Delivery Cost Heterogeneity and Vulnerability to Entry*

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1. INTRODUCTION

Virtually every post in an industrialized country delivers monopoly products everywhere at a uniform price in spite of large differences in the cost of serving different geographic areas. This raises the possibility of an entrant competing successfully even though it has higher costs than the incumbent. A simple example illustrates this. Suppose a post serves a country composed of two areas and its cost to deliver a piece of mail in one area is five cents and is 15 cents in the other. A breakeven post with a uniform tariff would charge its average cost of 10 cents a piece for delivery throughout the country. If a less efficient entrant's cost for serving the low cost area were six cents a piece, it could charge less than 10 cents in that area and be profitable. Each piece of mail that the entrant delivered would raise the average cost of delivery in the country. C*eteris paribus*, inefficient entry means that the total resources required to deliver mail increases.

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* **The views expressed in this paper are those of the authors and do not necessarily represent the opinions of La Poste or the Postal Rate Commission**

If in the above example the cost had been nine cents in the low cost area and 11 cents in the high cost area, it would be much more difficult for inefficient entry to occur. Delivery cost heterogeneity is an essential condition for inefficient entry and the degree of the heterogeneity would play an important role in determining the vulnerability to inefficient entry.[1]

The delivery function is the most important source of inherent cost differences between the geographic areas served by a post and, indeed between posts themselves. This paper explores the reasons that underlie differences in delivery costs among geographic areas. We do this by comparing delivery costs in two diverse countries: France and the U.S. We think that international comparisons can lead to important insights.

We first present demographic and postal delivery characteristics for the two countries. This leads us to develop the concept of postal density as a measure that reflects the impact of these characteristics on delivery costs. We examine differences in postal density for rural areas and for densely populated areas to identify the effect of different delivery practices in each country. A comparison is then made of the heterogeneity in delivery costs for France and the U.S. We proceed to explore the relative roles of postal density and volume as delivery cost drivers. Finally, we compare the engineering and econometric approaches used to estimate unit delivery costs for France and the U.S., respectively, over reasonable ranges of the delivery cost drivers. The data used for the analysis are described in the Appendix.

2. SOME BASIC COMPARISONS

It would seem that the variation of delivery costs within the U.S. would be greater than in France. Population density in the former ranges from very high (New York City) to very low (Wyoming and Montana). France, on the other hand, has densely populated cities but no areas as sparsely settled as in the United States.[2] Surprisingly, however, we will find that France has a greater variation in delivery costs.

France has 109 persons per square kilometer and the U.S. has 30. A greater percentage of the French population lives in cities, while a larger percentage of the U.S. population lives in suburbs. The distance between delivery points in France is much smaller than in the U.S. and, consequently, the modes of delivery are very different, as can be seen in Table 1.

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[1] The conditions for competitive entry depend on several other factors as well [Cohen et al. (2000), Cremer et al., (2000)].

[2] The population density (people per square kilometer) of the five least densely populated states in the continental U.S. are Wyoming 1.8, Montana 2.1, South Dakota 3.5, North Dakota 3.6 and Nevada 4.2. The population density of the two least populated departments of France, Creuse and Lozère, is 14 persons per square kilometer.

Table 1: Comparison of Mode of Delivery by Route in France and the U.S.

	France (Percent of Routes)	U.S. (Percent of Routes)
Foot	14 %	6 %
Bicycle/Motorbike	48	0[a]
Park and Loop[b]	N/A	39
Automobile[c]	38	55

[a]Rounds to less than one percent
[b]Park and loop refers to a route where the carrier parks his or her vehicle and serves a group of houses on foot, returns to the vehicle and drives to another location where the process is repeated.
[c]Automobile includes small trucks.

The geographic concentration of the French population permits much more efficient delivery by foot or bicycle than in the U.S.[3] In France only carriers serving rural areas use automobiles but in the U.S. it is the primary means of delivery. The quality of delivery service is also higher in France where all delivery is to a building. In the U.S. delivery is made to buildings and also to curbside mailboxes (in cities and suburbs) and to rural roadside mailboxes. This allows the carrier to place mail in the mailbox directly from the vehicle. In addition, in U.S. rural areas carriers serve principal roads only and residents who do not live on the carrier's line of travel must place their mailboxes on that road. This frequently results in roadside boxes being clustered where the carrier's line of travel intersects with roads not on the line of travel. These boxes are less expensive to serve than if they were spread out along the intersecting road.

Unlike France the U.S. also makes extensive use of kiosks for delivery.[4] They allow more efficient delivery because the carrier makes only one stop to deliver to several addresses (commercial or residential). This requires recipients to walk some distance from their homes or offices to the kiosk to collect their mail. Eight and a half million addresses or seven percent of the total addresses served have mail delivered to kiosks.

3. POSTAL DENSITY

The variable cost of delivery depends on volume delivered, thus the comparison of variable costs between France and the U.S. is straightforward. It might seem that population density could be used to compare differences in the fixed cost of delivery. We have seen, however, that population density is not the only explanation for fixed cost differences. The fixed cost of

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[3] The smaller volume per capita for France (320 in 1999) in comparison to the U.S. (739) also contributes to efficient delivery by foot or bicycle.

[4] Kiosks are free standing structures containing locked mailboxes (as few as three or four and as many as sixty or so). They are called "neighborhood delivery centralized box units."

delivery (called route time in U.S. delivery cost analyses),[5] is accounted for by the need for the carrier to move from one stop[6] to another whatever the mode of delivery. Therefore we use "postal density" as the driver of fixed costs.

Postal density is the number of delivery points that can be visited by the carrier in one hour of time, excluding loading time and the variable portion of access time and the variable portion of travel time to and from the route. It renders endogenous all of the physical characteristics of the route including the mode of delivery, the "grouping-ratio" (addresses per stop), and the difficulty of accessing the buildings.[7] This measure also makes comparison possible in spite of the differences in quality of delivery service.[8]

Delivery to a multiple address building or to a multiple address kiosk means that the fixed cost of traveling to that stop is spread among the several addresses which receive mail there. The concept of postal density conveniently expresses the cost consequences of both multi-address buildings and multi-address kiosks. We will see below that the variations in postal density are different from variations in population density. Postal density is a measure that contains two dimensions: exogenous cost drivers such as geographic and demographic characteristics of the areas served, and endogenous drivers reflecting the quality of delivery service. On the endogenous dimension, postal density could in principle be "tuned" by the postal operator by adjusting quality of service. Of course, an increase in postal density would require a reduction in the quality of service that may not be compatible with the way universal service obligations are defined in a country.[9]

3.1 Comparison of French and U.S. Postal Densities

Table 2 compares French and U.S. postal densities at various quantiles. The French postal density is higher at every quantile, but the ratio is strikingly high at the 95th and 90th quantiles where it exceeds 3 to 1. On average the French postal density exceeds the U.S. by a ratio of 2.5 to 1. This is somewhat less than the ratio of population density between France and the U.S. which is 3.6 to 1.[10]

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[5] S*ee* PRC Docket No. R2000-1.

[6] A stop can serve one or more addresses.

[7] It also gives a better view of the parts of the country that are actually populated. Totally deserted areas are not reflected in this driver.

[8] We mean by "quality of delivery service" such things as door, curbside or roadside line of travel delivery. The term as used here is not meant to include frequency of delivery.

[9] The ability of an operator to adjust quality of delivery service can be affected by the applicable postal law in each country. For example, French law requires delivery to the door. This level of delivery service, treated as a universal service obligation in France, is primarily defined by history and tradition. Thus, delivery quality (and therefore postal density) can in theory be tuned by the operator but in practice may be constrained by law.

[10] Part of the reason that the U.S. postal densities have such low values with a narrow range may be due to stale data. The USPS determines the amount of current carrier time based on the percentages of time spent in route and load activities calculated with data collected in 1985. New data may show an increase in variable load time to reflect the increased use of kiosks and a decrease in route time. This would produce higher postal densities.

Table 2: Postal Density Comparison with Routes Ranked by Postal Density

Quantile	France	USA	Ratio
95%	802	229	3.5
90	599	184	3.3
75	256	140	1.8
50	135	94	1.4
25	78	67	1.2
10	57	46	1.3
5	50	35	1.4

3.2 Rural Areas

Postal densities in rural areas of France and the U.S. are very different owing to the quality of service. We have found that the postal density in France of the 10 percent of addressees with the lowest population density is 46 while it is 89 in the equivalent areas of the U.S. This is remarkable in light of the much lower population densities in the U.S. Addresses in the most rural areas of France are much closer together than in the equivalent areas of the U.S. A French carrier must, however, turn into the farmer's driveway and proceed to the dwelling. Once there, he or she must alight from the vehicle and proceed to the mailbox, then return to the vehicle, turn it around and proceed to the road. In the U.S. the carrier remains on the road, stops at a roadside mailbox and places mail in it without leaving the vehicle.[11] This contributes to the affordability of postage in the U.S. Each country has made a different cost/service tradeoff, which is reflected in each country's concept of universal service.

Within the U.S. it is surprising that the average postal density of the bottom quartile of routes (ranked by cost) is lower than the postal density for the rural routes serving the least densely settled 10 percent of the population (50 versus 89). This is because rural routes in the U.S. have a higher postal density than most park and loop city routes and business routes. This in turn indicates the greater efficiency of delivering mail to roadside mailboxes compared to walking to the front door of a detached dwelling or business. Park and loop routes serve cities and their inner suburbs while curbline routes serve the outer suburbs. Thus, the postal density of carriers' walking between nearby stops is lower than that of carriers' driving between greatly separated stops. The postal density of 89 addresses per hour for the most rural population corresponds to roadside mailboxes that are 280 meters apart (on average). Many detached houses in cities are as close as 20 meters apart. In France, the bottom decile of routes ranked by population density averages 46. The average distance between two stops is around 400 meters, and the delivery to the door increases time between two stops.

[11] Moreover, on many roads served by rural carriers, mailboxes must be placed on only one designated side of the road. This relieves the carrier from the need to travel back down a road to serve curbside boxes on the other side of the road.

3.3 Densely Populated Areas

At the extreme, U.S. population densities are as high as French population densities. For example, Table 3 shows that the inner area of New York has a higher population density than that of Paris. But on average U.S. population densities are much lower as indicated in Table 3 which shows that the urbanized area of Paris is much more densely populated than that of New York.

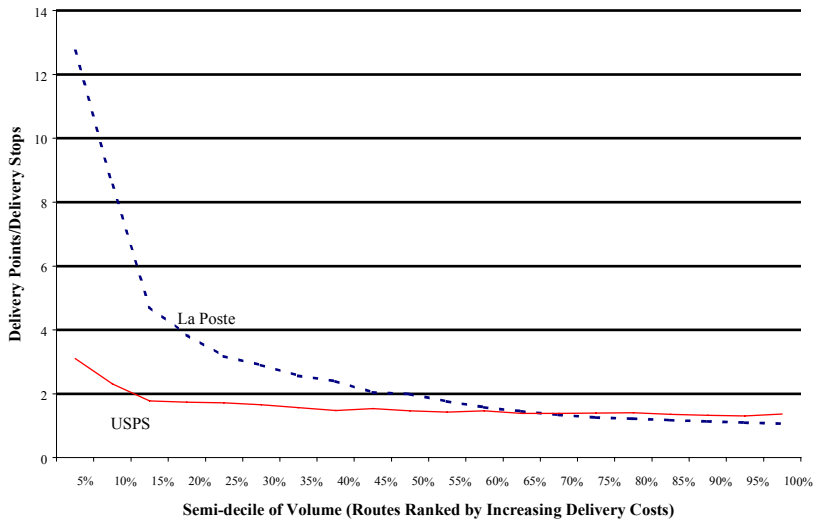
Table 3: Population and Population Density in New York and Paris[a]

	Paris		New York	
	Population (thousands)	Population per Sq. Kilometer	Population (thousands)	Population per Sq. Kilometer
Inner Area[b]	2,106	20,047	1,488	26,105
Urbanized	9,645	3,540	16,044	2,086

[a]Data Source: Demographia 2001
[b]Ville de Paris for Paris and the borough of Manhattan for New York

This is reflected in the ratio of multi-address stops to single address stops in the two countries. Figure 1 displays this relationship.[12] It shows the ratio of delivery points to stops ranked by cost. At the left side of the graph where volume is least costly to deliver we find the most multiple address stops. As the ratio of points to stops decreases, mail gets more expensive to deliver. La Poste has a much higher ratio of multiple address stops than the USPS.

Figure 1: Ratio: Delivery Points to Stops

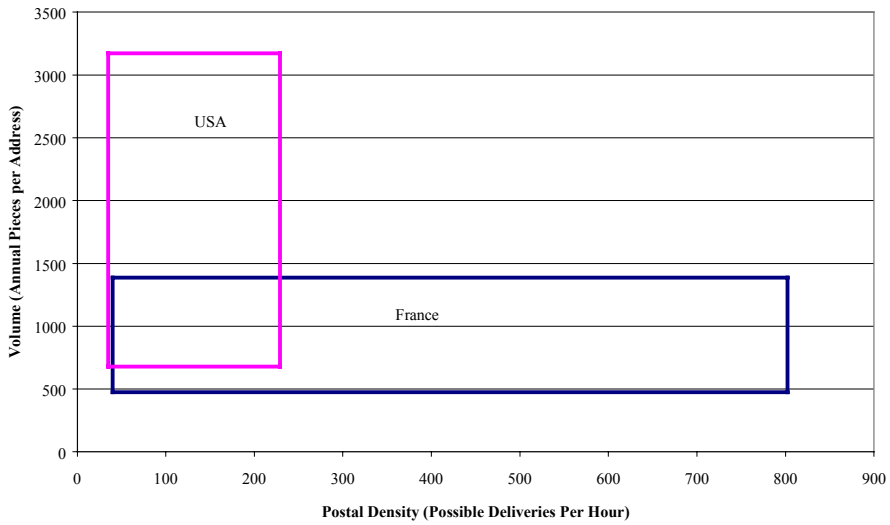


[12] Figure 1 contains data for USPS city carriers only.

3.4 Comparison of Variation in Postal Density and Volume

Figure 2 displays the range of postal density and annual volume per address that encompass approximately 90 percent of the routes in France and the United States. It shows much greater variation in French postal densities than for the U.S. and much smaller variation in volume per address in France than in the U.S. The area of overlap is quite small relative to the ranges for each country. The greater variation in volume per address in the U.S. is probably due to the fact that mail volume and income are highly correlated and the fact that the U.S. has a much larger variation in income per household than France.[13] The smaller variation in U.S. postal densities is due to differences in the quality of delivery service which dampen the impact of low population density on many routes. Because France has a uniform quality of delivery, its postal density differences are much greater.

Figure 2: Range of Postal Densities and Volumes for France and USA



4. HETEROGENEITY AND RELATIVE VULNERABILITY TO INEFFICIENT ENTRY

Figure 3 displays the distribution of normalized French and U.S. delivery costs for each semi-decile of volume (or traffic) when routes are ranked from least to most costly. To protect commercially sensitive data and to facilitate comparison we display normalized costs and not actual unit costs.[14] All unit costs are displayed relative to the mean of the distribution of unit costs. For purposes of this analysis we discard the first and last semi-deciles for each country because the observations upon which they are based contain data of questionable accuracy.

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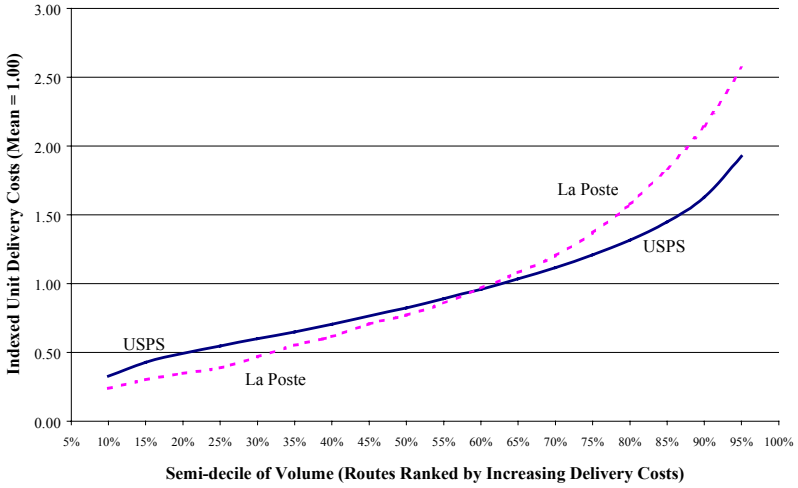
[13] *See* Cohen, et al., (2002).

[14] Unit costs refer to carrier street time measured in seconds per delivered piece. Time is an international currency and facilitates cost comparisons.

Figure 3: Comparison of Unit Delivery Costs of La Poste and USPS



We see that the range of the French distribution is greater than the U.S. distribution. The former begins with a cost of 0.24 (relative to the mean) and ends with a cost of 2.57 (relative to the mean). The U.S., on the other hand, begins with a cost of 0.33 and ends with a cost of 1.93. The standard deviation of the normalized French distribution is half again as large as the normalized U.S. distribution (0.67 vs. 0.44). Thus, the French distribution is more heterogeneous than the U.S. distribution.

Vulnerability to inefficient entry can be addressed using delivery cost heterogeneity. Some indicators of vulnerability are: the percentage of the volume that has a unit cost less than half the mean, the size of the area between actual costs and the average cost, and the average slope of the cost curve. These are based on the conjecture that an entrant would seek to compete where the unit delivery cost was very low while using the uniform tariff as an umbrella price. These measures of vulnerability make sense, of course, only with a uniform tariff constraint, and more generally when geographical cost oriented tariffs are not applied.

Figure 3 reveals that in France 33 percent of the volume has a cost less than half the mean while in the U.S. only 20 percent of the volume is below this threshold. *Ceteris paribus,* France is more vulnerable to inefficient entry. Another relevant factor would be the geographical concentration of the low cost volume. We believe that the low cost volume is scattered over perhaps a hundred or more U.S. metropolitan areas while in France the volume is concentrated in relatively few cities. Thus, it would be far easier for an entrant to market its alternative service in France than in the U.S. In addition, France has about half the per capita volume of the U.S. giving it less economies of scale. This means that the consequence of volume erosion would be greater in France than in the U.S. There are, of course, other relevant factors affecting entry such as wage premium, efficiency of operation and classification efficiency.[15]

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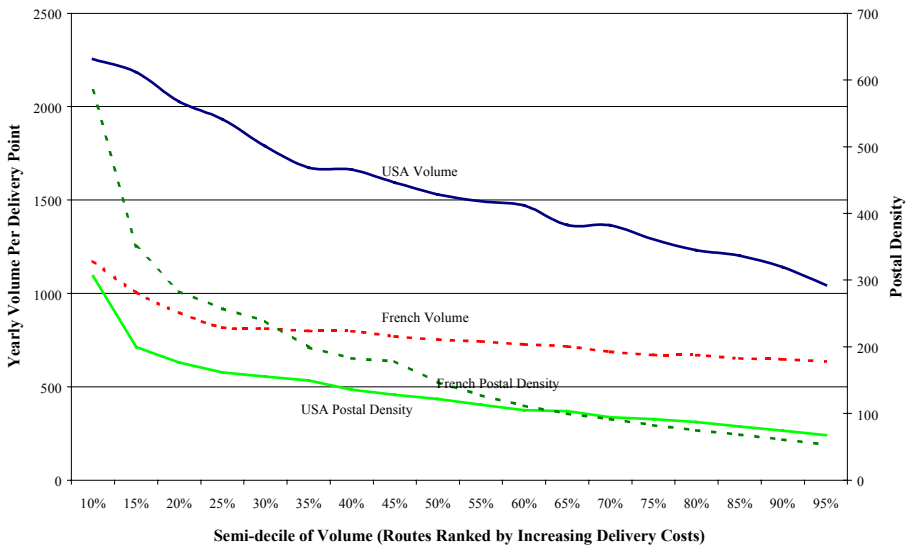
[15] *See* Cohen, et al., (2002).

Figure 4 compares French and U.S. traffic and French and U.S. postal densities when routes are ranked by cost. We see that in both countries the volume for the least costly areas is approximately twice that of the most costly areas. Thus, the volume range for both is about two to one. The range of postal density is much greater for both countries. The maximum is eleven times the minimum for France and 4.5 times the minimum for the U.S. The greater variation in French postal density leads to a greater variation in French unit costs relative to the U.S. As discussed below, the lower French volume magnifies the impact on unit cost from the variations in postal density.

Figure 4: Volume Per Delivery Point and Postal Density



The different ranges in postal density and volume when routes are organized by cost rather than organized by postal density or volume (as displayed earlier in Figure 2) demonstrate the interaction of postal density, volume, and delivery costs. In particular the actual volume ranges shown in Figure 2 are much greater than the two to one ratios observed in Figure 4.

Figure 4 displays an interesting phenomena in that for the most costly 35 percent of the routes the postal density in France is lower than in the U.S. This is due to the fact that in the U.S. the most sparsely populated areas do not correspond to the highest cost routes. This is partly explained by the line-of-travel requirement, which greatly reduces the cost of delivery in areas with low population density. Moreover, in the U.S. the routes with the lowest postal density are not the routes with the lowest traffic.[16] In France, on the contrary, routes with the lowest postal density have the lowest volumes. This also explains why there is greater heterogeneity in costs in France than in the U.S.

[16] This is probably linked with a wealth effect, as volumes are driven by the wealth of the recipient (see Kolin and Davis (1999), Berthelemy and Toledano (2000)).

5. INTERACTION OF THE COST DRIVERS

In this section we examine the impact of changes in postal density and volume per address on the average cost in each country. French average costs are derived from an engineering model mentioned in the Appendix and described in detail in Roy (1999).

The U.S. average costs are derived from an econometrically estimated translog equation of street time.[17] The equation relates street time to volume per address, postal density, and the number of addresses. The number of addresses is set as a "control" variable in the equation, allowing us to develop average costs.

Table 4 presents La Poste and USPS normalized street delivery costs for each combination of quartiles of low, medium and high postal densities and volumes per address. Data for each country are presented, with the U.S. values immediately below the French values. Postal density in France is higher than in the U.S. in all quartiles and ranges from 78 addresses/hour at the low quartile to 256 addresses/hour at the highest quartile. This range of postal densities is much greater than the corresponding U.S. range of 67 to 140 addresses per hour. The annual volume per address is higher in all quartiles, and its range is wider in the U.S.

Table 4. 1999 La Poste and USPS
Index of Average Costs*

La Poste USPS		Low Postal Density (PD) (78 Addresses/Hour) (67 Addresses/Hour)	Medium Postal Density (135 Addresses/Hour) (94 Addresses/Hour)	High Postal Density (256 Addresses/Hour) (140 Addresses/Hour)	% Change in AC (due to PD)
	Low Volume				
La Poste	(673 Pieces/Address/Year)	1.81	1.09	0.62	-66%
USPS	(1,090 Pieces/Address/Year)	1.76	1.28	0.92	-48%
	Medium Volume				
La Poste	(767 Pieces/Address/Year)	1.64	1.00	0.58	-65%
USPS	(1,448 Pieces/Address/Year)	1.35	1.00	0.73	-46%
	High Volume				
La Poste	(946 Pieces/Address/Year)	1.40	0.87	0.52	-63%
USPS	(1,919 Pieces/Address/Year)	1.04	0.79	0.59	-43%
La Poste	% Change in AC (due to Vol)	-23%	-20%	-16%	
USPS	% Change in AC (due to Vol)	-41%	-38%	-36%	

* Street Time only (Seconds per Piece)
Note: Low = 25% Quartile; Medium = 50% Quartile or Median; and High = 75% Quartile.

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[17] The specification of the estimated translog equation is:

$$ST=\beta_0+\beta_1 ln Q+\beta_2(ln Q)^2+\beta_3 ln D+\beta_4(ln D)^2+\beta_5 ln B+\beta_6(ln B)^2+\beta_7(ln Q)(ln D)+\beta_8(ln Q)(ln B)+\beta_9(ln D)(ln B)$$

Where: ST = Street Time

Q = Volume (Pieces per Address)

D = Postal Density (Addresses per Hour of Fixed Time)

B = Addresses

The translog equation was estimated using 1999 data from 39,737 rural routes and a stratified sample of 8,300 city routes.

Table 4 shows that in both countries volume is a more important cost driver at low postal density than at high postal density. This is because, *ceteris paribus,* at low postal density the fixed costs are higher and the potential for scale economies is therefore greater. Conversely, at high postal densities the fixed costs are lower and thus the potential for scale economies is not as great.

Similarly, postal density is a more important cost driver in both countries at low volume because at low volume the savings in fixed costs realized from increasing postal density are spread to fewer pieces. Conversely, postal density is a less important cost driver at high volume because the savings from an increase in postal density are spread across a greater number of pieces.

It should be noted that the impact of postal density on cost is greater in France than in the U.S. since France has a wider range of postal densities and lower volumes. In contrast, the impact of volume is greater in the U.S. than in France because the U.S. has lower postal densities and a greater variation in volumes. Finally, postal density appears to be a more important driver of unit street delivery costs than volume over the actual ranges in France and the U.S.

6. UNIT COST BEHAVIOR

The La Poste simulation model and the cost function developed for the USPS, described above, provide alternative means of estimating average unit costs over a range of volumes per delivery point and postal densities. Figure 5 displays average costs generated with the La Poste simulation model and data for French postal activities. Figure 6 displays the average unit costs generated with the cost function for the USPS.

Figure 5: Unit Delivery Costs as a Function of Volume and Postal Density Derived from La Poste Delivery Cost Simulation Model

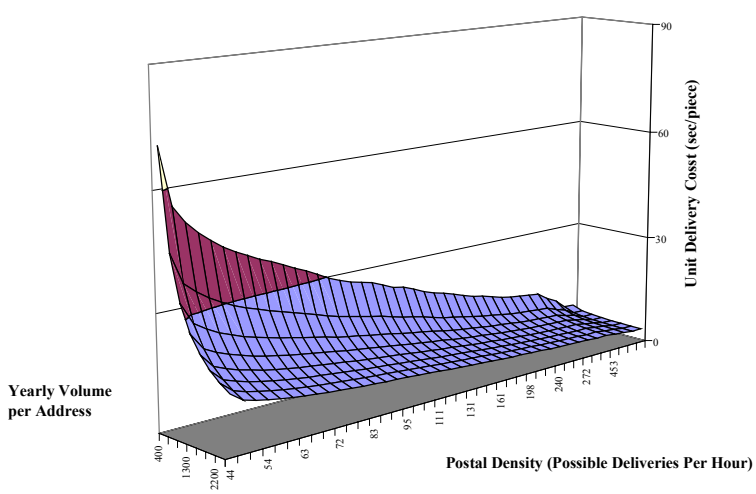
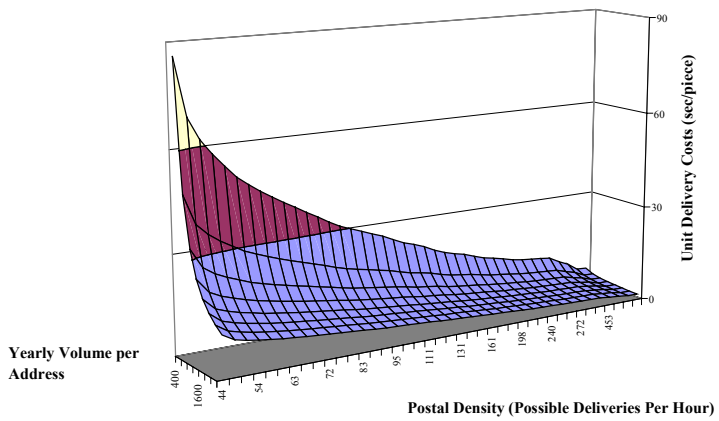


Figure 6: Unit Delivery Costs as a Function of Volume and Postal Density Derived from a Translog Model with USPS Data



The remarkably similar shapes of the two surfaces demonstrate a convergence of simulation and regression approaches to estimating the behavior of delivery costs with postal density and volume per address as cost drivers. The difference in unit delivery costs values reflect different input prices in the two countries.

The figures visually demonstrate the relationship between low postal density and/or low volume and high average unit costs; and conversely the relationship between high postal density and/or high volume and low average unit costs. Also, the figures exhibit the rapid change in unit delivery costs as either volume or density increase. However, once either high volume or high density is achieved, the opportunities for further reductions in average unit costs by increases in either volume or density are minimal.

7. CONCLUSIONS

The analysis of delivery costs for France and the U.S. demonstrates that street delivery costs are more heterogeneous in France than in the U.S. *Ceteris paribus*, France is more vulnerable to inefficient entry than the U.S.

The heterogeneity of delivery costs is driven by differences in volume, geographical characteristics and quality of delivery service. The concept of postal density captures the non-volume factors in a single measure. Rationalizing street delivery cost by decreasing the quality of delivery service can have a profound impact on the postal density and consequently, on delivery cost.

Due to this rationalization of delivery cost in the U.S., the postal densities of the most sparsely populated areas are higher than the densities of the most sparsely populated areas of France.

Postal density appears to be a more important driver of unit street delivery costs than volume over the actual ranges in France and the U.S. Furthermore, high postal densities reduce the impact of volume on unit street delivery costs, and high volume reduces the impact of postal density.

APPENDIX:

Delivery Data

France

The delivery data for La Poste are obtained for each delivery area. A delivery area represents a postcode (or several postcodes in some cases). The territory is divided into nearly 6000 delivery areas. Each area averages 12 routes (with of course a very high deviation)[18]. The unit costs (expressed in seconds and normalized as explained) are estimated by an engineering model[19] to allow for simulations over variations of traffic. They are obtained the following way: The information system allows the description of each area with geographic characteristics (population, number of stops, number of delivery points, surface, length of streets or roads) and traffic. The delivery model constructed by La Poste uses hundred of parameters, and allows the calculation of the unit costs of street delivery with an error of less than three percent in each area. At this stage, one unit cost is calculated for each area. It gives a quite aggregate view of street costs compared to the fineness of U.S. costs. In reality, each area is quite heterogeneous: it generally consists of a small town and an outlying area with different geographical characteristics. To have a more precise view of unit costs (and to have a better level of comparison with U.S. costs which are by route instead of by geographic area), the costs are then divided into two groups per area. We finally obtain 12,000 unit costs in 12,000 areas.[20] The sub-areas are then ranked on the criteria of increasing unit costs. They are re-aggregated into increments of five percent of traffic: the first five percent of traffic delivered is reached with 23 areas, and the last five percent of traffic is obtained with 900 areas.

U.S.

U.S. delivery data are from the City Carrier Cost System and the Rural National Mail Count System.[21] City carriers make up 72 percent of the routes and rural carriers make up the remainder.[22]

The City Carrier System contains a stratified sample of 8,300 routes and the 1999 Rural National Mail Count System provides data on 39,737 rural routes. The data elements used in this study are: the number of addresses served; the number of stops; (for city carriers only) volume per address, and address per kilometer (for rural carriers only). City carrier time is derived from the USPS Cost Segments and Components Report for FY 1999 and the average time is

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[18] Paris has 20 delivery areas and more than 1000 routes, and many delivery areas, like in Lozère only have one route.

[19] *See* Roy 1999 "A Technico Economic Analysis of the Costs of Outside Work in Postal Delivery". This model is used in the cost accounting system to determine costs by products.

[20] These sub-areas represent an average of six routes per area.

[21] *See* PRC Docket No. R2000-1.

[22] Approximately 30 percent of rural routes serve non-rural urban suburbs.

calculated and used for all city carrier routes. Rural carrier time is included in the rural mail count system.

Variable and Fixed Costs

We divide out-of-office delivery costs into their components using the method developed by the U.S. Postal Service.[23] Load time is included in the variable costs. For simplicity the variable portion of access and travel to and from the beginning of the route are ignored. The remaining time is fixed and includes the time between stops (route time and the fixed portion of access) and the fixed portion of travel time.

[23] *See* PRC Docket No. R2000-1.

REFERENCES

Berthélémy, Françoise L. and Joëlle Toledano. 2000. "In France, Mail Goes Where the Money and Business Are." In *Current Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers

Cohen, Robert, William Ferguson, John Waller, and Spyros Xenakis. 2000. "Universal Service without a Monopoly." In *Current Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers

Cohen, Robert, Carla Pace, Matthew Robinson, Gennaro Scarfiglieri, Vincenzo Visco Comandini, John Waller and Spyros Xenakis. 2002. "A Comparison of the Burden of Universal Service in Italy and the United States." In *Postal and Delivery Services: Pricing, Productivity, Regulation and Strategy*, edited by M.A. Crew and P.R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

Cremer, Helmuth, André Grimaud, and Jean-Jacques Laffont. 2000. "The Cost of Universal Service in the Postal Sector." In *Current Directions in Postal Reform*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

Cremer, Helmuth, André Grimaud, Jean-Pierre Florens, Sarah Marcy, Bernard Roy, and Joëlle Toledano. 2001. "Entry and Competition in the Postal Market: Foundations for the Construction of Entry Scenarios." *Journal of Regulatory Economics* 19 (no. 2, March): 107-121.

Demographia 2001, www.demographia.com/db-lonlanypar.htm.

Kolin, Marshall and E. Davis. 1999. "Mail Goes Where the Money Is: A Study of Rural Mail Delivery in the US." In *Emerging Competition in Postal and Delivery Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

Roy, Bernard. 1999 "Technico-Economic Analysis of the Costs of Outside Work in Postal Delivery." In *Emerging Competition in Postal and Delivery Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

PRC Docket No. R2000-1 *USPS LR-I-1, Summary Description of USPS Development of Costs by Segments and Components, FY 1998*. Postal Rate Commission, www.prc.gov.