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RESPONSES OF OFFICE OF THE CONSUMER ADVOCATE WITNESS MARK J. ROBERTS TO INTERROGATORIES OF UNITED STATES POSTAL SERVICE (USPS/OCA-T1-19-26)

(October 13, 2006)

The Office of the Consumer Advocate hereby submits the responses of Mark J. Roberts to interrogatories USPS/OCA-T1-19-26, dated September 29, 2006. The interrogatories are stated verbatim and are followed by the response.

Respectfully submitted,

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RESPONSE OF OCA WITNESS MARK J. ROBERTS
TO INTERROGATORIES USPS/OCA-T1-19-26

USPS/OCA-T1-19. Please refer to OCA-T-1, Table 1 (page 13) and page 14, lines 11-19, where you describe your model for the "estimated " in Table 1 as employing the "same equations as the labor demand equations used in this paper [replacing] the log hours variable on the left-hand side with the log TPF in the operation." Please also refer to the Stata program threestep.do, in OCA-LR-2.

a. Please confirm that your estimating equations for the "estimated " in Table 1,as implemented in the program threestep.do, have the mathematical form (omitting certain subscripts):

$$\ln TPF_i = \ _i + \ _i \ln FHP_{shp} + \ X_i + \ ,$$

where the subscript j indicates cost pool, i indicates site, and shp indicates the shape of mail associated with cost pool j; is a vector of coefficients; X_j is a vector of control variables (year and technology dummy variables, capital variables, relative wage); and is a random disturbance term. If you do not confirm, please provide the correct form of your equations and explain fully.

b. Please confirm that in the MODS system, total pieces fed are defined such that, for cost pool j:

$$TPF_i = FHP_i + SH_i + \text{Rejects}_i.$$

where FHP_j is the FHP in cost pool j, SH_j is subsequent handlings in cost pool j, and $Rejects_j$ is rejected and reworked pieces (for automated operations). If you do not confirm, please provide the relationship you believe to be correct, and please cite all supporting documentation for your position.

c. Does the equation you confirm (or otherwise provide) in response to part (a). assume that the effect of a unit of FHP on the TPF in cost pool j is unaffected by the cost pool within a shape category in which the FHP is recorded? If you claim it does not, please show in detail how the effect may differ by the source of FHP. If so, please describe and provide all formal testing you, performed or other evidence you developed, to indicate that the assumption is correct.

d. Did you consider any other specifications for the "estimated " in Table 1? If so, please describe each in detail, provide all results you obtained from each alternative specification you explored, and explain why you prefer the specification you confirm (or otherwise provide) in part (a) over each alternative.

e. Does the specification for the "estimated " you presented in your Table 1 account, in any way, for the mailflow characteristics you confirmed in response to USPS/OCA-T1-7? If so, please explain in detail how your models do so. If not, why not?

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RESPONSE TO USPS/OCA-T1-19

(a) Confirmed, although please note that the coefficient vector varies by operation and should be written as $_j$.

(b) Confirmed as a definition, if by "subsequent handlings" you mean all pieces handled in cost pool *j* that received their FHP count in some other cost pool. In my understanding SH_j is not reported in the MODS data. Also since FHP_j is measured using weight and a conversion factor, while TPF_j is measured using machine counts (see USPS-T12, Section II.E, p. 23, line 19 to p. 24, line 15), this relationship would not hold in the MODS data even if SH_j was measured independently.

(c) This question appears to be asking if the coefficient $_j$ in the regression in part (a) will depend on which operations are responsible for the FHP count in the plant. The answer is no, it does not depend on where the FHP is assigned, but it does depend on how intensively operation *j*is used in sorting the ma il volume received in the plant. As an example, suppose that all the letter mail received in the plant is barcoded, receives its FHP count in the BCS operation, and skips the OCR operation entirely, then $_{OCR}$ will equal zero. Suppose instead that 70% of the letter mail is barcoded and receives its FHP count in the BCS operation and skips OCR. The remaining 30% of the letter mail received in the plant goes through the OCR operation and each piece generates one TPF, then $_{OCR}$ will equal .3. It does not matter if the mail that passes through the OCR operation received its FHP count in OCR or in some previous step, if there was one. The

coefficient $_j$ does not depend on where FHP is assigned in the plant, but it does depend on how much of the total mail received in the plant passes through operation *j.*

(d) No.

(e) No. Placing this structure on the estimating equations is not necessary for measuring the relationship between the volume of mail entering the plant and the piece feedings in different operations.

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USPS/OCA-T1-20. Please refer to OCA-T-1, Tables 1 and 3-7. Please also refer to your response to USPS/OCA-T1-8. [OCA was informed by the Postal Service that this question refers to interrogatory 8 rather than interrogatory "X," as originally filed by the Postal Service.]

a. Please confirm that your estimating equations for the "estimated " in Table 1 have the mathematical form (omitting certain subscripts):

$$\ln HRS_i = \quad_i + \quad_i \ln FHP_{shp} + \quad X_i + \quad ,$$

where the subscript j indicates cost pool, i indicates site, and shp indicates the shape of mail associated with cost pool j; is a vector of coefficients; X_i is a vector of control variables (year and technology dummy variables, capital variables, relative wage); and is a random disturbance term. If you do not confirm, please provide the correct form of your equations and explain fully.

b. Please confirm that your estimating equations for the "base models" in Tables 3-7, have the mathematical form (omitting certain subscripts):

$$\ln HRS_i = \quad_i + \quad_{i,out} \ln FHP_{shp,out} + \quad_{i,in} \ln FHP_{ship,in} + \quad^1 X_i + \quad ,$$

where the subscript j indicates cost pool, i indicates site, and "shp" indicates the shape of mail associated with cost pool j; "out" and "in" indicate, respectively, the outgoing and incoming operations for the given shape; is a vector of coefficients; X_j is a vector of control variables (year and technology dummy variables, capital variables, relative wage); and is a random disturbance term. If you do not confirm, please provide the correct form of your equations and explain fully.

c. Does the equation you confirm (or otherwise provide) in response to part (a) assume that the effect of a unit of FHP on the workhours (HRS) in cost pool j is unaffected by the cost pool within a shape category in which the FHP is recorded? If not, please show in detail how the effect may differ by the source of FHP.

d. Does the equation you confirm (or otherwise provide) in response to part (b) assume that the effect of a unit of FHP on the workhours (HRS) in cost pool j may be different for incoming FHP versus outgoing FHP, but otherwise is unaffected by the cost pool within a shape category in which the FHP is recorded? If not, please show in detail how the effect may differ by the cost pool in which the FHP is recorded.

RESPONSE TO USPS/OCA-T1-20

(a) Confirmed, although please note that the coefficient vector varies by operation and should be written as $_j$.

(b) Confirmed, subject to the same comment in part (a).

(c) This question appears to be asking if the coefficient $_j$ in the regression in part (a) will depend on which operations are responsible for the FHP count in the plant. The answer is no, it does not depend on where the FHP is assigned, but it does depend on how intensively operation *j* is used in sorting the mail volume received in the plant. As an example, suppose that all the letter mail received in the plant is barcoded, receives its FHP count in the BCS operation, and skips the OCR operation entirely, then $_{OCR}$ will equal zero. Suppose instead that 70% of the letter mail is barcoded and receives its FHP count in the BCS operation and skips OCR. The remaining 30% of the letter mail received in the plant goes through the OCR operation and each piece requires the same number of labor hours to handle, then $_{OCR}$ will equal .3. It does not matter if the mail that passes through the OCR operation received its FHP count in OCR or in some previous step, if there was one. The coefficient $_j$ does not depend on where FHP is assigned in the plant, but it does depend on how much of the total mail received in the plant passes through operation *j.*

(d) The answer is the same as the answer to part (c) except now the coefficients $_{j,IN}$ and $_{j,OUT}$ allow the relationship between hours and FHP to vary depending on whether the FHP is assigned in an incoming or outgoing operation. The coefficient $_{j,OUT}$, for example, will not depend on where the FHP in the outgoing

operation is assigned but will depend on how much of the outgoing FHP passes through operation *j*.

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USPS/OCA-T1-21. Please refer to your responses to USPS/OCA-T1-4c and to USPS/OCA-T1-20b. Please also refer to USPS-T-12 at page 45, line 21, to page 46, line 1. Dr. Bozzo states:

> In Prof. Roberts's notation, his models use
>
> $$H_L = (FHP_{Out,Letter}, FHP_{In,Letter}) \quad \textbf{(8)}$$
>
> $$H_F = (FHP_{Out,Flat}, FHP_{In,Flat}) \quad \textbf{(9)}$$

a. Given the specification(s) you confirm or provide in response to USPS/OCA-T1-20b, is Dr. Bozzo wrong to claim that your "base" models for letter- and flat-shape operations "use" MODS FHP handlings as given by equations (8) and (9)? If so, please explain.

b. Please confirm that your estimating equations include no terms for "volumes" other than MODS FHP handlings. (That is, this question addresses right-hand-side variables in your estimating equation, not instrumental variables you use to identify your models.) If you do not confirm, please explain fully what other volume or handling measures you claim to use, and show in detail where you use them.

RESPONSE TO USPS/OCA-T1-21

(a) If Dr. Bozzo is saying that my model specifies and estimates the relationship between labor hours in an operation and MODS FHP in the plant, then I agree. If he is saying that I must specify or estimate a relationship between hours and piece handlings in an operation or between piece handlings in an operation and MODS FHP, I disagree.

(b) Confirmed. Although MODS FHP is disaggregated into multiple categories. In the base model it is disaggregated into FHP_{IN} and FHP_{OUT} for each shape. In OCA-T-1, Sections V.C and VIII.C, each of these is further disaggregated into two categories reflecting the level of automation preparation.

USPS/OCA-T1-22. Please consider the econometric specification of your labor demand models. Please explain in detail why you consider it appropriate to include capital variables on the right-hand side of your estimating equations, and explain why you feel your econometric treatment of your capital variables—including your treatment of those variables as exogenous, predetermined, or such description as you deem appropriate—is justified.

RESPONSE TO USPS/OCA-T1-22

The reason that capital variables are included in the labor demand models follows directly from the specification of the production function and cost minimization assumption. It is explained in detail in Roberts (2002) , Section II, particularly II.B, and IV.B, and Roberts (2006), Section II.C. The empirical model treats the capital stock of each of several types of machines as exogenous in the labor demand. That means that the stocks of machinery do not respond to quarterly shocks to the labor demand equations. Rather, the deployment of capital reflects longer-term considerations including the development of new technology. It is also true in the PCN data that the stock of a type of equipment often remains constant in a plant, sometimes for several years, and is clearly not being adjusted to short-run fluctuations in demand for mail processing.

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USPS/OCA-T1-23. Please refer to your response to USPS/OCA-T1-4(e).

a. Please confirm that the OCA's precise distribution key request was as follows:

> OCA/USPS-1. Please provide a separate distribution key and a separate dollar total for each of the following "cost pools," where each pool is an aggregate of MODS codes.
>
> a. Pool *Lo* : {29, 30, 40, 46, 47, 91, 261, 262, 271, 272, 281, 291, 297, 831, 832, 841, 842, 851, 852, 861, 862, 871, 872, 881, 882, 891, 892, 961, 962, 971, 972} This group of codes is intended to contain all and only outgoing letter operations. Please verify that the list is correct for FY 2005, or make necessary corrections, before creating the distribution key and dollar total.
>
> b. Pool *Li*: {43, 44, 45, 150, 160, 168, 169, 243, 246, 249, 263, 264, 265, 266, 267,273, 274, 275, 276, 277, 278, 283, 284, 285, 286, 287, 293, 294, 295, 296, 297,298, 483, 484, 485, 486, 493, 504, 833, 834, 835, 836, 837, 843, 844, 845, 846,847, 853, 854, 855, 856, 857, 863, 864, 865, 866, 867, 868, 869, 873, 874, 875,876, 877, 878, 879, 883, 884, 885, 886, 887, 893, 894, 895, 896, 897, 898, 899, 914, 915, 916, 917, 918, 919, 925, 926, 963, 964, 965, 966, 967, 973, 974, 975, 976, 977, 978, 979} This group of codes is intended to contain all other (not outgoing) letter operations. Please verify that the list is correct for FY 2005, or make necessary corrections, before creating the distribution key and dollar total.
>
> c. Pool *Fo :* {60, 69, 70, 141, 142, 331, 332, 421, 422, 441, 442, 461, 462, 811, 812} This group of codes is intended to contain all and only non-Priority outgoing flat operations. Please verify that the list is correct for FY 2005, or make necessary corrections, before creating the distribution key and dollar total.
>
> d. Pool *Fi :* {73, 74, 75, 143, 144, 145, 146, 147, 148, 170, 175, 178, 179, 194, 195, 196, 197, 333, 334, 335, 336, 337, 338, 423, 424, 425, 426, 427, 443, 444, 445, 446, 447, 448, 451, 463, 464, 465, 466, 467, 468, 813, 814, 815, 816, 817} This group of codes is intended to contain all other (not outgoing) non-Priority flat operations. Please verify that the list is correct for FY 2005, or make necessary corrections, before creating the distribution key and dollar total.

e. Pool *Po :* {50, 51, 52, 100, 130, 134, 135, 138, 255, 258, 320, 321, 322, 450, 818} This group of codes is intended to contain all outgoing operations not included in *Lo* or *Fo.* Please verify that the list is correct for FY 2005, or make necessary corrections, before creating the distribution key and dollar total.

f. Pool *Pl*: {53, 54, 55, 136, 137, 139, 200, 257, 259, 324, 325, 326, 819} This group of codes is intended to contain all operations not included above. Please verify that the list is correct for FY 2005, or make necessary corrections, before creating the distribution key and dollar total.

If you do not confirm, please explain fully.

b. Please confirm that the OCA's distribution key request neither mentions FHP, nor provides any other methodological directions other than the intended level of MODS operation aggregation. If you do not confirm, please explain fully.

RESPONSE TO USPS/OCA-T1-23

(a) Confirmed

(b) Confirmed. No consideration of FHP was necessary. These six cost pools are aggregates over the sorting operations used to process incoming and outgoing letters, flats, and parcels.

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OCA/USPS-T1-24. Please refer to your response to USPS/OCA-T1-4. Consider a mailstream that may be divided into outgoing and incoming operations, with processing nodes (origin and destination plants, ADCs/AADCs, etc.) consistent with the Postal Service's network.

a. Please confirm that, according to MODS FHP definition, FHP count(s) should be recorded in the first distribution (sorting) operation where a piece of mail is sorted, in each facility where the piece receives distribution (sorting) handling. If you do not confirm, please explain fully.

b. Please confirm that, for a given piece of mail, the number and location (by incoming/outgoing operations and/or network nodes) of FHP counts (if any) may depend on the piece's origin-destination pair and/or presort level. If you do not confirm, please explain.

c. Consider a collection of mailpieces of a given shape and subclass (say, P1) whose origin/destination pair and/or presort level permits it to bypass piece sorting operations in plants entirely. Please confirm that such mailpieces should generate no FHP counts in MODS. If you do not confirm, please explain how you believe pieces that bypass sorting operations would generate FHP.

d. Is it your understanding that ODIS-RPW volumes include, in principle, the number of unique pieces in P1 notwithstanding that the P1 pieces do not generate FHP? Please explain any negative answer fully.

e. Let V1 denote the number of pieces in P1. Is it your understanding that, in principle, ODIS-RPW counts the V1 pieces in P1 under the appropriate subclass or other mail category measured in that system? Please explain any negative answer fully.

f. Please confirm that the relationships between V1 and FHP may be represented as follows:

$$FHP_{out,1} = 0 \bullet V1$$
$$FHP_{in,1} = 0 \bullet V1$$

If you do not confirm, please explain fully.

g. Please express the equations relating FHP to V1 in vector or matrix notation,

h. In your framework, what is the marginal cost in the sorting operations you model for a piece in the set P1? Show in detail how your variability models and any feasible subclass distribution approach you consider appropriate would produce the correct result, in principle, and explain whether the method is an example of the "constructed marginal cost" method, the "volume variability/distribution key" method (as those terms are used in USPS-LR-L-1, Appendix H) or some other method.

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i. Consider a collection of mailpieces P2, with volume V2, whose origin/destination pair and/or presort level permits it [sic] enter piece sorting operations at the destination plant. Do you agree that such mailpieces should generate one incoming FHP count each, no outgoing FHP counts, and V2 pieces should be recorded in ODIS-RPW? If not, please explain fully the basis for your disagreement.

j. Please confirm that the relationships between V2 and FHP may be represented as follows:

$$FHP_{out,2} = 0 \bullet V2$$
$$FHP_{in,2} = 1 \bullet V2$$

k. Please confirm that the relationship between V2 and your shape-based FHP outputs could be characterized using equations similar to those in part i, by specifying the additional detail of the shape-based mailstream in which the FHP for the V2 volumes are recorded, and with zero FHP recorded in the other FHP outputs. If you do not confirm, please explain.

l. Please express the equations relating FHP to V2 in part i in vector or matrix notation.

m. Consider a collection of mailpieces P3, with volume V3, whose origin/destination pair and/or presort level requires sorting at an outgoing plant, an ADC or AADC, and an incoming plant that is not the same facility as the ADC/AADC. Do you agree that such mailpieces should generate one outgoing FHP count each, two incoming FHP counts each, and V3 pieces should be recorded in ODIS-RPW? If not, please explain fully the basis for your disagreement.

n. Please confirm that the relationships between V2 and FHP may be represented as follows:

$$FHP_{out,3} = 1 \bullet V3$$
$$FHP_{in,3} = 2 \bullet V3$$

If you do not confirm, please provide the equations you believe to be correct and explain fully how your equations are consistent with MODS FHP measurement practices.

o. Please express the equations relating FHP to V1 in vector or matrix notation.

p. Do you agree that relationships to those in parts (f), (j), and (n) could be specified for each of the N operationally distinct volume categories, with the nth category (volume Vn) given by

$$FHP_{out,n} = a_{out,n} \bullet Vn$$
$$FHP_{in,n} = a_{in,n} \bullet Vn$$

Where $a_{out,n} \geq 0$ and $a_{in,n}$ n ≥ 0 are parameters that depend on the characteristics of Vn and the structure of Postal Service sorting operations? If not, please provide the relationships you believe to be correct and explain fully.

q. Please confirm that the sum V1+V2+...+Vn+...+VN is, by definition, the total number of unique pieces in the postal system. If you do not confirm, please explain fully.

r. Please confirm that, in general, the sums of the FHP variables will be different from the sum in part (q). If you do not confirm, please show how the sums of FHP and the sums of the volumes are identical.

s. Let FHP_{in} be the sum of incoming FHP for each of the N volume categories, and FHP_{out} be the corresponding sum of outgoing FHP. Please express the relationship between the vectors (FHP_{in}, FHP_{out}) and (V1,... ,Vn,... ,VN) in vector/matrix notation.

t. Please refer to USPS-T-12, pages 45-46 (equations 8 and 9) and page 49, lines 14-18, especially equation 14. Taking Ki to represent your vector of capital controls, Xi to represent other control variables in your models, and with the handlings Hi are specified using the appropriate vector of shape-based FHP in Dr. Bozzo's equation (8) or (9) (USPS-T-12, pages 45-46), is Dr. Bozzo incorrect in characterizing your labor demand equations as cases of his equation 14? If so, please explain in detail how equation (14) fails to encompass your estimating equations as a special case.

u. Consider the equation H = A • V, where H is a vector of FHP handlings and V is a vector of ODIS-RPW volumes (i.e. unique piece counts by subclasses and/or other relevant characteristics)—i.e., a variation of Dr. Bozzo's equation 5, at USPS-T-12, page 45—where A is a matrix of coefficients that depends on the characteristics of V and of the Postal Service's mailflows. Is it your testimony that such an equation mischaracterizes the relationship between FHP handlings and RPW volumes? If so, please explain in detail how it does so.

RESPONSE TO USPS/OCA-T1-24

I believe this question addresses the issue of constructing a distribution key for the cost pools that can be constructed using my elasticity estimates. Before attempting to answer the detailed parts, let me summarize and draw a parallel with the USPS methodology.

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The three-part methodology used by the USPS first uses plant-level panel data from MODS to estimate the relationship between piece handlings in a sorting operation and labor hours. A constant elasticity of hours with respect to piece handlings is constructed for each sorting operation (USPS-T-12, Table 1, page 3). The estimation of the elasticities does not utilize any information on the volume of mail in each plant. Once these elasticities have been constructed the use of plant-level MODS data is finished.

The second step of the process constructs the total expenditure on labor in each sorting operation by summing over the expenditure in all plants. Each sorting operation is referred to as a cost pool. The total expenditure in each cost pool is multiplied by the constant elasticity for that cost pool estimated in the first step. This produces the volume-variable cost of each sorting operation/cost pool (USPS-T-11, Table 1).

The third step of the process occurs entirely at the aggregate level. Each cost pool is disaggregated or distributed across the CRA rate classes using the share of piece feedings in the cost pool that are attributable to each rate class. These rate class shares are constructed by sampling piece feedings in the cost pool/sorting operation. A rate class that appears frequently in the sample of piece feedings will generate a large share and thus a large fraction of the cost pool's variable costs will be distributed to it. This distribution is done separately for each cost pool. The volume-variable costs for each rate class are then constructed by summing over the cost pools.

Contrast this with the methodology I recommend. First, I define categories of mail based on the type of processing that they require. Specifically, mail receiving an outgoing sort in a processing plant is treated as one category of mail and mail receiving an incoming sort is treated as another category. (These categories can be further divided based on levels of presorting as described in OCA-T-1, Section V.C.). These are the output categories for each plant. I next use the MODS plant-level data to estimate the relationship between the volume of mail in each output category and labor hours in each sorting operation. This produces a constant volume elasticity for each sorting operation for each category of output (for example, OCA-T-1, Table 4, Panel A). Specifically, plant-level information on the volume of mail is used to estimate these relationships. Next I aggregate these elasticities across sorting operations to get a total labor demand elasticity for each category of output (the last column of OCA-T-1, Table 4, Panel A). At this point the use of the plant-level MODS data is finished.

This is the point at which my testimony in OCA-T-1 stops because I do not have the additional information needed to carry out the distribution of costs to rate classes. Nonetheless I can describe how it should be done. The remaining two steps parallel the last two steps used by the USPS, but with a couple of differences.

The next step is to create pools of volume-variable costs for each category of output (not each sorting operation). This is done by constructing the total cost of processing each category of output, for example the total cost of processing all outgoing mail, by summing the expenditures to process that category of mail over all plants. Each of these cost pools is then scaled by the elasticity of hours with respect to that category of

output. This is the volume variable cost for this category of output. Notice that the cost pools, and thus volume variable costs, are defined for each category of output, not each sorting operation.

The final step is to allocate each of these cost pools across rate classes. This would be done by constructing a distribution key that gives the share of each rate class that appears in the output category. You would construct this by sampling the pieces of mail in each output category and constructing the shares of each rate class in the total. A rate class that accounted for many of the mail pieces in the output category would receive a large share of the variable cost for that output category. Notice that the sampling to construct the distribution key should be based on pieces of mail in the output category, not piece feedings in a sorting operation as used in the USPS methodology. The goal should be to construct a random sample of the pieces of mail in an output category and use it to construct the empirical frequency distribution across the rate classes for the output category. This would be repeated for each output category so there is a different distribution key for each output category.

a. Confirmed.
b. Confirmed.
c. Confirmed. If the mailpieces are not processed in piece sorting operations they will not generate FHP. They will also not generate any processing costs.
d. I have not worked with the ODIS-RPW data and do not know enough about its sampling methodology to answer this.

e. See my answer to part (d).

f. See my answer to part (c).

g. See my answer to part (d).

h. See my answer to part (c).

i. Confirmed that it should generate one incoming FHP and no outgoing FHP. I have not worked with the ODIS-RPW data and do not know enough about its sampling methodology to answer the question with respect to V2.

j. See my answer to part (i).

k. See my answer to part (i).

l. See my answer to part (i).

m. Confirmed that it should generate one outgoing FHP and two incoming FHP. I have not worked with the ODIS-RPW data and do not know enough about its sampling methodology to answer the question with respect to V3.

n. See my answer to part (m).

o. See my answer to part (m).

p. It is not clear what is meant by "distinct volume categories." It would be helpful to have a complete listing of what these distinct volume categories are.

q. See my answer to part (d).

r. While I do not know exactly what sum is being referred to in part q, I agree that summing FHP over all plants will not equal the number of pieces of mail in the postal system. A single piece of mail can pass through more than one plant and so can receive more than one FHP count during its processing journey.

s. See my answer to part (d).

t. Yes, Dr. Bozzo is incorrect in characterizing my labor demand equations as special cases of his equation 14. My labor demand functions depend on the volume of mail in the plant, not the piece handlings in an operation. See Roberts (2002), Section II.A and Roberts (2006), Sections II.B, II.C, II.E, and IV.A for the details of the model that give rise to my labor demand equations. To write the equation in this way and then to say that I specify "handlings with a common Hi for all operation within a shape-based mailstream," confuses the general case and the special case. In Roberts (2006), Section III, I show that the USPS model that gives rise to labor demand equations like equation 14 is a special case of the model I develop, not the other way around.

u. See the last paragraph of my comments in the introduction to this question for how to define H, A, and V in this equation in a way that makes sense for use as a distribution key given my modeling framework.

RESPONSE OF OCA WITNESS MARK J. ROBERTS
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USPS/OCA-T1-25. Please refer to your responses to USPS/OCA-T1-3(b)-(d). Also consider a product transformation function (as in Robert G. Chambers, Applied Production Analysis, Cambridge University Press 1989, page 260) describing a Postal Service plant with the form:

$$g\left(H, L, K; H^{*}, L^{*}, K^{*}; X, X^{*}\right)$$

where *H*, *L, K,* and *X* are, respectively, vectors of handlings (i.e., the operations' "outputs"—possibly but not necessarily your FHP volume measures), variable (labor) inputs, quasi-fixed inputs, and other factors affecting the production process (e.g., site-specific factors) for the modeled cost pools. Asterisks denote the corresponding variables, if any, for operations outside the scope of your analysis.

Considering that you claim not to have considered models with cost pool-level handlings, and have no operational explanation for how your preferred characterization of sorting output is consistent with cost causation in any sorting operation activities in any cost pool, is it your testimony that a transformation function such as that expressed above is only a "clear production model" using your characterization of output, and not any other? If so, what is the basis for your belief?

RESPONSE TO USPS/OCA-T1-25

Please review question USPS/OCA-T1-3d and my response. The question had a specific list of activities and I did not say that I "have no operational explanation for how (my) preferred characterization is consistent with cost causation in any sorting operation activities in any cost pool." Further, the production model that was referred to in question 3b was one that used FHP disaggregated by USPS cost pool as the output variable. That is what I was being asked to consider in the question and I do not consider that specification to be justified for the reasons I gave.

In Roberts (2006), Sections II and III, I develop two complete, internally consistent production models and show how they compare. One model (section III) utilizes the assumptions of separability and proportionality that are made in the USPS framework and relies on "cost drivers" for each operation. The other model (Section II)

does not make these assumptions and relies on the volume of mail in the plant. Whether the more restrictive USPS model is more appropriate as a basis for estimating mail processing costs, depends on whether the separability and proportionality assumptions are true. In OCA-T-1, Section IV, I provide empirical evidence that the proportionality assumption is not true and in USPS/OCA-T1-3c I provide evidence that the separability assumption is not true.

RESPONSE OF OCA WITNESS MARK J. ROBERTS
TO INTERROGATORIES USPS/OCA-T1-19-26

USPS/OCA-T1-26. Please refer to your response to USPS/OCA-T1-3(d). Considering that you have no operational explanation for how your preferred characterization of sorting output is consistent with cost causation in any sorting activities in any sorting cost pool, on what basis can you conclude that the model modifications you implemented between your March 2006 paper and OCA-T-1 resulted in more plausible results, or otherwise improved your results?

RESPONSE TO USPS/OCA-T1-26

Please review question USPS/OCA-T1-3d and my response. The question had a specific list of activities and I did not say that I "have no operational explanation for how (my) preferred characterization is consistent with cost causation in any sorting operation activities in any cost pool." Further, the production model that was referred to in question 3b was one that used FHP disaggregated by USPS cost pool as the output variable. That is what I was being asked to consider in the question and I do not consider that specification to be justified for the reasons I gave.

There are 4 basic modifications that I made to the model or data used in my March 2006 paper in preparing OCA-T-1. These are summarized in OCA-T-1, Section III, particularly points 2, 3, and 4 and developed in more detail in the paper. First, I changed the sample period by adding 2005 and deleting 1999-2001. See OCA-T-1, Section V.A. for explanation. Second, I extended the model by disaggregated incoming and outgoing FHP each into two groups reflecting the level of pre-processing. See OCA-T-1, Section V.C for motivation and Section VIII.C for discussion of results. Third, I used the quarterly dummy variables as additional instrumental variables. See OCA-T-1, section VII and my response to USPS/OCA-T1-12. Fourth, when estimating the labor demand curves for flat sorting operations, I divided the sample into two groups

based on whether the AFSM technology was used. See OCA-T-1, Section VIII.D for discussion. The last three changes are all extensions of the model and results in my March 2006 paper. The one that has a significant effect on the results is the last one. In my March 2006 paper, I pointed out that the output elasticity for manual flat sorting had fallen in magnitude relative to the estimate in Roberts (2002) and that the introduction of the AFSM appeared to be the source of the change. In OCA-T-1 I develop this point in more detail and find that the relationship between manual hours and the volume of flats depends heavily on whether or not the plant uses the AFSM technology. See the discussion and explanation in OCA-T-1, page 49, line 4 to page 50, line 16.