Postal Rate Commission
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Before the
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

Postal Rate and Fee Changes, 2006) Docket No. R2006-1

RESPONSE OF OFFICE OF THE CONSUMER ADVOCATE WITNESS
J. EDWARD SMITH TO PRESIDING OFFICER'S INFORMATION REQUEST NO. 25
(November 27, 2006)

The Office of Consumer Advocate hereby submits the response of J. Edward Smith to Presiding Officer's Information Request No. 25, dated November 17, 2006. The question is stated verbatim and is followed by the response.

Respectfully submitted,

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1. In "Response of Postal Service Witness Bradley to POIR No. 9, Question 9," witness Bradley concluded that dropping all interaction terms from his full quadratic street time variability model would introduce bias if the omitted variables were correlated with the regressors remaining in the restricted model. He observed that the benefit of dropping all interaction terms was a reduction in multicollinearity.
   a. Please determine whether the regressors dropped from the full quadratic models in CC2A and CC3A which yielded models CC2B and CC3B (in Table 1 of OCA-T-3) are correlated with the regressors remaining in CC2B, and CC3B, respectively. For these tests, please provide the SAS logs and output, or other appropriate outputs.
   b. Please provide your opinion of the relative merits of omitting or retaining the interaction terms referenced above, in terms of their effects on multicollinearity and bias.

RESPONSE

The SAS program, SAS log, and SAS output for CC2A and CC2B used to generate this response are presented in the Equation 2 folder of Library Reference OCA-LR-L-10**.** The SAS program, SAS log, and SAS output for CC3A and CC3B used to generate this response are presented in the Equation 3 folder of OCA-LR-L10**.**

(a) The correlation matrices are presented below. For Equation 2, the matrix of correlations between the regressors (on the rows) and the interaction terms (in the columns) presents the correlations and the p-value for the null hypothesis of no correlation. There is correlation between the variables in the restricted model and the omitted variables. In some cases the correlation is substantial, most noticeably in the case of small packages.

Equation 2 Correlation Matrix

Pearson Correlation Coefficients, N = 1545
Prob > |r| under H0: Rho=0

	lf	lse	lcv	lspr	ldp	fse	fcv
let	0.85678	0.37775	0.50269	0.78128	0.90886	0.32424	0.46113
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
let2	0.89447	0.28365	0.42846	0.86051	0.91252	0.23139	0.38115
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf	0.86695	0.29209	0.42200	0.60662	0.67950	0.37405	0.55249
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf2	0.91453	0.20098	0.37814	0.63271	0.65883	0.28023	0.52721
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq	0.12284	0.88722	0.19021	0.10605	0.17143	0.87188	0.17768
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq2	0.09984	0.78055	0.15850	0.09850	0.14221	0.75533	0.14730
	<.0001	<.0001	<.0001	0.0001	<.0001	<.0001	<.0001
cv	0.17430	0.18147	0.80651	0.15918	0.16572	0.17221	0.72481
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cv2	0.06320	0.07834	0.61391	0.08147	0.06611	0.05976	0.46908
	0.0130	0.0021	<.0001	0.0013	0.0093	0.0188	<.0001
spr	0.65389	0.27026	0.40834	0.86214	0.71580	0.23618	0.38471
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
spr2	0.63609	0.14048	0.27396	0.92374	0.65193	0.11534	0.24589
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp	0.61420	0.34568	0.37235	0.60983	0.84987	0.29188	0.35430
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp2	0.62973	0.31569	0.31606	0.64053	0.89798	0.25896	0.30416
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens	0.24429	0.03377	0.06283	0.18294	0.42601	0.02116	0.00407
	<.0001	0.1846	0.0135	<.0001	<.0001	0.4059	0.8731
dens2	0.16291	-0.04681	0.02470	0.11356	0.34370	-0.05048	-0.03648
	<.0001	0.0658	0.3320	<.0001	<.0001	0.0473	0.1518

Equation 2 Correlation Matrix, Continued

Pearson Correlation Coefficients, N = 1545
Prob > |r| under H0: Rho=0

	fspr	fdp	scv	sspr	sdp	cspr	cdp
let	0.71967	0.81136	0.18891	0.30325	0.30994	0.35412	0.41448
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
let2	0.74795	0.77156	0.11367	0.21377	0.21925	0.27194	0.31148
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf	0.76043	0.87638	0.16077	0.23913	0.23743	0.30507	0.36405
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf2	0.81469	0.88559	0.09219	0.15364	0.15076	0.25553	0.30139
	<.0001	<.0001	0.0003	<.0001	<.0001	<.0001	<.0001
seq	0.09825	0.15932	0.69370	0.87596	0.90532	0.15473	0.23058
	0.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq2	0.08987	0.13163	0.66621	0.82162	0.78674	0.13790	0.19137
	0.0004	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cv	0.16506	0.18282	0.55461	0.19100	0.18223	0.74541	0.83552

	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cv2	0.06795	0.06240	0.51876	0.08066	0.08071	0.63543	0.65845
	0.0075	0.0142	<.0001	0.0015	0.0015	<.0001	<.0001
spr	0.83878	0.68869	0.18067	0.33717	0.26093	0.46601	0.40827
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
spr2	0.87188	0.61506	0.08079	0.18874	0.13071	0.35949	0.25401
	<.0001	<.0001	0.0015	<.0001	<.0001	<.0001	<.0001
dp	0.58187	0.78335	0.20947	0.32672	0.38317	0.31686	0.44138
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp2	0.60305	0.81149	0.17402	0.29373	0.35092	0.26537	0.37635
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens	0.14877	0.31918	-0.00464	0.02417	0.03438	-0.01129	0.02659
	<.0001	<.0001	0.8552	0.3424	0.1768	0.6575	0.2963
dens2	0.07909	0.23576	-0.04527	-0.04470	-0.04450	-0.04417	-0.01578
	0.0019	<.0001	0.0753	0.0790	0.0803	0.0826	0.5355

Equation 2 Correlation Matrix, Continued

Pearson Correlation Coefficients, N = 1545
Prob > |r| under H0: Rho=0

	spdp	ldns	fdns	sdns	cdns	spdns	dpdns
let	0.74563	0.55245	0.53772	0.25444	0.28791	0.52417	0.42681
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
let2	0.74105	0.56558	0.51752	0.16959	0.25072	0.51922	0.39146
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf	0.60016	0.31869	0.50427	0.19601	0.15053	0.37680	0.25838
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf2	0.59223	0.27758	0.46084	0.11836	0.09935	0.34201	0.20563
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq	0.14813	-0.00008	0.01611	0.81437	0.09419	0.03568	-0.00303
	<.0001	0.9975	0.5270	<.0001	0.0002	0.1610	0.9052
seq2	0.13413	0.01688	0.02684	0.69294	0.08823	0.04587	0.01528
	<.0001	0.5074	0.2917	<.0001	0.0005	0.0715	0.5485
cv	0.17760	0.00653	-0.00890	0.11273	0.74684	0.00515	-0.03582
	<.0001	0.7977	0.7266	<.0001	<.0001	0.8398	0.1594
cv2	0.08203	0.00740	0.00197	0.07425	0.68090	0.02759	-0.00407
	0.0013	0.7712	0.9384	0.0035	<.0001	0.2785	0.8729
spr	0.91603	0.25670	0.31310	0.19442	0.13346	0.50948	0.24509
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
spr2	0.88971	0.21455	0.25970	0.08237	0.06707	0.45480	0.17823
	<.0001	<.0001	<.0001	0.0012	0.0084	<.0001	<.0001
dp	0.77870	0.50875	0.53373	0.28799	0.19307	0.60233	0.57512
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp2	0.81774	0.58316	0.60863	0.25087	0.16120	0.70725	0.68201
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens	0.26151	0.86615	0.82764	0.17711	0.36881	0.79465	0.91171
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens2	0.18899	0.85868	0.80696	0.01975	0.30083	0.74335	0.90806
	<.0001	<.0001	<.0001	0.4379	<.0001	<.0001	<.0001

The SAS System

Equation 3 Correlation Matrix

Pearson Correlation Coefficients, N = 1545
Prob > |r| under H0: Rho=0

	lf	lse	lcv	lspr	ldp	fse	fcv
let	0.85678	0.37775	0.50269	0.78128	0.90886	0.32424	0.46113
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
let2	0.89447	0.28365	0.42846	0.86051	0.91252	0.23139	0.38115
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf	0.86695	0.29209	0.42200	0.60662	0.67950	0.37405	0.55249
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf2	0.91453	0.20098	0.37814	0.63271	0.65883	0.28023	0.52721
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq	0.12284	0.88722	0.19021	0.10605	0.17143	0.87188	0.17768
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq2	0.09984	0.78055	0.15850	0.09850	0.14221	0.75533	0.14730
	<.0001	<.0001	<.0001	0.0001	<.0001	<.0001	<.0001
cv	0.17430	0.18147	0.80651	0.15918	0.16572	0.17221	0.72481
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cv2	0.06320	0.07834	0.61391	0.08147	0.06611	0.05976	0.46908
	0.0130	0.0021	<.0001	0.0013	0.0093	0.0188	<.0001
spr	0.65389	0.27026	0.40834	0.86214	0.71580	0.23618	0.38471
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
spr2	0.63609	0.14048	0.27396	0.92374	0.65193	0.11534	0.24589
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp	0.61420	0.34568	0.37235	0.60983	0.84987	0.29188	0.35430
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp2	0.62973	0.31569	0.31606	0.64053	0.89798	0.25896	0.30416
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens	0.00877	-0.06177	-0.06023	-0.01771	0.09739	-0.06853	-0.09437
	0.7305	0.0152	0.0179	0.4867	0.0001	0.0070	0.0002
dens2	-0.00814	-0.07714	-0.05894	-0.02404	0.05819	-0.08007	-0.08429
	0.7491	0.0024	0.0205	0.3451	0.0222	0.0016	0.0009

Equation 3 Correlation Matrix, Continued

Pearson Correlation Coefficients, N = 1545
Prob > |r| under H0: Rho=0

	fspr	fdp	scv	sspr	sdp	cspr	cdp
let	0.71967	0.81136	0.18891	0.30325	0.30994	0.35412	0.41448
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
let2	0.74795	0.77156	0.11367	0.21377	0.21925	0.27194	0.31148
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf	0.76043	0.87638	0.16077	0.23913	0.23743	0.30507	0.36405
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cf2	0.81469	0.88559	0.09219	0.15364	0.15076	0.25553	0.30139
	<.0001	<.0001	0.0003	<.0001	<.0001	<.0001	<.0001

seq	0.09825	0.15932	0.69370	0.87596	0.90532	0.15473	0.23058
	0.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
seq2	0.08987	0.13163	0.66621	0.82162	0.78674	0.13790	0.19137
	0.0004	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cv	0.16506	0.18282	0.55461	0.19100	0.18223	0.74541	0.83552
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
cv2	0.06795	0.06240	0.51876	0.08066	0.08071	0.63543	0.65845
	0.0075	0.0142	<.0001	0.0015	0.0015	<.0001	<.0001
spr	0.83878	0.68869	0.18067	0.33717	0.26093	0.46601	0.40827
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
spr2	0.87188	0.61506	0.08079	0.18874	0.13071	0.35949	0.25401
	<.0001	<.0001	0.0015	<.0001	<.0001	<.0001	<.0001
dp	0.58187	0.78335	0.20947	0.32672	0.38317	0.31686	0.44138
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dp2	0.60305	0.81149	0.17402	0.29373	0.35092	0.26537	0.37635
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens	-0.03714	0.04007	-0.06619	-0.05400	-0.05424	-0.08604	-0.09355
	0.1446	0.1154	0.0093	0.0338	0.0330	0.0007	0.0002
dens2	-0.03764	0.01851	-0.06483	-0.06514	-0.07029	-0.07627	-0.08816
	0.1392	0.4673	0.0108	0.0104	0.0057	0.0027	0.0005

Equation 3 Correlation Matrix, Continued

Pearson Correlation Coefficients, N = 1545
Prob > |r| under H0: Rho=0

	spdp	ldns	fdns	sdns	cdns	spdns	dpdns
let	0.74563	0.44526	0.37355	0.09983	0.04385	0.34438	0.31718
	<.0001	<.0001	<.0001	<.0001	0.0849	<.0001	<.0001
let2	0.74105	0.42842	0.33148	0.04144	0.04421	0.30439	0.26802
	<.0001	<.0001	<.0001	0.1034	0.0824	<.0001	<.0001
cf	0.60016	0.23950	0.39163	0.06824	-0.00465	0.23434	0.17413
	<.0001	<.0001	<.0001	0.0073	0.8550	<.0001	<.0001
cf2	0.59223	0.18169	0.31685	0.01746	-0.01887	0.17948	0.11529
	<.0001	<.0001	<.0001	0.4927	0.4585	<.0001	<.0001
seq	0.14813	-0.01778	-0.01127	0.64288	0.00394	0.02283	-0.01718
	<.0001	0.4849	0.6582	<.0001	0.8771	0.3698	0.4997
seq2	0.13413	-0.00526	-0.00058	0.46915	0.01037	0.01796	-0.00609
	<.0001	0.8364	0.9817	<.0001	0.6839	0.4805	0.8109
cv	0.17760	-0.01419	-0.03659	0.03352	0.65026	-0.01444	-0.06565
	<.0001	0.5773	0.1505	0.1879	<.0001	0.5705	0.0098
cv2	0.08203	0.00376	-0.00330	0.03124	0.60310	0.02230	-0.01457
	0.0013	0.8827	0.8969	0.2197	<.0001	0.3810	0.5672
spr	0.91603	0.16606	0.17714	0.09353	-0.00432	0.37568	0.16395
	<.0001	<.0001	<.0001	0.0002	0.8653	<.0001	<.0001
spr2	0.88971	0.11199	0.12180	0.01473	-0.01643	0.26480	0.09183
	<.0001	<.0001	<.0001	0.5629	0.5188	<.0001	0.0003
dp	0.77870	0.41075	0.37137	0.13696	-0.02006	0.44082	0.47676
	<.0001	<.0001	<.0001	<.0001	0.4308	<.0001	<.0001
dp2	0.81774	0.45340	0.41249	0.09255	-0.01023	0.49066	0.53973
	<.0001	<.0001	<.0001	0.0003	0.6880	<.0001	<.0001
dens	0.01535	0.69032	0.70751	0.28107	0.28538	0.68255	0.73278

	0.5465	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
dens2	0.00159	0.58061	0.62367	0.17607	0.18381	0.55495	0.62939
	0.9503	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

(b) Relevant issues for determining the inclusion or exclusion of variables include the following: whether the variables are drivers of delivery time (i.e., relevant to the explanation of the equation), whether the exclusion of the variables will create bias, whether there are statistical problems that need to be addressed, and whether the correct function form has been specified.

*Whether the variables are justified by economic theory and are drivers of delivery time (i.e., relevant to the explanation of the equation)***:** I discuss the density variable as related to economic theory in my response to question 2(c) of POIR No. 25. My comments in this response are focused on the cross-product variables. Based on Postal Service testimony, it appears that there is interaction in handling procedures by city carriers in delivering the various types of mail--letters, flats, sequenced mail, etc. For example, casual observation in the field shows that a bundle of mail and possibly a small parcel will be wrapped in a flat for insertion, while sequenced mail will be handled separately. The carrier's actions in delivering DPS letters and cased flats and letters appear to be related to the handling of sequenced mail. Accordingly, it appears that interaction terms are drivers of carrier time and should be retained if one is modeling delivery time as a function of the shapes. However, there has been some consideration of modeling the delivery process in terms of three major bundles—(1)DPS, (2) Cased Mail, and (3) Sequenced Mail. Collection volumes are modeled in the same equation as the three bundles. Accountables and large parcels are separately estimated in an

additional equation. For the current modeling effort, I believe that, in general, the full quadratic is the appropriate approach.

Whether the exclusion of the variables will create bias: The exclusion of a variable that is a driver would create a bias in the estimation effort. However, in the case of a variable strongly correlated with another variable, not much additional information is imparted by the variable's use. Although one would wish to use the cross-product terms to capture interactions among types of mail during the delivery process, in the case of the cross-products involving "spr," it is clear that substantial correlation may permit the dropping of cross-product variables related to "spr".

Whether there are statistical problems that need to be addressed: There appears to be a substantial collinearity problem in the estimation process, and this process appears to be exacerbated by the use of cross-product variables as well as squared variables. It appears that collinearity has had a substantial negative impact on the estimation process; as a practical matter one could advocate the dropping of cross products in order to address collinearity. The use of time series data over a time period substantially longer than that used by witness Bradley should help to reduce high Variance Inflation Factors (VIF)resulting from multicollinearity . In the case of small packages, it appears that the cross-product terms cause a VIF problem in the case of the "spr" variable; if additional data over a longer time period cannot be used, the "spr" variables are logical candidates for being dropped. However, the record contains no discussion of the dropping of cross products as related to the estimation of flexible functional forms. Furthermore, from an empirical viewpoint, the dropping of the "spr"

variable appears to be inappropriate. Accordingly, one is faced with a tradeoff between solving estimation problems versus maintaining a general model

Whether the correct function form has been specified: The advantages of a flexible functional form have been documented. However, the choice of the specific flexible functional form of the many available functional forms has not been fully explored. Alternatively, in a small computational neighborhood, functions can be adequately specified in simple linear terms, another issue which has not been explored. Clearly a simple linear form is, in general, inadequate; whether this is true within the ranges of the variables has not been examined.

In conclusion, my opinion is that additional research will substantiate the use of the three-bundle approach, that collinearity and its resulting problems could be reduced through the use of a data set extending over a longer period of time, and that from a theoretical viewpoint all cross products should be retained in the current model. However, from an estimation viewpoint a strong case can be made for the dropping of the “spr” based cross-product terms, recognizing that one might not then have a flexible functional form.

2. In "Response of Postal Service Witness Bradley to POIR No. 9, Question 11," witness Bradley reported the results of selectively removing the terms that interacted with the small parcels variable.

a. Please run the full quadratic models reported in CC2A and CC3A (in Table 1 of OCA-T-3), but drop those interaction terms that interact with the small parcels variable.

b. Please report the t-values and standard deviations of the marginal time estimates obtained using the specification requested in 2a.

c. Please provide your opinion of the relative merits of these models, your proposed CC6B model (in Table 1 of OCA-T-3), and the model proposed by the Postal Service and employed by the Commission in R2005-1.

d. For these procedures, please provide the SAS log and output, or other appropriate outputs.

RESPONSE

(a) The programs and outputs may be found in Library Reference OCA-LR-L-10 in the files Eq2DropSPR and Eq3DropSpr.

(b) The t values and standard deviations are in the SAS output.

(b) It is not unusual to develop equations based on the ad-hoc selection of variables; there are numerous examples of ad-hoc estimation efforts in the Operations Research literature, and the equations have in many cases met the needs for which they were developed. Ad-hoc specification is not necessarily bad, even though the equations are not directly consistent with economic theory.

In the current proceeding, however, I have criticized the use of the density variable, based on my understanding of microeconomic theory. I believe that the variable is of an ad-hoc nature; a derivation of the cost function resulting in the inclusion of density could

show me to be wrong. However, I have not yet seen such a derivation. In fact, the information that I have seen leads me to conclude that the use of the density variable is incorrect.

Michael Intriligator,[1] noting that "The modern approach to the theory of the firm is based on the concept of duality…." outlines the variables used in a production function (Equation 8.2.1), cost function (Equation 8.2.57), cost curve (Equation 8.2.14), and factor demand function (Equation 8.2.28). The density variable does not have the characteristics of any of the variables referenced by Intriligator in any of the functions cited. It does not represent output, factor prices, or product prices. Rather, the density variable appears to measure delivery characteristics that are subsumed in some type of maximization or adjustment process for efficient City Carrier delivery; the process is then modeled by an equation with the economically relevant variables.

The use of the density variable is inappropriate. However, if one is committed to the use of the density variable, then it should be computed correctly. As I have indicated on page 7 of my testimony (OCA-T-3), density is not correctly computed in witness Bradley's model**.** This problem is evident from the response given by witness Bradley to interrogatory OCA/USPS-T14-2 (Tr. 13/3788-89). To be specific, it appears that density for a ZIP code as computed by witness Bradley is a function of the number of routes reporting deliveries in a given ZIP code. Accordingly, the total number of delivery points, presumably indicative of area congestion and/or other physical layout, does not appear to be correctly delineated in the density computations. The computational problems are outlined in the interrogatory. I do not believe that witness

[1] Michael D. Intriligator, Ronald G. Bodkin, and Cheng Hsiao, *Econometric Models, Techniques, and Applications*, Prentice Hall, 1996; the partial quote is on page 283.

Bradley's answer accurately refutes or clarifies the problem. I view his density variable to be incorrect as computed. As computed by witness Bradley, density appears to measure route coverage and volume, not density. Accordingly, I view both forms of Equation CC1 (witness Bradley advocated equation CC1B) and equation CC2 as incorrect.

Although use of the density variable appears to be incorrect, it should be noted that many of the characteristics that the variable allegedly captures are also captured by the delivery points variable when the variable is disaggregated. The disaggregation of the delivery points variable yields statistically meaningful results.

I analyzed the effects of dropping the cross-product terms involving the "spr" variable. In the case of the full quadratic for CC3A, there was a negative sign for small packages as originally reported in my testimony. The sign problem vanishes when the model is rerun with the elimination of the cross-product terms associated with "spr," and the Variance Inflation Factors are substantially decreased. Insofar as data are available on collection volume, CC3A is superior to both versions of CC6 The reason CC6 was run was to examine the effect of the elimination of collection volume, the variable not being available in DOIS. Accordingly, CC3A with "spr" cross products removed is a (limited) full quadratic with marginal costs that appear to comport with what one would expect. Assuming that one chooses not to use the three bundle approach, this model appears to be superior to witness Bradley's model, being more of a full quadratic, having more reasonable marginal cost relationships, and not being burdened with an incorrectly specified density variable. Whether the modified CC3A model would apply in today's environment, given the increased use of DPS mail (leading to the consideration

that the three bundle approach may be more reasonable as a model of City Carrier costs), is not clear.

Based on the existing dataset and operating procedures in use in 2002, the CC3A equation modified to remove “spr” cross products appears to be preferable to the equation advocated by witness Bradley in modeling City Carrier delivery in terms of letters, flats, etc. I have not, however, specifically addressed parcels and accountables, because I view witness Bradley’s estimation as irrelevant. Clearly, all time for the delivery of large parcels and accountables should be attributable; this has been demonstrated by the Postal Service’s ability to specifically and separately time and measure the activity. If the accountables and large parcels were not delivered, then there would be no time measured; the Postal Service knows from the database exactly how much time is spent in delivering large parcels and accountables. Accordingly, the estimation procedures for Parcels and Accountables are irrelevant.

(d) The information is in the files Eq2DropSPR and Eq3DropSpr in OCA-LR-L-10.