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DOCKET R97-1

DIRECT TESTIMONY
OF
STEVEN H. WADE
ON BEHALF OF
UNITED STATES POSTAL SERVICE

Contents

Autobiographical Sketch

My name is Steven H. Wade. I am currently a contractor to the US Postal Service employed by IPFC Incorporated. I am also a part-time employee of the US Department of Energy. My duties at the department of Energy involve working with a small team whose responsibility is to develop and maintain models of energy demand for residential and commercial buildings. These models are used for policy analysis and are part of a large, integrated modeling system which also produces annual projections of energy supply and demand.

Prior to my current situation, I was employed by the Postal Service between September, 1984, and August, 1993, first as a Principal Economist, later as a Supervisory Economist. I provided rebuttal testimony on behalf of the US Postal Service in R87-1[1]. My testimony covered econometric issues arising from intervenor testimony in the area of city carrier and vehicle service driver statistical analyses.

I received a Ph.D. in Economics from the University of Arizona in 1980. My dissertation was an econometric study of the effects of decreasing block pricing (a pricing structure that was widely used by electric utilities) on individual consumer demand functions. I also hold Bachelor of Science Degree, *Phi Beta Kappa*, in mathematics from Purdue University in 1974, and am a member of the American Economics Association.

[1] Postal Rate Commission, Docket No R87-1, USPS-RT-11

Purpose and Scope of Testimony

The purpose of my testimony is to address the volume-variability of Cost Segment 8, covering vehicle service driver (VSD) operations. A review of the past treatment of VSD volume variability shows that an estimate from R77-1 was based on operational considerations and assumptions for a single facility, and provided a variability of about 7 percent. Subsequent estimates through R87-1 have used similar operational assumptions, but increased the coverage of facilities or updated the data used for the estimate. For R90-1, the Postal Service proposed a variability based on the estimated intra-SCF highway contract route variability, 47.3%. The goal of this study is to minimize the operational assumptions behind the estimate by performing a statistical analysis of how VSD workhours relate to hypothesized cost-driving factors. The sources of the data for this study are:

- postal Form 4533 for vehicle service drivers;
- a survey of facilities utilizing VSDs which was done in 1993 and will be described below; and
- workhour usage from the National Workhour Reporting System for postal fiscal year 1993.

The body of material which supports my conclusions consists of this testimony and Workpapers A through F. The regression data are printed in Workpaper D, which also provides the detailed regression results. Library Reference H-150 includes electronic copies of the regression data as well as electronic versions of the facility and route data for each of the 89 facilities.

Vehicle Service Drivers

Vehicle service drivers perform a variety of mail transportation tasks. Their activities include transporting mail between general mail processing facilities (GMFs, main offices) and other facilities (such as other GMFs, airport mail facilities and associated offices), between GMFs and carrier stations, and making collection stops. An individual driver's schedule is largely fixed and deviations are generally small. Most offices require notification if the driver deviates from schedule by more than 15 minutes. The scheduled runs for VSDs are largely determined in order to provide mail to operations at times when mail is needed for processing. For example, more than one run to a carrier station is generally required because of the nature of the carrier workload. An initial, early run is made to provide carriers with mail so that they can begin casing mail as soon as their shift starts. A subsequent run brings the remaining mail that needs to be delivered during the day which had not been processed at the plant in time for the first run.[2]

Review of Previous Volume Variability Estimates for Vehicle Service Drivers

R77-1, R80-1, R84-1, R87-1

The Postal Service's position in these four omnibus cases relied on variability estimates from an analysis of time at stop (load/unload time) and volume. In R77-1, the variability estimate of 7% was based on an analysis of time at stop for the vehicle service drivers from a single city, Washington, DC. In R80-1, the methodology of analyzing

[2] See USPS-LR-H-1 for a more complete description of VSD activities

stop time was maintained, but the analysis was expanded to cover 9 cities. The estimated variability was 16%. In R84-1 and R87-1, the variabilities were also based on this methodology. The R87-1 estimate was also 16%.

R90-1, R94-1

The USPS position in R90-1 was that VSD variability would require studies and analyses that had not been undertaken. In lieu of such analysis, the USPS proposed that VSD variability use the same variability as determined for intra-SCF highway contract routes. The logic of this proposal was that the services provided are similar. This estimate was 47.3%. The Postal Rate Commission in its decision, adjusted this estimate by averaging it with the earlier variability to arrive at an estimate of 31.65%. This estimate was also used for R94-1.

Description of Form 4533

Postal Form 4533 lists a variety of information concerning the route and scheduling of a single driver. Form 4533 includes information about the capacity of the truck used, the number of hours for which the route is scheduled, the frequency of the route (5 days, 6 days, Saturdays only, etc...), the daily and annual route mileage, the arrival and departure times for all stops, the facility name of the stop (e.g., AMF, GMF, carrier station, branch, collection address, etc...) and a description of duties to be performed at the stop. Approximately 98 percent of VSD workhours are scheduled using this form. The drivers not scheduled are usually dispatched for runs on an as needed basis. A sample Form 4533 is included in Workpaper A.

Description of the Survey of Plant and Distribution Facilities

A survey of all P&D facilities with vehicle service drivers was undertaken during Fiscal Year 1993. The purpose of the survey was to gather information to supplement VSD data available from Form 4533 and the National Workhours Reporting System (NWRS).[3] The data which were compiled for this analysis included all facilities with VSDs that responded to the survey form with usable and consistent information.[4] A sample survey form is included in Workpaper A.

For all facilities which responded to the survey with good information, postal Forms 4533 were collected for all of their VSD routes which were scheduled using these forms. For some facilities, not all driver schedules are reported on a form, so one of the purposes of the survey was to ascertain the degree to which forms were used at particular facilities. The primary purpose of the survey was to facilitate the development of a measure of the volume of mail transported by VSDs. For individual offices, there is no postal data system which collects statistics for the mail volume transported by VSD operations (such as pieces, weight, cubic feet, or cubic foot-miles). Thus, for this analysis, some measure of volume needed to be collected as part of a special study.

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[3] The inter-office transportation functions of VSDs are sometimes performed by contractors (highway contract routes or HCRs) The use of VSDs and HCRs varies from facility to facility This survey addresses the variability of VSD hours based on the volumes and network covered by VSD activities as determined from the data reported on Form 4533

[4] In 1993, there were 149 non-BMC facilities which properly reported significant VSD workhours. Of these, 89 responded to the questionnaire with data which was judged to be valid

There are basically two options for obtaining a measure of volume: a special study to collect actual volume data which would involve additional time and expense, or the survey method used here to aid in the derivation of a volume measure from the Form 4533 data. Cubic-foot miles (CFM) is the most comprehensive measure of volume for VSD activities and was the volume measure used for the variability analysis below. CFM gives weight to both cubic feet and the distance that the mail is transported. The survey requested estimates of average annual load factors by truck types.[5] CFM for a route was constructed by multiplying its truck capacity by the load factor by the number of trips times the average distance of each trip. An adjustment for unscheduled trips was made for facilities where appropriate, and the CFM for a facility is the sum across all the routes (refer to the data transformations described in Workpaper C).

Modeling Vehicle Service Driver Workhours

Vehicle service driver operations encompass many discrete tasks or categories of operations. A list of the more significant VSD operations includes: clock-in, on-call, spotter activities (moving trailers around within the yard area of a facility), maneuvering, loading, training, wash-up, processing paperwork, and driving between stops. There are several categories of VSD operations which are not directly related to either volume or meeting operating schedules at the route-level. For an individual route, additional volume which is not enough to cause an extra trip will possibly only affect load time For larger volume increases, a potential response to additional volume might be to increase truck size, if it is possible to do so for a particular route.

[5] Since certain activities, especially vehicle load time, may be related to the degree of truck capacity utilized, adjustments for average utilization are desirable.

At the facility level, responses to volume changes can be optimized among several routes, not just over individual routes -- routes can be adjusted by reconfiguring the stops and schedules, potentially among two or more routes. Also, part-time flexible, casual and over-time hours can be adjusted. However, at some point, large and persistent volume changes will require adjustments in the number of routes and drivers. When this occurs, more than just loading time can be affected by volume.

The general form of the models that were estimated using data at the facility level is:

(1) HOURS = f(CFM, AVGMPH, AVGDIST, AVGCAP, NETWORK)[6]

where,

CFM measures the cubic-foot miles of mail distributed over the network served by the facility (as described above),

AVGDIST measures the average scheduled mileage per scheduled trip for a facility,

AVGMPH measures the scheduled average travel speed and accounts for road conditions such as the terrain and congestion,

AVGCAP measures the trip-weighted average truck volume in cubic feet, and

NETWORK is a measure of the facilities and other stops (customer pickups, collections) routinely serviced by the facility.

[6] Workpaper C describes in detail the calculation of the elements of the general formulation.

CFM and NETWORK. Of the above set of variables, all are potentially important in explaining the usage of VSD hours. However, in my view, the two most critical measures are CFM and NETWORK. CFM potentially affects loading time in a direct fashion at the route level. Furthermore, at the facility level, changes in CFM may cause adjustments in either the number of trips or the number of VSD routes. In such cases, other components of VSD hours, not viewed as volume variable at the route-level, will be affected. The expectations for the coefficient of the CFM variable is that it should be positive; other things being equal, higher levels of CFM increase VSD workhour requirements.

The NETWORK variable is also critical, because many VSD trips are made explicitly to provide mail to operations at times when mail is needed for processing, regardless of volume. Thus, other factors equal, more runs will be required for networks which service more facilities. In the sample of VSDs used in this analysis, network size varies widely, from as few as 4 to as many as 155 unique stops.

Ideally, the network measure(s) would include concepts to quantify the variety of physical dimensions of the network. Such dimensions might include the number of stops, the distance between stops, the types of stops (possibly distinguishing AMCs, BMCs, other offices and branches, carrier stations and collection stops), and the total route-miles that need to be traveled daily in order to meet the operational requirements, total square miles, the population in the facility's service area, or some measure of network or population density.

Since the goal of this analysis is to estimate volume variability, another important criterion is that the network concepts should not include potential control variables that postal managers can alter in response to volume fluctuations. For example, the number of daily trips might serve as a network measure, but the number of trips also potentially varies in response to volume. If the network concepts are also possibly affected by volume, then separating the pure response to volume from other effects would be difficult if not impossible.

For this analysis, it was necessary to rely on a network concept that could be readily derived from the Form 4533 data. The concept of unique stops, called STOPS in the regression models, was chosen because it could be counted directly from the forms. Categorizing the stops was considered, however, there was enough ambiguity in the description of stop names to cause this to be problematic.

AVGDIST. Average distance characterizes the average trip length and is a dimension of the network variable. All other factors equal, a VSD facility with longer average trip lengths should use more VSD hours. The sign of the coefficient of the AVGDIST variable can be either positive or negative, however, the variability of total workhours with respect to AVGDIST should be greater than zero (i.e., other factors equal, longer trips require more workhours).[7]

In my view, a more preferable distance concept would be a measure of the network miles that would need to be traversed daily if volumes were very small. For example, two trips to the carrier stations might be needed, regardless of volume. Average trip distance will fail to include this feature of the network. Since this concept could not be derived from the Form 4533 data, the alternative was to use average trip distance.

AVGMPH. The average scheduled travel speed will affect the requirements for driving time. Given fixed volume and network characteristics, higher average travel speeds should reduce VSD hour requirements by reducing driving time. Thus, the expectation for the coefficient of this variable is that it should be negative (faster average travel speed reduces VSD hours).

AVGCAP. Average capacity is a measure of the average truck size utilized. Facilities with a higher proportion of larger trucks will have larger average capacities and may be able to transport greater CFM volumes with fewer VSD hours. The expectation

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[7] In the logarithmic formulations discussed below the variability or elasticity of workhours with respect to AVGDIST is the sum of the coefficients on CFM and AVGDIST. This is because changes in average trip distance affect CFM multiplicatively. Therefore, the requirement that the elasticity of workhours with respect to AVGDIST be greater than zero implies a constraint on the sum of these two coefficients Since the coefficient for CFM is expected to be greater than zero, the coefficient for AVGDIST can be negative as long as its magnitude is smaller than that of the coefficient for CFM

for the coefficient of this variable is that it should be negative (larger average capacity reduces VSD hours).

Model Specification and Estimation

The general specification given in (1) above was the starting point for two models based on a double-logarithmic functional form (i.e., logarithms of both the dependent variable and the explanatory variables are taken prior to estimating the regression). The first model included all of the variables in (1). The second model restricted the explanatory variables to the three which were found to be statistically significant in the first model. Then, starting from the explanatory variables included in the second model, interactions and second-order terms were added, and both logarithmic (translog model) and non-logarithmic versions were estimated. The non-logarithmic version was judged unsatisfactory for a variety of reasons. The translog specification had a total of 5 out of 9 explanatory variables with statistically insignificant coefficients. Dropping the insignificant interactions and second-order terms from the translog specification resulted in the final model from which the recommended variability was derived. One additional model was estimated to test the sensitivity of the parameter estimates in the recommended model to the re-introduction of the two variables dropped between Model 1 and Model 2. The resulting volume variability was only slightly affected.

Model 1, Log-Linear

The first model estimated included all five independent variables specified in the general formulation from (1) above including all of the hypothesized variables – STOPS, CFM, AVGMPH, AVGDIST, and AVGCAP.[8] Since there are no higher-order terms (interactions between independent variables and/or squared or second-order terms) this model is referred to as log-linear (i.e., linear in logarithms). The t-statistics for the variables, AVGDIST and AVGCAP, were not statistically significant in this regression.

The coefficients of the other three variables indicated a high degree of statistical significance (above 95%) and had signs consistent with expectations. The variabilities indicated that adding either STOPS or CFM increases workhour requirements, while higher average travel speeds reduce workhour requirements. The volume variability estimate for this model is 62.6%. Variability with respect to stops is estimated to be 30.2% and for AVGMPH is -66.7%. The corrected r-square for this model is .926, and a plot of the residuals sorted in ascending order of workhours does not show any strong correlation with size. Overall, the results for this model are quite good. Exhibit 1 provides summary results, and Workpaper D gives complete results for this model and the other models discussed below.

[8] The model was estimated by first taking logarithms of all of the variables divided by the mean value for that variable across all included observations, or "mean-centering" the data This technique will facilitate obtaining volume variability estimates and confidence intervals for the variabilities when the model includes higher-order terms as for Models 3 through 6.

1

Exhibit 1. Regression Results

	Model 1: Log-Linear		Model 2: Restricted Log-Linear	
	Coefficients	*t Statistics*	*Coefficients*	*t Statistics*
Intercept	(0.073)	(1.3)	(0 078)	(1.5)
STOPS	0.302	2.5	0.279	2.6
CFM	0.626	8.5	0.620	11.1
AVGMPH	(0.667)	(2.0)	(0.921)	(4.7)
AVGDIST	(0 203)	(1.0)		
AVGCAP	0.060	0.3		
Adjusted R-Square	0.926		0.931	
Residual Sum of Squares	4.783		4.880	
Degrees of Freedom	47		49	
STOPS Variability	30 18%	2.5	27.85%	2.6
CFM Variability	62.64%	8.5	62.03%	11.1
AVGMPH Variability	-66.69%	(2.0)	-92.13%	(4.7)

	Model 3: Untransfromed Data with Interactions & 2nd-Order		Model 4: Translog Based on Model 2	
	Coefficients	*t Statistics*	*Coefficients*	*t Statistics*
Intercept	61,485	0.5	(0 117)	(2 0)
STOPS	2,705	0 9	0.086	0.4
CFM	0.2778	4.1	0.775	7 3
AVGMPH	(10,200)	(1 2)	(1 289)	(4 8)
stops^2	(30.80)	(1 8)	(0.073)	(0.5)
cfm^2	-6.61E-09	(1.5)	0.089	1.5
avgmph^2	280.60	1.9	0.165	0 3
stopsXcfm	1.10E-03	1.6	(0.167)	(0.3)
stopsXavgmph	(18.05)	(0.2)	(0.090)	(0.5)
cfmXavgmph	-1.10E-02	(5.3)	(0.339)	(1.9)
Adjusted R-Square	0 940		0.942	
Residual Sum of Squares	37,984		3.427	
Degrees of Freedom	43		43	
STOPS Variability	12 17%	n/c	8.57%	0.4
CFM Variability	75 78%	n/c	77.53%	7.3
AVGMPH Variability	-252.48%	n/c	-128.88%	(4 8)

2 n/c - not computed

1

Exhibit 1. Regression Results (continued)

	Model 5: Restrictions on Model 4		Model 6: Model 5 with AVGDIST and AVGCAP	
	Coefficients	*t Statistics*	*Coefficients*	*t Statistics*
Intercept	(0.147)	(2.9)	(0.136)	(2.5)
STOPS	0.340	3.5	0.329	3.0
CFM	0.654	10.7	0.688	8.5
AVGMPH	(1.223)	(5.8)	(1.019)	(3.1)
stops^2				
cfm^2	0.038	2.3	0.040	2.3
avgmph^2				
stopsXcfm				
stopsXavgmph				
cfmXavgmph	(0.262)	(3.0)	(0.253)	(2.9)
AVGDIST			(0.151)	(0.8)
AVGCAP			(0.065)	(0.3)
Adjusted R-Square	0.942		0.940	
Residual Sum of Squares	3.794		3.728	
Degrees of Freedom	47		45	
STOPS Variability	34.02%	3.5	32.93%	3.0
CFM Variability	65.45%	10.7	68.78%	8.5
AVGMPH Variability	-122.28%	(5.8)	-101.90%	(3.1)

F Tests for Multiple Parameter Restrictions	*# Restrictions*	*F-Statistic*	*Significance*
Model 2 Restrictions vs Model 1................	2	0.478	0.623
Model 2 Restrictions vs Model 4................	6	3.037	0.014
Model 5 Restrictions vs Model 4................	4	1.151	0.346
Model 2 Restrictions vs Model 5.........	2	6.724	0.003

2

Model 2, Restricted Log-Linear

The next regression constrained the coefficients of the two insignificant variables from Model 1, AVGDIST and AVGCAP, to be zero by dropping them as explanatory variables. For Model 2, the adjusted R-square improved and all variables retained statistical significance and expected signs. A test of the "joint restriction," of both coefficients to zero is provided by an F-test.[9] The calculated F-statistic for the joint restriction is 0.478, and so low for the relevant degrees of freedom that the hypothesis that both coefficients are zero cannot be rejected.[10] Model 2 yields a volume variability estimate of 62.0% and a STOPS variability of 27.9%. Neither coefficient varies substantially from those in Model 1, and both retain highly significant t-statistics. The variability estimate for AVGMPH increased noticeably (became a larger negative number), and its t-statistic increased from -2.0 to -4.7.

To investigate the validity of the assumed log-linear functional form, the core variables from this equation served as the basis for additional models which included interactions between pairs of independent variables plus second-order terms.[11] All but one of these follow-up regressions maintained the logarithmic functional form, the exception was estimated in natural or untransformed units, and will be described next.

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[9] See Maddala, *Econometrics*, McGraw-Hill, 1977, page 112

[10] To reject this hypothesis as the 5% significance level would require a test F-value of approximately 3.2

[11] An alternative procedure would have been to estimate a very general model with all five of the identified independent variables, their pair-wise interactions and second order terms. This approach was not used because of the large number of parameters (21) that would have resulted

Model 3, Untransformed Data with Interactions and Second-Order Terms

The results for Model 3 estimated using untransformed data were generally unacceptable compared with the previous log-linear specifications. The primary defect, in my view, is that the estimated coefficients yield implausible volume variability estimates for many of the facilities (negative volume variabilities, or extremely large variabilities, for example).[12] Another problem with this regression is that the residuals, when plotted after first sorting the observations in ascending order of workhours, exhibit a striking increase with size. This feature is indicative of heteroscedasticity which causes "inefficient" parameter estimates and biased estimates of parameter significance.[13] Given the problems that were found with this model specification, a similar regression using logarithms instead of untransformed data was estimated.

Model 4, Translog based on Model 2 Independent Variables

Rather than attempting to correct the problems with the Model 3, the parallel interactions and second-order terms were added to the logarithmic specification. This formulation is referred to as the translog specification. Even though many of the individual t-statistics are insignificant, the overall fit of this model is statistically better than either of the log-linear specifications. Since the log-linear specification of Model 2 can be obtained by simultaneously restricting the six added interaction and second-order terms, an F-test of this restriction is easy to construct. The joint hypothesis that all six terms are zero is rejected strongly (at a significance level above 5%, see the bottom of

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[12] See Workpaper D for a complete listing of the variabilities for all of the facilities used in this regression

[13] See Maddala, *Econometrics*, McGraw-Hill, 1977, pages 259-274

Exhibit 1, "Model 2 Restrictions vs Model 4"). Thus, at least some of the non-linear terms are contributing substantially to the fit. In contrast to Model 3, the residuals displayed virtually none of the correlation with facility size (workhour usage) that was found when using the untransformed (non-logarithmic) data.

For the mean-centered translog, the estimated variabilites evaluated at the mean values of the independent variables are the coefficients of the first-order terms.[14] The volume variability estimate based on this model is 77.5% evaluated at the mean values for STOPS, CFM and AVGMPH. The variability for STOPS dropped from around 30% in Models 1 and 2 to 8.6% and its t-statistic indicates that it is no longer statistically significant. The variability for AVGMPH is -128.9%, and is remains near its previous level of significance.

As with Model 3, the variabilities vary by facility. Also as for Model 3, computed variabilites for some of the facilities are implausible, several taking on signs opposite of what is expected. For example, for some of the smaller facilities, the variability for AVGMPH is positive; while for some of the larger facilities the variability for STOPS is negative. The variability for CFM did not display any implausible signs.

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[14] Since the variables were first mean centered, the coefficients for the first-order terms (STOPS, CFM, AVGMPH represent the variabilites for these variables For example, see Postal Rate Commission, Opinion and Recommended Decision, Docket No R87-1, Appendix J, CS XIV, pages 25 and 27 at [043] and [049] for a discussion of the implications of mean-centering.

Model 5, Restricted Version of Model 4

Model 4, with the complete set of second-order and interactions, has five coefficients with t-statistics less than one, highly insignificant. With t-statistics this small, these coefficients are prime candidates for restricting to zero. The coefficient of the first-order term for STOPS is one of these five coefficients, but because of its strong statistical significance in the linear model, and because I view it as a crucial explanatory variable, it was retained at this stage. Dropping the other four insignificant terms, led to the elimination of the interactions between STOPS and CFM, and STOPS and AVGMPH, and the second-order terms for both STOPS and AVGMPH. After re-estimating, the t-statistics for the remaining coefficients in Model 5, including the coefficient for STOPS, are now all statistically significant at the 5% significance level or better. The test of the joint hypothesis for the four zero restrictions cannot be rejected (see the bottom of Exhibit 1, "Model 5 Restrictions vs Model 4"). On the other hand, when compared with Model 2, (which restricts the squared term for CFM and the interaction between CFM and AVGMPH to both be zero), the hypothesis that these two coefficients are zero is rejected at above the 1% significance level (see the bottom of Exhibit 1, "Model 2 Restrictions vs Model 5").

As for Models 3 and 4, this specification allows volume variability to vary by facility. Evaluated at the mean values for STOPS, CFM and AVGMPH, the estimated volume variability is 65.4%. The 95 percent confidence interval for volume variability is between 53.1% and 77.7%. The variability for STOPS is 34%, and does not vary by facility in this restricted specification. The variability for AVGMPH is -122.3%. Furthermore, all of the computed variabilities for all facilities agree with prior expectations for their signs.

Volume variability increases as facility size increases.[15] Intuitively, this might be due to potentially greater flexibility that larger facilities have in optimizing to volume changes. Larger operations will have a greater number of routes across which to make adjustments and may posses truck fleets with more varied capacities. Thus, larger facilities may stay closer to optimum, with less "excess" capacity than smaller facilities which have less flexibility for optimizing. Also in larger facilities, a relatively small percentage increase in volume might be enough of a total volume change to warrant an extra route. Whereas at a smaller facility, a 5-percent increase in volume might be less than the amount which would justify an additional route, and thus might be absorbed.

Model 6, Sensitivity of Model 5 to Re-Introducing AVGCAP and AVGDIST

Model 6, includes all of the effects in Model 5, but with the two variables, which were initially deleted before investigating the more complex functional forms, re-introduced. The purpose of this model was to test the sensitivity of the Model 5 to the effects which were considered theoretically plausible, but which did not display significance in the log-linear models. The resultant volume variability was 68.8%, slightly higher than for Model 5, but with a higher estimated standard error. The 95% confidence interval for volume variability is between 52.4% and 85.1%, encompassing

[15] See Workpaper D for a complete listing of variabilities by facility for this model..

the "sharper" estimate from Model 5 on both sides. Because of the relative insensitivity of the estimates, the estimates from Model 5 were used in the subsequent analysis.

Recommendation

The results from the Model 5 with restricted interactions and second-order terms was judged to be the best overall model. It provides a statistically better fit to the data than the log-linear models, and does not display any obvious heteroskedasticity. Finally, the estimated variabilities for individual facilities all have signs as expected.

Adjustment for BMCs

Bulk mail centers also utilize VSDs, but because their use is of such a different nature, they were excluded from the survey data and this analysis. BMCs use a very large proportion of spotter hours which involve moving trailers around the yard. The proportion of spotter salary and benefits to total VSD salary and benefits is 84 percent in BMCs compared with only about 3 percent at P&D facilities.[16] Since a variability for the total accrued dollars in Cost Segment 8 is required, and since CS 8 includes both VSDs used at BMCs and P&Ds, an adjustment to the VSD variability estimate obtained from the sample of P&D facilities is needed. The adjustment is based on the assumption that volume variability for spotter workhours is zero.[17] The adjustment is shown in Exhibit 2 and results in an overall variability estimate of 59.86%. This is the estimate used in the roll-forward analysis for CS 8 volume variability.

[16] See Workpaper E.

[17] The assumption of zero variability is consistent with earlier treatments of even larger blocks of VSD workhours as not volume variable and is proposed in lieu of a study of BMC VSD usage.

Exhibit 2. Derivation of Overall LDC 34 Volume Variability

	LDC 34 Total		BMCs		Plants	
	Accrued Costs	Variability	Accrued Costs	Variability	Accrued Costs	Variability
Total	$410,283,643		$41,707,379		$368,576,264	**65.45%**
Non-Spotter	$365,643,648	67.16%	$6,466,078	67.2%	$359,177,569	67.16%
	89.12%		15.50%		97.45%	
Spotter	$44,639,995	0.00%	$35,241,301	0.0%	$9,398,695	0.00%
	10.88%		84.50%		2.55%	
Weighted Average		**59.86%**		10.4%		65.45%

Sources: BMC and Spotter Shares, Workpaper E; For Accrued Costs See USPS-LR-H-9.