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UNITED STATES OF AMERICA
POSTAL REGULATORY COMMISSION
WASHINGTON, DC 20268-0001

Before Commissioners: Ruth Y. Goldway, Chairman;
Tony L. Hammond, Vice Chairman;
Mark Acton;
Dan G. Blair; and
Nanci E. Langley

Modification of Analytical Principles in Periodic Reporting (Proposal Two) Docket No. RM2009-7

ORDER ON ANALYTICAL PRINCIPLES USED IN PERIODIC REPORTING (PROPOSAL TWO)

(Issued December 7, 2009)

I. INTRODUCTION AND SUMMARY

On July 7, 2009, the Postal Service filed a petition to change the method by which it estimates the piece characteristics of mail that is processed in its non-automated facilities as part of its Bulk Revenue, Pieces, and Weight (BRPW) subsystem of its Revenue, Pieces, and Weight (RPW) data reporting system.[1] Currently piece characteristic data are generated by a census of automated offices and a sample of non-automated offices. Under the proposal, only data reported for automated offices would be used. Piece characteristics for non-automated offices would be inferred from

[1] Petition of the United States Postal Service Requesting Initiation of a Proceeding to Consider Proposed Change in Analytic Principles (Proposal Two), July 7, 2009 (Petition).

data reported at automated offices of a similar size. The "modeling" approach proposed assumes that piece characteristics of a postal product can reliably be predicted by the size of the facility in which it was last processed.

The Commission concludes that for all mail categories except Within-County Periodicals, the modeling approach underlying Proposal Two is likely to produce results that are as accurate as the current method. Proposal Two is, therefore, approved for use in estimating the piece characteristics of those mail categories. For estimating the piece characteristics of Within-County Periodicals, the Commission concludes that the Postal Service has not demonstrated that the modeling approach produces reliable results. It therefore requires the Postal Service to supplement its modeled estimates of Within-County piece characteristics with either a special census conducted every third year, or with more reliable Trial Balance results, if such results can be achieved through revised accounting procedures.

II. THE POSTAL SERVICE PROPOSAL

In Proposal Two, the Postal Service requests a change in the method by which the BRPW reporting system estimates the piece characteristics of bulk mail. The current approach combines piece characteristic data from a census of automated offices (those equipped with the Postal One data reporting system) with data from a sample of non-automated offices. The proposed approach would use only data reported by Postal One offices. Non-automated offices would no longer be sampled. To compensate for the absence of data on the piece characteristics of products exiting the system at non-automated offices, the proposed approach would infer the piece characteristics for non-Postal One offices from data reported at Postal One offices of a similar size. The basic assumption underlying this "modeling" approach is that piece characteristics of a postal product can reliably be predicted by the size of the facility in which it was last processed.

Under Proposal Two, all offices (Postal One and non-Postal One) would be ranked by Trial Balance revenue in the relevant General Ledger account. The offices then would be stratified based on their rank. Within each stratum, a weighting or inflation factor would be constructed consisting of the ratio of the Trial Balance revenue for all offices (Postal One and non-Postal One) to the corresponding Postal One revenue. The weighting factor would be applied to the Postal One piece characteristic data for the stratum. The weighted stratum estimates would then be aggregated to form national totals for the recorded piece characteristics exhibited by each mail category.

The Commission concludes that for all mail categories except Within County Periodicals, the modeling approach underlying Proposal Two is likely to produce results that are as accurate as the current method. Proposal Two is, therefore, approved for use in estimating the piece characteristics of those mail categories. For estimating the piece characteristics of Within County Periodicals, the Commission concludes that the Postal Service has not demonstrated that the modeling approach produces reliable results. It, therefore, requires the Postal Service to supplement its modeled estimates of Within County piece characteristics with either a special census conducted every third year, or with more reliable Trial Balance results, if such results can be achieved through revised accounting procedures.

III. SUPPORT FOR THE PROPOSED MODEL

The basic assumption underlying the Postal Service's proposed model is that mail processed in offices earning similar levels of revenue (defined by strata) will have similar piece characteristics. The Postal Service asserts that it is "intuitively satisfying" to assume that for a given product, the mix of rate elements, revenue per piece, and weight per piece, vary by an office's revenue size. Accepting this assumption allows piece characteristics found at small offices equipped with Postal One to be used as proxies for the piece characteristics of mail found at non-Postal One offices of the same size. The Postal Service further argues that for any given revenue stratum, mail at

Postal One offices provides a close proxy for mail at non-Postal One offices because there are "many more" of the former than the latter. It observes that because smaller offices are the last to be converted to Postal One, unconverted offices are becoming concentrated in the smaller strata. It reasons that the identification of non-Postal One offices with small size grows stronger with time, making Postal One offices closer proxies for non-Postal One offices over time. Because the pool of non-Postal One offices is continually shrinking, it says, the passage of time makes the sampling approach less tenable. For all of these reasons, according to the Postal Service, its proposed modeling approach is reasonable, and more accurate than the current approach. Attachment to the Petition at 2.

The Postal Service presented data in several forms as empirical support for its proposal. It attempted to demonstrate that there is a correlation between a product's mail characteristics and facility size by showing that the mix of products and rate categories within the Standard Regular class varies by stratum (*see* Table 2 in Appendix B to the Petition), and the mix of products within the Periodicals class (Within County and Outside County) varies by stratum.[2]

The Postal Service presented a sensitivity analysis in which the proposed model stratification for First-Class Presort was expanded and then contracted (*see* Table 4 of Appendix B to the Petition). These alternate stratifications produced only slight variation in the estimates of piece characteristics. *See* Tables 5 and 6 in Appendix B to the Petition. The Postal Service concludes from this that its proposed weighting class model is robust to variations in stratification. Attachment to the Petition at 5.

The Postal Service recognizes that of all market dominant services, Within County Periodicals is most dependent on the validity of its proposed model, since non-Postal One offices account for roughly one-third of Within County revenue—far more

[2] *See* Responses of the United States Postal Service to Chairman's Information Request No. 1, August 20, 2009, Table CHIR 1, Q.2 (Postal Service Response to CHIR No. 1).

than any other service.[3] In an attempt to validate its proposed model with respect to its ability to approximate the piece characteristics of Within County Periodicals, the Postal Service conducted a special census of non-Postal One offices. It gathered revenue information from those offices for all products within the Periodicals class for all of Quarter Three of FY 2008.

The special census targeted 3,300 non-Postal One offices, of which almost 89 percent responded. Postal Service Response to CHIR No. 1, Question 4(a). The census indicated that within non-Postal One offices, Within County revenue accounts for 31.2 percent of Periodicals revenue. The Postal Service compares this with 33.2 percent implied by the proposed model, and 40.0 percent estimated for the current BPRW sample method.

Viewing the special census result as measuring "true Periodicals mail activity" in the quarter covered, the Postal Service argues that the closeness of the Within County revenue share implied by the model (33.2 percent) to that indicated by the special census (31.2 percent) validates the proposed model. By the same token, it argues that the greater distance of the special census result from the estimate produced by the current sample-based BRPW (40.0 percent) can be interpreted as the amount by which the current method overstates Within County revenue. Attachment to the Petition at 3. It ascribes much of the error in the sample-based estimate to its use of a sample frame and blow-up factors that are obsolete.

Moving from the current sample-based method of estimating Within County mail characteristics to the proposed modeling method in FY 2008 would have reduced the cost coverage for Within County Periodicals from 94.5 percent to 82.9 percent. *See* the table below.

[3] The next highest share of revenue from non-Postal One offices is 6.24 percent for First-Class Presort cards.

Rev./Pc. (Cents)	**10.73**	**10.66**	**(0.06)**	**-0.6%**
Attributable Cost ($ 000)	**94,344**	**94,344**	**0**	**0.0%**
Cost/Pc. (Cents)	**11.35**	**12.87**	**1.51**	**13.3%**
Cost Coverage	**94.5%**	**82.9%**		

Sources: USPS Petition, Appendix A, Tables 3 and 5 and USPS Response to CIR No. 1, Question 3.

The Postal Service argues that a similar downward revision to estimated Within County revenue would result if Proposal Two were rejected and the current method were applied using an updated sample frame and blow-up factors. *Id*. at 5.

Besides greater accuracy, the Postal Service asserts that the annual cost of applying the modeling approach would be about a tenth as much as updating and applying the current sample-based method ($20,000 vs. $200,000). *Id*. at 3-4 and Postal Service Response to CHIR No. 1, Question 4(e).

IV. COMMENTS

Public Representative.[4] In the Public Representative's comments, she notes that the key assumption underlying the proposed modeling approach is that mail category volumes processed at offices of similar size have similar piece characteristics. She shows that the system revenue contribution from non-Postal One offices has gone from

[4] Public Representative Comments in Response to Order No. 245, July 29, 2009 (Public Representative Comments).

10 percent to 1 percent in the last 4 years, and is likely to shrink further in the future. Because the contribution from non-Postal One offices is so small, she argues, the issue of frame bias that would arise if piece characteristics do not correspond to facility size is irrelevant for most products. Public Representative Comments at 3. She adds that under the current method, the accuracy of the results for the sampled portion of the BRPW is doubtful because the variance estimation procedure is inefficient and there is a systematic bias associated with the use of inappropriate blow-up factors. This, she says, is an additional reason not to retain the current method that employs sample results from non-Postal One offices. *Id*.

National Newspaper Association.[5] Many of the members of the NNA mail newspapers at Within County rates. NNA notes that getting accurate measures of Within County mail characteristics has been an intractable problem. It points out that historically, the sample-based BRPW volume estimates have fluctuated widely when there were no obvious market fluctuations to explain them. It notes that in FY 1999, the Postal Service implemented what it hoped would be a more reliable way to measure Within County's share of Periodicals revenue by establishing separate Account Identifier Code (AIC) accounting codes for Within County and Outside County Periodicals. NNA notes that in Docket No. R2006-1, the Postal Service declared the accounting-based estimate to be unreliable, since it was substantially smaller than the sample-based BRPW estimate. NNA further notes that, in view of the unreliability of the various measurements of Within County's share of Periodicals volume available in Docket No. R2006-1, the Commission resorted to using a 4-year moving average to estimate Within County volume.

NNA argues that for those mailing at Within County rates, it is critical that piece characteristic data collected from non-Postal One offices be accurate, since nearly one-third of Within County volumes are reported in those offices. *Id*. at 6. It notes that the

[5] Comments of the National Newspaper Association (NNA), July 31, 2009 (NNA Comments).

accuracy of unit cost estimates depends on accurate volume estimates. It also notes that, unlike most market dominant classes, unit attributable cost estimates for components of the Periodicals class are likely to directly impact rates because Periodicals rates hover below the marginal cost floor established in section 2622(c)(2) of the PAEA, and there is substantial pressure to raise Periodicals rates above that floor.

NNA does not oppose the modeling approach proposed by the Postal Service outright, *id*. at 10, but it urges the Postal Service not to rely on it exclusively. Asserting that there are dire consequences for Within County mailers if the modeling approach proves to be inaccurate, NNA urges the Postal Service to collect piece characteristic data for Periodicals in a regular census (quarterly or annually) of non-Postal One offices as a reality check on the modeled results. *Id*. at 2. It also urges the Commission to continue to employ multiple-year averages when estimating Within County volume. *Id*. at 10.

V. COMMISSION ANALYSIS

Proposal Two is what is generally known in survey sampling as a weighting-class method for adjusting data to compensate for survey non-response. Weighting-class methods use variables that are known for all units in the selected sample (revenue, in this instance) to form weighting-adjustment classes on the assumption that the characteristics of interest that are not known for the non-responders are similar to those for the responders. Totals for the respondents in the weighting-adjustment classes are increased so that the resulting measurements represent the non-respondents' share of the population as well as their own. In the approach proposed by the Postal Service, the excluded data from the non-automated offices would be treated as survey non-response (or non-coverage of the non-Postal One frame); the offices in the Postal One census would be treated as "survey respondents," and the proposed strata defined by the Trial Balance revenue rankings are the "weighting classes."

A. Accuracy of Proposal Two as Applied to Mail Categories Generally

The Commission's task is to determine whether weighting Postal One data in the manner that the Postal Service proposes will compensate for the non-Postal One offices that would be excluded under the proposed "modeling" method. The Appendix to this Order provides the theoretical framework for answering this question if appropriate data were available to which the theory could be applied. Formula 1.3 in the Appendix shows that the accuracy of the estimates derived from the proposed non-response model depends on the combined effect of (1) the validity of the assumption that the Postal One and the non-Postal One offices in the same strata have "similar" BRPW characteristics; (2) the manner in which the strata are defined; (3) the distribution of the automated and non-automated offices in the strata; and (4) the appropriateness of the stratum weights.

If there is a substantial difference between the mean values of the measured volume (or some other piece characteristic) for the Postal One and non-Postal One offices in a given stratum, and the number of non-Postal One offices in the stratum is relatively large, then a significant bias can be expected in the related estimated total. The Postal Service did not estimate the differences in mean values reported by Postal One and non-Postal One offices. The Postal Service did not describe its stratification design methodology, so how effectively that design might control within-strata variation is unknown. More importantly, it did not show that there is a definitive functional relationship between Postal One and non-Postal One offices within a given strata. Consequently, it failed to provide substantial support for the underlying assumption that the mail characteristics for the smaller Postal One offices can serve as a proxy for the corresponding characteristics of Non-Postal One offices with similar revenue.

However, as the Public Representative noted, for most of the mail categories the contribution of the non-Postal One offices to the BRPW estimates derived from the model is relatively small. Public Representative Comments at 6. This means that non-

response (non-coverage) or frame bias that would be caused by a difference in the mean values of the mail characteristics between Postal One and non-automated offices is a non-issue for most mail categories. In addition, as the Public Representative points out, the current sampling method is imprecise, and the panel frames and "blow-up" factors are obsolete. *Id.* at 4-5. This argues against retention of the current method.

The sensitivity analysis presented by the Postal Service to validate the stratifications in its weighting-class approach was selective. It merely confirmed that Postal One offices account for more than 95 percent of the target population for most categories of mail so that there would be very little error in BRPW estimates that could be ascribed to the weighting imposed by the new methodology. All of the alternative stratifications considered would essentially result in the same national totals when the various strata are summed. However, this may not be the case for Within County Periodicals, where estimates clearly could vary with changes in stratification design.

B. Proposal Two as Applied to Within County Periodicals

Some assessment of the effectiveness of the modeling alternative to accurately estimate the piece characteristics of Within County Periodicals can be made through an empirical analysis of the effects of the factors discussed in the previous section. This analysis reinforces the concerns expressed by the NNA regarding the quality of current Within County BRPW estimates, and its concerns that the weighting-adjustment class model proposed by the Postal Service is potentially biased.

As described above, the Postal Service conducted a special census of Periodicals revenues for Quarter 3 of FY 2008. Because the relative share of Within County revenue indicated by the census was close to the relative share implied by its proposed model, the Postal Service concluded that the special census validated the model. This comparison, however, may be somewhat misleading. To an extent, it appears that apples were compared to oranges.

The Postal Service compared the Within County revenue share indicated by the census (31.2 percent) with that implied by the proposed model (33.2 percent) and the estimate obtained from the BRPW sample of non-Postal One offices (40.0 percent). *See* Table 4 in Appendix A to the Petition. The census results were obtained from 89 percent of a frame of 3,300 non-Postal One offices with Periodicals mail activity. The size of the frame used in the Quarter 3 BRPW panel appears to be 5,141. *Id*. It is not clear that the number of non-Postal One offices to which the model result for Quarter 3 is applied is equal to either of these numbers. The 8.8 percent difference between the Within County revenue share indicated by the special census and the BRPW sample results (40.0 – 31.2 percent) for Quarter 3 does less to establish the superiority of the model than the Postal Service asserts. This difference is not likely to be statistically significant in light of the large sampling error associated with sample estimate.[6]

The Postal Service concluded that the model implies non-Postal One office activity with reasonable accuracy because its implied percentage of Within County revenue (33.2 percent) is close to that obtained from the Quarter 3 census. The methodology used to imply the modeled percentage, however, raises doubts about its validity. In addition to the possible differences in the respective frames employed, the model implies an annual percentage figure for FY 2008, but is compared to a percentage figure obtained from a census that covered only Quarter 3. Furthermore, the percentages implied by the model are derived data that have been adjusted to match Trial Balance revenue. Consequently, two effects—non-response modeling and Trial Balance adjusting—are reflected in the BRPW estimates, and they affect the comparison with the census results. This is clearly shown by the mathematical expression of an estimator incorporating both adjustments illustrated in the Appendix attached to this Order at page 3 of 8. The effect of class-weighting of Postal One

[6] The sampling error associated with the BRPW sample estimate may be relatively large as a result of the small sample sizes in the panel strata.

revenues is amplified with the Trial Balance adjustment. This obscures the effect of class-weighting of Postal One revenues.[7]

The ability of the model to accurately estimate the mail characteristics of Within County mail at non-Postal One offices can be evaluated empirically by comparing the revenue estimates obtained from the special census for those offices with the revenue estimates for those offices implied by the model. The table below compares the two sets of revenue estimates over the same time period (Quarter 3 of FY 2008).

Comparison of Model Estimates for Non-CBCIS Offices with "Census" Results Periodicals, Quarter 3, 2008

Stratum	Model Estimates for Non-CBCIS Offices*		Census Estimates for Non-CBCIS Offices		Difference	
	In County	Outside County	In County	Outside County	In County	Outside County
1	0	0	0	0	0	0
2	32,739	111,007	96,053	289,046	(63,314)	(178,039)
3	99,165	237,756	302,394	577,780	(203,229)	(340,024)
4	257,144	608,692	443,708	928,827	(186,564)	(320,135)
5	479,591	972,590	555,581	1,248,014	(75,990)	(275,424)
6	754,488	1,500,730	822,856	1,888,532	(68,368)	(387,802)
7	507,486	1,032,190	500,260	1,162,630	7,226	(130,440)
8	408,459	695,781	337,087	794,259	71,372	(98,478)
9	316,446	411,451	262,665	475,748	53,781	(64,297)
Total	**2,855,517**	**5,570,198**	**3,320,604**	**7,364,836**	**(465,086)**	**(1,794,639)**
Total Percent Difference					**-14.0%**	**-24.4%**
* These estimates are derived from the table on page 5 of 8 in the Appendix to this Order.						

[7] By adjusting the stratum revenue for mail categories that Postal One offices report to match the stratum revenue for those same categories reported in the Trial Balance, the Postal Service treats the Trial Balance revenues as actual mail category revenues. If Trial Balance revenues reflect actual revenues, the difference between Trial Balance revenues and those reported by the Postal One system can be interpreted as reporting error in that system. The differences by stratum can be observed in column 9 of the table on page 5 of 8 in the Appendix to this Order. They are substantial, rising to almost 70 percent in some strata in some quarters. They are large enough to raise doubts about the accuracy of Postal One reporting and the proposed modeling approach that relies on it. The reasons for the large differences between the revenues recorded in the financial accounts and those reported by Postal One should be investigated, since neither should be subject to sampling error. These differences vary substantially from quarter to quarter; therefore, the reason for their apparent seasonality should be part of that investigation.

If the special census values were viewed as "true," the observed calculated differences between those values and the model values imply that the model would underestimate Within County revenue from non-Postal One offices by more than $465,000 (14 percent), and Outside County revenues by $1,795,000 (24 percent). On a stratum-by-stratum basis, the implied errors are much greater. The actual differences are larger than this since there was an 11 percent non-response rate. If the census represented fewer offices than those on which the modeled estimates are based, then the actual differences could be larger still. Since total revenue, volume, and weight from selected reference periods are among the principal variables of interest for BRPW estimation, these results cast doubt on the ability of the model to accurately estimate Within County Periodicals mail characteristics in non-Postal One offices.

C. Findings

The Postal Service's proposed model produces estimates of mail characteristics that are as good, or better, than the current method for all categories of mail but Within County Periodicals because only that category has a substantial share of its total volume processed in non-Postal One facilities. Accordingly, Proposal Two's modeling approach is accepted for all mail categories except Within County Periodicals.

With respect to Within County Periodicals, the Postal Service has not demonstrated that the modeling approach will provide better estimates than the current sample-based method. The data and analysis offered in support of the proposal are somewhat ambiguous and inconsistent. The proposed modeling procedure would introduce a bias to the BRPW estimation process of a magnitude that cannot be reliably estimated from the information presented by the Postal Service, although the bias would diminish with time as more offices are equipped with Postal One. A comparison of non-Postal One revenues implied by the model differ substantially from those obtained from the special census, raising the prospect that the model could produce sizable errors.

The current sample-based method does not appear to produce reliable estimates of Within County mail characteristics either. As noted earlier, it was for that reason that the Postal Service established separate accounting codes for Within County and Outside County Periodicals revenue so that their revenue shares could be recorded directly from the books of account. The Postal Service concedes, however, that some offices probably do not distinguish between the two codes, and report Within County revenue under the code intended for Outside County revenue. Postal Service Response to CHIR No. 1, Question 4(b).[8]

NNA asks that the Postal Service be required to corroborate the results of its modeling approach with a quarterly or annual census of Periodicals activity at non-Postal One offices. The Postal Service replies that a regular census would be too costly (about $200,000 per census). *Id.*, Question 4(e).

Because there is no assurance that the current sample-based estimation method or the proposed model-based estimation method produces Within County data that are reliable, the Commission concludes that Within County's revenue share estimated by the Postal Service's modeling approach must be corroborated in one or more of the following ways at the election of the Postal Service:

1. Taking a quarter-long census of Within County revenues at non-Postal One offices conducted every third year, beginning with FY 2011 Quarter 3, or

2. Revising the AIC codes that record FY 2011 Periodicals revenue, coupled with any necessary retraining of data reporters to produce accurate Trial

[8] The Postal Service supports this inference by noting that total revenue for Periodicals as a whole shown by the Trial Balance matches the corresponding amount obtained by the special census for Quarter 3, but that Within County revenue shown by the Trial Balance is 11 percent less than the amount obtained from the special census.

Balance revenue figures for Within County and Outside County Periodicals.[9]

If the percent of non-Postal One offices becomes too small to be a significant source of error in modeling the mail characteristics of Within County mail, the Postal Service may seek an end to the requirement that it corroborate the modeled results.

It is ordered:

For purposes of periodic reporting to the Commission, the Commission accepts the changes in analytical principles proposed in the Petition of the United States Postal Service Requesting Initiation of a Proceeding to Consider Proposed Change in Analytic Principles (Proposal Two), July 7, 2009, except as the body of this Order modifies Proposal Two with respect to estimating the mail characteristics of Within County Periodicals.

By the Commission.

Shoshana M. Grove
Secretary

[9] Postal facilities are equipped with a Chart of Accounts that explains the meaning and application of the Postal Service's financial accounts. Presumably, if an employee reporting Periodicals revenues is guided by that manual, the employee would turn to the list of accounts in the manual. *See, e.g.,* ACR 2008, USPS LR-FY08-6. AIC No. 41310-135 is labeled "Revenue—Postage—Periodicals." Neither the label nor the narrative explanation of what the account is intended to include limits the account to Outside County revenue. An employee who is not meticulous could infer that account no. 135 is meant to apply to all periodicals. This contrasts with AIC No. 41316-224, which is labeled "Periodicals—Within County (only)." Both the label and the narrative explanation of what the account is intended to cover limit the account to Within County revenue. An inadequately trained data reporter might assume that account no. 224 is a subaccount to be rolled up into account no. 135 rather than an amount that is exclusive of the amount reported in account # 135. The Postal Service concedes that it has not audited these financial accounts to see if they are being accurately interpreted. Postal Service Response to CHIR No. 1, question 4(b)(ii). The time to do so has come. Since account # 135 and account no. 224 are not being consistently interpreted as intended to reflect mutually exclusive amounts, it is possible that relabeling account no. 135 as "Periodicals—Outside County (only)" in the Chart of Accounts, making it clear in the narrative explanation that the account is meant to reflect only Outside County revenue, and drawing this revision to the attention of data reporters in each facility, would correct the reporting of Periodicals revenue to the point that it would serve as a check on the accuracy of the Postal Service's model.

THEORETICAL FRAMEWORK FOR ANALYSIS OF PROPOSAL TWO

To help determine whether it is plausible that weighting Postal One data as the Postal Service proposes will accurately compensate for the weighted sample data from non-Postal One offices that would be excluded under the proposed "modeling" method, a theoretical approach is developed below.

For the population of N_1 Postal One (automated) and N_2 Non-Postal One (non-automated) offices, denoted respectively by $U_1 = \{U_{11}, U_{12}, \ldots, U_{1N_1}\}$ and $U_2 = \{U_{21}, U_{22}, \ldots, U_{2N_2}\}$, the proposal is to take a complete census of U_1 and collect no survey data from U_2. However, the goal is to estimate mail characteristics for the combined population $U = U_1 + U_2$. For BRPW survey variable y, let Y_k denote the population value for the k_{th} unit or office of U. In addition, Y_{hk} represents the k_{th} population value in the h_{th} stratum (weighting-adjustment class). The weighting-adjustment class estimator for a population total Y_T (revenue, volume, weight) can be generally expressed as

$$\hat{Y}_T = \sum_1^H w_h \sum_{k=1}^{N_{h1}} Y_{hk}. \qquad (1.1)$$

Let N_{h1} and N_{h2} be the number of automated and non-automated offices in stratum h, respectively. In addition, $N_{h1} + N_{h2} = N_h$, $N_1 = \sum_h N_{h1}$, and $N_2 = \sum_h N_{h2}$. For the h_{th} stratum $w_h = \frac{N_{h1}+N_{h2}}{N_{h1}}$ is the stratum adjustment used to compensate for the exclusion of data from U_2, the frame of non-automated offices. The non-response error associated with the stratum estimate of y is

$$\epsilon_h = \frac{N_{h1}+N_{h2}}{N_{h1}} \sum_{k=1}^{N_{h1}} Y_{hk} - \left(\sum_{k=1}^{N_{h1}} Y_{hk} + \sum_{k=N_{h1+1}}^{N_h} Y_{hk} \right) \quad (1.2)$$

$$= \left(1 + \frac{N_{h2}}{N_{h1}}\right) \sum_{1}^{N_{h1}} Y_{hk} - \left(\sum_{1}^{N_{h1}} Y_{hk} + \sum_{N_{h1+1}}^{N_h} Y_{hk} \right)$$

$$= \frac{N_{h2}}{N_{h1}} \sum_{1}^{N_{h1}} Y_{hk} - \sum_{N_{h1+1}}^{N_h} Y_{hk}$$

$$= N_{h2}(\bar{Y}_{h1} - \bar{Y}_{h2}) \quad (1.3)$$

Therefore, the total "non-response error" of estimator $\hat{Y}_T$ becomes

$$\epsilon_t = \sum_{1}^{H} N_{h2} \, (\bar{Y}_{h1} - \bar{Y}_{h2}). \quad (1.4)$$

The accuracy of the estimates derived from $\hat{Y}_T$ depends upon the combined effect of (1) the manner in which the H strata are defined; (2) the validity of the assumption that the offices from U_1 and U_2 belonging to the same strata have "similar" BRPW characteristics; (3) the distribution of the automated and non-automated offices in the strata; and (4) the appropriateness of the stratum weights. If there are strata for which the difference between the means of variable y for the automated and non-automated offices is sizable, and the number of non-automated offices in the strata is relatively large, then a significant bias can be expected in the related estimated total.

While the BRPW estimator proposed by the Postal Service can be represented by equation1.1, the stratum weight would be expressed as

$w'_h = \frac{T_{h_1} + T_{h2}}{R_{hp}} = \left(\frac{T_{h1}+T_{h2}}{T_{h1}}\right)\left(\frac{T_{h1}}{R_{hp}}\right)$, where for the h_{th} stratum T_{h1} and T_{h2} are the Trial Balance revenues for the automated and non-automated offices respectively, and R_{hp} is the reported Postal One revenue. From the expression, it is clear that the stratum weights for the model are products of two adjustments. The first adjustment is

designed to compensate for non-response, and the second is the "Trial Balance Adjustment" designed to control the revenue estimate for the stratum to its Trial Balance value. If the non-response adjustment is denoted by φ_h and the Trial Balance adjustment by c_h and the other notation of equation 1.1 is retained, the proposed estimator can be expressed as

$$\tilde{Y}_T = \sum_1^H \phi_h \, c_h \sum_{k=1}^{N_{h1}} Y_{hk}. \qquad (2.1)$$

An estimator for the error associated with $\hat{Y}_T^{'}$ becomes

$$\epsilon_t = \sum_1^H \left(\sum_1^{N_{h1}} Y_{hk} \left(\frac{T_{h1}+T_{h2}}{T_{h1}}\right)\frac{T_{h1}}{R_{hp}} - \left(\sum_1^{N_{h1}} Y_{hk}\frac{T_{h1}}{R_{hp}} + \sum_{N_{h1+1}}^{N_h} Y_{hk\frac{T_{h2}}{R_{hp}^{'}}}\right)\right) \qquad (2.2)$$

$$= \sum_1^H \left(\sum_1^{N_{h1}} Y_{hk}\frac{T_{h2}}{R_{hp}} - \sum_{N_{h1+1}}^{N_h} Y_{hk\frac{T_{h2}}{R_{hp}^{'}}}\right) \qquad (2.3)$$

Estimates derived from equation 2.3 are contingent upon the ratio of the Trial Balance revenue for the stratum and stratum revenue obtained from the postal statements, where for the non-automated offices $R_{hp}^{'}$ is the total revenue for the stratum that could be obtained from the postal statements.

Data from the 2008 quarter 3 survey can be used to (1) approximate this error; (2) evaluate potential effects of different stratification schemes, particularly for Periodicals, and consequently (3) make an assessment of the effectiveness of the new model. In six of the nine strata that constitute the suggested Periodicals stratification, there is a sizable percentage of non-automated offices. To the extent that the underlying assumptions of the model are invalid, there will be significant error in RPW estimates for the mail category.

A more definitive assessment of the effectiveness of the modeling alternative can be achieved through an empirical analysis of the effects of these factors and their interactions. The table below consists of data and analysis provided by the Postal Service to document the Within County/Outside County revenue shares implied by its proposed model and presented in Table 4 of Appendix A to the Petition.

Derivation of Estimates of Q3 2008 Revenue Totals—Periodicals

Stratum	CBCIS Revenue			Trial Balance Periodicals ($T_{h1} + T_{h2}$)	Control Factor for All Offices	Controlled Revenue		Trial Balance for CBCIS Offices (T_{h1})	Control Factor for CBCIS Offices	Controlled Revenue for CBCIS Offices		Model Estimates for Non-CBCIS Offices	
	In County	Outside County	Total (R_{hp})			In County	Outside County			In County	Outside County	In County	Outside County
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	9,020,121	517,320,562	526,340,683	528,121,889	1.0034	9,050,646	519,071,243	528,121,889	1.0034	9,050,646	519,071,242	0	0
2	2,359,796	8,001,226	10,361,021	11,187,938	1.0798	2,548,132	8,639,806	11,044,191	1.0659	2,515,393	8,528,799	32,739	1 11,007
3	1,321,142	3,167,545	4,488,687	5,616,363	1.2512	1,653,047	3,963,316	5,279,442	1.1762	1,553,882	3,725,560	99,165	237,756
4	1,192,499	2,822,792	4,105,291	5,677,536	1.4140	1,686,169	3,991,367	4,811,700	1.1983	1,429,024	3,382,675	257,144	608,692
5	1,162,303	2,357,102	3,519,406	5,714,076	1.6236	1,887,105	3,826,971	4,261,895	1.2100	1,407,515	2,854,381	479,591	972,590
6	862,611	1,715,794	2,578,405	5,658,858	2.1947	1,893,183	3,765,675	3,403,639	1.3201	1,138,695	2,264,945	754,488	1,500,730
7	318,324	647,450	965,774	2,832,929	2.9333	933,749	1,889,180	1,293,253	1.3391	426,263	866,990	507,486	1,032,190
8	162,356	276,563	438,920	1,704.110	3.8825	630,351	1,073,759	599,870	1.3667	221,892	377,978	408,459	695,781
9	120,930	157,237	278,167	1,113,045	4.0014	483,885	629,160	385,148	1.3846	167,439	217,709	316,446	411,451
Total	16,520,084	536,466,270	552,986,354	567,626,744		20,766,267	546,860,476	559,201,028		17,910,750	541,290,278	2,855,517	5,570,198

Sources:

(1) – CBCIS reported In – County revenue.
(2) – CBCIS reported Outside County revenue.
(3) – Total reported CBCIS Periodical Revenue.
(4) – Total Periodicals Trial Balance revenue for CBCIS and Non-CBCIS offices.
(5) = (4)/(3).
(6) = (1)x(5).
(7) = (2)x(5).
(8) – Periodicals Trial Balance revenue for CBCIS reporting offices.
(9) = (8)/(3).
(10) = (1)x(9).
(11) = (2)x(9.
(12) = (6) – (10).
(13) = (7) – (11).

Columns (1) through (7) show the process by which the proposed model would calculate Periodicals revenue shares and other mail characteristics. Columns (8) through (13) show an analytical exercise in which Periodicals revenue shares are implied by the proposed model. Column (8) through (11) calculate the Periodicals revenue shares that would be implied if revenues reported by Postal One were inflated to correspond to the Trial Balance revenue for the respective strata for Postal One offices only. The Postal One office revenue shares in columns (10) and (11) are viewed as a subset of the all-office revenue shares shown in columns (6) and (7). Subtracting columns (10) and (11) from columns (6) and (7), respectively, yields residual amounts that can be interpreted as the revenue shares that the model implies for non-Postal One offices. *See* columns (12) and (13). The total Within County revenue share of 33.9 percent for Quarter 3 implied by the model is within 10 percent of the "true" 31.2 percent share obtained from the special census of non-Postal One offices.

The table below (which also appears in the text of this Order at page 12) shows the Periodicals revenue shares by stratum obtained from the special census for the same time period (Quarter 3 of FY 2008).

Comparison of Model Estimates for Non-CBCIS Offices with "Census" Results Periodicals, Quarter 3, 2008

Stratum	Model Estimates for Non-CBCIS Offices*		Census Estimates for Non-CBCIS Offices		Difference	
	In County	Outside County	In County	Outside County	In County	Outside County
1	0	0	0	0	0	0
2	32,739	111,007	96,053	289,046	(63,314)	(178,039)
3	99,165	237,756	302,394	577,780	(203,229)	(340,024)
4	257,144	608,692	443,708	928,827	(186,564)	(320,135)
5	479,591	972,590	555,581	1,248,014	(75,990)	(275,424)
6	754,488	1,500,730	822,856	1,888,532	(68,368)	(387,802)
7	507,486	1,032,190	500,260	1,162,630	7,226	(130,440)
8	408,459	695,781	337,087	794,259	71,372	(98,478)
9	316,446	411,451	262,665	475,748	53,781	(64,297)
Total	**2,855,517**	**5,570,198**	**3,320,604**	**7,364,836**	**(465,086)**	**(1,794,639)**
Total Percent Difference					**-14.0%**	**-24.4%**

* These estimates are derived from the table on page 5 of 8 in the Appendix to this Order.

Comparing the special census revenue with the revenue implied by the model for non-Postal One offices shows results that differ substantially across most strata, and not in a consistent direction. If the special census represents "true" revenues by strata, the substantial differences between it and the modeled estimates raise doubts about the ability of the model to estimate Within County mail characteristics accurately for non-Postal One offices.