Updated Estimates of Australia Post's Mail Centre and Delivery Centre Cost Elasticities

Report prepared for
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EXECUTIVE SUMMARY

Australia Post has requested Economic Insights to update its January 2014 econometric analysis of the likely effects of declining mail volumes and declining mail density on Australia Post's future costs. We do this by econometrically estimating cost elasticities which show the percentage change in costs in response to a one per cent change in output. A cost elasticity of one would indicate that costs change by exactly the same percentage as output while a cost elasticity of zero would indicate that costs are totally independent of output changes.

This study provides information on postal cost elasticities specifically for Australia and using recent data from the period of secularly declining mail volumes. It also uses flexible functional forms for the estimated cost function and covers all inputs whereas earlier studies have tended to use simple functional forms and only cover labour data.

We estimate total cost and variable cost functions for panel data on Australia Post's key mail centres (MCs) and for panel data on its delivery centres (DCs). The current update includes an extra 13 months of data compared to Economic Insights (2014). This increases the number of monthly MC observations available by 15 per cent from 440 to 505 and the number of DC observations available by 80 per cent from 2,000 to 3,625. Consistent DC data were available for only 16 months at the time of our January 2014 study.

For MCs we obtain a total cost elasticity of 0.48, implying that a 1 per cent decrease in all outputs would correspond to a 0.48 per cent decrease in total MC costs. Looking at the actual output changes observed between 2012–13 and 2013–14 the total standard letter equivalents processed in the four MC processing stages examined decreased by 5 per cent. The estimated MC cost elasticities imply that MC real costs would have reduced by 2.4 per cent.

For DCs we include three key outputs: the number of articles delivered, the number of delivery points served and the distance travelled on delivery rounds. The total cost elasticity for articles delivered is 0.225, for points served is 0.137 and for distance travelled on rounds is 0.149. These results are somewhat different to those in Economic Insights (2014) which indicated that DC total costs were affected much more by changes in the number of points than by changes in either articles or distance, both of which had a minor implied impact on DC total costs. Further investigation of the reasons for these differences in results revealed a very high degree of correlation among the three DC output variables. This means that while the sum of the output coefficients will still be accurate, little weight can be placed on the magnitude of individual output coefficients (despite them all being significant in this case).

Between 2012–13 and 2013–14 the number of articles delivered fell by 4 per cent while the number of delivery points Australia Post is required to serve increased by 1.9 per cent. Distance travelled on rounds increased only marginally by 0.1 per cent. Combining these annual changes with the estimated real cost elasticities (subject to the qualification above), the impact on Australia Post's annual real delivery costs is a decrease of 0.8 per cent.

Thus, while the fall in postal article numbers has continued in the last year, the increase in the number of points Australia Post is required to serve has continued to increase steadily. Consequently, while MC real costs – which are driven by articles numbers – have fallen by around half the fall in articles numbers, DC real costs have decreased much less because the

impact of increased delivery points has partly offset the effects of declining articles numbers.

Delivery accounts for 62 per cent of Australia Post's reserved service operational costs, processing (ie MCs) accounts for 19 per cent and other costs such as acceptance and transport also account for 19 per cent. Using this information and assuming that the cost elasticities of other inputs such as acceptance and transport are zero (as stated during the previous review), we conclude that the output changes observed between 2012–13 and 2013–14 in isolation are likely to have decreased Australia Post's reserved service real costs by around 0.95 per cent[1].

[1] –0.0095 = 0.62 x (–0.008) + 0.19 x (–0.024) + 0.19 x 0

1 INTRODUCTION

Following a request from the Australian Competition and Consumer Commission (ACCC), Australia Post has requested Economic Insights to update its econometric analysis of the likely effects of declining mail volumes and declining mail density on Australia Post's future costs.

Economic Insights (2014) undertook an econometric analysis of the likely effects of declining mail volumes and declining mail density on Australia Post's future costs by estimating cost elasticities which show the percentage change in costs in response to a one per cent change in output. A cost elasticity of one would indicate that costs change by exactly the same percentage as output while a cost elasticity of zero would indicate that costs are totally independent of output changes.

Cost elasticities provide important information on how a business's costs change as its output changes. Generally all business will have some proportion of their costs that are fixed and these will not change (in the short term) as output volumes change. Importantly though, the proportion of costs that are fixed can vary between scenarios where output volumes are increasing compared to output volumes decreasing (ie there can be an asymmetry between these situations). For example, mail processing machines usually have to be run throughout a shift and can accommodate increases in throughput with little increase in costs but the fixed cost of their ownership and operation cannot readily be scaled back as volumes decline.

Cost elasticities are also likely to be influenced by the operating environment the business faces. For example, in postal services population density is likely to be an important influence on the proportion of the business's costs that are relatively fixed and, hence, on its ability to reduce costs in the face of declining volumes. Postal services operating in countries with high population densities are more likely to be able to combine rounds and achieve other economies as volumes decline than postal services with more sparse population densities.

When assessing the scope for cost reduction in the face of declining mail volumes, it is important to use cost elasticities that reflect the business's own characteristics and its current circumstances rather than drawing on overseas results that may bear little resemblance to the circumstances facing the business.

Economic Insights (2014) estimated total cost and variable cost functions for panel data on Australia Post's key mail centres (MCs) and for panel data on its delivery centres (DCs), with both panels covering over 80 per cent of mail articles. We obtained total cost output elasticities of 0.44 for MCs and of 0.76 for DCs. The corresponding variable cost output elasticities were 0.56 for MCs and 0.58 for DCs. These estimates were the first to have been prepared using data specifically relating to Australia Post and also the first relating to the period of secular decline in postal volumes starting in 2008 – between 2007–08 and 2012–13 the number of mail articles delivered fell by 18 per cent (Australia Post 2010, 2013).

Australia Post has been able to supply us with data for an extra 13 months for its MCs and DCs compared to our January 2014 study. This increases the number of monthly MC observations available from 440 to 505 – an increase of 15 per cent in the number of observations. However, the number of DC observations increases by 80 per cent from 2,000 to 3,625 because consistent national data were available for only 16 months at the time of our January 2014 study. Thus, while we would expect to see only marginal changes in our MC results due to the 15 per cent increase in observations, the 80 per cent increase in DC observations could be expected to produce more robust estimates which could differ more from the initial estimates.

The results we obtain in the current updated study are total cost output elasticities of 0.48 for MCs and of 0.51 for DCs. The corresponding variable cost output elasticities were 0.58 for MCs and 0.36 for DCs.

The following section of the report briefly reviews previous studies of overseas postal service cost elasticities. Section 3 then describes the data, estimation process and results for MCs while section 4 does the same for DCs. Conclusions are then drawn in section 5.

2 PREVIOUS POSTAL COST ELASTICITY ESTIMATES

In reviewing Australia Post's mail volume and cost forecasts submitted with its previous draft changes to the domestic reserved letter service, the Australian Competition and Consumer Commission's (ACCC's) consultant, Frontier Economics (2010), noted that there was no reviewable information supplied to support the relationship between output and costs postulated. It also noted that the implied elasticities appeared low in comparison to those derived from a number of international studies. Frontier Economics calculated Australia Post's overall implied cost elasticity to be 0.14 based on its statements that its acceptance and transport functions were largely fixed while the cost elasticity was 0.25 for processing and 0.30 for delivery. Frontier Economics noted this compared to a number of international studies which estimated postal cost elasticities to be between 0.60 and 0.70. These studies included Moriarty et al (2006) prepared for the UK regulator, PostComm, using Royal Mail network data, NERA (2004) using data from the ten original European Union countries and Bozzo (2009) using USPS data. Other US studies cited included those of Fenster at al (2008) and Cohen et al (2004).

In response, Australia Post (2011) noted that these studies were of limited relevance to Australia because, among other things, they were all undertaken in an environment of increasing volumes and for countries with higher population densities than Australia. Australia Post further argued there was likely to be an asymmetry in the cost/volume relationship between situations of increasing volumes versus declining volumes with a more inelastic relationship applying for declining volumes, ie it is harder to reduce costs in response to volume reductions as more costs then become akin to fixed costs.

Australia Post also argued that a higher population density implies that delivery costs are a smaller proportion of total costs and, since delivery costs are less variable when volume falls, the total cost elasticity in high density countries is likely to be higher.

In reviewing the relevance, reliability and comparability of the elasticity estimates reported in the international studies cited by Frontier Economics (2010) in providing an indication of the elasticity that may be applicable to the case of Australia Post, some relevant questions for each study are:

1. Is the model short run (SR) or long run (LR)?
2. Are mail volumes increasing or decreasing over the sample period?
3. Is the econometric method appropriate?
4. Are the data reliable?
5. Are all inputs (costs) included?
6. Are all aspects of mail services included (collection, processing, delivery, etc.)?
7. Is population density comparable to that in Australia?
8. Is the functional coverage similar to Australia?

We now briefly address each of these questions.

1. *Is the model SR or LR?*

   Four of the five papers estimate models that could be classed as LR models, with the exception of Bozzo (2009) which estimates a SR model where capital quantity is held fixed. As a consequence, this SR model is likely to underestimate the LR elasticity (all else equal).

2. *Are mail volumes increasing or decreasing over the sample period?*

   In all five papers the sample data covers periods of increasing or constant volumes. The current situation in Australia is one of relatively rapidly decreasing volumes. We expect asymmetry in elasticities in at least the short run, because it is usually easier to expand labour and capital rather than contract it. Thus the SR elasticity estimates reported are likely to be over estimates.

3. *Is the econometric method appropriate?*

   We have econometric concerns with a number of the papers. Cohen (2004) does not use any econometrics, and instead "estimates" a cost function using a single data point from 1999 and relies upon the assumption of a linear technology and a (not clearly explained) allocation of costs among volume and network activities. Fenster (2008) estimates a production function, which assumes output is endogenous and inputs are exogenous. Given that it is more likely that the converse applies, these estimates could suffer from endogeneity bias. The Bozzo (2009) and NERA (2004) studies estimate models that rely upon an assumption of cost minimising behaviour. However, in a regulated monopoly outside interference in input allocation decisions (eg involving labour) may occur.

4. *Are the data reliable?*

   The data used in Fenster (2008) and Bozzo (2009) are acknowledged to suffer from recording errors (but both studies do use estimation methods which attempt to ameliorate these effects). As noted above, Cohen (2004) is based on a single data point. The NERA (2004) data involves data across 25 countries, where price deflators and capital cost measures are a particular concern.

5. *Are all inputs (or costs) included?*

   Fenster (2008) and Bozzo (2009) only include direct (run-time) labour and capital for each process, and exclude ancillary labour and other items. Given that ancillary labour tends to be less variable with volume, this could produce upward biased elasticity estimates. Bozzo (2009) and Moriarty (2006) only include labour inputs, which tend to be more variable with volumes (relative to other inputs), and hence also may produce elasticities which are larger than total elasticities.

6. *Are all aspects of mail services included (collection, processing, delivery, etc)?*

   Fenster (2008) and Bozzo (2009) only look at processing centres. These are expected to have higher elasticities relative to other activities (such as collection, transport, delivery and corporate overheads) which tend to have higher proportions of fixed costs. Moriarty (2006) only considers processing and delivery centres. Other activities (such as collection, transport, corporate overheads) which tend to have high proportions of fixed costs are not included.

7. *Is population density comparable to that in Australia?*

   In all five studies, the countries considered (USA, UK and EU members) have population densities that are notably higher than Australia's. As a consequence, the proportion of fixed costs in the collection, transport and delivery functions are expected to be lower than in Australia, and hence elasticities would be expected to be higher.

8. *Is the functional coverage similar to Australia?*

   The Fenster (2008) and Bozzo (2009) studies look at US mail centres which are likely to have a different functional coverage to Australian MCs. The US MCs are likely to be more disaggregated and specialised in their functions than the six main Australian MCs. This would be in part because in the US they have too many addresses given the size of the population for the bar–code reading machines to handle in one pass so they have to break the process down into more stages. Hence, one may need to aggregate several US MCs to get the equivalent functions that are done by each of the six main Australian MCs. The impact of this functional difference between the US and Australia means that using the results of these studies to infer appropriate values for Australia is not likely to be appropriate.

From this brief review we can see that the five overseas studies that have been cited in the reviews of previous notifications are likely to have limited relevance to the situation Australia Post faces.

This study provides updated information on postal cost elasticities specifically for Australia and using recent data from the period of secularly declining mail volumes. It also uses flexible functional forms for the estimated cost function and covers all inputs whereas earlier studies have tended to use simple functional forms and only cover labour data.

3 AUSTRALIA POST'S MAIL CENTRE COST ELASTICITIES

3.1 Mail centre data

Australia Post provided detailed monthly output and cost data and annual asset data on its six major metropolitan MCs for the period July 2006 to November 2014. The six MCs included are:

- Adelaide Mail Centre (SA)
- Dandenong Letters Centre (Vic)
- Northgate Mail Centre (Qld)
- Perth Mail Facility (WA)
- Sydney West Letters Facility (NSW), and
- Underwood Mail Centre (Qld).

In 2012–13 these six MCs accounted for over 80 per cent of overall mail processing costs. Around 80 per cent of articles processed in these six MCs were reserved services. The results from the analysis will thus be representative of reserved service processing costs. Processing costs account for just under 20 per cent of overall reserved service operational costs.

Volume data for the six MCs were extracted from Australia Post's Mail and Delivery Centre Statistics (MDCS) database which is updated daily while financial and asset data were extracted from Australia Post's SAP financial system. The MC data started to be recorded in its current format in 2007–08. As with any database there were some early changes to the way items were recorded and increasing automation of recording with progressively less reliance on manual data entry has improved the accuracy of data over time. Some anomalous observations (mainly found in 2007–08 and 2008–09) have been interpolated, based largely on relative movements of the item between months in subsequent years.

Data are included for the 89 months from July 2006 to November 2014 for all MCs except Underwood which is included only up to June 2012 due to its increasing focus on parcels and subsequent reclassification as a parcels centre rather than an MC. This leads to a total of 505 observations for the MC analysis.

3.3.1 Mail centre outputs

Australia Post's MCs undertake four key stages of mail processing being:

- culling, franking and cancelling (CFC)
- optical character reading (OCR)
- bar code sorting (BCS), and
- manual sorting (MS)

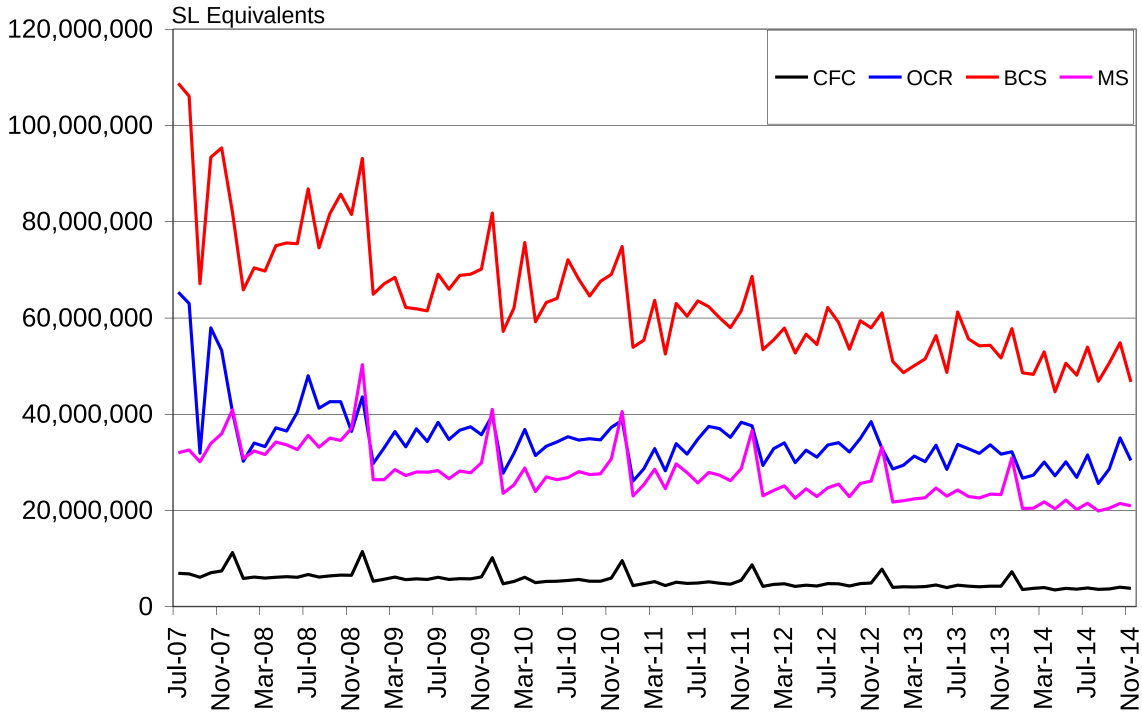
Data on a total of 81 individual MC processes were provided by Australia Post. These processes were allocated to one of the four key stages with assistance from Australia Post operational experts. These individual processes are further associated with one of four broad types of mail being:

- Standard letters (SL)
- Large letters (LL)
- Small parcels (SP), and
- Large parcels (LP).

The four different types of mail listed above have progressively increasing resource requirements. Since the shares of these mail types will differ between MCs and between months, it is important to allow for these differences in resource requirements across the 505 MC observations. We do this by converting the number of articles handled in each of the four key MC processing stages into numbers of 'standard letter equivalents'. Conversion factors were derived from data on volumes and costs of around 30 different types of mail and MC processes supplied by Australia Post. Since MC activities could not be consistently separated within these data, overall unit cost relativities were used to derive the conversion factors for forming the number of standard letter equivalents. Relative to a standard letter unit cost of one, the unit cost of large letters is taken to be 1.8, of small parcels to be 8.9 and of large parcels to be 15.

The allocation and conversion factor matrix used to form the number of standard letter equivalents handled in each of the four key MC processing stages is presented in appendix A.

Figure 1: **Adelaide Mail Centre outputs (SL equivalents)**



The four MC outputs are plotted in figures 1–6 for each of the six included MCs. In most cases the output quantities tend to trend down over time. Underwood MC is notable by its relatively high and increasing manual sort output reflecting its transition to a parcels centre. The December monthly seasonal peak in volumes is evident in all cases.

Figure 2: **Dandenong Letters Centre outputs (SL equivalents)**

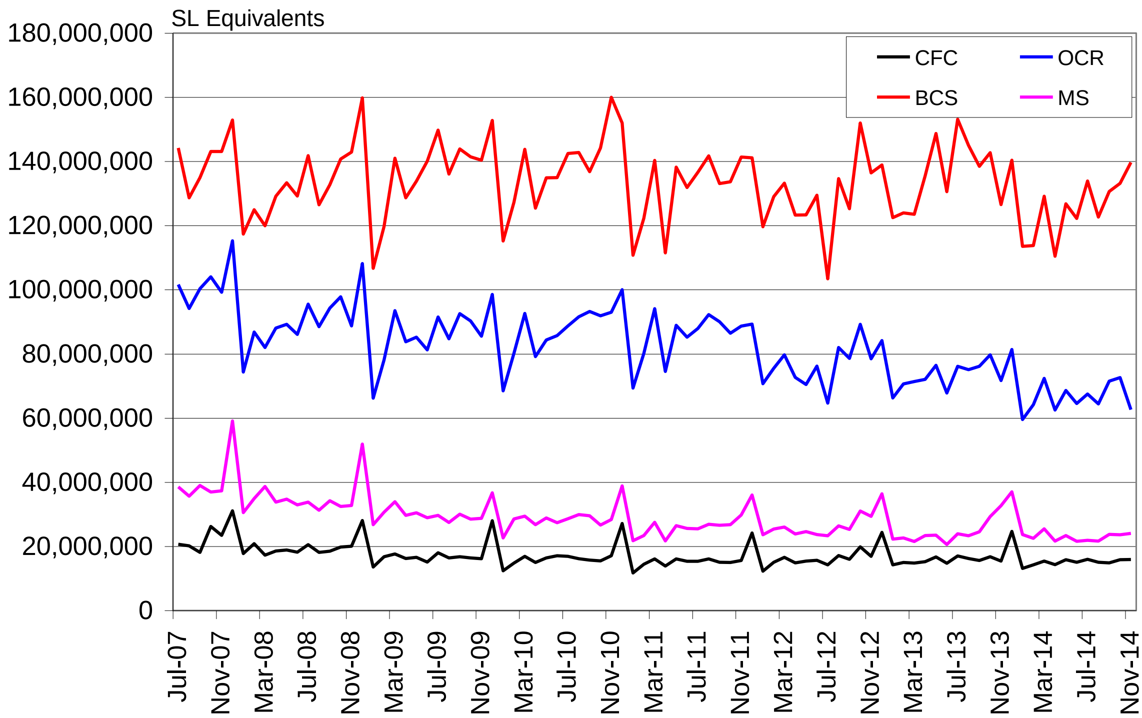


Figure 3: **Northgate Mail Centre outputs (SL equivalents)**

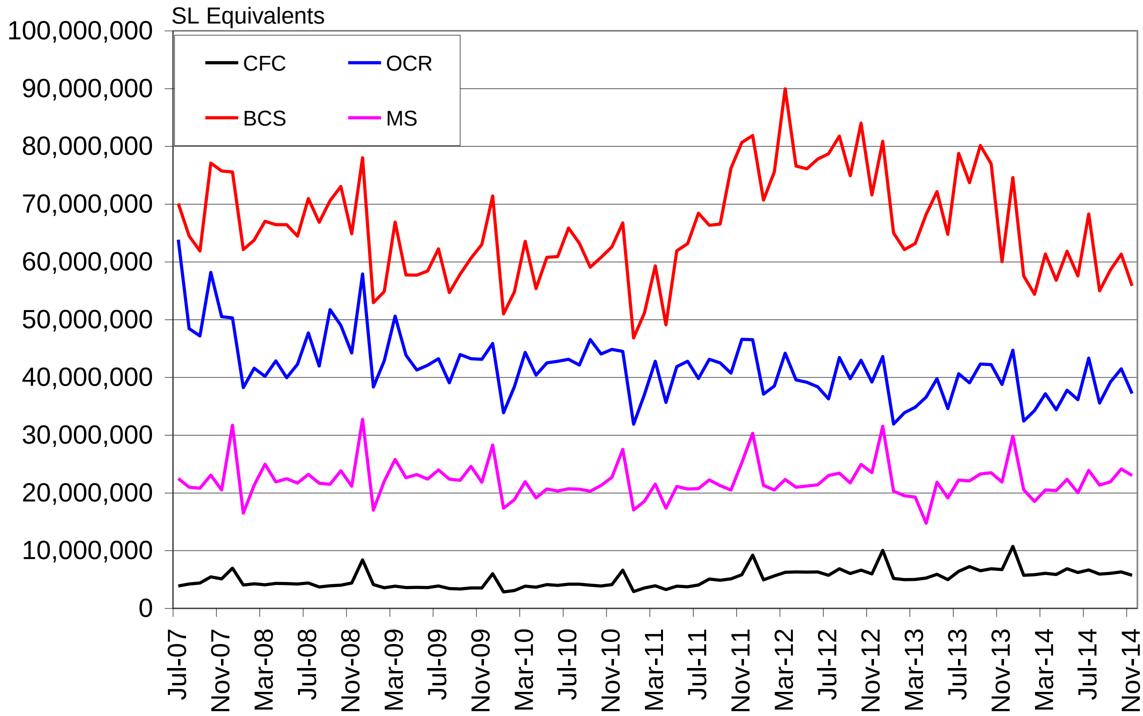


Figure 4: **Perth Mail Facility outputs (SL equivalents)**

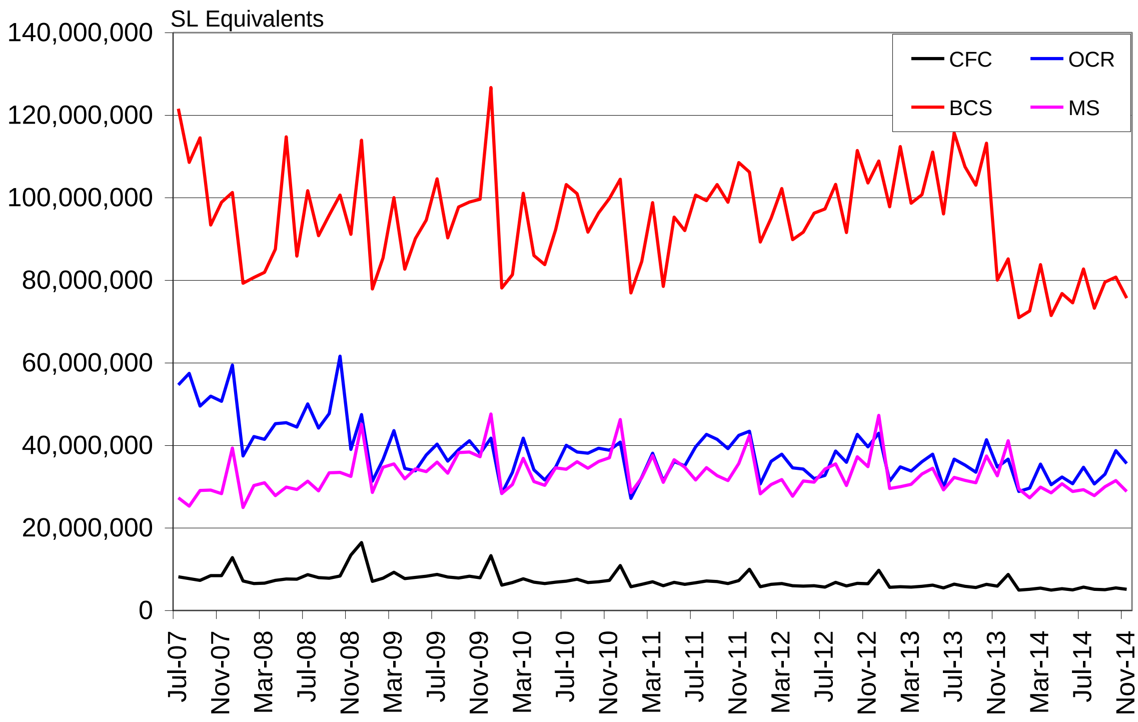


Figure 5: **Sydney West Letters Facility outputs (SL equivalents)**

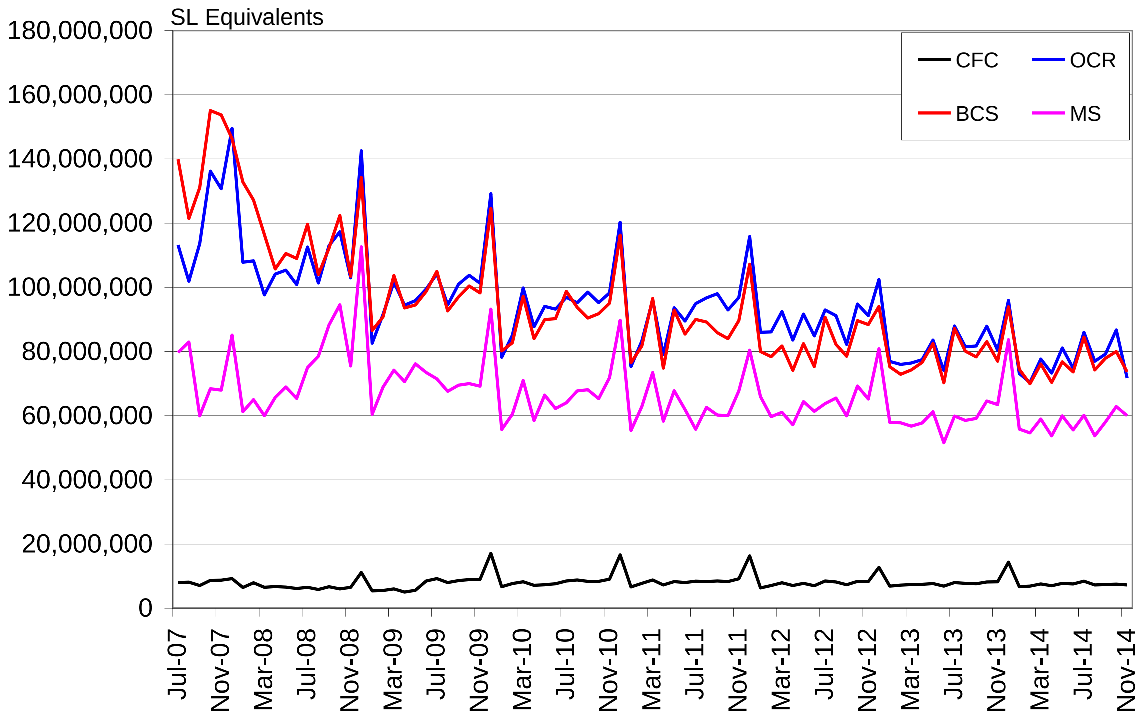
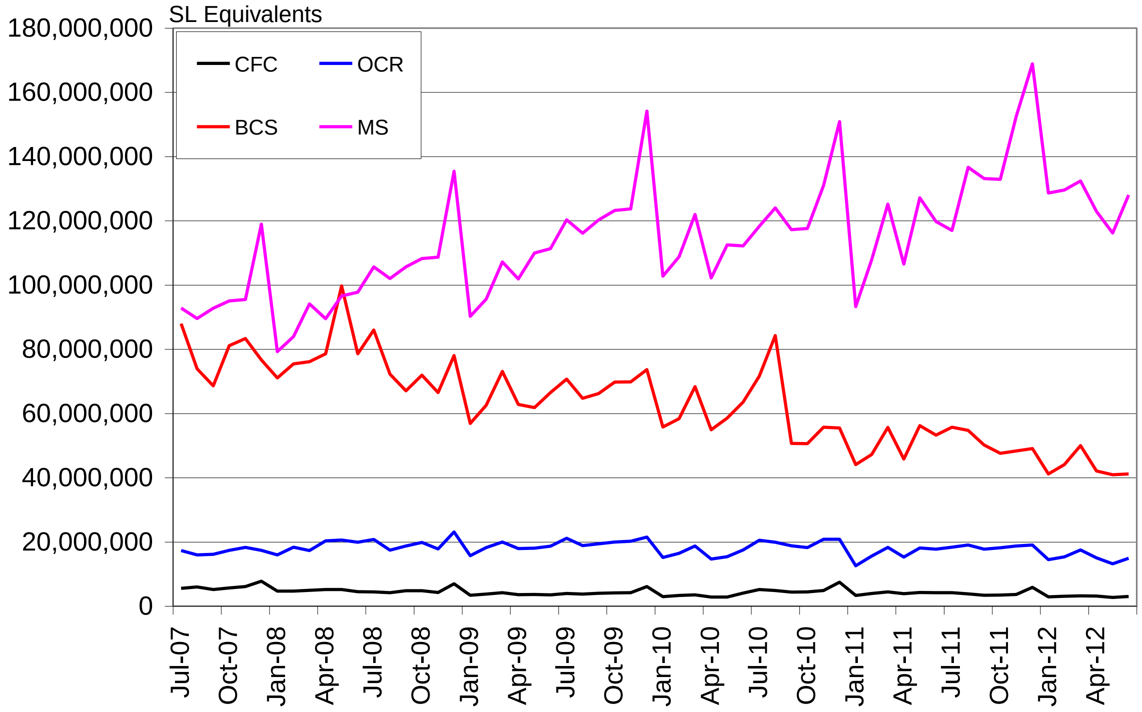


Figure 6: **Underwood Mail Centre outputs (SL equivalents)**



3.1.2 Mail centre non–capital inputs

Australia Post provided detailed monthly operating cost data on each of the six included MCs. These data were divided into labour costs and other (non–labour and non–capital) costs for the analysis. Labour costs comprised directly employed staff labour costs (including on–costs), contract labour and staff–associated costs. An Australia Post–specific labour price index was formed based on scheduled wage increases included in Australia Post's Enterprise Bargaining Agreements (EBAs).

The other costs category includes the remaining non–capital costs making up trading expenditure (excluding notional expenses) with the exception of air transport. Air transport costs are excluded as they are not a facility cost and disproportionately impact Perth MC costs. Notional expenses are excluded to avoid double counting with our explicitly included capital costs. In the absence of more specific price information, the consumer price index (CPI) is used as the price index associated with other costs.

In the first half of the time period examined there were a number of cost reallocations for some of the MCs and, in some cases, creation of additional cost centres. In most cases these reallocations were subsequently reversed by Australia Post. To ensure consistency of treatment we have aggregated relevant cost centre accounts for each MC and, where necessary, interpolated items that were temporarily transferred to product rather than facility reporting.

3.1.3 Mail centre capital inputs

Australia Post provided detailed MC asset data separately covering Plant and equipment and Buildings. Plant and equipment data supplied included:

- Asset code (eg ZP14)
- Acquisition value
- Accumulated depreciation, and
- Book value

These data were supplied for each of the six MCs for the 13 years from 2000–01 to 2013–14 and covered some 6,500 items each year across the six MCs in up to 300 asset categories. It is important to note that each reported item could relate to multiple physical items, such as 2 or more PCs, but in our calculations we implicitly treat the data as if each reported item only contains one physical item (or, alternatively, a number of similarly classified physical items purchased at the same point in time). Australia Post separately supplied detailed information on the expected asset life for each asset category.

Our calculations (for each asset category in each year in each MC) proceeded as follows:

- Use the asset code (eg ZP14) to allocate an assumed asset life (eg 5 years)
- Estimate the approximate average age of assets in the asset category by the formula:

  Asset age = accumulated depreciation / acquisition value × asset life

- Use the asset age information to convert the (nominal) acquisition value into a real acquisition value (in 2013 dollars) by the formula:

  Real acquisition value = Nominal acquisition value × CPI index,

  where the CPI index has a base of 1 in 2012–13. We used the ABS March quarter CPI index in these calculations. Note that the CPI index used depends on the asset age AND the year involved (eg an asset age of 6 years in 2010–11 equates to a period lag of 6+2=8 years which means that the 2004–05 CPI index would be used in this case).

- Calculate a real annuity using three pieces of information:
  - Real acquisition value
  - Asset life, and
  - Real interest rate of 7 per cent per annum.

These annuities are then added together to obtain an aggregate Plant and equipment estimate for each MC in each year until the end of the asset's expected life has been reached. These annual values are then divided by 12 to obtain monthly values. Real annuities for the five included months of 2014–15 (for which no annual data is currently available) were formed by extrapolating the change in monthly real annuities between 2012–13 and 2013–14.

For Buildings data, in addition to the same book value information as supplied for Plant and equipment, Australia Post also supplied us with data on current cost asset valuations or 'fair values' for the 14 year period 2000–01 to 2013–14. Australia Post uses an external valuer to revalue its MC buildings on a 3 year rotational basis and the assets that are not individually valued in a particular year are adjusted by use of a property index. As this additional information is available, we use a different approach to forming the Buildings real annuity.

Our calculations (for each year in each MC) proceeded as follows:

- Convert the (nominal) current cost values into real values (in 2013 dollars) by the formula:

  Real fair value = Nominal fair value × CPI index,

  where the CPI index has a base of 1 in 2012–13. We used the ABS March quarter CPI index in these calculations. Note that the CPI index used depends only on the year involved because the fair value is already in "current cost" terms.

- Calculate a real annuity using three pieces of information:
  - Real asset valuation
  - Asset life of 40 years
  - Real interest rate of 7 per cent per annum.

These annual values are then divided by 12 to obtain monthly values.

3.2 Econometric estimation of a total cost function for MCs

We begin by defining the following notation:

TC = nominal total cost;

$Y = (Y_1, Y_2, ..., Y_M)$ = an M×1 vector of output quantities; and

$W = (W_1, W_2, ..., W_M)$ = a K×1 vector of input prices.

We use lower case notation to define the natural logarithms of variables. For example, $y_1 = \log(Y_1)$.

The two most commonly used functional forms in econometric estimation of cost functions are the Cobb–Douglas and translog functional forms. These functions are linear in logs and quadratic in logs, respectively.

The Cobb–Douglas cost function may be written as:

$$tc_{ijt} = \alpha_0 + \sum_{k=1}^{K} \alpha_k w_{kijt} + \sum_{m=1}^{M} \beta_m y_{mijt} + \lambda_1 t + v_{ijt}\,, \qquad (1)$$

while the translog cost frontier may be specified as:

$$\begin{aligned} tc_{ijt} = {} & \alpha_0 + \sum_{k=1}^{K} \alpha_k w_{kijt} + 0.5 \sum_{k=1}^{K} \sum_{l=1}^{K} \alpha_{kj} w_{kijt} w_{lijt} + \sum_{m=1}^{M} \beta_m y_{mijt} + 0.5 \sum_{m=1}^{M} \sum_{n=1}^{M} \beta_{mn} y_{mijt} y_{nijt} \\ & + \sum_{k=1}^{K} \sum_{m=1}^{M} \gamma_{km} w_{kijt} y_{mijt} + \sum_{k=1}^{K} \delta_k w_{kijt} t + \sum_{m=1}^{M} \phi_m y_{mijt} t + \lambda_1 t + 0.5 \lambda_{11} t^2 + v_{ijt}, \end{aligned} \qquad (2)$$

where subscripts i, j and t denote MC, month and year, respectively. Furthermore, the regressor variable "*t*" is a time trend variable used to capture the effects of year to year technical change, v_{ijt} is a random disturbance term and the Greek letters denote the unknown parameters that are to be estimated.

A cost function should be homogenous of degree one in input prices, which means that the multiplication of all input prices by any constant value multiplies the costs by the same constant. The required homogeneity restrictions for the Cobb–Douglas are

$$\sum_{k=1}^{K}\alpha_k = 1, \tag{3}$$

while for the translog they are

$$\sum_{k=1}^{K}\alpha_k = 1, \quad \sum_{k=1}^{K}\alpha_{kl} = 0 \;\; (l = 1,2,...,K), \quad \sum_{k=1}^{K}\gamma_{kl} = 0 \;\; (l = 1,2,...,M), \quad \sum_{k=1}^{K}\delta_k = 0. \tag{4}$$

In our analysis of MCs, we have identified a set of K=4 input variables:

1. labour
2. plant and equipment (P&E)
3. buildings
4. other,

and a set of M=4 output variables:

1. CFC = culling, franking and cancelling
2. OCR = optical character reading
3. BCS = bar code sorting
4. MS = manual sorting.

In our assessment these input and output categories represent the key aspects of production in Australia Post MCs.

These variables would imply the need to estimate $M+K+2$ parameters for the Cobb–Douglas function and $M+K+2+(M+K)(M+K+1)/2$ for the translog function. It is tempting to choose the Cobb–Douglas functional form because it involves the estimation of fewer parameters. However, given that it only provides a first–order approximation to the true unknown functional form, it has a number of shortcomings. For example, it assumes that elasticities remain constant over all data points, and hence that scale economies and technical change must also be constant over time. Furthermore, it has particular shortcomings in multi–output settings, because it cannot accommodate a production possibility curve that is concave to the origin (ie one which incorporates the fundamental property of diminishing returns). Hence, we will use the translog model as our first choice, and then conduct a formal statistical test to see if the restrictions implicit in the Cobb–Douglas apply in our data.

In our discussion above we noted that four input variables have been identified and measured. However, in identifying possible price variables associated with these four input categories, we concluded that a wage price index was appropriate for the labour category, while the Australian Bureau of Statistics (ABS) Consumer Price Index (CPI) was the best available price measure for the remaining three categories of inputs. As a result, the number of price variables in our model reduces from K=4 to K=2.

Furthermore, when we attempted to estimate an econometric model with K=2 input price variables and the homogeneity restrictions imposed, we found that the price coefficients were not well estimated in some models, producing own price elasticities outside of the theoretical 0–1 range. This is perhaps not unexpected, given that our EBA–based labour price index only involves eight unique values. As a consequence, we decided to impose the restriction that the input price elasticities are equal to the mean input cost shares for the sample. This implies an assumption of cost minimising behaviour at the sample mean data point.

In practical terms, this involved the construction of an aggregate input price index using a Tornqvist index formula (using the sample mean input cost share weights of 79 per cent and 21 per cent for the wage index and CPI, respectively), and then using this aggregate input price index to deflate the nominal total cost measure. We then use a real (as opposed to nominal) total cost measure as the dependent variable and omit input price variables from the regressor list.[2]

Given that our data set involves data on a number of units (MCs) observed over a number of years and months (ie monthly panel data), we have chosen to include dummy variables to capture differences in production activities across MCs and across months. We define six dummy variables for MCs 1 to 6:

$$DMC_{hijt} = 1 \text{ when } h = i, \text{ and is 0 otherwise, } (h = 1,...,6).$$

And 12 dummy variables for months 1 to 12:

$$DMO_{gijt} = 1 \text{ when } g = \text{j}, \text{ and is 0 otherwise, } (g = 1,...,12).$$

With these additions, our translog cost function becomes:

$$\begin{aligned} rtc_{ijt} &= \alpha_0 + \sum_{m=1}^{4} \beta_m y_{mijt} + 0.5 \sum_{m=1}^{4} \sum_{n=1}^{4} \beta_{mn} y_{mijt} y_{nijt} + \sum_{m=1}^{4} \phi_m y_{mijt} t + \lambda_1 t + 0.5 \lambda_{11} t^2 \\ &\quad + \sum_{h=2}^{6} \eta_h DMC_{hijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt}, \end{aligned} \qquad (5)$$

where *rtc* refers to real total cost.

Note that one dummy variable is omitted from each group to avoid perfect multicollinearity in the econometric model. Hence, the "base category" in our model becomes MC1 in month 12 (December).

With these changes, we obtain a final *fixed effects panel data model* where there are 38 unknown parameters to be estimated from a sample size of 505 observations.

[2] The imposition of this restriction had very minimal effects of the output elasticities obtained.

3.3 Econometric results for the mail centre total cost function

The model in equation (5) is estimated using a variant of *ordinary least squares* (OLS) regression, where OLS is applied to data that has been transformed to correct for serial correlation (assuming a common autoregressive parameter across the MCs)[3]. We have also chosen to report *panel–corrected standard errors*, where the standard errors have been corrected for cross–sectional heteroskedasticity. The estimation methods used follow those described in Beck and Katz (1995) and Greene (2000, Ch15) and have been calculated using the POOL command in Shazam Version 10 Econometrics Software (Northwest Econometrics 2007).

The econometric results are reported in table 1, where we observe that the majority of estimated coefficients have t–ratios in excess of 1.96, indicating that they are statistically different from zero at the five per cent level of significance, and the R–Square is a healthy 98.6 per cent.

It is important to note that the regressor variables (except for the dummy variables) have been mean–corrected prior to estimation (in all the econometric models in this report). This does not change the substance of the empirical results in any way, but has the advantage that it allows one to interpret the first order coefficients as elasticities at the sample means, which saves considerable secondary calculations.

We first discuss the first–order coefficients of the four output variables. All four output coefficients have the expected positive signs, implying that extra output incurs extra costs. The estimated coefficient of the CFC output is 0.108, implying that a 1 per cent increase in CFC will lead to a 0.108 per cent increase in costs (all else held constant), at the sample mean. The corresponding coefficients of OCR, BCS and MS, are 0.072, 0.152 and 0.148, respectively, implying elasticities at the sample means of 0.072 per cent, 0.152 per cent and 0.148 per cent, respectively.

When added together, these four output elasticity estimates provide a total elasticity measure of 0.108+0.072+0.152+0.148=0.480, implying that a 1 per cent increase in all outputs will lead to a 0.48 per cent increase in total MC costs. Equivalently, it implies that a 1 per cent *decrease* in all outputs should correspond to a 0.48 per cent *decrease* in total MC costs, which is of particular interest in this study. This linear combination estimate (0.480) has an estimated standard error of 0.038, producing a 95 per cent confidence interval of (0.401, 0.554).

The first order coefficient of the YEAR (time trend) variable is negative as expected (and statistically significant).[4] The value of –0.010 implies that costs decrease at a rate of 1 per cent per year (all else held constant), at the sample mean. This estimate of technical change of 1 per cent can be compared to rates of 1 to 2 per cent that are generally found in empirical studies of various industries.

[3] As recommended by Beck and Katz (1995).

[4] All references to statistical insignificance are at the 5 per cent level, unless otherwise stated.

Table 1: **Econometric results for the mail centre panel data total cost function**

VARIABLE	COEFFICIENT	ST-ERROR	T-RATIO
CFC	0.108	0.026	4.103
OCR	0.072	0.038	1.876
BCS	0.152	0.041	3.679
MS	0.148	0.031	4.729
YEAR	-0.010	0.003	-4.013
MO1	-0.107	0.022	-4.861
MO2	-0.137	0.020	-6.836
MO3	-0.118	0.019	-6.230
MO4	-0.080	0.021	-3.912
MO5	-0.115	0.019	-5.963
MO6	-0.130	0.020	-6.488
MO7	-0.138	0.019	-7.352
MO8	-0.122	0.019	-6.472
MO9	-0.142	0.019	-7.419
MO10	-0.120	0.018	-6.697
MO11	-0.127	0.017	-7.418
MC2	0.818	0.039	20.800
MC3	0.074	0.015	5.039
MC4	0.061	0.015	4.002
MC5	0.852	0.044	19.400
MC6	0.101	0.118	0.862
CFC*CFC	0.129	0.074	1.732
CFC*OCR	-0.170	0.046	-3.704
CFC*BCS	0.003	0.112	0.024
CFC*MS	-0.039	0.031	-1.249
OCR*OCR	0.194	0.105	1.836
OCR*BCS	-0.021	0.094	-0.227
OCR*MS	-0.015	0.058	-0.256
BCS*BCS	0.053	0.239	0.220
BCS*MS	0.000	0.064	-0.003
MS*MS	0.057	0.049	1.169
YEAR*YEAR	0.006	0.001	4.209
YEAR*CFC	-0.015	0.007	-2.180
YEAR*OCR	-0.012	0.007	-1.679
YEAR*BCS	0.026	0.011	2.298
YEAR*MS	0.010	0.006	1.761
CONSTANT	14.847	0.016	926.400
BUSE R-SQUARE			*0.986*

The estimated coefficients of the 11 monthly dummy variables are all negative. This is as expected, given that the base month of comparison is December. We expected that costs would be higher in December because of the extra overtime expenditure used in dealing with increased volumes associated with the Christmas rush. For example, the estimated coefficient of MO3 (March) is –0.118, implying that costs in March are 11.8 per cent below those in December (all else held constant), at the sample mean. The other ten monthly dummy variable coefficients are interpreted in a similar manner.

The estimated coefficients of the 5 MC dummy variables are interpreted in a similar manner. Recalling that the base MC is MC1, the estimated coefficient of MC4 is 0.061, which implies that costs in MC4 are 6.1 per cent higher than those in MC1 (all else held constant), at the sample mean, and so on.

The estimated coefficients of the other (second order) coefficients are difficult to interpret directly. Their main use is in allowing one to estimate elasticities at points other than the sample means (after some calculations).

A number of hypothesis tests were also conducted to see if a more parsimonious model could be used to describe these data. We conducted a hypothesis test to see if a Cobb–Douglas functional form was appropriate for these data. The parameter restrictions involved setting the 15 second order coefficients in equation (5) to zero producing a Cobb–Douglas cost function of the form:

$$rtc_{ijt} = \alpha_0 + \sum_{m=1}^{4} \beta_m y_{mijt} + \lambda_1 t + \sum_{h=2}^{6} \eta_h DMC_{hijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt}, \quad (6)$$

The F–test statistic with 15 and 468 degrees of freedom was 4.459 with a p–value of 0.000, indicating that the null hypothesis of a Cobb–Douglas model cannot be accepted at a 5 per cent level of significance, implying that the translog form is the preferred model.

We conducted a second hypothesis test to see if the 11 monthly dummy variables were a significant addition to the model. The F–test statistic with 11 and 468 degrees of freedom was 10.427 with a p–value of 0.000, indicating that the null hypothesis of these 11 coefficients being zero could not be accepted at a 5 per cent level of significance, implying that the 11 monthly dummy variables were a significant addition to the model.

We conducted a third hypothesis test to see if the 5 MC dummy variables were a significant addition to the model. The F–test statistic with 5 and 468 degrees of freedom was 121.470 with a p–value of 0.000, indicating that the null hypothesis of these 5 coefficients being zero could not be accepted at a 5 per cent level of significance, implying that the 5 MC dummy variables were a significant addition to the model.

To summarise, we illustrate the pricing implications of our MC total cost function findings using the changes observed in relevant variables across the first five MCs as a whole between 2012–13 and 2013–14 in the following calculations. The total standard letter equivalents processed in the four MC processing stages decreased by 5.02 per cent over this period. The wage rate index increased by 1.63 per cent while the CPI increased by 2.71 per cent between the two years. Combining these changes with their relevant cost elasticities and including the estimated impact of technical change, we obtain the following estimated change in total costs:

$$0.480 \times (-0.0502) + 0.790 \times 0.0163 + (1 - 0.790) \times 0.0271 + (-0.010) = -0.0155$$

That is, the combined effects of the 5.02 per cent reduction in output, the 1.63 per cent increase in the wage rate, the 2.71 per cent increase in the price of other inputs and capital and ongoing technical change would have been an overall MC cost reduction of 1.55 per cent between 2012–13 and 2013–14. The effect on MC total costs of the output reduction in isolation would have been a reduction in total MC costs of 2.41 per cent (from the first term above).

3.4 Econometric estimation of a mail centre variable cost function

The above estimates for a total cost function provide elasticity estimates that assume that all costs (including capital costs) can be varied when output varies. Hence they provide an estimate of how costs can be varied in the long run, when there is sufficient time to adjust quantities of capital.

In the short run, one is unable to easily adjust capital inputs, and hence it is of interest to also estimate a variable cost function, where the dependant variable is variable costs (total costs minus capital costs). This function will allow us to estimate the degree to which variable costs respond to output changes (with capital quantity held fixed).

To define our new model we define the additional notation:

RVC = real variable costs (labour plus other costs deflated by an aggregate input price index),

CAP = capital quantity (real P&E and building costs).

and once again we use lower case notation to define the natural logarithms of variables. For example, $rvc = \log(RVC)$.

Note that the real variable cost measure is obtained by deflating nominal variable cost by an aggregate input price index, where the sample mean input cost share weights are 91 per cent and 9 per cent for the wage index and CPI, respectively.

Our translog variable cost function is then defined as:

$$\begin{aligned} rvc_{ijt} = {} & \alpha_0 + \sum_{m=1}^{4} \beta_m y_{mijt} + 0.5 \sum_{m=1}^{4} \sum_{n=1}^{4} \beta_{mn} y_{mijt} y_{nijt} + \sum_{m=1}^{4} \phi_m y_{mijt} t + \lambda_1 t + 0.5 \lambda_{11} t^2 \\ & + \rho_1 cap_{ijt} + 0.5 \rho_{11} cap_{ijt} cap_{ijt} + \sum_{m=1}^{4} \psi_{1m} cap_{ijt} y_{mijt} + \tau_1 cap_{ijt} t \\ & + \sum_{h=2}^{6} \eta_h DMC_{hijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt}, \end{aligned} \tag{7}$$

and the Cobb–Douglas becomes:

$$rvc_{ijt} = \alpha_0 + \rho_1 cap_{ijt} + \sum_{m=1}^{4} \beta_m y_{mijt} + \lambda_1 t + \sum_{h=2}^{6} \eta_h DMC_{hijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt} \tag{8}$$

3.5 Econometric results for the mail centre variable cost function

The model in equation (7) is estimated using the same econometric methods used in the previous section. That is, we correct for serial correlation and have chosen to report *panel–corrected standard errors*, where the standard errors have been corrected for cross–sectional heteroskedasticity.

The econometric results are reported in table 2, where we again observe that the majority of estimated coefficients have t–ratios in excess of 1.96, indicating that they are statistically different from zero at the five percent level of significance, and the R–Square is an impressive 98.2 per cent.

We first discuss the first–order coefficients of the four output variables. All four output coefficients have the expected positive signs, implying that extra output incurs extra variable costs. The estimated coefficient of the CFC output is 0.139, implying that a 1 per cent increase in CFC will lead to a 0.139 per cent increase in variable costs (all else held constant), at the sample mean. The corresponding coefficients of OCR, BCS and MS, are 0.056, 0.200 and 0.187, respectively, implying elasticities at the sample means of 0.056 per cent, 0.200 per cent and 0.187 per cent, respectively.

When added together, these four output elasticity estimates provide a total elasticity measure of 0.139+0.056+0.200+0.187=0.582, implying that a 1 per cent increase in all outputs will lead to a 0.582 per cent increase in variable costs. Equivalently, it implies that a 1 per cent *decrease* in all outputs should correspond to a 0.582 per cent *decrease* in variable costs, which is of particular interest in this study. This linear combination estimate (0.582) has an estimated standard error of 0.047, producing a 95 per cent confidence interval of (0.490, 0.673).

The total elasticity measure in the variable cost function (0.582) is larger than that obtained in the total cost function (0.480). This is as expected, given that variable costs are expected to be more "flexible" over the short time frame considered in these data.

The first order coefficient of the YEAR (time trend) variable is negative as expected. The value of –0.011 implies that variable costs decrease at a rate of 1.1 per cent per year (all else held constant), at the sample mean. This estimate of technical change is approximately the same as that found in the total cost function.

The first order coefficient of the CAP variable is negative as expected (implying input substitution). It has a value of –0.173 implying that a 1 per cent increase in capital will lead to a 0.173 per cent decrease in variable costs (all else held constant), at the sample mean. However, we note that this measure is small and statistically insignificant. This may be a consequence of the fact that capital does not vary substantially during the sample period.

The estimated coefficients of the monthly dummy variables and MC dummy variables are similar to those seen in the total cost function, and are interpreted in a similar manner.

Once again, a number of hypothesis tests were also conducted to see if a more parsimonious model could be used to describe these data. We conducted a hypothesis test to see if a Cobb–Douglas functional form was appropriate for these data. The parameter restrictions involved setting the 28 second order coefficients in equation (7) to zero producing the Cobb–Douglas variable cost function reported in equation (8).

The F–test statistic with 21 and 461 degrees of freedom was 3.847 with a p–value of 0.000, indicating that the null hypothesis of a Cobb–Douglas model cannot be accepted at a 5 per cent level of significance, implying that the translog form is the preferred model.

Table 2: **Econometric results for the mail centre panel data variable cost function**

VARIABLE	COEFFICIENT	ST-ERROR	T-RATIO
CFC	0.139	0.030	4.563
OCR	0.056	0.048	1.168
BCS	0.200	0.047	4.256
MS	0.187	0.037	5.086
YEAR	-0.011	0.004	-3.058
CAP	-0.173	0.105	-1.649
MO1	-0.117	0.026	-4.510
MO2	-0.161	0.024	-6.618
MO3	-0.142	0.023	-6.074
MO4	-0.094	0.025	-3.802
MO5	-0.139	0.024	-5.907
MO6	-0.153	0.024	-6.327
MO7	-0.163	0.023	-7.038
MO8	-0.146	0.023	-6.320
MO9	-0.169	0.024	-7.173
MO10	-0.142	0.022	-6.348
MO11	-0.152	0.021	-7.113
MC2	1.053	0.179	5.880
MC3	0.087	0.031	2.835
MC4	0.100	0.043	2.343
MC5	1.000	0.223	4.486
MC6	0.128	0.128	1.001
CFC*CFC	0.083	0.087	0.960
CFC*OCR	-0.105	0.092	-1.138
CFC*BCS	-0.009	0.128	-0.073
CFC*MS	-0.052	0.039	-1.345
OCR*OCR	0.060	0.183	0.328
OCR*BCS	-0.246	0.096	-2.566
OCR*MS	-0.182	0.174	-1.043
BCS*BCS	0.027	0.262	0.104
BCS*MS	0.024	0.076	0.318
MS*MS	0.119	0.060	1.974
YEAR*YEAR	0.007	0.003	2.465
YEAR*CFC	-0.016	0.008	-1.826
YEAR*OCR	-0.035	0.016	-2.249
YEAR*BCS	0.033	0.014	2.350
YEAR*MS	0.015	0.007	1.987
CAP*CAP	-0.093	0.152	-0.614
CAP*CFC	-0.056	0.066	-0.837
CAP*OCR	0.045	0.125	0.361
CAP*BCS	0.184	0.110	1.666
CAP*MS	0.267	0.062	4.281
CAP*YEAR	0.012	0.011	1.131
CONSTANT	14.633	0.072	203.500
BUSE R-SQUARE			*0.982*

We conducted a second hypothesis test to see if the 11 monthly dummy variables were a significant addition to the model. The F–test statistic with 11 and 461 degrees of freedom was 9.565 with a p–value of 0.000, indicating that the null hypothesis of these 11 coefficients being zero could not be accepted at a 5 per cent level of significance, implying that the 11 monthly dummy variables were a significant addition to the model.

We conducted a third hypothesis test to see if the 5 MC dummy variables were a significant addition to the model. The F–test statistic with 5 and 461 degrees of freedom was 12.523 with a p–value of 0.000, indicating that the null hypothesis of these 5 coefficients being zero could not be accepted at a 5 per cent level of significance, implying that the 5 MC dummy variables were a significant addition to the model.

To summarise, we illustrate the implications of our MC variable cost function findings using the changes observed in output variables across the first five MCs as a whole between 2012–13 and 2013–14 in the following calculations. As noted above, the total standard letter equivalents processed in the four MC processing stages decreased by 5.02 per cent while the wage rate index increased by 1.63 per cent and the CPI increased by 2.71 per cent between the two years. Combining these changes with their relevant variable cost elasticities and including the estimated impact of technical change, we obtain the following estimated change in variable costs:

$$0.582 \times (-0.0502) + 0.910 \times 0.0163 + (1 - 0.910) \times 0.0271 + (-0.011) = -0.0229$$

That is, the combined effects of the 5.02 per cent reduction in output, the 1.63 per cent increase in the wage rate, the 2.71 per cent increase in the price of other inputs and capital and ongoing technical change would have been an MC variable cost reduction of 2.3 per cent between 2012–13 and 2013–14. The effect on MC variable costs of the output reduction in isolation would have been a reduction in variable MC costs of 2.9 per cent.

4 AUSTRALIA POST'S DELIVERY CENTRE COST ELASTICITIES

4.1 Australia Post delivery centre data

Australia Post provided detailed monthly output and cost data and annual asset data on its 125 urban DCs for the period July 2012 to November 2014. DC data are available for a shorter period than MC data because they have only recently been integrated into the nationally consistent MDCS and SAP databases. Before this DC records were maintained at a state and territory level using different reporting conventions between state offices. Australia Post's output reporting is generally on an average per work day basis. We converted this to monthly totals based on the number of working days per month for our analysis.

Since our January 2014 study, Australia Post has changed the format of its DC output reporting. The current reporting format does not include the variables we require to update the previous DC study. Australia Post has therefore rerun its reports for the period November 2013 to November 2014 using its old reporting format which has taken some time to implement. As an interim measure, Australia Post ran the November 2014 report first and we initially interpolated DC output between October 2013 and November 2014 using the actual endpoints and the same pattern of variation around the intervening trend line as occurred during the same period 12 months earlier. However, actual data are now available for all of the 13 additional months and these are used in the analysis reported here. It should be noted that, in some cases, there were substantial differences between the actual output data for the last 13 months of the period and the interim estimates of DC outputs, perhaps reflecting increased variability in mail deliveries as well as a declining trend.

Rural and remote DCs were excluded from the analysis because they tend to have quite different characteristics to urban DCs. Rural and remote DCs are typically smaller, are often run in conjunction with post offices and make greater use of contractors. Articles delivered are generally less than for urban DCs but distances covered per route are considerably longer. The urban DCs included in the analysis generally cover over 85 per cent of delivery activity nationally. The 125 included DCs are listed in appendix B.

The output and cost data used in the analysis excludes parcel delivery by contractors. Instead it focuses on mail delivery on daily rounds, generally undertaken by motorbike, cycle or on foot. Small parcels delivered on normal rounds are included in the analysis. The results from the analysis will thus be representative of reserved service delivery costs. Delivery costs account for just over 60 per cent of overall reserved service operational costs.

Volume data for the 125 DCs were extracted from Australia Post's Mail and Delivery Centre Statistics (MDCS) database which is updated daily while financial and asset data were extracted from Australia Post's SAP financial system. The DC data runs for 29 months from July 2012. Some points and distance observations for October and November 2014 were incomplete and were extrapolated from preceding observations. This leads to a total of 3,625 observations for the DC analysis, an increase of 80 per cent compared to our January 2014 study.

4.1.1 Delivery centre outputs

We include three outputs for Australia Post's DCs being:

- Number of articles delivered
- Number of delivery points served, and
- Distance covered on rounds.

While Australia Post is not paid per delivery point or per kilometre of rounds, the inclusion of the number of delivery points and distance covered as output variables captures an important function that Australia Post is required to perform. There are many precedents in econometric analyses of other network industries, such as electricity, gas and water distribution, where volume supplied, number of customers and distance covered are often the first three output variables specified to capture the range of functional outputs and also differences in density across firms (or data points). In this case differences in density relate to both mail density (ie articles per customer) and customer density (ie customers per round kilometre). The Australian Energy Regulator (2014) has recently used a broadly analogous output specification to measure electricity distribution performance.

4.1.2 Delivery centre non–capital inputs

Australia Post provided detailed monthly operating cost data on each of the 125 included DCs. These data were divided into labour costs and other (non–labour and non–capital) costs for the analysis. Labour costs comprised directly employed staff labour costs (including on–costs), contract labour and staff–associated costs. An Australia Post–specific labour price index was formed based on scheduled wage increases included in Australia Post's Enterprise Bargaining Agreements.

The other costs category includes the remaining non–capital costs making up trading expenditure (excluding notional expenses). Notional expenses are excluded to avoid double counting with our explicitly included capital costs. In the absence of more specific price information, the consumer price index (CPI) is used as the price index associated with other costs.

4.1.3 Delivery centre capital inputs

Australia Post provided detailed DC asset data covering Plant and equipment and Buildings. Asset data supplied included:

- Asset code
- Acquisition value
- Accumulated depreciation, and
- Book value

These data were supplied for each of the 125 included DCs for 2012–13 and 2013–14 and covered numerous items in up to 13 broad asset categories. In the interests of keeping the calculations manageable, we proceeded by forming real annuities at this broad asset category level. In our calculations we implicitly treat the data as if each broad asset category only contains one physical item (or, alternatively, a number of similarly classified physical items with the same average age). Australia Post separately supplied detailed information on the expected asset life for each asset type and, from this, we formed a representative weighted average asset life for each broad asset category.

Our calculations (for each broad asset category for each DC) proceeded as follows:

- Estimate the approximate average age of assets in the asset category by the formula:

  Asset age = accumulated depreciation / acquisition value × asset life

- Use the asset age information to convert the (nominal) acquisition value into a real acquisition value (in 2013 dollars) by the formula:

  Real acquisition value = Nominal acquisition value × CPI index,

  where the CPI index has a base of 1 in 2012–13. We used the ABS March quarter CPI index in these calculations. Note that the CPI index used depends on the asset age AND the year involved (eg an asset age of 6 years in 2010–11 equates to a period lag of 6+2=8 years which means that the 2004–05 CPI index would be used in this case).

- Calculate a real annuity using three pieces of information:
  - Real acquisition value
  - Asset life, and
  - Real interest rate of 7 per cent per annum.

These annuities are then added together to obtain an aggregate capital input estimate for each DC in 2012–13 and 2013–14. These annual values are then divided by 12 to obtain monthly values. Real annuities for the five included months of 2014–15 (for which no annual data is currently available) were formed by assuming the same real monthly annuity applied as in 2013–14. This is similar to the approach adopted in our January 2014 study.

Unlike MCs, no separate fair value or current cost data are available for DC buildings and so buildings are included as one of the broad asset categories above.

4.2 Econometric estimation of a total cost function for DCs

We use similar notation to that used above for the MC analysis:

RTC = real total cost;

$Y = (Y_1, Y_2, ..., Y_M)$ = an M×1 vector of output quantities (and related measures); and

$W = (W_1, W_2, ..., W_M)$ = a K×1 vector of input prices.

We again use lower case notation to define the natural logarithms of variables. For example, $y_1 = \log(Y_1)$.

Furthermore, we again consider the Cobb–Douglas and translog functional forms.

In this analysis of DCs, we have identified a set of K=3 input variables:

1. labour
2. capital
3. other

and a set of M=3 output variables:

1. ART = articles delivered
2. PTS = points delivered to
3. DIS = distance covered on delivery round.

In our assessment these input and output categories represent the key aspects of production in Australia Post DCs.

As noted in our econometric analysis of MCs (see above) we excluded input price variables from the list of regressors in the econometric model because we had only 11 unique price values in our nine years of MC EBA–based labour price data. Given that we have only 29 months of data (over a two year period) in this DC analysis we have only five unique EBA–based labour price index values. As a result, it is not feasible to include input price variables as regressors in the DC econometric model either. We thus construct an aggregate input price index using a Tornqvist index formula (using sample mean share weights), and then use this price index to deflate the cost measure that is used as the dependant variable. Hence we also use real (as opposed to nominal) cost measures in the DC analysis. Our aggregate input price index uses sample mean input cost share weights of 60 per cent and 40 per cent for the wage index and CPI, respectively.

We have again chosen to include dummy variables to capture differences in production activities across months. We define 12 dummy variables for months 1 to 12:

$DMO_{gijt} = 1$ when g = j, and is 0 otherwise, (g = 1,...,12).

However, we have decided to not include dummy variables for the 125 DCs in our econometric model. This is because the data on distance (DIS) and points (PTS) varies little from month to month in each DC over the 29 month time period (as one would expect). If these 125 dummies are included, they are almost exactly correlated with these two variables and hence would make it impossible for one to obtain reliable elasticity estimates.

Given the above discussion, our translog total cost function for DCs is defined as:

$$rtc_{ijt} = \alpha_0 + \sum_{m=1}^{3}\beta_m y_{mijt} + 0.5\sum_{m=1}^{3}\sum_{n=1}^{3}\beta_{mn} y_{mijt} y_{nijt} + \sum_{g=1}^{11}\theta_g DMO_{gijt} + v_{ijt}, \qquad (9)$$

where $rtc = \log(RTC)$ relates to real total cost and all other notation is as previously defined. Note that the technical change time trend has been omitted (since it is near impossible for one to identify technical change over a 29 month period).

Thus we have a *fixed effects panel data model* where there are 21 unknown parameters to be estimated from a sample size of 3,625 observations.

4.3 Econometric results for the total cost function for DCs

The model in equation (9) is estimated using similar econometric methods to those used in the previous section. That is, we correct for serial correlation and have chosen to report *panel–corrected standard errors*, where the standard errors have been corrected for cross–sectional heteroskedasticity.

The econometric results are reported in table 3, where we observe that the majority of estimated coefficients have t–ratios in excess of 1.96, indicating that they are statistically different from zero at the five percent level of significance. The R–Square is 43.2 per cent, which is lower than that obtained in the MC analysis. This is as expected, given the larger variability across DCs and the omission of cross–sectional dummy variables in the DC model.

We now discuss the first–order coefficients of the three output variables. All three output coefficients have the expected positive signs, implying that extra output incurs extra costs. The estimated coefficient of the ART output is 0.225, implying that a 1 per cent increase in articles delivered will lead to a 0.225 per cent increase in costs (all else held constant), at the sample mean. The corresponding coefficients of PTS and DIS, are 0.137 and 0.145, respectively, implying elasticities at the sample means of 0.137 per cent and 0.145 per cent, respectively. This implies that DC total costs are affected roughly equally by changes in any one of the three outputs of articles, points and distance.

These results are somewhat different to those in Economic Insights (2014) and our initial results using the interim estimated DC output for the additional 13 months. In those results DC total costs were affected much more by changes in the number of points than by changes in either articles or distance, both of which had a minor implied impact on DC total costs. Further investigation of the reasons for these differences in results revealed a high degree of correlation among the three output variables. Pair–wise correlation coefficients for the three outputs range from 0.85 to 0.96. With 3,654 observations, the critical value for significant correlation using a two tailed test at the 2 per level is around 0.10. This means there is an extremely high degree of correlation among these variables. As a result, there will be a high degree of multicollinearity in the regression. This means that little weight can be placed on the magnitude of individual output coefficients (despite them all being significant in this case). The sum of the output coefficients, however, will still be accurate.

When added together, these three output elasticity estimates provide a total elasticity measure of 0.225+0.137+0.149=0.510, implying that a 1 per cent increase in all outputs will lead to a 0.510 per cent increase in costs. Equivalently, it implies that a 1 per cent *decrease* in all outputs should correspond to a 0.510 per cent *decrease* in costs. This linear combination estimate (0.510) has an estimated standard error of 0.022, producing a 95 per cent confidence interval of (0.466, 0.553).

The above total elasticity measure is of most use when <u>all</u> output measures increase proportionally. Thus, this measure would have been of some interest 10 years ago, prior to the recent substantial impact of emails and similar technologies upon postal volumes. However, given that in recent years the volume of articles are decreasing while the number of delivery points and distance are increasing, the three output elasticities ideally need to be considered individually.

The number of articles delivered by Australia Post peaked in 2007–08 at 5.6 billion articles (Australia Post 2010, p.113) and has since declined by over 21 per cent to approximately 4.4 billion articles in 2013–14 (Australia Post 2013, p.131; Australia Post 2014, p.23). This translates to an average annual decline of around 4 per cent. Combining this with the articles cost elasticity of 0.225, the impact on Australia Post's annual real delivery costs would have been –0.9 per cent. However, as noted above, only limited reliance can be placed on this calculation due to the high degree of multicollinearity present in the regression model.

Over this same 7 year period, however, the number of delivery points Australia Post is required to serve have increased by 7.6 per cent from 10.5 million in 2007–08 to 11.3 million in 2013–14. This translates to an average annual increase of around 1.2 per cent. Combining this with the points cost elasticity of 0.137, the implied impact on Australia Post's annual real delivery costs would have been 0.2 per cent – although this is subject to the same qualification as above.

Table 3: Econometric results for the panel data total cost function for DCs

VARIABLE	COEFFICIENT	ST-ERROR	T-RATIO
ART	0.225	0.015	15.424
PTS	0.137	0.029	4.645
DIS	0.149	0.023	6.396
MO1	-0.060	0.007	-8.792
MO2	-0.117	0.008	-14.496
MO3	-0.049	0.009	-5.325
MO4	-0.054	0.010	-5.480
MO5	-0.047	0.011	-4.369
MO6	-0.092	0.010	-9.191
MO7	-0.056	0.010	-5.528
MO8	-0.069	0.009	-7.294
MO9	-0.061	0.009	-7.063
MO10	-0.040	0.008	-4.882
MO11	-0.073	0.006	-11.832
ART*ART	0.192	0.046	4.161
ART*PTS	-0.128	0.051	-2.477
ART*DIS	-0.066	0.036	-1.801
PTS*PTS	-0.168	0.093	-1.800
PTS*DIS	0.024	0.054	0.438
DIS*DIS	0.119	0.048	2.472
CONSTANT	12.857	0.018	700.900
BUSE R-SQUARE			*0.432*

Only limited information is available on changes in the distance Australia Post delivery officers travel on their rounds. For the 125 DCs included in our analysis, the total distance travelled on rounds increased marginally by 0.14 per cent over the course of 2012–13. Taking this as being representative of the average annual increase over the last 6 years – something which is reasonable given the ongoing growth over this period in the number of delivery points that had to be covered – and combining it with the distance cost elasticity of 0.145, the impact on Australia Post's annual real delivery costs would have been 0.02 per cent, again subject to the same qualification.

Combining the impacts of actual average annual changes in articles delivered, delivery points and distance travelled over the last 6 years, the implied impact on Australia Post's annual real delivery costs is a decrease of 0.73 per cent (=0.225 x (–0.041) + 0.137 x 0.013 + 0.149 x 0.001).

If we look at the actual changes in the latest year, we find that some of the changes observed over the last 7 years tend to moderate a little in 2013–14 although much of this was due to the postage generated by the federal election in that year. For example, between 2011–12 and 2012–13 the number of articles delivered fell by 5.4 per cent while the number of delivery points Australia Post is required to serve increased by 1.8 per cent. Between 2012–13 and 2013–14 the fall in the number of articles moderated temporarily due to the effects of the federal election that year with a fall of 4 per cent and the number of delivery points increased by around 0.9 per cent. Taking the penultimate year as the likely more typical of ongoing trends and combining these annual changes with the estimated real cost elasticities, the impact on Australia Post's annual real delivery costs is an decrease of 0.95 per cent (=0.225 x (–0.054) + 0.137 x 0.018 + 0.149 x 0.001). This compares to an impact on Australia Post's annual real delivery costs of a decrease of 0.76 per cent (=0.225 x (–0.040) + 0.137 x 0.009 + 0.149 x 0.001) in the less typical latest year of 2013–14. These figures are subject to the same qualification given that limited reliance can be placed on the individual output coefficients given the degree of multicollinearity present.

Adding the effect of input price changes using an analogous method to that for MCs, the implied change in Australia Post's annual nominal delivery costs is an *increase* of 0.9 per cent (= –0.0095 + 0.60 x 0.0149 + (1 – 0.6) x 0.0227) in 2012–13 and an *increase* of 1.3 per cent (= –0.0076 + 0.60 x 0.0163 + (1 – 0.6) x 0.0271) in 2013–14.

Returning to the estimated coefficients in table 3, we see the 11 monthly dummy variables are all negative. This is as expected, given that the base month of comparison is December. We expected that costs would be higher in December because of the extra overtime expenditure used in dealing with increased volumes and more hand addressed Christmas cards. For example, the estimated coefficient of MO3 (March) is –0.049, implying that costs in March are 4.9 per cent below those in December (all else held constant), at the sample mean. The other ten monthly dummy variable coefficients are interpreted in a similar manner.

A number of hypothesis tests were also conducted to see if a more parsimonious model could be used to describe these data. We conducted a hypothesis test to see if a Cobb–Douglas functional form was appropriate for these data. The parameter restrictions involved setting the 6 second order coefficients in equation (9) to zero producing a Cobb–Douglas total cost function of the form:

$$rtc_{ijt} = \alpha_0 + \sum_{m=1}^{3} \beta_m y_{mijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt}, \tag{10}$$

The F–test statistic with 6 and 3604 degrees of freedom was 13.950 with a p–value of 0.000, indicating that the null hypothesis of a Cobb–Douglas model cannot be accepted at a 5 per cent level of significance, implying that the translog form is the preferred model.

We conducted a second hypothesis test to see if the 11 monthly dummy variables were a significant addition to the model. The F–test statistic with 11 and 3604 degrees of freedom was 49.703 with a p–value of 0.000, indicating that the null hypothesis of these 11 coefficients being zero could not be accepted at a 5 per cent level of significance, implying that the 11 monthly dummy variables were a significant addition to the model.

4.4 Econometric estimation of a variable cost function for DCs

The above estimates for a total cost function provide elasticity estimates that assume that all costs (including capital costs) can be varied when output varies. Hence, they provide an estimate of how costs can be varied in the long run, when there is sufficient time to adjust quantities of capital.

In the short run, one is unable to easily adjust capital inputs, and hence it is of interest to also estimate a variable cost function, where the dependant variable is variable costs (total costs minus capital costs). This function will allow us to estimate the degree to which variable costs respond to output changes (with capital quantity held fixed).

To define our new model we define the additional notation:

RVC = real variable costs (measured using real labour and other costs),

CAP = capital quantity (measured using real capital costs).

and once again we use lower case notation to define the natural logarithms of variables. For example, $rvc = \log(RVC)$. Note that the real variable cost measure is obtained by deflating nominal variable cost by an aggregate input price index, where the sample mean input cost share weights are 80 per cent and 20 per cent for the wage index and CPI, respectively.

Our translog variable cost function is then defined as:

$$\begin{aligned} rvc_{ijt} = {} & \alpha_0 + \sum_{m=1}^{3} \beta_m y_{mijt} + \rho_1 cap_{ijt} + 0.5 \sum_{m=1}^{3} \sum_{n=1}^{3} \beta_{mn} y_{mijt} y_{nijt} + 0.5 \rho_{11} cap_{ijt} cap_{ijt} \\ & + \sum_{m=1}^{3} \psi_{1m} cap_{ijt} y_{mijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt}, \end{aligned} \tag{11}$$

and the Cobb–Douglas becomes:

$$rvc_{ijt} = \alpha_0 + \sum_{m=1}^{3} \beta_m y_{mijt} + \rho_1 cap_{ijt} + \sum_{g=1}^{11} \theta_g DMO_{gijt} + v_{ijt}. \tag{12}$$

4.5 Econometric results for the variable cost function for DCs

The model in equation (11) is estimated using the same econometric methods used in the previous section. That is, we correct for serial correlation and have chosen to report *panel–corrected standard errors*, where the standard errors have been corrected for cross–sectional heteroskedasticity.

The econometric results are reported in table 4, where we again observe that the majority of estimated coefficients have t–ratios in excess of 1.96, indicating that they are statistically different from zero at the five percent level of significance, and the R–Square is an acceptable 52.5 per cent.

We now discuss the first–order coefficients of the three output variables. All three output coefficients have the expected positive signs, implying that extra output incurs extra costs. The estimated coefficient of the ART output is 0.198, implying that a 1 per cent increase in articles delivered will lead to a 0.198 per cent increase in costs (all else held constant), at the sample mean. The corresponding coefficients of PTS and DIS are 0.012 and 0.154, respectively, implying elasticities at the sample means of 0.012 per cent and 0.154 per cent for the number of delivery points and the total distance travelled on rounds, respectively.

These results are again quite different to those in Economic Insights (2014) and our initial results using the interim estimated DC output for the additional 13 months. In those results DC variable costs were dominated much more by changes in the number of points than by changes in either articles or distance. As was the case for the total cost function, there will be a high degree of multicollinearity in the variable cost function regression due to the extremely high degree of correlation among the three output variables. This is manifested in this instance by the points coefficient changing from being dominant and very significant in the earlier results to being very small and insignificant once actual output data are added for the additional 13 months. As a result, little weight can again be placed on the magnitude of individual output coefficients but the sum of the output coefficients will, however, still be accurate.

When added together, these three output elasticity estimates provide a total elasticity measure of 0.198+0.012+0.154=0.364, implying that a 1 per cent increase in all outputs will lead to a 0.364 per cent increase in variable costs. Equivalently, it implies that a 1 per cent *decrease* in all outputs should correspond to a 0.364 per cent *decrease* in variable costs. This linear combination estimate (0.364) has an estimated standard error of 0.025, producing a 95 per cent confidence interval of (0.315, 0.414).

The total elasticity measure in the variable cost function (0.364) is smaller than that obtained in the total cost function (0.510). This is not as expected, given that variable costs are expected to be more "flexible" over the short time frame considered in these data.

However, as discussed above, the total elasticity measure is of most use when <u>all</u> output measures increase proportionally. However, given that in recent years the volume of articles are decreasing while the number of delivery points is increasing, the three output elasticities again ideally need to be considered individually. The extent to which we can do this, however, is limited by the presence of multicollinearity in the regression model.

The first order coefficient of the CAP variable has a value of 0.347 implying that a 1 per cent increase in capital will lead to a 0.347 per cent increase in variable costs (all else held constant), at the sample mean. This positive coefficient is not as one would expect if input substitution between capital and variable inputs was possible. One explanation could be that CBD DCs use less capital because their rounds are either walk rounds or bicycle rounds and also have lower unit costs because they have higher volumes per point. Hence low capital is associated with low costs. Alternatively, having more staff doing deliveries requires more motor vehicles and more indoor space sorting and preparation which leads to capital and variable costs being complements rather than substitutes in this case. This warrants further investigation.

Table 4: Econometric results for the panel data variable cost function for DCs

VARIABLE	COEFFICIENT	ST-ERROR	T-RATIO
ART	0.198	0.014	13.932
PTS	0.012	0.032	0.389
DIS	0.154	0.023	6.681
CAP	0.347	0.026	13.314
MO1	-0.065	0.007	-9.689
MO2	-0.121	0.008	-15.031
MO3	-0.048	0.009	-5.278
MO4	-0.052	0.010	-5.344
MO5	-0.041	0.011	-3.928
MO6	-0.088	0.010	-8.890
MO7	-0.064	0.010	-6.346
MO8	-0.077	0.009	-8.162
MO9	-0.067	0.009	-7.873
MO10	-0.044	0.008	-5.300
MO11	-0.078	0.006	-12.600
ART*ART	0.074	0.056	1.330
ART*PTS	-0.026	0.045	-0.572
ART*DIS	-0.044	0.037	-1.195
PTS*PTS	-0.063	0.098	-0.643
PTS*DIS	-0.042	0.060	-0.701
DIS*DIS	0.153	0.049	3.138
CAP*CAP	0.101	0.044	2.308
CAP*ART	0.006	0.035	0.173
CAP*PTS	-0.097	0.057	-1.705
CAP*DIS	0.031	0.040	0.765
CONSTANT	12.789	0.016	814.900
BUSE R-SQUARE			*0.525*

The estimated coefficients of the monthly dummy variables are similar to those seen in the total cost function, and are interpreted in a similar manner.

Once again, a number of hypothesis tests were also conducted to see if a more parsimonious model could be used to describe these data. We conducted a hypothesis test to see if a Cobb–Douglas functional form was appropriate for these data. The parameter restrictions involved setting the 10 second order coefficients in equation (11) to zero producing the Cobb–Douglas variable cost function reported in equation (12).

The F–test statistic with 10 and 3,599 degrees of freedom was 5.819 with a p–value of 0.000, indicating that the null hypothesis of a Cobb–Douglas model cannot be accepted at a 5 per cent level of significance, implying that the translog form is the preferred model.

We conducted a second hypothesis test to see if the 11 monthly dummy variables were a significant addition to the model. The F–test statistic with 11 and 3,599 degrees of freedom was 54.046 with a p–value of 0.000, indicating that the null hypothesis of these 11 coefficients being zero could not be accepted at a 5 per cent level of significance, implying that the 11 monthly dummy variables were a significant addition to the model.

To summarise, we illustrate the implications of our DC variable cost function findings using the changes observed in output variables between 2011–12 and 2012–13 and between 2012–13 and 2013–14 in the following calculations. Recall that the number of articles delivered fell by 5.4 per cent while the number of delivery points increased by 1.8 per cent and distance travelled increased marginally by 0.14 per cent in 2012–13. We assumed that the quantity of capital used by each DC did not change between 2011–12 and 2012–13. The effect on DC real variable costs of these changes was a decrease in real variable DC costs of 1 per cent (=0.198 x (–0.054) + 0.012 x 0.018 + 0.154 x 0.001 + 0.347 x 0). Going from 2012–13 to 2013–14 the corresponding decrease in real variable DC costs was 0.8 per cent (=0.198 x (–0.040) + 0.012 x 0.009 + 0.154 x 0.001 + 0.347 x 0). These figures are subject to the same qualification given above that limited reliance can be placed on the individual output coefficients given the degree of multicollinearity present.

Adding the effect of input price changes using an analogous method to that for MCs, the approximate change in Australia Post's annual nominal variable delivery costs is an *increase* of 0.6 per cent (= –0.0103 + 0.85 x 0.0149 + (1 – 0.85) x 0.0227) in 2012–13 and an *increase* of 1.0 per cent (= –0.0077 + 0.85 x 0.0163 + (1 – 0.85) x 0.0271) in 2013–14.

5 CONCLUSIONS

The current study provides updated cost elasticity estimates for the conditions Australia Post currently faces. The econometric results update those developed in Economic Insights (2014) and use flexible functional forms, data reflecting the secular decline in postal volumes now occurring and Australia's actual population density, and use comprehensive cost measures covering all postal service inputs. This contrasts with most previous studies which have used simple functional forms, have used data from periods of increasing postal volumes and countries with much higher population densities than Australia, and have often only concentrated on labour costs.

Looking at the effects of the actual output changes observed between 2012–13 and 2013–14 on MC and DC costs, we find that the estimated MC cost elasticities imply that MC real costs would have reduced by 2.4 per cent while DC real costs would have decreased by 0.8 per cent. While the fall in postal article numbers continued in the last year, the increase in the number of points Australia Post is required to serve has continued to increase steadily. Consequently, while MC real costs – which are driven by articles numbers – have fallen, DC real costs have decreased much less because the impact of increased delivery points has partly offset the effects of declining articles numbers. Significant levels of correlation between DC outputs do, however, make it difficult to quantify the exact impact on DC real costs.

Using data supplied by Australia Post on its reserved service operational costs taken from its SAP accounting system, delivery accounts for 62 per cent of reserved service costs, processing (ie MCs) accounts for 19 per cent and other costs such as acceptance and transport also account for 19 per cent. Using this information and assuming that the cost elasticities of other inputs such as acceptance and transport are zero, we conclude that the output changes observed between 2012–13 and 2013–14 in isolation are likely to have decreased Australia Post's reserved service real costs by around 0.95 per cent (=0.62 x (–0.008) + 0.19 x (–0.024) + 0.19 x 0).

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APPENDIX A: MC OUTPUT ITEMS ALLOCATION AND CONVERSION FACTOR MATRIX

Process	CFC	OCR	BCS	MS
AEG OCR - Metro		1		
AEG OCR - Regional		1		
EMS Despatch				8.9
EMS Inbound Opening				8.9
EMS Outbound				8.9
BCS			1	
Cancellation - Face Up Large Letters	1.8			
Cancellation - Face Up Small Letter Bundles	1			
Cancellation - TSC42	1			
Cancellation - TSC81	1			
Cancellation - TSC85	1			
Cancellation - Handstamping Small Letters	1			
Cancellation - Handstamping Small Parcels	8.9			
Cancellation - GG	1			
Cancellation - RAP17 Automatic Tipper	1			
Cancellation - RAP17 Manual Tipper	1			
Competition Mail			1	
Express Post				8.9
FMOCR - With Manual Feeder		1.8		
FMOCR - Without Manual Feeder		1.8		
Flicksort - LL				1.8
Flicksort - SL				1
LL Spectrum 10 - 12 Coding Stations				1.8
LL Spectrum 10 - 15 Coding Stations				1.8
MLOCR		1		
Manual Sort Bullrings				1.8
Manual Sort LL Domestic				1.8
Manual Sort LL Overseas				1.8
Manual Sort LP Domestic (ULD array)				15
Manual Sort SL Domestic (MMF)				1
Manual Sort SL Domestic (VSD/VSF)				1
Manual Sort SL Overseas				1
Manual Sort SP Domestic				8.9
Manual Sort SP Overseas				8.9
SP Spectrum 10 - 15 Coding Stations				8.9
Video Coding LL				1.8
Video Coding SL				1
Dock - Airmail Receipt And Despatch				1
Dock - Empty ULD And Tray Management				1

Process	CFC	OCR	BCS	MS
Dock - General				1
Mail Movement - Express Post				8.9
Mail Movement - Large Letters		1.8		
Mail Movement - Large Parcels				15
Mail Movement - Small Letters			1	
Mail Movement - Small Parcels				8.9
Mail Preparation - Large Letters		1.8		
Mail Preparation - Large Parcels				15
Mail Preparation - Small Letters		1		
Mail Preparation - Small Parcels				8.9
Cancellation - Handstamping Large Letters	1.8			
Non-Processing Hours				1
Mail Movement - TMS Induction			1	
BCS Sequence Two Pass Sorting			1	
BSP Bullring				1
Cancellation - Handstamping Large Parcels	15			
Despatch Consolidation Bullring				1
Dock - Airmail Despatch				1
Dock - Airmail Receipt				1
Dock - Load/Unload Transportation Vehicles				1
Dock Movement				1
Mail Movement - TCS Induction			1	
Manual Sort LP Domestic				15
Manual Sort SL Domestic				1
Print Post Bullring				1
Receipt Streaming Bullring				1
UMS Bullring				1
PSHS - Face Up				15
PSHS - Manual Coding				15
PSHS - Take Off				15
Manual Sort LP Domestic Non Machinable				15
EMS Processing (free) Interstate				8.9
Manual Sort ECI/EPI to Overseas				8.9
Manual Sort EMS Domestic				8.9
Manual Sort Packets Overseas				8.9
BCS Sequence Sorting			1	
TMS		1		
Despatch LC/AO Overseas				8.9
Registered Insured & EPI Documents				8.9
Network Assistance				1
MARS Sequence Sorting			1	
Manual Sort XL Parcels Domestic				15

APPENDIX B: INCLUDED DELIVERY CENTRES

State	Delivery centre	State	Delivery centre
ACT	Canberra North DC	**Qld (cont)**	Noosaville DC
	Canberra South DC		Sandgate DC
			Stafford DC
NSW	Alexandria DF		Tingalpa DC
	Frenchs Forrest DF		Toowong DC
	Hornsby DC		Virginia DC
	Ingleburn DF		Yatala DC
	Kingsgrove DF		
	Kirrawee DC	**SA/NT**	Adelaide City DC
	Leightonfield DF		Darwin DC
	Murwillumbah DC		Edinburgh North DC
	Nepean DF		Gawler DC
	North Ryde DC		Glynde DC
	Seven Hills DF		Kent Town DC
	St Leonards DF		Lonsdale DC
	Strathfield DC		Marleston DC
	Taren Point DC		Melrose Park DC
	Tweed Heads DC		Modbury North DC
			Palmerston DC
Qld	Albion DC		Port Adelaide DC
	Arundel DC		Regency Park DC
	Beaudesert da		Salisbury South DC
	Brendale DC		Somerton Park DC
	Brisbane Cty DC		
	Bundall DC	**Tas**	Burnie DC
	Burleigh DC		Devonport DC
	Burpengary DC		Eastern Shore DC
	Caboolture DC		Kingston DC
	Caloundra DC		Launceston DC
	Capalaba DC		Ulverstone DC
	Cleveland DC		Western Shore DC
	Coorparoo DC		Airport West DC
	Ferny Hills DC		
	Gympie DC	**Vic**	Bacchus Marsh DC
	Kelvin Grove DC		Bayswater DC
	Kenmore DC		Belgrave DC
	Logan City DC		Bentleigh East DC
	Loganholme DC		Braeside DC
	Mansfield DC		Brighton DC
	Nambour DC		Bundoora DC
	Nerang DC		Burwood DC

State	Delivery centre	State	Delivery centre
Vic (cont)	Cranbourne DC	**WA**	Bassendean DC
	Dandenong DC		Bibra Lake DC
	Deepdene DC		Canning Vale DC
	Epping DC		Clarkson Annexe
	Ferntree Gully DC		Gwelup DC
	Gisborne DC		Joondalup DC
	Hawthorn DC		Kelmscott DC
	Heidelberg West DC		Malaga DC
	Hoppers Crossing DC		Mandurah DC
	Melton DC		Midland DC
	Moorabbin DC		Nedlands DC
	Mooroolbark DC		Northam DC
	Mornington DC		Osborne Park DC
	Mount waverley DC		Palmyra DC
	Narre Warren DC		Rockingham DC
	Nunawading DC		Walliston DC
	Port Melbourne DC		Wangara DC
	Preston DC vic		Welshpool DC
	Research DC		West Leederville DC
	Richmond DC		
	Rosebud DC		
	Seaford DC		
	Somerton DC		
	St Albans DC		
	St Kilda DC		
	Sunbury DC		
	Templestowe DC		
	Western Shore DC		