the Australian Information Commissioner, www.oaic.gov.au

Reserve Bank of Australia, www.rba.gov.au

APPENDIX A DATA AND DATA DESCRIPTIONS

A.1 Internal Australia Post data

Australia Post supplied, July 1995 to April 2023, letter volume and revenue data to Diversified Specifics in the form of revenue-based volumes. Models were generally developed using data to December 2022 due to the unavailability of drivers from external institutions. Information on the proposed percentage changes in the price of individual letter services were also provided by Australia Post and are presented in Table F.1.1 of Appendix F. Additionally, auxiliary data used in the econometric testing process was supplied by Australia Post including delivery service performance measurements for small and large, excluding Print Post, letter segments.

A.2 Externally sourced data

To facilitate association testing and the generation of econometric models, Diversified Specifics obtained variables from a variety of external sources. Each variable utilised within this testing process is outlined in Table A.2.1. Variables obtained were used to test developed hypothesis in an unbiased and structured manner. Externally sourced variables outlined Table A.2.1 that were not included in the final econometric models, were not found to be statistically significant in relation to segment-specific volume movements or did not meet the test of common-sense based on the accepted principles of economic theory relating to the postal industry. Such tests do not diminish the economic significance of the associated hypotheses tested.

Table A.2.1 Data descriptions

Volume predictor	Measurement variable or proxy	Data frequency	Data source
Australian Non-farm GDP	Australian Non-farm GDP	September 1995 to December 2022 – Quarterly series	Gross Domestic Product minus Agriculture, Forestry and Fishing (A), Cat. No. 5206.0 Table 6 Gross Value Added by Industry, Australia, Chain volume measures, Australian Bureau of Statistics, *www.abs.gov.au*
Advertising industry health measure	S&P/ASX 200 consumer discretionary index	September 1995 to December 2022 – Quarterly series	Created by Diversified Specifics. Original Data from Media Index (defunct) & the S&P/ASX 200 consumer discretionary index, *www2.asx.com.au*
Australian cheque volumes	Principal component index for e-substitution: Other (Ordinary) small letters only	January 2002 to December 2022 – Monthly series	Total number of cheques, Cheques – Original Series – C5.1, Payment System, Reserve Bank of Australia, *www.rba.gov.au*
Real price of Other (Ordinary) small letters	Real price of an Other (Ordinary) small letter	September 1995 to December 2022 – Quarterly series	1) Other small letter volumes (revenue based) and revenue, Australia Post 2) CPI: ABS Cat. No. 6401.0 TABLES 1 and 2. All Groups, Index Numbers and Percentage Changes, Consumer Price Index, Australia Bureau of Statistics, *www.abs.gov.au*
Real price of Other (Ordinary) large letters	Real price of an Other (Ordinary) large letter	September 1995 to December 2022 – Quarterly series	1) Other large letter volumes (revenue based) and revenue, Australia Post 2) CPI: ABS Cat. No. 6401.0 TABLES 1 and 2. All Groups, Index Numbers and Percentage Changes, Consumer Price Index, Australia Bureau of Statistics, *www.abs.gov.au*
Real price of PreSort small letters	Real price of a PreSort small letter	September 1995 to December 2022 – Quarterly series	1) PreSort small letter volumes (revenue based) and revenue, Australia Post 2) CPI: ABS Cat. No. 6401.0 TABLES 1 and 2. All Groups, Index Numbers and Percentage Changes, Consumer Price Index, Australia Bureau of Statistics, *www.abs.gov.au*
Real price of PreSort large letters	Real price of a PreSort large letter	September 1995 to December 2022 – Quarterly series	1) PreSort large letter volumes (revenue based) and revenue, Australia Post 2) CPI: ABS Cat. No. 6401.0 TABLES 1 and 2. All Groups, Index Numbers and Percentage Changes, Consumer Price Index, Australia Bureau of Statistics, *www.abs.gov.au*
Real price of Print Post	Real price of a Print Post mail item	September 2006 to December 2022 – Quarterly series	1) Print Post volumes (revenue based) and revenue, Australia Post 2) CPI: ABS Cat. No. 6401.0 TABLES 1 and 2. All Groups, Index Numbers and Percentage Changes, Consumer Price Index, Australia Bureau of Statistics, *www.abs.gov.au*

Volume predictor	Measurement variable or proxy	Data frequency	Data source
Domestic broadband index	Principal component index for e-substitution	March 2002 to December 2018 – Quarterly series	Created by Diversified Specifics. Original Data from: 1) Australia Bureau of Statistics Internet Activity, Australia, December 2009, December 2012, and June 2018, *www.abs.gov.au*; 2) Snapshot of Broadband data, Australian Competition & Consumer Commission, *www.accc.gov.au*
Wireless broadband subscribers	Principal component index for e-substitution	December 2008 to September 2013 – Quarterly series	Created by Diversified Specifics. Original Data from: 1) Australia Bureau of Statistics Internet Activity, Australia, December 2012 and June 2018, *www.abs.gov.au*; 2) Snapshot of Broadband data, Australian Competition & Consumer Commission, *www.accc.gov.au*
Number of wholesale NBN services in Australia	Principal component index for e-substitution	June 2015 to December 2022 – Quarterly series	Number of Wholesale NBN Services in Operation (SIOs) by Technology Type, Australian Competition & Consumer Commission, *www.accc.gov.au*
Australian mobile subscribers	Principal component index for e-substitution	March 2000 to December 2022 – Quarterly series	1) Australian annual mobile phone subscribers, International Telecommunication Union, *www.itu.int;* *2) ACCC Internet Activity RKR data as at 30 June 2022, Table 2: Broadband and mobile plan services in operation (SIOs) by type of access connection*, *www.accc.gov.au*
Australian retail trade	Australian retail trade	September 1995 to December 2022 – Quarterly series	Retail trade (G), Cat. No. 5206.0 Table 6 Gross Value Added by Industry, Australia, Chain volume measures, Australian Bureau of Statistics, *www.abs.gov.au*
Direct entry payments for debit transfers	Principal component index for e-substitution: Other (Ordinary) small letters only	January 2002 to December 2022 – Monthly series	Number of debit transfers, Direct Entry and NPP – Original Series – C6.1, Payment System, Reserve Bank of Australia, *www.rba.gov.au*
Australian population	Estimated Australian population	September 1995 to September 2022 – Quarterly series	Australia Bureau of Statistics, Cat. No. 3101.0 Table 1. Population Change, Summary - Australia ('000), *www.abs.gov.au*
Paper as an input cost	Paper as an input cost for letters	September 1995 to December 2022 – Quarterly series	Australia Bureau of Statistics, Producer Price Index, Table 14 Cat Number 6427014, 15 Pulp, paper and converted paper product manufacturing, *www.abs.gov.au*
Business confidence	NAB Business confidence index	April 1997 to December 2022 – Monthly series	NAB business confidence index, NAB Monthly Business Survey, Net balance (NSA)+100, National Australia Bank, *www.business.nab.com.au*
Post-global financial crisis	Post-global financial crisis	December 2008 to December 2022	Dichotomous variable, Created by Diversified Specifics.

Volume predictor	Measurement variable or proxy	Data frequency	Data source
COVID-19	Post-COVID-19 & Individual quarters related to the pandemic	March 2020 to December 2022	Dichotomous variables, Created by Diversified Specifics related to: 1) Post onset of COVID-19 within Australia 2) Individual quarters following the onset of COVID-19 within Australia
Initial public offerings	Market capitalisation associated with large initial public offerings	September 1995 to December 2022 – Quarterly series	Created by Diversified Specifics. Original Data from the Australian Stock Exchange, S&P/ASX 300, *www2.asx.com.au*
Australia Post delivery service performance	Australia Post delivery service performance for small and large letter segments	September 1998 to December 2022 – Quarterly series	Supplied by Australia Post under two settings: 1) Constant delivery service standards. 2) Variable delivery service standards under temporary regulatory relief arrangements.
Australian consumer price index	Deflator	September 1998 to December 2022 – Quarterly series	Australia Bureau of Statistics, 6401.0 Consumer Price Index, Australia, TABLES 1 and 2. CPI: All Groups, Index Numbers and Percentage Changes, *www.abs.gov.au*
Australian consumer price index for telecommunication equipment and services	Cross-price effects	September 1998 to December 2022 – Quarterly series	Australia Bureau of Statistics, 6401.0 Consumer Price Index, Australia, TABLE 7. CPI: Group, Sub-group and Expenditure Class, Weighted Average of Eight Capital Cities, *www.abs.gov.au*
Political events	Australian Federal/State elections, referendums & national census	Various	Australian Electoral Commission, *www.aec.gov.au*. Dichotomous variables, Created by Diversified Specifics.
Cash rate	RBA cash rate	January 5, 2011 to December 31, 2022 – Daily series	Reserve Bank of Australia, F1 Interest rates and yields – money market, Cash Rate Target on date, Publication date: April 6 2023, *www.rba.gov.au*

APPENDIX B HYPOTHESED DEMAND DRIVERS

B.1 Hypothesised demand drivers

This econometric study is premised upon testing a set of key letter volume demand hypotheses. Each hypothesis, outlined in Table 1.6.1., links fluctuations in prospective drivers to movements in domestic letter volume demand. All hypotheses require information on a primary data source or proxy to facilitate testing. Detailed explanations, information on the primary data source or proxies deployed related to each variable tested are contained in Appendix B of the previous demand update in this series.[106] The following sub-sections listed in this Appendix are intended to highlight any significant variations to a select number of the variables considered in the econometric modeling process.

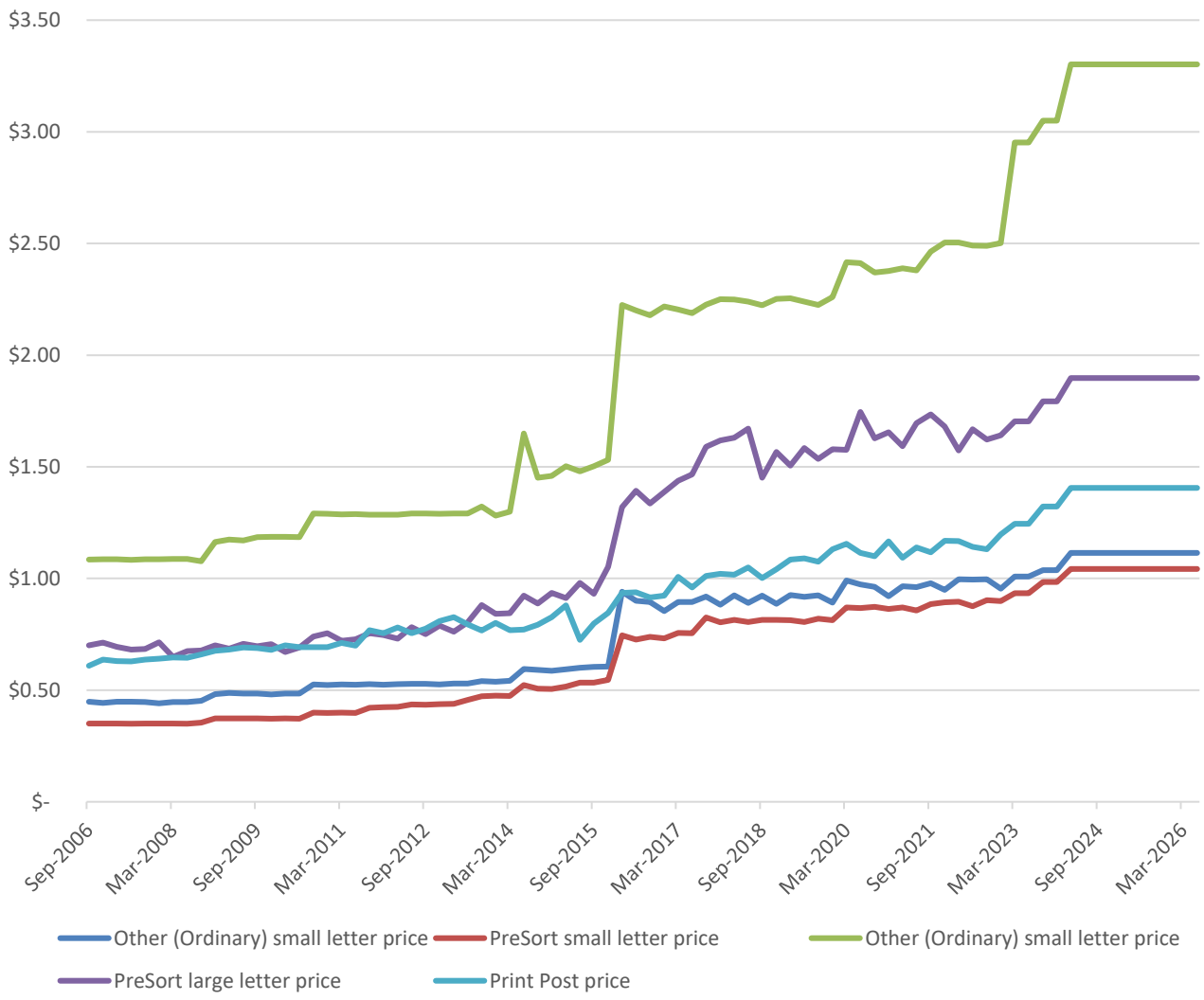
Prior letter volume demand studies in this series have always been premised upon obtaining appropriate data that is reflective of the hypotheses developed. In some cases, the desired data was either not publicly available or, over time, became redundant. Additionally, for some of the explanatory variables assessed previously, data sources had been discontinued or were not available on a quarterly basis. Where these issues were considered problematic, the data was either not included in the econometric process or interpolations/extrapolations were undertaken. The process of econometric modeling remains ongoing, consistently adapting to include new or revised data sources, strategies, and methods. This continual enhancement strategy attempts to ensure the models maintain their precision and statistical significance in light of fluctuating market situations and the emerging trends that tend to characterize the typical modern day postal industry.

[106] Diversified Specifics (2022); see bibliography.

B.1.1 Own price

Revealed preference revenue-based volume (RBV) data is utilised to derive an average unit revenue factor to proxy the nominal price of each letter service. To obtain the price for a given segment, each of the sub-segments are weighted according to 2021/22 volume proportions. For the purposes of this study these segmented average revenue factors are used as an indicative measure of the rate that the customer is charged. [107]The customer then reacts based on their budget and available market options. The nominal price of Australia Post's domestic letters by segment is presented in Chart B.1.1.1, inclusive of the proposed rate rises contained in Appendix F.

Chart B.1.1.1 Nominal price of Australia Post's domestic letters by segment (Quarterly, indexed)[108]



[107] The final own-price variable utilised in the econometric testing phase are deflated for inflation by historical Australian CPI figures, see Table A.2.1.

[108] Data source: Australia Post. See Table A.2.1.

B.1.2 Differing CPI Sources

Each nominal price series outlined in Section B.1.1 is adjusted using the Australian Consumer Price Index (CPI) to remove the effects of inflation from the analysis, thus providing a more accurate picture of the underlying economic trends. Following the ACCC 2022 recommendation to alter the source of the CPI, Diversified Specifics have elected to retain the ABS measure for reasons of consistency.[109] Indeed, the source of the RBA CPI figures is the ABS, therefore the RBA CPI figures are identical to those provided by the ABS. This is evident in the data and via the definition provided by the RBA:

> *"The most well-known indicator of inflation is the Consumer Price Index (CPI), which measures the percentage change in the price of a basket of goods and services consumed by households. In Australia, the CPI is calculated by the Australian Bureau of Statistics (ABS) and published once a quarter. To calculate the CPI, the ABS collects prices for thousands of items, which are grouped into 87 categories (or expenditure classes) and 11 groups. Every quarter, the ABS calculates the price changes of each item from the previous quarter and aggregates them to work out the inflation rate for the entire CPI basket."*[110]

As acknowledged by the ACCC, this is a low level issue and Diversified Specifics agrees with the 2022 ACCC decision finding:

> "*given the inelastic price elasticity estimates and relatively small impact of the proposed rate increases found, the impact of changing the CPI measure on forecast letter volumes is immaterial*."[111]

[109] The Australian Consumer & Competition Commission (2022); see bibliography.

[110] See www.rba.com where the source of the RBA CPI figures is identical to the Diversified Specifics CPI data source: ABS Cat No 6401.0.

[111] The Australian Consumer & Competition Commission (2022), pp. 19; see bibliography.

B.1.3 E-substitution

Digital substitution is defined by a behavioural migration away from using the physical letter item of communication, towards alternative, often online, platforms. The phenomenon of e-substitution is a nebulous concept given the complexities associated with:

1) measuring the growth and penetration of various technologies; and
2) quantifying the extent these technologies are supplanting letter communications.

In previous studies, Diversified Specifics acknowledge the difficulties in e-substitution measurement however utilise principal component techniques to combine a variety of variables, each monitoring usage levels of differing technologies, to capture the underlying characteristics of e-substitution within Australia. These variables include:

- Direct entry payments for debit transfers
- Cheque volumes as a traditional mode of bill payments
- Number of wholesale NBN Services in operation
- Domestic broadband activity
- Wireless broadband subscribers
- Australian mobile phone subscribers

For recent trends and a comprehensive description on the methodological approach to principal component analysis replicated for the purposes of this update see Diversified Specifics (2022), Section B.1.2.[112]

[112] All statistical tests relating to the construction of each principal component index have been replicated for the purposes of this study. While the results of such tests are omitted from this documentation, they are available upon request from Diversified Specifics.

B.1.4 Seasonality

One key demand characteristic shared across the letter volume segments is a pronounced tendency for seasonal fluctuations. These seasonal elements underline inherent demand patterns over the course of a year. To better comprehend the underlying demand drivers, Diversified Specifics generally adjusts all letter volume variables for seasonality prior to econometric modeling. Seasonal factors not only assist in understanding the demand trends but also provide crucial insights into volume changes throughout any given year. The quarterly, dynamic, seasonal factors for each letter volume segment are presented in Tables B.1.4.1 to B.1.4.5.

Table B.1.4.1 Other small letter dynamic seasonal factors

	1st	2nd	3rd	4th	AVERAGE
1995			99.9	114.3	107.1
1996	91.3	95.8	100.1	114.0	100.3
1997	91.6	95.5	100.4	113.9	100.3
1998	91.8	95.0	100.7	114.2	100.4
1999	91.8	94.4	101.0	114.7	100.5
2000	91.7	93.8	101.3	115.2	100.5
2001	91.5	93.5	101.3	115.8	100.5
2002	91.1	93.5	101.2	116.1	100.5
2003	90.9	93.7	101.2	116.0	100.4
2004	90.8	94.0	101.1	115.5	100.4
2005	90.9	94.5	101.0	115.2	100.4
2006	90.7	95.2	100.7	114.9	100.4
2007	90.5	95.7	100.6	114.5	100.4
2008	90.4	96.2	100.6	114.0	100.3
2009	90.6	96.4	100.7	113.4	100.3
2010	90.8	96.5	100.7	112.7	100.2
2011	91.3	96.6	100.8	112.1	100.2
2012	91.6	96.8	100.8	111.4	100.2
2013	91.8	97.3	100.6	110.8	100.2
2014	92.0	97.7	100.5	110.2	100.1
2015	92.2	98.2	100.2	109.9	100.1
2016	92.3	98.5	100.2	109.5	100.1
2017	92.5	98.8	99.9	109.3	100.1
2018	92.8	98.6	100.1	109.0	100.1
2019	93.0	98.6	100.0	109.0	100.2
2020	93.0	98.4	100.3	108.8	100.1
2021	93.0	98.6	100.3	108.7	100.1
2022	93.1	98.4	100.4	108.6	100.1
AVERAGE	91.7	96.3	100.6	112.6	

Table B.1.4.2 Other large letter dynamic seasonal factors

	1st	2nd	3rd	4th	AVERAGE
1995			102.4	109.5	106.0
1996	90.2	98.6	102.8	109.4	100.2
1997	90.2	98.4	103.3	109.1	100.2
1998	90.2	98.0	103.9	108.8	100.2
1999	90.3	97.4	104.7	108.6	100.3
2000	90.5	96.6	105.7	108.2	100.3
2001	90.7	95.9	106.5	107.9	100.3
2002	90.8	95.7	106.8	107.6	100.2
2003	90.9	95.7	107.0	107.0	100.2
2004	91.2	96.1	106.9	106.2	100.1
2005	91.5	96.6	106.7	105.4	100.1
2006	91.9	97.4	106.1	104.9	100.1
2007	92.2	97.8	105.6	104.7	100.1
2008	92.5	98.1	105.2	104.7	100.1
2009	92.7	98.0	104.9	104.9	100.1
2010	92.8	98.0	104.6	105.2	100.1
2011	93.0	97.6	104.4	105.6	100.2
2012	93.2	97.3	104.2	106.2	100.2
2013	93.2	96.9	104.1	106.7	100.2
2014	92.9	96.9	104.0	106.9	100.2
2015	92.8	96.8	104.0	106.9	100.1
2016	92.9	96.8	103.9	106.9	100.1
2017	93.1	96.6	104.0	107.1	100.2
2018	92.9	96.4	104.2	107.6	100.3
2019	92.6	95.8	104.7	108.4	100.4
2020	91.9	95.3	105.2	109.2	100.4
2021	91.2	94.9	105.8	109.7	100.4
2022	90.8	94.6	106.1	110.0	100.4
AVERAGE	91.8	96.8	104.9	107.3	

Table B.1.4.3 PreSort small letter dynamic seasonal factors

	1st	2nd	3rd	4th	AVERAGE
1995			105.5	103.1	104.3
1996	95.7	96.1	105.4	103.0	100.1
1997	95.7	96.6	105.0	102.7	100.0
1998	95.8	97.4	104.3	102.4	100.0
1999	95.8	98.4	103.5	102.1	100.0
2000	96.0	99.2	102.6	102.0	100.0
2001	96.2	99.7	102.2	101.9	100.0
2002	96.3	99.8	102.1	102.0	100.0
2003	96.2	99.6	102.4	101.9	100.0
2004	96.1	99.5	102.7	101.9	100.1
2005	96.0	99.4	102.9	101.9	100.1
2006	95.9	99.3	103.0	102.0	100.1
2007	95.8	99.2	103.2	102.0	100.1
2008	95.8	99.0	103.6	101.8	100.0
2009	95.8	98.7	104.1	101.5	100.0
2010	95.9	98.4	104.8	100.8	100.0
2011	96.2	98.2	105.4	100.1	100.0
2012	96.6	98.0	105.8	99.6	100.0
2013	96.8	98.1	105.8	99.2	100.0
2014	97.1	98.2	105.7	99.1	100.0
2015	97.1	98.5	105.4	99.3	100.1
2016	96.9	98.9	104.9	99.6	100.1
2017	96.7	99.2	104.3	100.2	100.1
2018	96.6	99.2	103.9	100.8	100.1
2019	96.4	99.0	103.6	101.5	100.1
2020	96.1	98.9	103.5	101.8	100.1
2021	96.0	98.8	103.4	102.1	100.1
2022	96.1	98.5	103.5	102.2	100.1
AVERAGE	96.2	98.7	104.0	101.4	

Table B.1.4.4 PreSort large letter dynamic seasonal factors

	1st	2nd	3rd	4th	AVERAGE
1995			98.5	123.4	111.0
1996	83.8	98.2	98.3	124.4	101.2
1997	83.1	98.2	98.3	125.3	101.2
1998	82.5	97.9	99.0	125.6	101.2
1999	81.9	98.0	99.5	124.8	101.1
2000	82.6	96.8	100.5	123.8	100.9
2001	83.6	95.6	101.5	122.2	100.7
2002	85.4	93.7	102.4	121.6	100.8
2003	86.2	93.0	102.2	122.4	100.9
2004	86.3	92.3	102.1	123.7	101.1
2005	85.6	92.0	103.1	123.6	101.1
2006	85.2	91.3	105.3	121.8	100.9
2007	85.4	90.3	108.0	119.5	100.8
2008	85.8	89.3	110.8	117.0	100.7
2009	86.6	88.3	113.4	114.5	100.7
2010	87.5	87.6	115.0	112.8	100.7
2011	88.2	87.1	115.9	112.1	100.8
2012	88.6	86.8	115.8	112.8	101.0
2013	88.2	86.3	116.4	113.4	101.1
2014	87.8	85.9	116.7	114.5	101.2
2015	87.1	85.4	117.3	115.3	101.3
2016	86.4	85.6	116.9	116.2	101.3
2017	85.8	85.9	116.8	115.8	101.1
2018	85.7	86.9	116.2	114.7	100.9
2019	86.1	87.6	116.6	112.5	100.7
2020	86.6	88.6	116.8	110.6	100.7
2021	87.1	89.0	117.7	108.8	100.7
2022	87.5	89.5	117.8	107.9	100.7
AVERAGE	85.8	90.6	109.2	117.9	

Table B.1.4.5 Print Post letter dynamic seasonal factors

	1st	2nd	3rd	4th	AVERAGE
2006			103.1	108.3	105.7
2007	92.1	97.3	103.2	108.1	100.2
2008	92.1	97.5	103.0	108.0	100.2
2009	92.0	97.9	102.8	107.8	100.1
2010	91.9	98.4	102.5	107.5	100.1
2011	92.2	98.6	102.4	106.9	100.0
2012	92.7	98.6	102.4	106.3	100.0
2013	93.4	98.2	102.9	105.5	100.0
2014	93.9	97.9	103.6	104.8	100.0
2015	94.2	97.5	104.4	104.2	100.1
2016	94.0	97.6	105.0	104.0	100.1
2017	93.6	97.8	105.2	104.1	100.2
2018	93.1	98.1	105.3	104.3	100.2
2019	92.6	98.3	105.4	104.4	100.2
2020	92.1	98.5	105.6	104.3	100.2
2021	92.0	98.6	105.9	104.1	100.1
2022	92.0	98.5	105.9	104.0	100.1
AVERAGE	92.7	98.1	104.0	105.7	

APPENDIX C QUALIFICATIONS

C.1 Econometric caveats

The interpretation of projections relating to segmented letter volumes via empirical modelling techniques must be conducted with all due caution. The *ex-ante* projections generated in this research undertaking are econometric in nature and they therefore depend heavily upon:

- Accurately projecting future growth rates for each of the exogenous drivers;
- An assumption that prior statistical associations detected by the modelling continues to hold over the projection period which may not always be the case as there is no guarantee the future will replicate the past;
- An assumption of comprehensiveness governing the statistically significant segmented letter volume drivers. That is, there are other variables logically associated with volume movements in each segment however significant variation over the sampled timeframe may not have been evident. Therefore, these drivers tend to be excluded from the econometric models. Such variables still retain economic, if not statistical, significance and should continue to be monitored by Australia Post and interested stakeholders; &
- The global/national economy remaining similar to that observed over the sampled timeframe.

The methodology employed acknowledges these limitations and the impossibility of embedding all possible contingencies within the *ex-ante* projection estimates. It is therefore recommended that any interpretation of the projection results generated by these models be augmented by further internal and market intelligence. That is, the generation of baseline *ex-ante* projections provided in this document should necessarily represent an initial step in the volume forecasting process at Australia Post. Ultimately the baseline must be augmented via further market intelligence on emerging trends and known future events that are not directly observable empirically.

The nature of developing econometric models based on historical data also suggests a need for on-going refinements and research to ensure an adequate currency of both the statistical associations and projections produced via the models. In developing the econometric projections an ideal scenario would involve a longer timeframe, an increased number of observations and greater degrees of freedom. These considerations were evaluated against the desire to estimate a set of parameters that more accurately reflect the status quo rather than examining a lengthier timeframe where the current forces of e-substitution, pricing and economic growth do not apply. In this regard, a series of structural break tests have, in some cases, impacted the selection of commencement dates for statistical evaluation and the results of these tests are summarised in Appendix E.

APPENDIX D ECONOMETRIC PROCESS

D.1 Methodological approach

This appendix summarises the econometric process deployed and reflects Diversified Specifics extensive experience modelling demand functions within the global postal industry.

Representing the cornerstone of this analysis is the selection of key letter volume drivers which are used to construct various scenarios regarding potential changes in real price, e-substitution and cross-price effects, as well as potentially significant macroeconomic events such as the GFC and COVID-19.

The core econometric methodology is premised on a structured approach for specifying a set of dynamic models that allow for both long-run and short-run movements combined with their interaction effects on letter volumes.

Formally this modelling framework is underlined by a vector error correction model (VECM) which explicitly models the dynamic trends contained within letter volume movements and their key drivers. Additionally, the long-run and short-run interactive effects are captured by error-correction components.

The VECM consists of two components:

1) the cointegrating equation which captures the long-run dynamical relationship between letter volumes and its determinants, and

2) the vector error equations which capture the short-run dynamics.

In the case of a bivariate model consisting of the variables y_t and x_t, the first component of the VECM is the cointegrating equation given by

$$y_t = \beta x_t + u_t$$

where ut captures transitory deviations between actual and long-run movements in y_t.

The short-run dynamical equations for y_t and x_t for the special case of no lags in the VECM are

$$\begin{aligned} y_t - y_{t-1} &= \gamma_1 u_{t-1} + v_{1t} \\ x_t - x_{t-1} &= \gamma_2 u_{t-1} + v_{2t} \end{aligned}$$

where v_{1t} and v_{2t} are disturbance terms, and γ_1 and γ_2 are known as the error-correction parameters which control how y_t and x_t adjust when the system is not at the long-run equilibrium at a point in time t, i.e., when $u_t \neq 0$.

The estimation of the VECM is performed using the Johansen estimator, which is a maximum likelihood procedure where the computations are performed using an eigen decomposition. Alternatively, an iterative procedure can be employed which imposes the cross-equation restriction on the VECM arising from the presence of cointegration.[113]

For letter segments where the sample size is restricted because of either data availability or the effects of structural change, a single equation approach based on dynamic ordinary least squares (DOLS) is also investigated.

The DOLS of Stock and Watson is a single equation cointegrating estimator based on augmenting the cointegrating equations with lags and leads of the change in the explanatory variables to purge the disturbance term of any autocorrelation.[114] In the case where y_t and x_t are single variables, the DOLS estimator is based on the estimating the following equation by ordinary least squares (OLS)

$$y_t = \beta x_t + \sum_{j=-q}^{r} \Delta x_{t+j} \delta_j + u_t$$

where u_t is the disturbance term which by assumption is independent of y_t and x_t . It is also necessary to replace the OLS estimator of the disturbance variance by the corresponding long-run estimator to ensure valid inferences.[115]

[113] Martin, Hurn, Harris (2013); see bibliography.

[114] Stock and Watson (1993); see bibliography.

[115] In the simulations, the statistical software package deployed in this research, EViews, uses the cointegrating equation component from the Johansen and DOLS procedures to generate the projections of letter volumes.

The VECM is a special case of a slightly more general dynamic model known as a vector autoregression, or VAR, as it imposes a set of cross-equation restrictions on the parameters of the VAR caused by the long-run component of the model impacting upon all variables within the dynamic system.

In a similar manner to previous letter volume demand updates in this series, the implementation of a dynamic VECM/DOLS framework for each letter segment follows a set of steps which constitute the defining methodological approach:

Step 1

The base model of each letter volume segment consists of a dynamic multivariate framework which has been developed and refined over successive letter volume demand updates. In recent times, for all segments the statistically significant letter volume drivers have traditionally consisted of real own price, e-substitution and cross-price effects, lagged dynamic variables as well as significant economic events within Australia, such as the GFC and COVID-19. Beyond these core drivers, tests for statistical relevance are conducted across a broader array of potential letter volume drivers such as additional macroeconomic variables, delivery service performance measurements, population size characteristics, events including elections or the national census and other variables that might result in letter volume fluctuations. Discriminatory statistical tests result in a revised set of narrowly defined demand drivers within a parsimonious framework for each letter volume segment.

An important set of variables investigated relate to those attempting to quantify the effects of e-substitution. This phenomenon is inherently difficult to measure as a broad set of factors affect the migration of letter-based communication towards the digital alternatives. Indeed, time series quantitative measurements on emerging technologies are often unavailable. There is also the added dimension of complexity as the technological landscape, penetration rates and the manner technological change impacts letter volumes is continually evolving. For these reasons identifying variables and constructing a consistent series to measure substitution provides additional challenges. This update utilises a refined set of variables to capture these e-substitution impacts by (i) recognising the different demand characteristics of each letter segment, and (ii) solely focusing on Australian, rather than worldwide, quantitative measures.

Step 2

In determining the long-run drivers of letter volume fluctuations, an exhaustive set of unit root tests are conducted to classify variables in terms of their stochastic trend behaviour.

Step 3

Related to the determination of the stochastic trend properties of the key variables in each model, tests for structural breaks are performed. This permits an identification of the dramatic changes in segmented letter volumes since the turn of the century caused by external shocks to the Australian economy including the GFC and from policy responses aimed at limiting the spread of COVID-19. This is in addition to the continual e-substitutive effects on letter volumes arising from the emergence and penetration of new technologies.

To capture and reflect the effects of demand shocks on letter volumes, structural break tests allow for a combination of shifts in the intercept and changes in the trend of the cointegrating systems. The outcomes of these tests when applied to each letter segment are used to determine whether the VECM's require augmentation directly to account for structural change effects not captured directly by the drivers of the specified models, and to identify the choice of estimation periods.

Step 4

The initial specification of the VECM dynamics is identified using various information criteria based on methods given by Akaike, Hannan-Quinn and Schwarz. In implementing these procedures, the lag length criteria are based on the VAR which is appropriate as it represents the unrestricted dynamical model of a VECM. For some letter segments, a potential range of lags are considered to determine optimality. In these cases, sensitivity analysis is performed by estimating the cointegrating system over a range of lags.

Step 5

The next phase of the econometric analysis involves establishing the presence of a long-run association amongst the drivers. As the drivers are identified to be integrated processes based on the unit root tests, the establishment of a long-run relationship is equivalent to testing for cointegration amongst all the drivers within each segment. The cointegration tests are based on the tests proposed by Johansen [116] which is appropriate for the VECM framework adopted in this project due to the multivariate tests of cointegration that are applied to a sequence of VECM specifications beginning with the unrestricted VAR model. In choosing these subset specifications, an allowance for intercepts in both long-run and short-run specifications is adopted for maximum flexibility. For estimated models based on single equation estimation methods, the Phillips-Ouliaris class of single equation unit root tests were also applied.

Step 6

An important component of the modelling process is the treatment of the demand effects resulting from macroeconomic policies implemented to limit the spread of COVID-19. Inspection of recent trends and movements in letter volumes suggest these pandemic related impacts varied widely across the differing letter volume segments. To capture these variations a range of indicator variables are employed in specifying the segmented models. A further component of the modelling process involves the impact of interest rate rises commencing in early 2022, on PreSort small volumes.

Step 7

Having established the presence of a long-run cointegrating equation, the VECM is then estimated to derive point estimates of the long-run and short-run parameters. This includes estimates of the error-correction parameters which control the dynamic equilibrium properties of the model.

[116] Johansen, S. (1995); see bibliography.

Step 8

For each letter segment the model is refined in terms of sample and variable selection because of the economic/statistical significance of the parameter estimates. The drivers must initially conform with conventional associations bound by the principles of economics and logical linkages governing how a potential driver relates to segmented letter volume movements. For example, all price elasticities should be inversely related to demand, and all income effects must be positive. For some of the segments, there might be dramatic changes in the time series properties of letter volumes resulting in changes in the choice of the starting date to estimate the parameters of the models. Following the methodological approach adopted in previous price notifications these choices are based on the results of structural break tests given in Section E. For some segments this restriction in sample size results in the adoption of a single cointegrating approach based on a DOLS estimator.

Step 9

Diagnostic tests are applied to each estimated model including within-sample goodness of fit tests in addition to tests for weak and strong exogeneity.

Step 10

The final stage of the econometric analysis involves undertaking various scenario tests to project future trends in letter volumes for each segment. The scenarios are based on a combination of the historical trends identified in the variables of the model together with assumed future patterns that the drivers may follow. These future patterns are based on proposed future price changes as provided by Australia Post and projections on consumer price movements as obtained from recognised forecasting institutions such as the IMF and the ABS. Some of the driver sensitivity analyses are also performed upon the e-substitution variables as well as other variables that are included in the final specification of the models, such as the official RBA cash rate and the impact of the privacy breaches in the second half of 2022.

Whilst the econometric methodology is common across all letter volume segments investigated by Diversified Specifics, nonetheless there are some specific features that are idiosyncratic to modelling each segment which require additional refinements.

These may include the choice of variables, final model specifications, sample periods, construction of COVID-19 indicators, etc. Some of these issues are elaborated on in these appendices with details of the estimated specifications governing all preferred econometric models and test statistics contained within Appendix E of this document.

APPENDIX E ECONOMETRIC MODELS

E.1 Other small letters

E.1.1. Structural break tests

Structural break tests on the Other small letter segment suggest two breaks:

1. The first break occurs in September 2012, see Table E.1.1.1.

Table E.1.1.1 Other small letter structural break test 1

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 9/01/2012
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.605566	0.1904
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:26
Sample (adjusted): 6/01/2002 6/01/2018
Included observations: 65 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.549884	0.097733	5.626382	0.0000
C	2.826998	0.613168	4.610475	0.0000
TREND	-0.005010	0.001028	-4.874288	0.0000
INCPTBREAK	0.010746	0.016008	0.671312	0.5046
TRENDBREAK	-0.012267	0.002795	-4.388703	0.0000
BREAKDUM	-0.051111	0.032109	-1.591785	0.1168

R-squared	0.994435	Mean dependent var	5.816672
Adjusted R-squared	0.993963	S.D. dependent var	0.369076
S.E. of regression	0.028676	Akaike info criterion	-4.177750
Sum squared resid	0.048516	Schwarz criterion	-3.977037
Log likelihood	141.7769	Hannan-Quinn criter.	-4.098556
F-statistic	2108.537	Durbin-Watson stat	1.994528
Prob(F-statistic)	0.000000		

2. The second break occurs in March 2014, see Table E.1.1.2.

Table E.1.1.2 Other small letter structural break test 2

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 3/01/2014
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.410882	> 0.99
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:24
Sample (adjusted): 12/01/2002 6/01/2018
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	1.008861	0.021565	46.78182	0.0000
D(LVOLUME_SA(-1))	-0.328865	0.116751	-2.816810	0.0067
D(LVOLUME_SA(-2))	-0.278513	0.116342	-2.393908	0.0200
C	-0.073811	0.130653	-0.564941	0.5743
INCPTBREAK	-0.035344	0.015973	-2.212731	0.0309
BREAKDUM	0.017165	0.030742	0.558372	0.5788

R-squared	0.994854	Mean dependent var	5.802803
Adjusted R-squared	0.994402	S.D. dependent var	0.366304
S.E. of regression	0.027406	Akaike info criterion	-4.265700
Sum squared resid	0.042813	Schwarz criterion	-4.061592
Log likelihood	140.3696	Hannan-Quinn criter.	-4.185423
F-statistic	2203.769	Durbin-Watson stat	2.028714
Prob(F-statistic)	0.000000		

For this segment the full sample period is used to estimate the model as the structural breaks identified by the structural break tests are captured by the movements in the key drivers of the model specification.

E.1.2. Lag specification tests

The lag structure tests suggest a VAR with 1 lag based on the SC and HQ statistics, hence a VECM with no lags is specified, see Table E.1.2.1.

Table E.1.2.1 Other small letters lag structure test

VAR Lag Order Selection Criteria
Endogenous variables: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous variables: C DUM_PRICE DUM_COVID1 DUM_COVID2
Date: 06/04/23 Time: 15:55
Sample: 3/01/2002 12/01/2022
Included observations: 80

Lag	LogL	LR	FPE	AIC	SC	HQ
0	119.2158	NA	8.90e-07	-2.580396	-2.103990	-2.389391
1	776.6288	1183.343	9.70e-14	-18.61572	-17.66291*	-18.23371*
2	791.6999	25.62092	9.99e-14	-18.59250	-17.16328	-18.01948
3	812.3875	33.10013	9.00e-14	-18.70969	-16.80407	-17.94567
4	832.7058	30.47745*	8.25e-14*	-18.81764*	-16.43562	-17.86262

E.1.3. Preferred Other (Ordinary) small letter econometric model

The VECM parameter estimates for the full sample is presented in Table E.1.3.1. This represents the preferred model highlighted by correctly signed and statistically significant cross-price and e-substitution variables. The own price elasticity of -.38 is greater in absolute value than the 2022 study of -.15, however this may be reflective of the longer data set and the effects of more recent shocks on letter volumes. Although the own-price elasticity is statistically insignificant, it is retained for economic significance. Auxiliary testing on differing specifications revealed excluding the cross-price variable does not qualitatively alter the own price point estimate, although it does become less significant with a lower p-value. [117]

[117] Intermediate statistical results are not presented however are available from Diversified Specifics upon request.

Table E.1.3.1 Preferred Other (Ordinary) small letter econometric model

Vector Error Correction Estimates
Date: 04/12/23 Time: 13:34
Sample (adjusted): 6/01/2002 12/01/2022
Included observations: 83 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOG(VOLUME_SA(-1))	1.000000
LOG(REALPR(-1))	0.376261 (0.30670) [1.22683]
LOG(SUBST(-1))	0.177563 (0.03194) [5.55984]
LOG(TELECOMCPI(-1)/CPI(-1))	-1.586374 (0.48103) [-3.29788]
C	-3.791300

Error Correction:	D(LOG(VOLUME_SA))	D(LOG(REALPR))	D(LOG(SUBST))	D(LOG(TELECOMCPI/CPI))
CointEq1	-0.041650 (0.01002) [-4.15524]	-0.009884 (0.00994) [-0.99433]	-0.149654 (0.01573) [-9.51369]	-0.012981 (0.00278) [-4.67025]
C	-0.020569 (0.00323) [-6.36271]	-0.003098 (0.00321) [-0.96647]	0.106660 (0.00507) [21.0243]	-0.009493 (0.00090) [-10.5898]
DUM_PRICE	-0.015880 (0.02914) [-0.54496]	0.447255 (0.02890) [15.4773]	-0.003131 (0.04573) [-0.06848]	-0.003583 (0.00808) [-0.44341]
DUM_COVID1	0.099681 (0.02925) [3.40836]	0.108753 (0.02900) [3.74966]	-0.156730 (0.04590) [-3.41481]	0.007384 (0.00811) [0.91055]
DUM_COVID2	-0.125095 (0.02937) [-4.25964]	0.008118 (0.02912) [0.27873]	-0.050176 (0.04609) [-1.08871]	0.020661 (0.00814) [2.53708]
R-squared	0.395633	0.763366	0.598989	0.251299
Adj. R-squared	0.364640	0.751230	0.578425	0.212904
Sum sq. resids	0.065133	0.064057	0.160413	0.005008
S.E. equation	0.028897	0.028657	0.045349	0.008013
F-statistic	12.76515	62.90559	29.12714	6.545099
Log likelihood	178.9597	179.6514	141.5551	285.4219
Akaike AIC	-4.191799	-4.208467	-3.290485	-6.757154
Schwarz SC	-4.046086	-4.062754	-3.144772	-6.611441
Mean dependent	-0.021066	0.003698	0.104129	-0.009198
S.D. dependent	0.036253	0.057456	0.069845	0.009032

Determinant resid covariance (dof adj.)	8.55E-14
Determinant resid covariance	6.67E-14
Log likelihood	787.9841
Akaike information criterion	-18.40926
Schwarz criterion	-17.70983
Number of coefficients	24

E.1.4. Cointegration tests

The cointegration test implies the null hypothesis of one cointegrating equation is not rejected at the 5% level of significance, see Table E.1.4.1.

Table E.1.4.1 Other small letter cointegration test

Date: 04/12/23 Time: 13:35
Sample (adjusted): 6/01/2002 12/01/2022
Included observations: 83 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous series: DUM_PRICE DUM_COVID1 DUM_COVID2
Warning: Critical values assume no exogenous series
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.651779	114.0148	47.85613	0.0000
At most 1	0.207629	26.45656	29.79707	0.1156
At most 2	0.082271	7.140342	15.49471	0.5614
At most 3	0.000175	0.014543	3.841465	0.9038

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

E.2 Other large letters

E.2.1. Structural break tests

The preferred Other large letter model is based on a VECM with the start of the sample determined by breakpoint unit root tests. Two break points are identified, given by 2014 Q1 and 2009 Q3. The results of two structural break tests are given in Table E.2.1.1. and Table E.2.1.2.

Table E.2.1.1 Other large letter structural break test 1

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 3/01/2014
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.265109	> 0.99
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 3/01/2014
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.339309	0.7829
Test critical values:	1% level	-5.347598	
	5% level	-4.859812	
	10% level	-4.607324	

*Vogelsang (1993) asymptotic one-sided p-values.

Table E.2.1.2 Other large letter structural break test 2

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 9/01/2009
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.529938	0.2239
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

E.2.2. Lag specification tests

The selection criteria (SC) optimal lag specification test suggests a VAR with 1 lag, resulting in a VECM with zero lags, see Table E.2.2.1.

Table E.2.2.1 Other large letter lag specification test

VAR Lag Order Selection Criteria
Endogenous variables: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST)
Exogenous variables: C
Date: 06/26/23 Time: 06:24
Sample: 3/01/2009 12/01/2022
Included observations: 56

Lag	LogL	LR	FPE	AIC	SC	HQ
0	25.41002	NA	9.02e-05	-0.800358	-0.691857	-0.758292
1	318.4779	544.2690	3.54e-09*	-10.94564*	-10.51164*	-10.77738*
2	324.8564	11.16228	3.90e-09	-10.85201	-10.09251	-10.55755
3	333.8811	14.82636	3.93e-09	-10.85290	-9.767887	-10.43224
4	336.7805	4.452600	4.96e-09	-10.63502	-9.224505	-10.08816
5	338.2483	2.096816	6.64e-09	-10.36601	-8.629994	-9.692960
6	341.1683	3.858622	8.54e-09	-10.14887	-8.087349	-9.349621
7	345.2874	5.001723	1.07e-08	-9.974549	-7.587527	-9.049106
8	361.8859	18.37693*	8.73e-09	-10.24592	-7.533400	-9.194284

E.2.3 Preferred Other (Ordinary) large letter econometric model

A restricted sample with a commencement date selected via the structural break testing procedure outlined in Section E.2.1 is adopted. This results in a preferred model, presented in Table E.2.3.1, that contains correctly signed price and e-substitution variables in the long run component of the model.[118] The model is dominated by the explanatory power of e-substitution although own-price is also statistically significant at conventional levels. The cross price variable is excluded from the preferred model because auxiliary testing incorporating such effects rendered the coefficients in the model nonsensical.[119] In the short run component of the model the CENSUS variable is statistically significant in the volumes, as are the COVID-19 dummy variables.

[118] E-substitution and price are significant at a 5% level of confidence.

[119] Intermediate statistical results are not presented however are available from Diversified Specifics upon request.

Table E.2.3.1 Preferred Other (Ordinary) large letter econometric model

Vector Error Correction Estimates
Date: 06/26/23 Time: 06:15
Sample: 3/01/2009 12/01/2022
Included observations: 56
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOG(VOLUME_SA(-1))	1.000000
LOG(REALPR(-1))	0.379729 (0.19848) [1.91322]
LOG(SUBST(-1))	0.609632 (0.05658) [10.7750]
C	-2.471000

Error Correction:	D(LOG(VOLUME_SA))	D(LOG(REALPR))	D(LOG(SUBST))
CointEq1	-0.043116 (0.03272) [-1.31785]	0.013745 (0.03448) [0.39862]	-0.095610 (0.01253) [-7.63327]
C	-0.028557 (0.00638) [-4.47435]	0.002237 (0.00673) [0.33257]	0.056624 (0.00244) [23.1738]
CENSUS	0.066822 (0.02958) [2.25919]	-0.015274 (0.03117) [-0.48998]	0.018104 (0.01132) [1.59875]
DUM_PRICE	-0.063433 (0.04145) [-1.53037]	0.371631 (0.04369) [8.50682]	0.012677 (0.01587) [0.79888]
DUM_COVID_TOTAL	5.71E-05 (0.01441) [0.00396]	-0.007134 (0.01519) [-0.46958]	-0.034206 (0.00552) [-6.19878]
DUM_COVID7	0.128894 (0.05205) [2.47641]	0.047493 (0.05486) [0.86576]	-0.009713 (0.01993) [-0.48745]
DUM_COVID8	-0.185533 (0.04313) [-4.30162]	0.005479 (0.04546) [0.12053]	0.030118 (0.01651) [1.82393]
R-squared	0.529855	0.606254	0.690146
Adj. R-squared	0.472286	0.558040	0.652205
Sum sq. resids	0.081528	0.090563	0.011949
S.E. equation	0.040790	0.042991	0.015616
F-statistic	9.203870	12.57427	18.18983
Log likelihood	103.4401	100.4971	157.2072
Akaike AIC	-3.444289	-3.339183	-5.364543
Schwarz SC	-3.191121	-3.086014	-5.111374
Mean dependent	-0.027109	0.007472	0.050855
S.D. dependent	0.056151	0.064668	0.026480

Log likelihood	377.1043
Akaike information criterion	-12.61087
Schwarz criterion	-11.74286
Number of coefficients	24

E.2.4. Cointegration tests

The results of the cointegration test suggest a single cointegrating equation, see Table E.2.4.1.

Table E.2.4.1 Other large letter cointegration test

Date: 06/26/23 Time: 06:19
Sample: 3/01/2009 12/01/2022
Included observations: 56
Trend assumption: Linear deterministic trend
Series: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST)
Exogenous series: CENSUS DUM_PRICE DUM_COVID_TOTAL DUM_COVID7 DUM_COVID8
Warning: Critical values assume no exogenous series
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.581421	60.08950	29.79707	0.0000
At most 1	0.128997	11.31972	15.49471	0.1926
At most 2	0.062021	3.585569	3.841465	0.0583

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

E.3 PreSort small letters

E.3.1. Structural break tests

Three structural breaks characterised the PreSort small letter volume series:

1. The first structural break test results, for a trend specification of the intercept only, suggests a break in June 2016, see Table E.3.1.1.

Table E.3.1.1 PreSort small letter structural break test 1

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 6/01/2016
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 7 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.485466	0.9065
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:16
Sample (adjusted): 3/01/2004 12/01/2022
Included observations: 76 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.921163	0.031719	29.04105	0.0000
D(LVOLUME_SA(-1))	-0.306780	0.109540	-2.800619	0.0067
D(LVOLUME_SA(-2))	-0.005717	0.113002	-0.050588	0.9598
D(LVOLUME_SA(-3))	0.399486	0.124073	3.219767	0.0020
D(LVOLUME_SA(-4))	-0.077797	0.125980	-0.617536	0.5390
D(LVOLUME_SA(-5))	0.020018	0.126049	0.158813	0.8743
D(LVOLUME_SA(-6))	0.310957	0.115140	2.700696	0.0088
D(LVOLUME_SA(-7))	0.383238	0.110493	3.468430	0.0009
C	0.482857	0.195824	2.465768	0.0163
INCPTBREAK	-0.040149	0.017076	-2.351167	0.0218
BREAKDUM	0.077756	0.033266	2.337385	0.0225

R-squared	0.988918	Mean dependent var	5.980425
Adjusted R-squared	0.987213	S.D. dependent var	0.276434
S.E. of regression	0.031259	Akaike info criterion	-3.959885
Sum squared resid	0.063514	Schwarz criterion	-3.622542
Log likelihood	161.4756	Hannan-Quinn criter.	-3.825066
F-statistic	580.0329	Durbin-Watson stat	1.814658
Prob(F-statistic)	0.000000		

2. Results of the second structural break test, for the trend and intercept, also identifies June 2016 as the break, see Table E.3.1.2.

Table E.3.1.2 PreSort small letter structural break test 2

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 6/01/2016
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 8 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.131415	0.8697
Test critical values:	1% level	-5.347598	
	5% level	-4.859812	
	10% level	-4.607324	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:17
Sample (adjusted): 6/01/2004 12/01/2022
Included observations: 75 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.881681	0.037784	23.33449	0.0000
D(LVOLUME_SA(-1))	-0.289478	0.109875	-2.634605	0.0106
D(LVOLUME_SA(-2))	-0.058030	0.114179	-0.508240	0.6131
D(LVOLUME_SA(-3))	0.198406	0.131379	1.510186	0.1361
D(LVOLUME_SA(-4))	-0.315183	0.137892	-2.285730	0.0257
D(LVOLUME_SA(-5))	-0.145228	0.132217	-1.098408	0.2763
D(LVOLUME_SA(-6))	0.179075	0.139154	1.286889	0.2029
D(LVOLUME_SA(-7))	0.201003	0.122555	1.640109	0.1060
D(LVOLUME_SA(-8))	-0.223015	0.115424	-1.932145	0.0579
C	0.756227	0.239835	3.153119	0.0025
TREND	-0.001306	0.000487	-2.680849	0.0094
INCPTBREAK	-0.033501	0.016186	-2.069743	0.0426
BREAKDUM	0.078239	0.031394	2.492175	0.0154

R-squared	0.990617	Mean dependent var	5.978293
Adjusted R-squared	0.988801	S.D. dependent var	0.277666
S.E. of regression	0.029384	Akaike info criterion	-4.060448
Sum squared resid	0.053531	Schwarz criterion	-3.658750
Log likelihood	165.2668	Hannan-Quinn criter.	-3.900054
F-statistic	545.4981	Durbin-Watson stat	2.004376
Prob(F-statistic)	0.000000		

3. Results of the third structural break test suggest a break in the series in September 2012, see Table E.3.1.3.

Table E.3.1.3 PreSort small letter structural break test 3

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 9/01/2012
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.745678	0.6816
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:18
Sample (adjusted): 6/01/2002 12/01/2022
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.688832	0.083074	8.291806	0.0000
C	1.915166	0.509005	3.762567	0.0003
TREND	0.000573	0.000574	0.998321	0.3213
INCPTBREAK	-0.012352	0.017638	-0.700330	0.4858
TRENDBREAK	-0.006770	0.002015	-3.360376	0.0012
BREAKDUM	-0.065853	0.041175	-1.599353	0.1138

R-squared	0.979858	Mean dependent var	5.990042
Adjusted R-squared	0.978550	S.D. dependent var	0.266703
S.E. of regression	0.039061	Akaike info criterion	-3.577837
Sum squared resid	0.117484	Schwarz criterion	-3.402981
Log likelihood	154.4802	Hannan-Quinn criter.	-3.507589
F-statistic	749.1611	Durbin-Watson stat	2.290928
Prob(F-statistic)	0.000000		

The empirical results for PreSort small letter volumes are based on the dominant structural break at June 2016, which corresponds to the period following the atypically large rate rises imposed in the March quarter of 2016.

E.3.2. Lag specification tests

The selection criteria (SC) lag specification tests suggest an optimal lag structure in the VAR of 1 lag, which implies an initial estimate of the VECM lag structure of zero lags, see Table E.3.2.1. The HQ statistic results in a less conservative VECM lag structure of 1 lag, however the SC lag structure is adopted in pursuit of a parsimonious model specification.

Table E.3.2.1 PreSort small letter lag specification test

VAR Lag Order Selection Criteria
Endogenous variables: LOG(VOLUME_SA) LOG(REALPR)
LOG(SUBST)
Exogenous variables: C DUM_2019Q2 @TREND(2020Q1)*DUM_COVID_TOTAL
D(CASHRATE)*(D(CASHRATE)>0)
Date: 06/05/23 Time: 07:04
Sample: 3/01/2002 12/01/2022
Included observations: 80

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3.671329	NA	0.000297	0.391783	0.749087	0.535037
1	504.5802	927.5590	1.13e-09	-12.08950	-11.46422*	-11.83881
2	520.0997	27.15915*	9.62e-10*	-12.25249*	-11.35923	-11.89436*
3	528.4217	13.93944	9.83e-10	-12.23554	-11.07431	-11.76997
4	531.1469	4.360297	1.16e-09	-12.07867	-10.64946	-11.50566

E.3.3. DOLS with sample based upon structural break tests

The preferred PreSort small letter volume model, contained in Table E.3.3.1., is based on a DOLS functional form, using the break points obtained from a structural break testing process outlined in the previous sections. The price elasticity of -0.45 is relatively similar in magnitude to the -0.55 estimated in the 2022 demand update. [120] A key addition to this model is the inclusion of the cost-of-living variable, proxied by positive upwards movements in the RBA's official cash rate. This variable allows the model to generate positive and statistically significant effects from the change in the base cash rate. To capture the effects of COVID-19 the model allows for the e-substitution elasticity to switch between non-COVID-19 (elasticity = -0.51) and COVID-19 (elasticity = -0.56) periods. Including the cross-price variable yields estimates with incorrect signs and nonsensical outcomes surrounding e-substitution. [121] The variable DUM_COVID_SUB3TMP captures the twin effects of the continual 2022 interest rate rises combined with the impact of the privacy breaches in the second half of 2022.

Table E.3.3.1 Preferred PreSort small letter econometric model

Dependent Variable: LOG(VOLUME_SA)
Method: Dynamic Least Squares (DOLS)
Date: 05/04/23 Time: 18:21
Sample: 6/01/2016 12/01/2022
Included observations: 27
Cointegrating equation deterministics: C D(CASHRATE)
(D(CASHRATE)>0) DUM_COVID_SUB3TMP@TREND(2021Q2)
Fixed leads and lags specification (lead=0, lag=0)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth
= 3.0000)

Variable	Coefficient	Std. Error	t-Statistic
LOG(REALPR)	-0.451713	0.302087	-1.495307
LOG(SUBST)*(1-DUM_COVID)	-0.507061	0.042638	-11.89226
LOG(SUBST)*(DUM_COVID)	-0.559988	0.041769	-13.40666
C	4.401471	1.537664	2.862440
D(CASHRATE)*(D(CASHRATE)>0)	0.078627	0.024050	3.269305
DUM_COVID_SUB3TMP*@TREND(2021 Q2)	-0.008158	0.005355	-1.523444

R-squared	0.978646	Mean dependent var	
Adjusted R-squared	0.969155	S.D. dependent var	
S.E. of regression	0.031040	Sum squared resid	
Long-run variance	0.000780		

[120] Diversified Specifics (2022); see bibliography.

[121] Intermediate VECM outputs are not presented however are available from Diversified Specifics upon request.

E.3.4 Cointegration test

The cointegration test is satisfied based on the Phillips-Ouliaris cointegration test via the discovery of one cointegrating vector at a 5% level of significance, see Table 3.4.1.

Table E.3.4.1 PreSort small letter cointegration test

Cointegration Test - Phillips-Ouliaris
Date: 06/05/23 Time: 07:30
Equation: OLS_DYNAMIC
Specification: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST)*(1 -DUM_COVID) LOG(SUBST)*(DUM_COVID) C D(CASHRATE) *(D(CASHRATE)>0) DUM_COVID_SUB3TMP*@TREND(2021Q2)
Cointegrating equation deterministics: C D(CASHRATE) *(D(CASHRATE)>0) DUM_COVID_SUB3TMP*@TREND(2021Q2)
Null hypothesis: Series are not cointegrated
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)
No d.f. adjustment for variances

	Value	Prob.*
Phillips-Ouliaris tau-statistic	-5.738292	0.0051
Phillips-Ouliaris z-statistic	-29.73997	0.0037

E.4 PreSort large letters

E.4.1. Structural break tests

A structural break test in the PreSort large letter volume series reveals:

1. A break in March 2015, see Table E.4.1.1.

Table E.4.1.1 PreSort large letter structural break test 1

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 3/01/2015
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.681373	0.8375
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:28
Sample (adjusted): 6/01/2002 12/01/2022
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.886924	0.042171	21.03163	0.0000
C	0.406288	0.154391	2.631555	0.0102
INCPTBREAK	-0.145405	0.046664	-3.116017	0.0026
BREAKDUM	0.102738	0.091011	1.128846	0.2624

R-squared	0.977217	Mean dependent var	3.251999
Adjusted R-squared	0.976351	S.D. dependent var	0.547354
S.E. of regression	0.084173	Akaike info criterion	-2.064900
Sum squared resid	0.559718	Schwarz criterion	-1.948330
Log likelihood	89.69337	Hannan-Quinn criter.	-2.018069
F-statistic	1129.477	Durbin-Watson stat	2.240006
Prob(F-statistic)	0.000000		

2. A second break identified in December 2015, see Table E.4.1.2.

Table E.4.1.2 PreSort large letter structural break test 2

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 12/01/2015
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.281894	0.8108
Test critical values:	1% level	-5.347598	
	5% level	-4.859812	
	10% level	-4.607324	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:29
Sample (adjusted): 6/01/2002 12/01/2022
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.811755	0.057359	14.15226	0.0000
C	0.720952	0.220693	3.266762	0.0016
TREND	-0.001673	0.000793	-2.108947	0.0382
INCPTBREAK	-0.155952	0.055723	-2.798677	0.0065
BREAKDUM	0.091125	0.090889	1.002599	0.3192

R-squared	0.978027	Mean dependent var	3.251999
Adjusted R-squared	0.976900	S.D. dependent var	0.547354
S.E. of regression	0.083191	Akaike info criterion	-2.077015
Sum squared resid	0.539812	Schwarz criterion	-1.931302
Log likelihood	91.19614	Hannan-Quinn criter.	-2.018476
F-statistic	867.9455	Durbin-Watson stat	2.128401
Prob(F-statistic)	0.000000		

3. A third break in June 2010, see Table E.4.1.3

Table E.4.1.3 PreSort large letter structural break test 3

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 6/01/2010
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.286497	0.8992
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:30
Sample (adjusted): 6/01/2002 12/01/2022
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.770031	0.069974	11.00455	0.0000
C	0.834246	0.254661	3.275908	0.0016
TREND	0.000898	0.001644	0.546237	0.5865
INCPTBREAK	0.014126	0.038632	0.365652	0.7156
TRENDBREAK	-0.009127	0.003285	-2.777971	0.0069
BREAKDUM	-0.090015	0.088273	-1.019733	0.3110

R-squared	0.978107	Mean dependent var	3.251999
Adjusted R-squared	0.976685	S.D. dependent var	0.547354
S.E. of regression	0.083576	Akaike info criterion	-2.056577
Sum squared resid	0.537841	Schwarz criterion	-1.881721
Log likelihood	91.34796	Hannan-Quinn criter.	-1.986330
F-statistic	688.0230	Durbin-Watson stat	2.046891
Prob(F-statistic)	0.000000		

As with the Other small letter segment, the full sample period is used to estimate the PreSort large letter model as the structural breaks identified through testing are captured by the movements in the key drivers of the model specification.

E.4.2. Lag specification tests

The initial lag specification tests imply an optimal lag structure in the VAR of 1 lag as based on the SC and HQ tests. This suggests an estimated PreSort large letter VECM lag structure containing zero lags, see Table E.4.2.1. However, when constructing a VECM based upon zero, one, two and three lags, the estimated coefficients fail the test of common sense since e-substitution is incorrectly signed on all occasions.[122] Increasing the lag structure to 4 lags results in a model where e-substitution, own price and cross price are correctly signed. Inspection of the t-statistics on many of the lagged variables also registered statistically significant parameter estimates. Additionally, this choice of lag structure yielded a single cointegrating equation as illustrated in Table E.4.4.1.

Table E.4.2.1 PreSort large letter lag specification test

VAR Lag Order Selection Criteria
Endogenous variables: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous variables: DUM_PRICE DUM_COVID2 DUM_COVID3 DUM_COVID8 C
Date: 06/05/23 Time: 07:18
Sample: 3/01/2002 12/01/2022
Included observations: 80

Lag	LogL	LR	FPE	AIC	SC	HQ
0	60.00116	NA	4.33e-06	-1.000029	-0.404522	-0.761273
1	708.7549	1151.538	5.85e-13	-16.81887	-15.74696*	-16.38911*
2	725.9695	28.83456*	5.72e-13*	-16.84924*	-15.30092	-16.22847
3	738.4878	19.71630	6.34e-13	-16.76220	-14.73747	-15.95043
4	755.2460	24.71827	6.37e-13	-16.78115	-14.28002	-15.77838

[122] Intermediate VECM outputs are not presented however are available from Diversified Specifics upon request.

E.4.3. VECM with sample based upon a lag structure of four

The preferred VECM is presented in Table E.4.3.1 which is based on the results of the lag specification tests combined with additional experimentation on the lag structure of the VECM. The model is characterised by a statistically significant own-price elasticity of -0.65 which is marginally greater, in absolute terms, than the -0.47 estimated within the 2022 demand update.[123] Both e-substitution and cross-price effects are also included within the long run component of the model given their statistical significance.

Table E.4.3.1 Preferred PreSort large letter econometric model

Vector Error Correction Estimates
Date: 05/04/23 Time: 18:35
Sample (adjusted): 6/01/2003 12/01/2022
Included observations: 79 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOG(VOLUME_SA(-1))	1.000000
LOG(REALPR(-1))	0.648370 (0.31350) [2.06819]
LOG(SUBST(-1))	0.177400 (0.06766) [2.62191]
LOG(TELECOMCPI(-1)/CPI(-1))	-1.431327 (0.59045) [-2.42414]
C	-0.397107

Error Correction:	D(LOG(VOLUME_SA))	D(LOG(REALPR))	D(LOG(SUBST))	D(LOG(TELECOMCPI/CPI))
CointEq1	-0.182246 (0.08659) [-2.10465]	0.024401 (0.05556) [0.43920]	-0.102161 (0.02293) [-4.45595]	-0.005347 (0.00899) [-0.59490]
D(LOG(VOLUME_SA(-1)))	-0.186809 (0.13539) [-1.37974]	-0.016817 (0.08687) [-0.19359]	0.055825 (0.03585) [1.55724]	0.003916 (0.01405) [0.27862]
D(LOG(VOLUME_SA(-2)))	0.234844 (0.14028) [1.67414]	-0.018363 (0.09001) [-0.20402]	0.078605 (0.03714) [2.11637]	0.008484 (0.01456) [0.58260]
D(LOG(VOLUME_SA(-3)))	0.144772 (0.15125) [0.95716]	-0.193069 (0.09705) [-1.98943]	0.104702 (0.04005) [2.61447]	-0.001245 (0.01570) [-0.07928]

[123] Diversified Specifics (2022); see bibliography.

D(LOG(VOLUME_SA(-4)))	-0.308067	0.024562	0.026013	0.007314
	(0.14336)	(0.09198)	(0.03796)	(0.01488)
	[-2.14897]	[0.26703]	[0.68534]	[0.49152]
D(LOG(REALPR(-1)))	-0.036305	-0.314799	0.088985	0.010426
	(0.19644)	(0.12604)	(0.05201)	(0.02039)
	[-0.18482]	[-2.49760]	[1.71086]	[0.51128]
D(LOG(REALPR(-2)))	0.033663	-0.018691	0.072219	-0.013044
	(0.17924)	(0.11501)	(0.04746)	(0.01861)
	[0.18781]	[-0.16253]	[1.52174]	[-0.70106]
D(LOG(REALPR(-3)))	-0.025564	-0.181676	0.073350	-0.017929
	(0.17604)	(0.11295)	(0.04661)	(0.01827)
	[-0.14522]	[-1.60841]	[1.57365]	[-0.98110]
D(LOG(REALPR(-4)))	-0.111355	0.178535	0.021969	0.002744
	(0.17902)	(0.11486)	(0.04740)	(0.01858)
	[-0.62202]	[1.55432]	[0.46348]	[0.14764]
D(LOG(SUBST(-1)))	0.292732	0.054420	0.127809	-0.032089
	(0.47823)	(0.30685)	(0.12662)	(0.04964)
	[0.61211]	[0.17735]	[1.00937]	[-0.64639]
D(LOG(SUBST(-2)))	0.063660	-0.032913	0.141182	-0.068674
	(0.45577)	(0.29244)	(0.12068)	(0.04731)
	[0.13967]	[-0.11255]	[1.16993]	[-1.45153]
D(LOG(SUBST(-3)))	-0.670616	-0.139624	0.053242	0.015403
	(0.44754)	(0.28715)	(0.11849)	(0.04646)
	[-1.49846]	[-0.48624]	[0.44932]	[0.33156]
D(LOG(SUBST(-4)))	-0.296500	0.145041	0.093506	0.066539
	(0.42121)	(0.27026)	(0.11152)	(0.04372)
	[-0.70393]	[0.53668]	[0.83845]	[1.52184]
D(LOG(TELECOMCPI(-1)/CPI(-1)))	0.783742	0.322066	-0.159471	0.226703
	(1.23323)	(0.79127)	(0.32652)	(0.12802)
	[0.63552]	[0.40702]	[-0.48839]	[1.77091]
D(LOG(TELECOMCPI(-2)/CPI(-2)))	-0.886549	0.200070	0.147120	0.030766
	(1.21911)	(0.78221)	(0.32279)	(0.12655)
	[-0.72721]	[0.25577]	[0.45578]	[0.24311]
D(LOG(TELECOMCPI(-3)/CPI(-3)))	0.381061	-0.391858	-0.125982	0.071912
	(1.23535)	(0.79263)	(0.32709)	(0.12823)
	[0.30846]	[-0.49438]	[-0.38517]	[0.56078]
D(LOG(TELECOMCPI(-4)/CPI(-4)))	0.660396	0.109968	0.005919	0.278525
	(1.18747)	(0.76191)	(0.31441)	(0.12326)
	[0.55614]	[0.14433]	[0.01883]	[2.25956]
C	0.053362	-0.002197	0.047476	-0.002553
	(0.04201)	(0.02695)	(0.01112)	(0.00436)
	[1.27034]	[-0.08153]	[4.26872]	[-0.58553]
DUM_PRICE	-0.126795	0.272095	0.015136	0.002642
	(0.08262)	(0.05301)	(0.02188)	(0.00858)
	[-1.53462]	[5.13259]	[0.69191]	[0.30810]
DUM_COVID2	-0.177105	0.084740	-0.018675	0.016439
	(0.08029)	(0.05152)	(0.02126)	(0.00833)
	[-2.20578]	[1.64490]	[-0.87845]	[1.97244]
DUM_COVID3	-0.131960	-0.036680	-0.035357	-0.015999

	(0.08494)	(0.05450)	(0.02249)	(0.00882)
	[-1.55362]	[-0.67305]	[-1.57221]	[-1.81465]
DUM_COVID8	-0.108349	-0.015879	-0.013676	0.000567
	(0.09255)	(0.05939)	(0.02451)	(0.00961)
	[-1.17065]	[-0.26739]	[-0.55806]	[0.05902]
R-squared	0.446265	0.537017	0.915026	0.427182
Adj. R-squared	0.242258	0.366444	0.883720	0.216143
Sum sq. resids	0.328561	0.135263	0.023033	0.003540
S.E. equation	0.075923	0.048714	0.020102	0.007881
F-statistic	2.187493	3.148319	29.22835	2.024191
Log likelihood	104.4618	139.5182	209.4441	283.4163
Akaike AIC	-2.087640	-2.975143	-4.745420	-6.618134
Schwarz SC	-1.427794	-2.315297	-4.085574	-5.958287
Mean dependent	-0.015490	0.004263	0.080127	-0.009626
S.D. dependent	0.087219	0.061201	0.058951	0.008902

Determinant resid covariance (dof adj.)	2.81E-13
Determinant resid covariance	7.61E-14
Log likelihood	744.7634
Akaike information criterion	-16.52565
Schwarz criterion	-13.76630
Number of coefficients	92

E.4.4 Cointegration test

The cointegration test suggests 1 cointegrating equation at the 5% level of significance, see Table E.4.4.1.

Table E.4.4.1 PreSort large letter cointegration test

Date: 05/04/23 Time: 18:37
Sample (adjusted): 6/01/2003 12/01/2022
Included observations: 79 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous series: DUM_PRICE DUM_COVID2 DUM_COVID3 DUM_COVID8
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.307099	49.74383	47.85613	0.0329
At most 1	0.157381	20.76130	29.79707	0.3727
At most 2	0.086078	7.233313	15.49471	0.5507
At most 3	0.001549	0.122486	3.841465	0.7263

E.5 Print Post

E.5.1. Structural break tests

Three structural breaks are evident within the Print Post volume series:

1. Structural break tests suggest a break in June 2015, see Table E.5.1.1.

Table E.5.1.1 Print Post structural break test 1

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 6/01/2015
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.985076	> 0.99
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:42
Sample (adjusted): 12/01/2006 12/01/2022
Included observations: 65 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.972017	0.028407	34.21734	0.0000
C	0.105738	0.116746	0.905709	0.3687
INCPTBREAK	-0.041834	0.021274	-1.966459	0.0538
BREAKDUM	0.133500	0.048526	2.751121	0.0078

R-squared	0.986177	Mean dependent var	3.788498
Adjusted R-squared	0.985497	S.D. dependent var	0.384350
S.E. of regression	0.046287	Akaike info criterion	-3.248368
Sum squared resid	0.130689	Schwarz criterion	-3.114559
Log likelihood	109.5720	Hannan-Quinn criter.	-3.195572
F-statistic	1450.635	Durbin-Watson stat	2.347712
Prob(F-statistic)	0.000000		

2. Results of the second structural break test identify a break in June 2019, see Table E.5.1.2.

Table E.5.1.2 Print Post structural break test 2

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 6/01/2019
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.399401	0.7495
Test critical values:	1% level	-5.347598	
	5% level	-4.859812	
	10% level	-4.607324	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:44
Sample (adjusted): 12/01/2006 12/01/2022
Included observations: 65 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.718712	0.082746	8.685705	0.0000
C	1.215853	0.357834	3.397808	0.0012
TREND	-0.004298	0.001183	-3.633930	0.0006
INCPTBREAK	-0.099407	0.034597	-2.873290	0.0056
BREAKDUM	0.074568	0.049303	1.512448	0.1357

R-squared	0.987113	Mean dependent var	3.788498
Adjusted R-squared	0.986254	S.D. dependent var	0.384350
S.E. of regression	0.045062	Akaike info criterion	-3.287738
Sum squared resid	0.121837	Schwarz criterion	-3.120477
Log likelihood	111.8515	Hannan-Quinn criter.	-3.221743
F-statistic	1148.984	Durbin-Watson stat	2.277658
Prob(F-statistic)	0.000000		

3. Results of the third structural break test suggest a break in March 2015, see Table E.5.1.3.

Table E.5.1.3 Print Post structural break test 3

Null Hypothesis: LVOLUME_SA has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 3/01/2015
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.468915	0.2511
Test critical values:	1% level	-5.719131	
	5% level	-5.175710	
	10% level	-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: LVOLUME_SA
Method: Least Squares
Date: 06/04/23 Time: 07:44
Sample (adjusted): 12/01/2006 12/01/2022
Included observations: 65 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOLUME_SA(-1)	0.516006	0.108302	4.764494	0.0000
C	2.053157	0.460051	4.462889	0.0000
TREND	-0.004356	0.001188	-3.666180	0.0005
INCPTBREAK	0.013922	0.022555	0.617232	0.5395
TRENDBREAK	-0.011264	0.002757	-4.085312	0.0001
BREAKDUM	-0.051352	0.045839	-1.120267	0.2671

R-squared	0.988588	Mean dependent var	3.788498
Adjusted R-squared	0.987621	S.D. dependent var	0.384350
S.E. of regression	0.042762	Akaike info criterion	-3.378546
Sum squared resid	0.107889	Schwarz criterion	-3.177833
Log likelihood	115.8027	Hannan-Quinn criter.	-3.299352
F-statistic	1022.242	Durbin-Watson stat	1.983161
Prob(F-statistic)	0.000000		

The three structural break tests suggest three separate structural breaks: March 2015, June 2015, and June 2019. The final VECM specification for Print Post is estimated based on the latter structural break as the model passes the common-sense test of sensible parameter estimates in addition to passing the test for cointegration.

E.5.2. Lag specification test

The lag specification tests imply a VAR with an optimal lag structure of 1, which suggests a VECM lag structure with zero lags, see Table E.5.2.1.

Table E.5.2.1 Print Post lag specification test

VAR Lag Order Selection Criteria
Endogenous variables: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous variables: C DUM_COVID_TOTAL
Date: 06/05/23 Time: 07:39
Sample: 3/01/2002 12/01/2022
Included observations: 62

Lag	LogL	LR	FPE	AIC	SC	HQ
0	200.7698	NA	2.34e-08	-6.218381	-5.943912	-6.110618
1	598.7772	718.9810*	1.04e-13*	-18.54120*	-17.71779*	-18.21791*
2	611.5896	21.49181	1.17e-13	-18.43837	-17.06603	-17.89956
3	621.0893	14.70924	1.47e-13	-18.22869	-16.30740	-17.47434
4	631.2924	14.48182	1.84e-13	-18.04169	-15.57147	-17.07182

E.5.3. VECM with sample based upon structural break tests

The estimated results contained in Table E.5.3.1. represent the preferred Print Post VECM model. The model contains zero lags and consists of the following statistically significant variables: e-substitution, own-price and cross-price effects. Auxiliary models were estimated however the exclusion of the cross price variable rendered own-price statistically insignificant.[124]

[124] Intermediate VECM outputs are not presented however are available from Diversified Specifics upon request.

Table E.5.3.1 Preferred Print Post letter econometric model

Vector Error Correction Estimates
Date: 04/17/23 Time: 22:27
Sample: 6/01/2019 12/01/2022
Included observations: 15
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOG(VOLUME_SA(-1))	1.000000
LOG(REALPR(-1))	0.646073 (0.15744) [4.10349]
LOG(SUBST(-1))	0.998690 (0.27895) [3.58020]
LOG(TELECOMCPI(-1)/CPI(-1))	-0.930076 (0.48115) [-1.93304]
C	-2.670391

Error Correction:	D(LOG(VOLUME_SA))	D(LOG(REALPR))	D(LOG(SUBST))	D(LOG(TELECOMCPI/CPI))
CointEq1	-0.871620 (0.23994) [-3.63268]	-0.053421 (0.16832) [-0.31738]	0.072324 (0.04914) [1.47187]	0.069005 (0.03071) [2.24727]
C	0.015518 (0.02505) [0.61945]	0.002215 (0.01757) [0.12602]	0.025456 (0.00513) [4.96183]	-0.019770 (0.00321) [-6.16667]
DUM_COVID_TOTAL	-0.106083 (0.04411) [-2.40480]	-0.010205 (0.03095) [-0.32978]	-0.002266 (0.00903) [-0.25083]	0.014559 (0.00565) [2.57895]
R-squared	0.529489	0.009838	0.356001	0.363171
Adj. R-squared	0.451071	-0.155189	0.248668	0.257033
Sum sq. resids	0.036683	0.018052	0.001538	0.000601
S.E. equation	0.055289	0.038786	0.011323	0.007076
F-statistic	6.752095	0.059615	3.316787	3.421681
Log likelihood	23.81713	29.13498	47.60353	54.65604
Akaike AIC	-2.775618	-3.484664	-5.947137	-6.887472
Schwarz SC	-2.634008	-3.343054	-5.805527	-6.745862
Mean dependent	-0.033987	-0.002548	0.024399	-0.012976
S.D. dependent	0.074625	0.036087	0.013063	0.008209

Determinant resid covariance (dof adj.)	2.70E-15
Determinant resid covariance	1.11E-15
Log likelihood	173.1463
Akaike information criterion	-20.95284
Schwarz criterion	-20.19759
Number of coefficients	16

E.5.4 Cointegration tests

The cointegration test is satisfied at the 5% level of significance, see Table 3.5.4.1. Additionally, at the 1% level there is the potential of another cointegrating equation, which from the empirical results in Section E.5.5 suggest the additional cointegrating relationship is between the two non-own-price variables within the system.

Table E.5.4.1 Print Post cointegration test

Date: 06/05/23 Time: 07:40
Sample: 6/01/2019 12/01/2022
Included observations: 15
Trend assumption: Linear deterministic trend
Series: LOG(VOLUME_SA) LOG(REALPR) LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous series: DUM_COVID_TOTAL
Warning: Critical values assume no exogenous series
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.958078	87.40861	47.85613	0.0000
At most 1 *	0.795605	39.82928	29.79707	0.0025
At most 2 *	0.625564	16.01375	15.49471	0.0418
At most 3	0.081717	1.278738	3.841465	0.2581

E.5.5 Additional cointegrating relationship

Table E.5.5.1 contains the estimated VECM of the two non-own-price variables contained within the Print Post model. The cointegration test results presented in Table E.5.5.2 support the hypothesis the two non-own-price variables are cointegrated.

Table E.5.5.1 VECM of two non-own-price variables

Vector Error Correction Estimates
Date: 06/05/23 Time: 07:36
Sample: 6/01/2019 12/01/2022
Included observations: 15
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
LOG(SUBST(-1))	1.000000	
LOG(TELECOMCPI(-1)/CPI(-1))	2.005769 (0.03727) [53.8234]	
C	-1.156676	
Error Correction:	**D(LOG(SUBST))**	**D(LOG(TELECOMCPI/CPI))**
CointEq1	-0.262334 (0.04849) [-5.41021]	-0.040086 (0.13991) [-0.28651]
D(LOG(SUBST(-1)))	1.021083 (0.08914) [11.4546]	-0.219740 (0.25721) [-0.85433]
D(LOG(TELECOMCPI(-1)/CPI(-1)))	0.284364 (0.12182) [2.33424]	-0.322366 (0.35151) [-0.91710]
C	0.001538 (0.00404) [0.38071]	-0.011744 (0.01165) [-1.00776]
DUM_COVID_TOTAL	0.001485 (0.00293) [0.50645]	0.000976 (0.00846) [0.11536]
R-squared	0.964982	0.261726
Adj. R-squared	0.950975	-0.033583
Sum sq. resids	8.37E-05	0.000696
S.E. equation	0.002892	0.008345
F-statistic	68.89264	0.886279
Log likelihood	69.44237	53.54744
Akaike AIC	-8.592316	-6.472992
Schwarz SC	-8.356299	-6.236975
Mean dependent	0.024399	-0.012976
S.D. dependent	0.013063	0.008209
Determinant resid covariance (dof adj.)		2.64E-10
Determinant resid covariance		1.18E-10
Log likelihood		128.9133
Akaike information criterion		-15.58844
Schwarz criterion		-15.02200
Number of coefficients		12

Table E.5.5.2 Cointegration test of the two non-own-price variables

Date: 06/05/23 Time: 07:48
Sample: 6/01/2019 12/01/2022
Included observations: 15
Trend assumption: Linear deterministic trend
Series: LOG(SUBST) LOG(TELECOMCPI/CPI)
Exogenous series: DUM_COVID_TOTAL
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.874543	31.36784	15.49471	0.0001
At most 1	0.015276	0.230901	3.841465	0.6309

APPENDIX F PROPOSED RATE CHANGES

F.1 Proposed rates

Australia Post's proposed rate changes and implementation dates for each letter segment are outlined in Table F.1.1. To facilitate econometric analysis, unique price variables for every segment were derived utilising nominal series of rates deflated by headline Australian CPI projections. In the development of each aggregated pricing variable, the individual rate changes were weighted based on 2021/22 volume proportions. To highlight the impact of price changes, an alternative price variable was constructed for each segment based upon an absence of any rate increases throughout the projection period.

Table F.1.1 Proposed rate changes for Australia Post's domestic letter services

	2023 Jan	*2023* Jul	*2024* Jan	*2024* Jul	*2025* Jan	*2025* Jul	*2026* Jan
Other Small Letters							
Ordinary Stamped	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Ordinary Stamped Priority	9.38%	0.00%	25.71%	0.00%	0.00%	0.00%	0.00%
Local Rate Regular	3.77%	5.46%	22.41%	0.00%	0.00%	0.00%	0.00%
Local Rate Priority	3.67%	5.31%	22.27%	0.00%	0.00%	0.00%	0.00%
Metered Imprint Charge Regular	4.59%	4.39%	25.21%	0.00%	0.00%	0.00%	0.00%
Metered Imprint Charge Priority	6.29%	2.96%	25.86%	0.00%	0.00%	0.00%	0.00%
Clean Regular	4.15%	4.87%	21.52%	0.00%	0.00%	0.00%	0.00%
Clean Priority	3.96%	6.92%	22.33%	0.00%	0.00%	0.00%	0.00%
Reply Paid Regular	3.91%	5.40%	21.94%	0.00%	0.00%	0.00%	0.00%
Reply Paid Priority	4.08%	5.88%	22.22%	0.00%	0.00%	0.00%	0.00%
Imprint Cash Regular	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Imprint Cash Priority	9.38%	0.00%	25.71%	0.00%	0.00%	0.00%	0.00%
Seasonal Greeting Cards	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Concession Stamps	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ordinary Prepaid Envelope Regular	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Pol Sl Sample Post	4.04%	6.62%	22.10%	0.00%	0.00%	0.00%	0.00%

	2023 Jan	*2023* Jul	*2024* Jan	*2024* Jul	*2025* Jan	*2025* Jul	*2026* Jan
PreSort Small Letters							
PreSort Regular	4.03%	5.41%	22.10%	0.00%	0.00%	0.00%	0.00%
Charity Mail Regular	3.24%	4.63%	3.37%	0.00%	0.00%	0.00%	0.00%
PreSort Promo Mail Regular (1175)	3.17%	4.39%	5.30%	0.00%	0.00%	0.00%	0.00%
PreSort Promo Mail Priority	3.11%	4.28%	5.68%	0.00%	0.00%	0.00%	0.00%
PreSort Priority	4.09%	7.10%	22.32%	0.00%	0.00%	0.00%	0.00%
Charity Mail Priority	3.64%	4.94%	4.05%	0.00%	0.00%	0.00%	0.00%
PreSort Promo Mail Regular (1075)	3.25%	4.50%	5.24%	0.00%	0.00%	0.00%	0.00%
Other Large Letters							
Metered Imprint Charge 0 250g Regular	4.59%	4.39%	25.21%	0.00%	0.00%	0.00%	0.00%
Metered Imprint Charge 0 250g Priority	5.50%	3.63%	25.55%	0.00%	0.00%	0.00%	0.00%
Metered Imprint Charge 250 500g Regular	4.59%	4.39%	25.21%	0.00%	0.00%	0.00%	0.00%
Metered Imprint Charge 250 500g Priority	5.04%	4.00%	25.39%	0.00%	0.00%	0.00%	0.00%
Imprint Cash 0 250g Regular	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Imprint Cash 0 250g Priority	9.22%	0.00%	25.33%	0.00%	0.00%	0.00%	0.00%
Imprint Cash 250 500g Regular	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Imprint Cash 250 500g Priority	9.17%	0.00%	25.19%	0.00%	0.00%	0.00%	0.00%
Ordinary Stamped 0 250g	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Ordinary Stamped 0 250g Priority	9.22%	0.00%	25.33%	0.00%	0.00%	0.00%	0.00%
Ordinary Stamped 250 500g	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Ordinary Stamped 250 500g Priority	9.17%	0.00%	25.19%	0.00%	0.00%	0.00%	0.00%
Local Rate Regular	4.19%	5.59%	21.88%	0.00%	0.00%	0.00%	0.00%
Local Rate Priority	4.10%	5.29%	22.18%	0.00%	0.00%	0.00%	0.00%
Clean Small Plus Regular	4.08%	5.60%	22.28%	0.00%	0.00%	0.00%	0.00%
Clean Small Plus Priority	4.05%	7.09%	22.22%	0.00%	0.00%	0.00%	0.00%
Reply Paid Regular	6.84%	0.58%	24.42%	0.00%	0.00%	0.00%	0.00%
Reply Paid Priority	5.89%	3.30%	21.81%	0.00%	0.00%	0.00%	0.00%
Ordinary Prepaid Envelope 0 250g Regular	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Ordinary Prepaid Envelope 250 500g Regular	9.09%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%

	2023 Jan	*2023* Jul	*2024* Jan	*2024* Jul	*2025* Jan	*2025* Jul	*2026* Jan
PreSort Large Letters							
PreSort Medium Regular	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PreSort Large 0 250g Regular	4.06%	5.35%	22.24%	0.00%	0.00%	0.00%	0.00%
Pre Sort Small Plus Regular	3.96%	5.38%	22.30%	0.00%	0.00%	0.00%	0.00%
Pre Sort Large 250 500g Regular	4.12%	5.45%	22.25%	0.00%	0.00%	0.00%	0.00%
Pre Sort Small Plus Priority	4.07%	7.04%	22.19%	0.00%	0.00%	0.00%	0.00%
Pre Sort Large 0 250g Priority	3.65%	6.45%	22.26%	0.00%	0.00%	0.00%	0.00%
Pre Sort Medium Priority	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pre Sort Large 250 500g Priority	3.92%	5.70%	22.21%	0.00%	0.00%	0.00%	0.00%
Charity Mail Regular	3.28%	4.63%	3.39%	0.00%	0.00%	0.00%	0.00%
Promo Post Small Plus Large Regular	3.17%	4.39%	5.30%	0.00%	0.00%	0.00%	0.00%
Promo Post 0 125 Regular	3.29%	4.45%	5.63%	0.00%	0.00%	0.00%	0.00%
Print Post Volumes							
Print Post - Standard Size							
Print Post Standard Regular	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Print Post Standard Priority	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Print Post Standard Regular (Reserved)	4.00%	6.09%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post Standard Priority (Reserved)	4.00%	7.58%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post - <500G							
Print Post <500g Regular	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Print Post <500g Priority	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Print Post <250g Regular (Reserved)	4.00%	6.09%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post <250g Priority (Reserved)	4.00%	7.58%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post 250-500g Regular (Non-Reserved)	4.00%	6.09%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post 251-500g Priority (Non-Reserved)	4.00%	7.58%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post - >500G							
Print Post >500g Regular	4.00%	6.09%	22.10%	0.00%	0.00%	0.00%	0.00%
Print Post >500g Priority	4.00%	7.58%	22.10%	0.00%	0.00%	0.00%	0.00%