Progress in the Competitive Agenda in the Postal and Delivery Sector

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16. Do differences in facility-specific mail processing unit costs have implications for the cost of the Universal Service Obligation?

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1 INTRODUCTION

It is widely accepted that the hallmark of universal service is ubiquity and uniformity. These traits can be applied to either a mail product, such as a uniform rate throughout the country, or to activities performed by the postal operator (PO), such as delivery six days a week to essentially all customers.[1] Two methods of calculating the cost of the USO are usually employed: the net avoided cost (NAC) method and the entry pricing (EP) method. The NAC measures the loss incurred by the post attributable to providing universal service. The EP measures the financial cost to the post of providing universal service after reducing or eliminating the reserved area. Previous work in this area has linked the cost of the Universal Service Obligation (USO) to the profitability of delivery routes. (Cohen, et al., 1999, 2000; Bradley and Colvin, 2000; Crew and Kleindorfer, 2000; Panzer, 2001) The relatively fixed nature of delivery costs and the large disparity in volumes per address result in wide variation in unit delivery costs across routes.[2] Routes with low unit delivery costs tend to be profitable to serve, while those with high unit delivery cost burden the United States Postal Service (USPS) with net losses.

In these previous analyses, the upstream costs of mail processing are either excluded or assumed to be uniform for all delivery areas. As seen in Table 16.1, mail processing costs make up a large share of total USPS costs. Consequently, they cannot be overlooked in calculating the cost of the USO.

In contrast to delivery, mail processing costs exhibit a very low fixity and therefore the wide range of average unit costs that are driven by volume levels on delivery routes is not expected in upstream activities. However, as seen in Figure 16.1, an examination of average mail processing unit costs by facility contradicts this expectation.

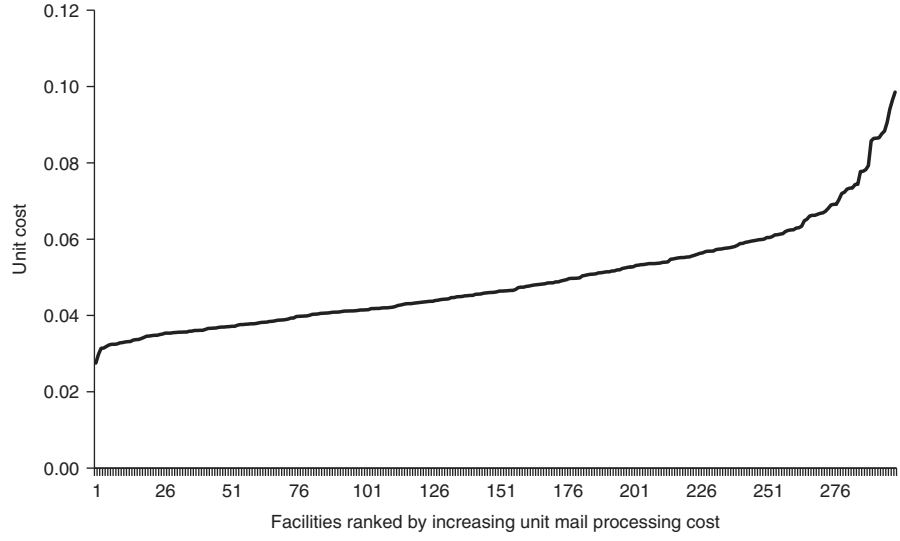
Since these differences are not a result of high fixed costs it could be argued that they should not be reflected in the cost of the USO because USPS may be able to alter standardize operations in the face of competition. However, as noted in the Commission's Advisory Opinion Concerning A Proposed Change in the Nature of Postal Services:

> Not only is the gap in [unit costs] across plants and operations remarkably wide, it has been remarkably durable. During a recent seminar on mail processing costs held at the Commission, a veteran Postal Service costing consultant noted that a roughly three-fold difference in mail

Table 16.1 USPS accrued costs by function (FY2005, in thousands of dollars)

	Accrued cost	Percent of total
Mail Processing	18,861,019	27.5
City Carrier Street Activity	10,603,311	15.5
City Carrier In-Office Activity	5,070,328	7.4
Rural Carrier	5,598,391	8.2
All Other	28,414,615	41.5
Total	68,547,664	100.0

Source: US PRC (2006, Docket No. R2006-1, USPS-LR-L-3).



Source: Postal Regulatory Commission.

Figure 16.1 Variation in USPS unit mail processing cost (FY2007)

> processing [unit costs] among plants has existed since the early 1970s, despite the transformation of mail processing from an all-manual activity to a highly specialized and automated process. (US PRC, 2006, p. 45)

This seems to indicate that there is something inherent in postal operations that lead to this wide variation in mail processing unit costs. Using the USPS as a case study, this chapter investigates how unit mail processing cost differences can impact on the calculation of the cost of the USO regardless of how the USO is defined or what method is used to calculate the cost of it.

The chapter is organized as follows. Section 1 provides background information and a motivation for the analysis. Section 2 sets out the scope and key elements in our approach to broadening an analysis of the costs of the USO. Section 3 describes the construction of the

dataset used in the analysis as well as our analytical approach. Section 4 reports differences in the upstream (mail processing) costs that are counter to the differences in downstream (delivery route) costs identified in past studies – an unexpected and surprising result for us. Section 5 provides some conclusions and policy implications, including the role of upstream mail processing costs in an accurate calculation of the costs of the USO. We find empirical evidence that analyses of either downstream-only or upstream-only costs may be biased in opposite directions. This result has implications for estimating the costs of the USO.

2 DETERMINING THE SCOPE OF THE USO

We shall begin by exploring how the cost differences can be linked to specific facility characteristics identified with the cost of the USO. The first step in this process is to determine what factors are likely to be associated with USO mail. We define the USO as the mandate to deliver mail at a uniform price to all addresses in the United States. Simplistically, the cost of the USO can be defined as the cost of sorting, transporting, and delivering pieces that would not be delivered without said mandate. Rural delivery routes, generally, are as likely to be profitable as urban delivery routes. While some routes designated by USPS as rural routes cover areas that might be more aptly categorized as suburban, the cost (per box and per piece) of rural routes is fairly uniform for all but the least dense (in boxes per mile) quintile of routes. Thus, the driving factor behind the difference in profitability is not urbanicity, but rather the volume per delivery point on the route (Cohen et al., 1993). Therefore, we used the volume of destinating mail per delivery point as another dimension in our analysis.

Ideally, the unit mail processing cost would be identified for each facility by geographic location. Combining these data with accurate mailflows would make it possible to estimate the end-to-end cost of mailpieces flowing through the system from origin to destination. If unit cost data were available by operation at each facility, the end-to-end cost of mailpieces by type and shape, such as cancelled, workshared, letters, flats, and parcels, could also be estimated. If these facility-specific data could be linked to actual delivery routes it would be possible to determine unprofitable mail flows in addition to unprofitable delivery areas. This, in turn, would allow for a deeper understanding of subsidized mail and would result in a more accurate estimate of the costs of the USO. Unfortunately, the data available to us did not have this level of detail. Specifically, we did not know the location of the facilities and were unable to link facilities with delivery routes. Consequently, our analysis was more limited in scope.

3 DATA CONSTRUCTION

The initial dataset had the following quarterly data for FY 2005 for 368 facilities (Bozzo, 2006): identification number, total pieces fed (TPF) by operation, total piece handlings (TPH) by operation, first-handling pieces (FHP) by operation, hours by operation, number and type of post offices served by the facility, volume destinating within the facility's area, number of delivery points by type of delivery unit, and a capitalization index.

The average productive hourly wage rate for mail processing operations and the ratio of indirect to direct costs were available from other data sources. Using these data in

conjunction with each other we were able to calculate for each facility: total volume, average unit mail processing cost, a measure of urbanicity, and volume per delivery point.

Total Volume

For each facility the data included three measures of workload; TPF – the number of pieces fed into each operation, TPH – the number of pieces successfully sorted on each operation and FHP – the number of pieces at each operation that are receiving their first sort at that facility. We use FHP as a measure of total volume because, logically, summing FHP across operations will yield the volume of mail sorted at that facility.[3] Summing TPF or TPH across operations would result in overcounting volume because pieces are often sorted in more than one operation.[4]

The FHP data we used in the analysis exhibited anomalies that were scrubbed for our final analysis. We first removed all observations that had zero hours or zero FHP. We also removed observations with negative or very low hours or FHP. These data were believed to be inaccurate and as we were unable to determine the source of the inaccuracies we believed it best to remove the observations. In some cases, the anomalies were present in only a few of the quarters for which we had data. However, because we were performing our analysis at the facility level we removed all observations for a given facility.

Finally, we performed a *z*-test on the data to identify observations that were more than three standard deviations from the mean. This resulted in the removal of 11 more facilities. Had we been able to determine that these observations were legitimate they would have been retained.

Unit Mail Processing Cost

To calculate the facility-specific unit cost we multiplied the total workhours by the productive hourly wage rate adjusted to include indirect costs. There is a concern with using the average productive hourly wage rate in attempting to isolate facility-specific costs. Ideally, the actual labor costs incurred at each facility would be used. These data, however, were not available to us. The problem is mitigated, however, by the fact that USPS pays a uniform wage across the country. Facility-specific wage differences arise from the seniority of the labor force and the use of casual employees. The percentage of overtime used in each facility would also contribute to differences in labor costs across facilities. To the extent that these factors were known, the calculation of unit costs would be more accurate. Application of the mail processing piggyback factor increases the hourly wage to account for indirect costs. Piggyback factors are ratios of total volume variable costs to volume variable labor costs for functions such as mail processing. In the mail processing case, the total volume variable costs include labor, supervisor, administrative, service-wide benefits, facility- and equipment-related costs, while the volume variable labor costs, in the denominator, are all non-supervisory, non-administrative labor costs.

The total volume variable cost for each facility was divided by FHP to get the facility-specific average unit cost:

$$Hours \times Wage\ Rate \times Piggyback\ Factor\ /\ FHP$$

Table 16.2 Categorization of route types

City	Suburban	Rural
CENT	NDCBU	RB
OTHER	CURB	HCR

Urbanicity

For each facility, the number of delivery points by route type was available in the dataset. Urbanicity was determined by the predominant type of delivery route serviced by each mail processing facility. The type of delivery routes include: curbline (CURB), neighborhood cluster box (NDCBU), central city (CENT), other city (OTHER), rural (RB), and highway contract route (HCR). CURB refers to deliveries made to receptacles that are located at the curb and do not require the carrier to leave the delivery vehicle. An NDCBU is a freestanding unit that serves more than one residential address. These are often installed in new residential developments. Central city refers to any mail-receiving unit, other than NDCBU, in which the carrier has access to more than one individual customer's receptacles by opening only one door. These are primarily located in city apartment buildings. Other includes park and loop and door slot delivery and generally require the carrier to leave the delivery vehicle and proceed on foot. HCR delivery is performed by contractors, not USPS employees. We categorized these types as shown in Table 16.2. The breakdown of delivery points was 44 percent city, 31 percent rural, and 25 percent suburban.

For each facility a city index was created by dividing the percentage of delivery points classified as city for that facility by the highest percentage of city delivery points. For example, for the facility with the highest percentage of city delivery points that percentage was 99.2 percent. The index for that facility is 1. A facility with 45 percent city delivery points would have an index of 0.454 (0.45/0.992). Suburban and rural indices were created in the same manner.

Pieces per Delivery Point (Density)

We used the average number of mailpieces per delivery point as a measure of density. This was calculated by dividing the destinating volume for each facility by the number of delivery points serviced by that facility. As stated above, the analysis would be enhanced if route information were available for each facility. This would enable calculation of profitable and unprofitable routes incorporating de-averaged mail processing costs.

We removed all facilities that had observations with zero destinating delivery volume. Although a unit mail processing cost could be developed for these facilities, we reasoned that they provided intermediate sorting and were therefore not relevant to our analysis which focuses on the mail processing cost at destinating facilities. It should be noted, however, that the costs of these facilities are real costs to the post. If a method for reasonably assigning these costs to other facilities could be developed the analysis would be enhanced. Alternatively, if we were developing a mailflow analysis these costs would be included as intermediate sorts.

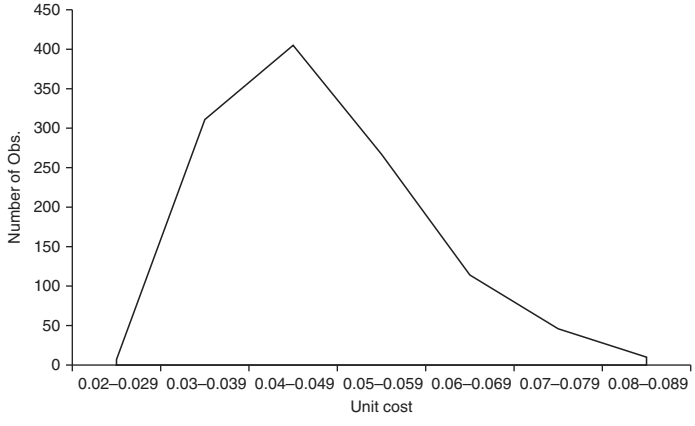


Figure 16.2 Distribution of facility-specific unit costs

4 RESULTS

Facility-specific unit costs ranged from a low of 2.2 cents to a high of 8.8 cents. The average cost is 4.8 cents. As seen in Figure 16.2, the distribution of unit mail processing costs approaches a normal distribution with the majority of observations falling between 3.0 and 6.0 cents.

This suggests that cream-skimming opportunities may exist in areas served by the facilities that fall within the tail. If these facilities are linked to areas where profitability on the distribution side is high (generally characterized by high volume per delivery point) they will be particularly attractive to competitors. To determine whether or not this potential cream-skimming opportunity exists, we compared the characteristics of the facilities that had unit costs above 6.0 cents with the averages for all facilities. The results are given in Table 16.3.

It can be seen that the facilities with unit costs above 6.0 cents have three key characteristics in common. They have a high percentage of city delivery points; 16 percentage points higher than the average. They have relatively more pieces per delivery point; 8 percent higher than the average; and a higher overall volume than the average facility. It would appear that if a competitor could undercut the 6.2 cent mail processing cost, a cream-skimming opportunity does exist.

To illustrate how these data impact on the analyses of the cost of the USO we shall construct a very simplified example (Box 16.1). In this example, we shall assume that the delivery route serves only local mail.[5] This assumption allows us to use the average mail processing unit cost produced in our analysis without having to adjust it for processing in other facilities. For illustrative purposes only this assumption is reasonable. Assume the following for Delivery Route A: (a) 500 delivery points, (b) fixed costs of the delivery, (c) route are \$1500, (d) variable delivery costs are 4.5 cents per piece, and (e) revenue is 10 cents per piece. Therefore, the number of pieces on the route is 231,500 (463 × 500); the revenue for the route is \$23,150; and the variable delivery costs equal \$10,418 (0.045 × 231,500). The mail processing costs vary depending on whether the system-wide average unit cost or the facility-specific average unit cost is used. Using system-wide average mail

Table 16.3 Characteristics of facilities with average mail processing costs above 6 cents

	> 6.0 cents	All facilities
Average MP unit cost	6.2	4.8
Percent rural	18%	24%
Percent suburban	24%	36%
Percent city	57%	41%
Pieces per delivery point	463	427
Total volume (millions)	240	169

BOX 16.1 EXAMPLE 1

	Using system-wide average assumption	Using facility-specific assumptions
Pieces per delivery point	463	
Delivery points on route	500	
Pieces per route	231,500	
Revenue per piece	0.1	
Total revenue	$ 23,150	$ 23,150
Variable delivery cost per piece	–0.045	
Total variable delivery costs	$ (10,418)	$ (10,418)
Fixed delivery cost	$ (1,500)	$ (1,500)
Unit mail processing cost	–0.048	–0.062
Total mail processing	$ (11,112)	$ (14,353)
Net profit	$ 121	$ (3,121)

processing costs results in Delivery Route A exhibiting a profit whereas using facility-specific mail processing costs results in a loss.

To determine whether the average mail processing unit cost differed by facility type we calculated it by quintile, quartile, and tertile. Inequality formulas were set up based on the constructed density and urbanicity (rural, suburban, and city) indices. For example, for a plant to be considered a 'rural' plant observation, the rural index had to be a value greater than or equal to the rural quantile used, and less than or equal to both the corresponding suburban and city index quantiles. The same inequalties with quantile cut-offs were used when adding density to the analysis. Table 16.4 displays the average unit costs for the plants falling into each density/urbanicity category.

In all cases, facilities that had fewer pieces per delivery point (lower density) exhibited lower mail processing unit costs than facilities with more pieces per delivery point. There could be several reasons for this somewhat surprising result. Sparse delivery density may

Table 16.4 Average unit mail processing cost matrix (cents)

	Rural	Suburban	City
	By tertile		
Dense	4.7	5.1	6.2
Sparse	4.1	3.5	5.3
	By quartile		
Dense	4.6	4.8	5.6
Sparse	4.3	4.5	5.2
	By quintile		
Dense	4.7	5.1	5.8
Sparse	4.2	3.9	5.8

Table 16.5 Population and wage differences

	Washington	Sioux City	USPS
Population	8,241,912	156,158	N/A
Average wage – all occupations ($)	54,300	32,550	48,000

Sources: US Census Bureau, Bureau of Labor Statistics, Payscale 2008 Salary Reports.

indicate facilities located in areas of the country with less population, particularly for facilities classified as rural or suburban. Often these areas have less robust economies than more highly populated areas. USPS's uniform wage rate means that a wage premium exists in some geographic areas but not in others. Table 16.5 illustrates differences in population and wages for the Washington, DC and the Sioux City, IA metropolitan areas. As can be seen, a USPS employee earning the national average USPS salary earns $15,450 more than the average employee in Sioux City and $6,300 less than the average employee in Washington, DC. In areas where USPS provides a wage premium turnover may be lower and the overall quality of the workforce may be higher. Consequently, productivity may be higher and unit costs lower. Another possible explanation is that facilities in areas with lower delivery density may have less-complex sorting schemes. Fewer scheme changes may also result in higher overall productivity.

Facilities classified as city had higher unit mail processing costs than both rural and suburban facilities. Again there may be several reasons for this. City facilities are more likely to be older and have less-efficient layouts than suburban or rural facilities. Inefficient layouts, such as multi-stories, contribute to lower productivity because movement of mail between operations is inhibited. As discussed above the wage premium would tend to be lower in urban areas versus non-urban areas. A further possible explanation was mentioned briefly by Fenster et al. (2008). Here the authors found that productivity may be affected by a facility's ability to schedule arriving and departing mail efficiently (Moriarty et al., 2007; Fenster et al., 2008). Scheduling problems may be more acute in city facilities due to road congestion and limited dock space.

Regardless of the reasons for the differences, the variation in unit mail processing costs

BOX 16.2 EXAMPLE 2

	Using system-wide average assumption	Using facility-specific assumptions
Pieces per delivery point	427	
Delivery points on route	500	
Pieces per route	213,500	
Revenue per piece	0.1	
Total revenue	$ 21,350	$ 21,350
Variable delivery cost per piece	–0.045	
Total variable delivery costs	$ (9,608)	$ (9,608)
Fixed delivery cost	$ (1,500)	$ (1,500)
Unit mail processing cost	–0.048	–0.035
Total mail processing	$ (10,248)	$ (7,473)
Net profit	$ (6)	$ 2,770

impact on the calculation of the cost of the USO. Using the same assumptions as example 1 we calculate the profitability of Delivery Route B, a sparse suburban route (Box 16.2). We substitute the system-wide average number of delivery points for the number used in example 1, and the mail processing unit cost from the tertile analysis above. We see that in this case a route that would have been deemed unprofitable using the system-wide average unit mail processing cost becomes profitable under the facility-specific method.

5 CONCLUSIONS

The unit cost of mail processing varies significantly across USPS facilities. Some of these differences appear to be correlated with facility traits such as urbanicity and pieces per delivery point. When these upstream cost differences are compared to the downstream cost differences found in previous studies of the USO, the results are surprising. Our analysis showed that mail processing costs in rural areas were lower, sometimes substantially so, than in city areas. These results contradict the previous belief that rural routes are more likely than city routes to be unprofitable.

Other studies based on downstream costs found that costs are higher in areas with lower density, while the empirical results of our upstream cost study reveal the opposite. This is not a result we had expected to find when we embarked on this research. We anticipated higher costs in sparse areas that would support the widely accepted approach to calculating the costs of the USO by adding an average or proportional mail processing costs to delivery route costs.

The unpredicted differences revealed in this investigation have implications for

calculating an accurate and complete cost of the USO. Moreover, these implications appear to be true regardless of the manner in which costs are calculated. For example, using the NAC approach, if the unit mail processing cost is known for each facility it is theoretically possible to accurately estimate the end-to-end cost of mailpieces by type, such as single-piece correspondence, bill payment, advertising, and so on. It would also be possible to determine unprofitable mail flows. Identifying unprofitable mailflows, rather than unprofitable delivery areas, allows for a more accurate estimate of the costs that would be avoided if the USO were eliminated.

Under the EP model, having an accurate measure of the cost of mail pieces as they flow through the system allows for better estimation of the net revenue that would be lost if the reserved area were eliminated or reduced. It also highlights geographic areas that may be particularly vulnerable to cream-skimming by identifying areas where the unit mail processing costs are high. If mail processing unit costs are high in dense delivery areas where there are many profitable distribution routes the opportunity to cream-skim may be enhanced. This is an interesting new wrinkle, for example, USPS may be vulnerable on delivery in dense areas, which is well known. However, USPS may also be vulnerable on the mail processing (upstream) side in these areas, making end-to-end competition even more likely. This is particularly true when viewed in the light of Panzar's (2001) finding that the sunk costs for postal services are relatively low, resulting in low barriers to entry.

NOTES

1. There are some very limited areas of the United States that do not receive a six day a week delivery.
2. For example, the summary in Bernard et al. (2002) shows for FY 1999 data that USPS average delivery costs for the highest cost 10 percent of their routes were about four times greater than for the lowest cost 10 percent of their routes.
3. It is important to note that while FHP may reflect a more accurate measure of total plant volume than either TPH or TPF, it is not error free. It is true that FHP mail are counted only once in a plant before being staged for first-piece sorting operations, however, FHP counts are estimated using scales that weigh and convert mail to piece counts using national conversion rates. Due to this reliance on weighing and converting, measurement error can occur in FHP counts. Mainly, errors in FHP counts occur when national conversion factors are not up to date or when plants are slow in implementing new conversion factors. Also, mail weight can vary based on location and time of year due to factors such as humidity.
4. If we were developing a mailflow analysis, a cost per sort could be calculated using TPH and applied to the number of sorts particular types of mail receive.
5. While this is a simplifying assumption, it should be noted that local mail has been increasing over time. The USPS has estimated in N2001-1 that 40–50 percent of plant workload is turnaround mail, which is up from a 25–40 percent turnaround estimate in R2001-1. This increase has occurred due to expanded postal product offerings, dropshipping and worksharing opportunities, and improved service quality for products.

REFERENCES

Bernard, Stephane, Robert Cohen, Matthew Robinson, Bernard Roy, Joelle Toledano, John Waller and Spyros Xenakis (2002), 'Delivery cost heterogeneity and vulnerability to entry', in Michael A. Crew and Paul R. Kleindorfer (eds), *Postal and Delivery Services: Delivering on Competition*, Boston, MA: Kluwer Academic, pp. 169–84.

Bozzo, A. Thomas (2006), Direct Testimony (USPS-T-12) and sponsored Library References, PRC Docket No. R2006-1.

Bradley, Michael D. and Jeff Colvin (2000), 'Measuring the cost of universal service for posts', in Michael A. Crew and Paul R. Kleindorfer (eds), *Current Directions in Postal Reform*, Boston, MA: Kluwer Academic, pp. 29–46.

Cohen, Robert H., William W. Ferguson, John D. Waller and Spyros S. Xenakis (1999), 'An analysis of the potential for cream skimming in the United States residential delivery market', in Michael A. Crew and Paul R. Kleindorfer (eds), *Emerging Competition in Postal and Delivery Services*, Boston, MA: Kluwer Academic, pp. 141–57.

Cohen, Robert H., William W. Ferguson, John D. Waller and Spyros S. Xenakis (2000), 'Universal service without a monopoly', in Michael A. Crew and Paul R. Kleindorfer (eds), *Current Directions in Postal Reform*, Boston, MA: Kluwer Academic, pp. 69–88.

Cohen, Robert H., William W. Ferguson and Spyros S. Xenakis (1993), 'Rural delivery and the Universal Service Obligation: a quantitative investigation', in Michael A. Crew and Paul R. Kleindorfer (eds), *Regulation and the Nature of Postal and Delivery Services*, Kluwer Academic, pp. 161–76.

Crew, Michael A. and Paul R. Kleindorfer (2000), 'Liberalization and the Universal Service Obligation in postal service', in Crew and Kleindorfer (eds), *Current Directions in Postal Reform*, Boston, MA: Kluwer Academic, pp. 3–28.

Fenster, Lawrence, Diane Monaco, Edward S. Pearsall and Spyros S. Xenakis (2008), 'Are there economies of scale in mail processing? Getting the answer from a large but dirty sample', in Michael A. Crew and Paul R. Kleindorfer (eds), *Competition and Regulation in the Postal and Delivery Sector*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 315–37.

Moriarty, Richard, Sophie Yorke, Greg Harman, John Cubbin, Meloris Meschi and Paul Smith (2006), 'Economic analysis of the efficiency of Royal Mail units and the implications for regulatory policy', in Michael A. Crew and Paul R. Kleindorfer (eds), *Liberalization of the Postal and Delivery Sector*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 165–82.

Panzar, John C. (2001), 'Funding Universal Service Obligations: the cost liberalization', in Michael A. Crew and Paul R. Kleindorfer (eds), *Future Directions in Postal Reform*, Boston, MA: Kluwer Academic, pp. 101–15.

US Postal Regulatory Commission (PRC) (2006), 'Evolutionary Network Development Service Changes Advisory Opinion Concerning a Proposed Change in the Nature of Postal Services', Docket No. N2006-1.