DRAFT

IMPLICATIONS OF DECLINING MAIL VOLUMES ON THE FINANCIAL SUSTAINABILITY OF THE U.S. POSTAL SERVICE AND OTHER POSTS

ROBERT COHEN, GEORGE MASON UNIVERSITY

CHARLES C. MCBRIDE, GEORGE MASON UNIVERSITY

MARCH 2012

THE ORIGINAL VERSION OF THIS PAPER WAS PREPARED IN 20110 UNDER A CONTRACT FROM THE U.S. POSTAL SERVICE OFFICE OF INSPECTOR GENERAL

1. Introduction

The recent decline in mail volume has given rise to concerns about the U.S. Postal Service's long-term financial sustainability. Mail volume peaked in 2006 at 213 billion pieces and then fell to 177 billion pieces in 2009. The Postal Service's latest volume estimate for 2012 is 158 billion pieces[1]. If mail volume were to drop much further, the Postal Service could enter a graveyard spiral of continuous price increases and volume declines. On the other hand, the Postal Service could reach a new price-cost equilibrium. The primary purpose of this paper is to show how further large declines in mail volume would increase the Postal Service's per piece (unit) costs and prices and how this would affect its financial sustainability. The paper's estimates of cost, price and sustainability are for volumes ranging from 150 billion down to 75 billion pieces. It assumes that prices would be increased annually to bring about financial breakeven.[2] The paper also examines the strategic planning implications of volumes declining to these levels.

This analysis employs the Cost Rollforward Model developed by the Postal Service and used by it and the Postal Regulatory Commission (PRC) to forecast costs in all rate proceedings conducted under the 1970 Postal Reorganization Act since the R80-1 omnibus rate case.[3] The model was used again by the Postal Service in its July 6, 2010 exigent rate filing with the PRC. In addition to its use in rate cases, we understand that the model is used by the Postal Service for internal analyses. For the purposes of this study, major enhancements had to be made to the Cost Rollforward Model, and we are calling the enhanced model the "GMU Cost Rollforward Model." These enhancements include the ability to calculate new breakeven volumes and prices that reflect own-price elasticities for the various categories of mail.

Finally, this paper includes a new section in which the GMU Model has been modified to study the results of large volume decreases in other posts with widely different current values for the

[1] This represents an estimated decline of 10 billion pieces from 2011. However, as of March 2012 it is declining more slowly than anticipated and so far volumes are on track to decline about 8 billion pieces.

[2] This paper does not predict volumes; it simply explores the implications of declining volumes if they were to occur.

[3] The model has undergone continuous improvements since it was first introduced.

ratio of fixed to total costs. It is hoped that other posts can use these results to estimate how much they must raise prices and/or cut costs to achieve financial sustainability in the future.

2. Major Findings for the U.S. Postal Service

- Many posts in developed countries in Europe and Japan have higher prices than in the United States. Their prices are as much as 80 percent higher when expressed in purchasing power parity. The mailing operations of these posts are almost all profitable. Thus, developed economies support these high postal prices.

- Our criterion for the financial sustainability of the Postal Service is that it will remain sustainable as long as its prices remain somewhat lower than the highest postal prices observed in other developed countries and its revenues cover its costs. Using the GMU Rollforward Model, we have estimated the increase in USPS prices that would be needed to achieve breakeven at 150, 125, 100 and 75 billion pieces (or declines in volume of 16, 29, 56 and 68 percent). Down to 100 billion, the price increase over inflation needed to breakeven financially would increase prices to a level that is substantially lower than the highest prices that we have observed in developed countries. Therefore we find that the Postal Service would be financially sustainable down to 100 billion pieces. Our criterion for sustainability does not tell us whether the Service would be sustainable below 100 billion pieces.

- Assuming that volume continues to decline to the levels examined in this paper, the current Postal Accountability and Enhancement Act (PAEA) price caps allowing pieces to increase annually at less than or equal to the Consumer Price Index (CPI) may not permit the Postal Service to remain financially sustainable. This assumes no changes to the Universal Service Obligation (USO) or other major breakthroughs in cost savings.

- It is expected that the variable cost of the Postal Service will decline along with volume and that, between 125 and 100 billion pieces, fixed costs will grow to become more than half of total cost. These should become a focus of management's attention.

Reducing fixed costs would moderate but not eliminate the above-inflation price increases required to breakeven.

- At lower volume levels, the decline in First-Class volumes, and especially single-piece First Class, will mean that the Postal Service will essentially cease being a two-way communications medium and will evolve into a broadcast medium. This would have profound implications for its basic structure including the processing, transportation and retail networks.

- Revenue losses due to declining volumes will have important implications for repaying debt and shouldering other legacy costs such as prefunding annuitant health benefits and the prior year portion of workers' compensation benefits. In addition, continuing losses and expenses not related to "moving the mail" from Periodicals and other loss-making categories of mail, operating 36,000 retail outlets, Alaska bypass mail, and other money losing activities will become an increasing burden.

- As prices increase in a declining volume scenario, reduced rates for nonprofit mail (which are cross-subsidies from regular mail) will become increasingly burdensome for regular mail users who will be experiencing significantly higher rates.

- As volume declines, the mail processing, transportation and retail functions will shrink considerably but delivery will shrink much less, leaving it larger than the other major functions combined. This has obvious implications for strategic planning. The network will have to be redesigned and R&D should concentrate on delivery. Further, the in-office portion of delivery will shrink with volume, but the street portion will remain largely intact. This means that industrial engineering R&D for street time cost reductions should become a priority.

3. Fixed and Variable Cost

When the Postal Service's volume declines it can be expected that its variable cost and total cost will decline.[4] Notwithstanding this decrease in total cost, the average cost per piece (average unit cost) will increase because the fixed costs will be spread over fewer pieces.

The GMU Rollforward Model uses volume as an input and calculates the resulting total cost of the Postal Service by determining the variable costs that result from changes in the input volume while holding fixed costs constant. Thus, it is a short term model in economic parlance. When volume declines by a large amount over time, economists expect fixed costs to decline as well.[5] Since we will be looking at the effects of large volume declines, we explored developing a model that allowed for changes in fixed costs (or what economists call a long run cost model). We were unable to estimate the fixed cost changes over the long run by examining historical postal cost data because the attribution methodology (that defines variable and fixed costs) has continually been refined over the years, thus preventing comparison between current costs and costs from previous periods. Thus, a short run model like the GMU Model calculates an upper bound on the increase in unit cost and prices that would result from a large decline in volume. We have compensated for the lack of fixed cost changes in the model by conducting sensitivity analyses to see the effect of fixed cost changes. We can say *a priori* that any decrease in fixed costs would partially offset the unit cost and price increases that would occur as volume declined.

4. Volume History

Figure 1 shows that since 1925 volume grew almost nine fold to the peak year of 2006. Since then, volume has declined by 17 percent through 2009 and the decline has continued into 2012. Figure 2 shows the annual change in total volume since 1925. It can be seen that actual volume declines have been associated with negative growth of the GDP (1930-1933, 1975, 1991, 2b001,

[4] The decline in variable cost may lag the volume decline by a year or so, because it is difficult to cut work hours over a short period of time. The Postal Service appears to have done a remarkable job in cutting variable cost during the very large volume decline associated with the recent recession. For example, volume declined 13.5 percent in 2009 and work hours declined 8.8 percent against an anticipated decline in variable costs of 8.1 percent.

[5] This is what is meant by the expression *all costs are variable in the long run.*

2007-2009). The only exception was in 1946 when the nation was shifting from a war to a peace time economy.[6]

Figure 1
USPS Mail Volume, 1925-2010

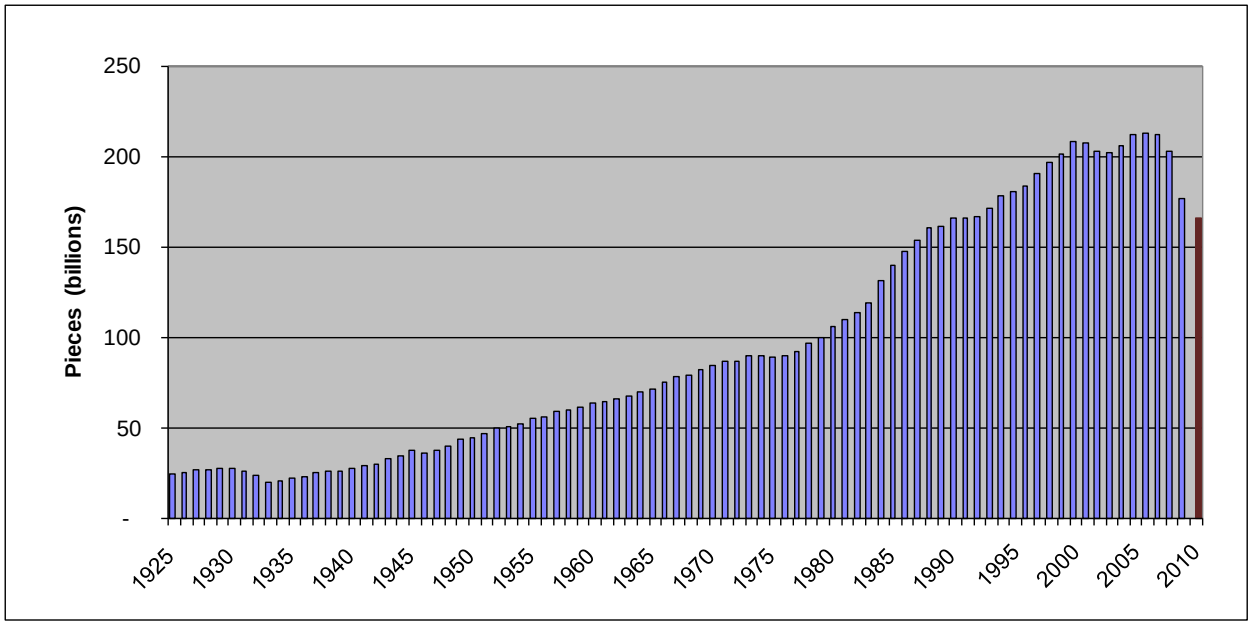
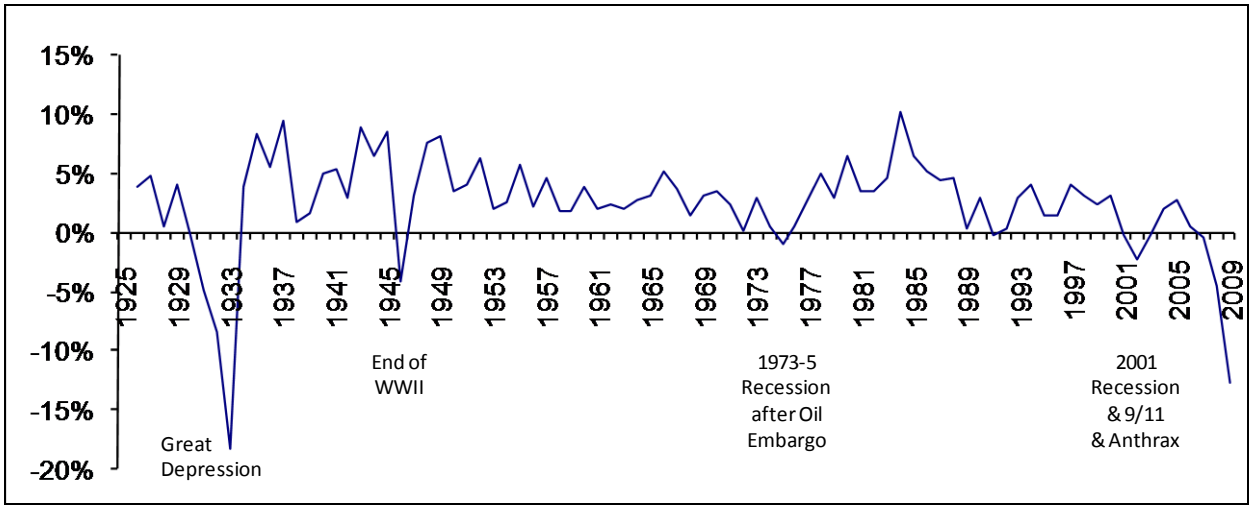


Figure 2
Annual Changes in USPS Mail Volume, 1925-2009



[6] It is worth noting that postal volume did not turn negative during the recessions in the 1940s, 1950s and 1960s. In addition, it did not turn negative in the recession of 1981 when volume was growing very rapidly owing to the introduction of worksharing discounts.

5. Financial Sustainability at Lower Volumes

As noted above, volume declines will mean that the Postal Service's average price will need to increase if the Postal Service is to break even financially. In this section we define "financial sustainability" in terms of the increase in price that would be implied by lower volumes.

U.S. Postal Service unit costs are among the lowest in the industrial world.[7] This cannot be explained by technology because posts in the other developed countries all use similar sorting equipment and operate in a similar fashion.[8] An important part of the explanation lies in economies of scale. All posts in developed countries are characterized by a large amount of fixed costs which in turn are due in large part to the delivery function.[9] When volume increases, the average cost per piece drops as there are more pieces to share the fixed cost burden. The United States has the second highest number of pieces per capita in the world, and this explains to a large degree why its costs and prices are among the lowest.[10] The fact that prices are significantly higher in most other developed countries is an encouraging sign for the financial sustainability of the U.S. Postal Service, because it means that in a modern economy, these prices are affordable. If volumes decline to the levels that we are analyzing and U.S. postal prices increase to achieve breakeven, they will approach the current level of other posts in the developed world. We believe that if U.S. prices do not significantly exceed those prices, then the U.S. Postal Service will remain sustainable at current levels of service.

Table 1 shows the 2007 mail volume per capita for 19 posts in developed countries as a percentage of the U.S per capita volume for 2007. It also presents each post's 2008 price for a first class stamp in 2008 purchasing power parity. The table displays the purchasing power

[7] See "The Role of Scale Economies in the Cost Behavior of Posts," Robert Cohen, *et al.*, Proceedings of Wissenschaftliches Institute fur Kommunikationsdienste GmbH (WIK) 8th Koenigswinter Seminar on "Regulating Postal Markets-Harmonized vs. Country Specific Approaches," February 2004.

[8] One difference is that in Europe and Japan many carriers use bicycles instead of automobiles because in their urban environments it is a cost effective mode of delivery. Another difference is rural delivery in Europe is generally to the door while it is to a roadside box in the U.S.

[9] The time it takes a carrier to move between stops is fixed since it is independent of the volume.

[10] Switzerland mails more pieces per inhabitant. Other factors include labor costs, service performance, post offices per capita, profit levels and miscellaneous costs such as prefunding retiree health care.

parity price in dollars. Purchasing power parity is the preferred way to compare prices between countries with different currencies.[11]

Table 1
International Comparison of the Price of a First-Class Stamp

Country	Prices in Purchasing Power Parity (U.S. $)	Per Capita Volume as a % of U.S. Per Capita Volume	EBIT Margin 2007*	EBIT Margin 2008*
New Zealand	0.32	33%	5.8%	4.6%
Australia	0.37	32**	NA	NA
Spain	0.41	20	NA	NA
US	**0.42**	**100**	**(6.8)**	**(3.7)**
Netherland	0.49	49	5.6	5.7
Luxembourg	0.53	57	NA	NA
Great Britain	0.54	46	0	0.9
Ireland	0.56	24	NA	NA
Sweden	0.59	49	6.3	3.6
Belgium	0.59	NA	NA	NA
France	0.60	42	5.9	2.6
Austria	0.62	43	11.5	10.1
Germany	0.64	35	3.1	3.4
Denmark	0.64	40	NA	NA
Portugal	0.67	16	NA	NA
Japan	0.69	25	NA	NA
Italy	0.71	14	0.7	(0.3)
Finland	0.72	57	5.2	4.4
Norway	0.78	53	0.3	(0.4)

Note: The first unit of postage in these countries is 20 grams vs. 28 grams (1 ounce) in the United States.

* Mail operations only. EBIT margin is EBIT (earnings before interest and taxes) divided by revenue.
** Australia 2008 volume
NA Not Available

[11] Exchange rates often vary widely over time. Purchasing power parities, however, remain remarkably constant over time between countries that do not have large inflation rates. For example, they changed by less than 1 cent over 2007, 2008 and 2009 between the United States, Germany and France. The purchasing power parity data used in Table 1 are from the *OECD Statistical Abstracts, Table 4, PPPs and exchange rates*.

The countries in the table are listed in the order of their purchasing power parity price. It can be seen that these countries all have much lower volume per capita than the United States and in most cases they have less than half the per capita volume. The purchasing power parity prices of the 15 posts with higher prices than the USPS range from 17 percent higher than the U.S. price to 86 percent higher. The last two columns show the EBIT[12] profit margin (operating earnings) for each post's mailing operations in 2007 and 2008.[13] Of the 11 posts for which EBIT data is available, two were unprofitable for one year and the United States was unprofitable for both years. This is important because it shows that unlike the United States, the prices in effect in these countries are not below cost.

As noted, 15 of the posts in the table have a First-Class stamp price in purchasing power parity that is greater than the U.S. price. Five have prices between 50 and 59 cents, six have prices between 60 and 69 cents, and three have prices higher than 70 cents. Obviously, economies in industrialized counties will support these prices. We take this to mean that the U.S. Postal Service would remain sustainable if its prices did not exceed this range by a significant amount. In this paper we will use the criterion that the Postal Service will remain financially sustainable as long as its stamp price does not exceed 69 cents in 2008 dollars. This means that it should not increase more than about 65 percent. In the interest of being conservative, we have drawn a line at 69 cents while the data would arguably support a higher figure. This criterion tells us at what price levels the Postal Service would be financially sustainable. It does not, however, give us a threshold for when price levels would become financially unsustainable.

[12] EBIT is an indicator of a company's profitability, calculated as revenue minus expenses, excluding tax and interest. EBIT is also referred to as "operating earnings." Many posts in the developed world have several businesses or are owned by firms that have several businesses. The EBIT margins shown are for the mailing operation only.

[13] The volumes, prices and EBIT margins are from *The Evolution of the European Postal Market since 1997*, *Annex, Country Fiches*, August 2009, ITA Consulting GmbH and WIK Consult GmbH. This paper was done for the European Commission. The table displays data for all developed countries that were included in that paper.

6. The Volume Mix Used in the Study

In addition to total volume, an explicit volume mix (by product) is required to operate the Enhanced GMU Model.[14] The Boston Consulting Group (BCG) estimated that the USPS would have 150 billion pieces for 2020.[15,16] BCG studied the volume trends of the classes of mail and forecast the following specific volume mix by class for 2020: First-Class Mail dropping 37 percent, advertising mail growing slightly and parcels growing about 4 percent per year. The growth in parcel volume would have a significant impact on revenue and net income because of their high revenue per piece and their high per piece contribution to overhead. This would mitigate somewhat the impact on postal finances from the First-Class volume decline. We extrapolate the BCG volume mix to arrive at a mix for 125, 100 and 75 billion pieces. We also show the sensitivity of postal costs to a different volume mix estimate.

If First-Class Mail volume declines 37 percent when total volume drops to 150 billion pieces in 2020, it would mean that there would be even further future declines in First-Class Mail and especially single piece as total volume approaches 100 billion pieces. Thus the Postal Service would become almost entirely a broadcast medium with little single-piece volume that today makes it a communication exchange medium. This transition would have profound implications for the basic structure of the Postal Service affecting service levels, transportation, retail, and mail processing facilities and hours of operation.[17] It would also argue for less frequent delivery. All of these changes would reduce expenditures and make prices more affordable. These observations serve to reinforce the point made in Section 3 about short run and long run cost models.

---

[14] A volume mix is the percentage of total volume that each product represents.

[15] See "Projecting Mail Volumes to 2020," Boston Consulting Group, March 2, 2010, http://www.usps.com/strategicplanning/_pdf/BCG_Narrative.pdf..

[16] Based on current trends, many observers now think that the BCG forecast was too optimistic and that volumes will be less than 150 billion in 2020.

[17] With little single-piece volume, the Postal Service would need to do little outgoing sorting. The imperative to sort mail on the evening shift would diminish and the Postal Service could shift much of its operations to the day shift, which would affect transportation designed around the last dispatch of value. It would permit more consolidation for transportation. Much less air transport would be needed. Facilities could be more easily consolidated because there would be less emphasis on speed of delivery.

7. The GMU Cost Rollforward Model

The version of the model used in this analysis is based on the public version of the Cost Rollforward Model that was used in the R2006-1 rate proceeding at the PRC. We have updated the model by substituting products for subclasses as the Postal Service has changed the Cost and Revenue Analysis (CRA) report reflecting the concepts used in the PAEA.[18]

The model projects future costs from base year costs reflecting changes due to

- Volume by product
- Cost level (labor and other resources)
- Efficiencies due to cost reduction programs
- Nonvolume workload (e.g., number of post offices and number of delivery stops)
- Servicewide costs (depreciation, workers' compensation, escrow requirements, etc.)

The model accepts these factors as inputs and applies them to the Postal Service cost system of 18 cost segments and about 170 cost components. The segments are listed below along with an example of a component that belongs to each segment:

Table 2
Cost Segments and Example Components

Segment	Example of Component
1 – Postmasters	Postmasters EAS 23 and below
2 – Supervisors and Technical Personnel	Higher Level Supervisors
3 – Clerks and Mail handlers, CAG A-J	Mail Processing, Administrative
4 – Clerks Cag K	Clerks
6 – City Delivery Carriers, In-Office	In-Office Direct Labor,
7 – City Delivery Carriers, Street	Network Travel, Support
8 – Vehicle Service Drivers	Vehicle Service Drivers
10 – Rural Carriers	Equipment and Maintenance Allowance
11 – Custodial Maintenance	Equipment Maintenance
12 – Motor Vehicle Service	Supplies and Materials, Personnel

[18] See Appendix A for a detailed description of the GMU Model, including the Cost Rollforward Model and its enhancements developed for this paper.

13 – Miscellaneous Operating Costs	Carfare and Tolls, Contract stations
14 – Purchased Transportation	Highway, Air
15 – Building Occupancy	Rents, Fuel and utilities
16 – Supplies and Services	Equipment
17 – Research & Development	R&D
18 – Administration and Regional Operations	Headquarters
19 – General Management Systems	Supplies &Services
20 – Other Accrued Expenses	Equipment Depreciation

8. The Base Year – FY 2009

In this study the base year for the GMU Rollforward Model is FY 2009. This means that the Postal Service volumes, costs and revenues from the CRA for that year are the starting point. In FY 2009 the Service incurred a loss of $3.8 billion or 5.6 percent of revenue. We first increase prices by 5.6 percent to allow for breakeven in 2009. This initial price increase causes volumes, costs and revenues to decline because of the effect of price elasticity.[19] Thus, it is again necessary to increase prices to achieve breakeven.[20] We then arrive at the *adjusted volume, cost, revenue and price increase.* It can be seen in Table 3 that a 6.5 percent increase in the average revenue per piece would have been required to achieve breakeven in 2009.[21] In all cases we go through this two-step process in estimating the price increase necessary to break even, first raising rates and calculating the effects of elasticity on volumes and costs and then raising rates for a second time.

[19] The own price elasticities for market dominant products are from the January 20, 2010 submission to the PRC by the Postal Service, and the competitive product elasticities were furnished on a confidential basis to the Office of Inspector General by the Postal Service.

[20] This iteration is similar to that in the rate proceedings conducted under the old Postal Reorganization Act where future costs were forecast by the model and then an initial price increase was calculated so that revenues and costs would be equal. This increase causes volumes and costs to decline and so a second price increase is introduced. Theoretically this iteration could continue as the ultimate breakeven price is approached. As a practical matter the iteration is stopped when the costs and revenue are in virtual balance.

[21] In a sense this means that our estimation of future price increases required by future decreases in volume starts in a hole because this amount must be added to any price increase needed to offset the losses that would result from a further decrease in volume from 2009 levels.

Table 2
Base Year Volumes, Cost and Revenue and Adjusted Base Year Volume, Cost and Revenue after Allowing for a Price Increase to Breakeven
(2009 dollars)

Item	Initial Value	After Mailer Response to Price Increase
Volume	177.5 B	173.0 B
Cost	$71.9 B	$70.7 B
Revenue	$68.1 B	$70.7 B
Profit/(Loss)	($3.8 B)	($0.001 B)
Price Increase Required to Break Even	5.6%	6.5%

9. The Base Case

The base case is for a volume forecast of 150, 125, 100 and 75 billion pieces in the year 2020 using the BCG volume mix (representing a decline of 16, 29, 56, and 68 percent.). The base case assumes Consumer Price Index (CPI)-based changes for labor cost and other cost levels beyond 2009, and consequently our cost results are in real 2009 dollars. Similarly, CPI-based price increases are assumed to occur each year, so revenues are also in real 2009 dollars. In addition, there are no allowances for improvements in efficiency. However, we incorporate the costs of changes to the nonvolume workload measures including the number of delivery stops and the number of post offices. Delivery stops are growing with household formations, and the number of post offices has been slowly declining. Nonvolume-related costs have been projected to the year 2020 and are discounted to FY 2009 levels assuming an average annual CPI increase of 3.0 percent.

The most significant change from the 2009 CRA is the treatment of retiree health care costs. The Postal Service pays the employer's share of health care premiums for Postal Service retirees. Historically, the Postal Service has made these premium payments when they came due on a "pay-as-you-go" basis. The PAEA required the prefunding of these payments. Under the PAEA, the Postal Service is required to make substantial prefunding payments of more than $5 billion annually through FY 2016 to a fund for retiree health benefits while it continues to pay for current retirees. After FY 2016, payments for current retirees will come from this fund, and

the Postal Service will prefund the cost of retiree health care benefits that employees earn each year and make amortization payments for any unfunded liability.

The Postal Service succeeded in making the prefunding payments due in 2007 and 2008, but because of the Postal Service's financial difficulties, Congress substantially reduced the payment required in 2009 by $4 billion. A similar reduction may be approved this year. In developing the model we debated how much to assume the Postal Service would spend for retiree health care in the future. Given its current financial situation, it seems unlikely the Postal Service will be able to meet the PAEA's schedule, but it is not yet clear what will happen.[22] We considered assuming the Postal Service would continue to fund on a pay-as-you-go basis, but such a change would require legislation. Ultimately, because of the uncertainty, we decided to assume the Postal Service would continue to make payments as required according to the transition assumed by the PAEA. We used the estimated 2020 payment provided by the Office of Personnel Management to the Government Accountability Office.[23] This payment, a combination of current employee costs and an amortization payment, is assumed to be $7.3 billion in 2020,[24] not much more than the projected pay-as-you-go payment of $6.4 billion. The sensitivity of our retiree health care assumption is examined below.

The base case also includes a change in the model from the way it was normally run in rate cases for what are called longer run costs.[25] These are costs such as floor space that are allocated to mail categories based on volume but whose total costs are not expected to change in the short term. Since this analysis is focused on long-term cost changes, we allow these costs to vary with volume in total as well as by mail category. Thus, the model recognizes three kinds of costs: short run variable, longer run variable and fixed costs.

---

[22] The Office of Inspector General has asserted that the Postal Service has been overcharged for its pension payments by $75 billion, and the overpayment could potentially be used to cover unfunded retiree health care liability. A subsequent PRC analysis agreed that the Postal Service had been overcharged but estimated the amount at $50 to $55 billion using a different methodology.

[23] U.S. Government Accountability Office, *USPS Strategies and Options*, Report No. GAO-10-455, April 2010, http://www.gao.gov/new.items/d10455.pdf.

[24] These costs are also discounted to FY 2009 levels assuming an average annual CPI increase of 3.0 percent.

[25] These are also called "PESSA" costs in cost model jargon. This acronym stands for property, equipment, supplies, services, and administrative.

a. Base case results

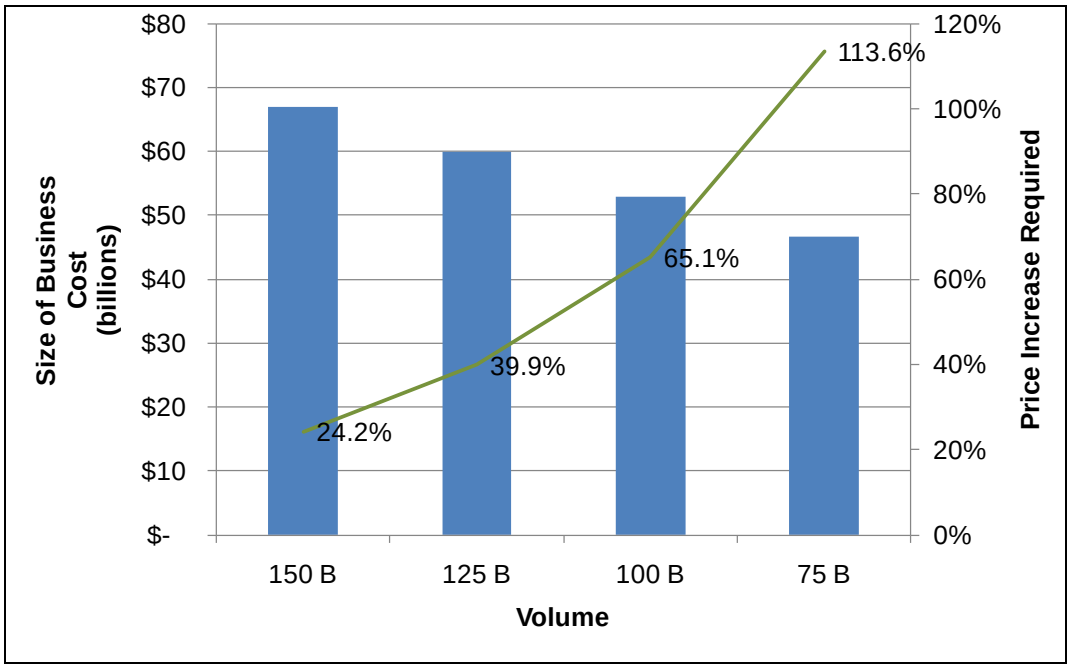
The model results for the base case are shown in Table 4 and in Figure 3. For 150 billion pieces (-12 percent), the table shows that volume would drop to 136.8 billion pieces as a result of the elasticity response to increased prices and costs and revenues would drop to $67 billion in 2009 dollars after the required price increase. Real (or inflation adjusted) prices would have to increase by 24.3 percent or 2 percent annually. It appears that at the volume levels of 150, 125 and 100 billion pieces -12, 6, 41 percent), the Postal Service would be financially sustainable according to the criterion set forth above. It can be seen in Figure 3 that below 100 billion pieces (41 percent), the required rate increases slope sharply upward. At 75 billion pieces (-66 percent), it would require more than doubling prices. Our criterion does not tell us whether the Service would be financially sustainable at that level.[26] The table also shows the number of work years that would be used at each volume level. In 2009 the Postal Service would use 704,000 work years in a breakeven scenario, and it can be seen that the number of workers will decline substantially if volume drops to the levels examined. They would drop even further if the Service manages to reduce some of its fixed costs.

Table 3
Cost Model Results for the Base Case
(billions)

Initial Volume	Volume after Price Increase	Cost & Revenue (2009 Dollars)	Breakeven Revenue Increase Required Above CPI	Annual Revenue Increase Required Above CPI	Number of Work Years (000)
150	136.8	$67.1	24.3%	2.0%	636
125	108.6	60.0	39.9	3.1	564
100	81.3	53.1	65.5	4.7	495
75	55.5	46.7	113.4	7.1	429

[26] It should be noted that Postal Service rate increases for major subclasses have been as high as 33 percent in the past.

Figure 3
Cost Model Results for the Base Case



As Table 4 shows, if volume declines, even to 150 billion pieces, there will have to be real price increases (i.e., prices must be increased above inflation).

The annual price increase required depends on the year the volume level will be reached. We have arbitrarily assumed that year would be 2020. However, the model is essentially atemporal. So the target year could be 2030, 2040, etc. If the target year was later than 2020, the annual change required for breakeven price increases would decline.

10. Strategic Planning Implications

a. Reduced income

As volume declines, total revenue will decline in parallel. In addition the average revenue per piece will increase (assuming breakeven prices are charged). Table 5 shows the adjusted (taking into account price elasticities) breakeven revenue/income at the volumes examined and average revenue per piece in 2009 dollars. Declining revenue will have profound implications for repaying debt and shouldering legacy costs such as prefunding annuitant health benefits and the

prior years' portion of workers' compensation benefits. The base case assumptions for the GMU Model do not include the repayment of debt, but they do include paying for retiree health benefits. In addition, continuing losses and expenses not related to "moving the mail" from Periodicals and other loss-making categories, operating 36,000 retail outlets, Alaska bypass mail, etc. will become an increasing burden. Finally, reduced rates for nonprofit mail are cross-subsidies from ordinary mail and funding these cross-subsidies will become increasingly burdensome for ordinary mail because of their average price increase.

Table 4
Base Case Adjusted Total Revenue/Income and Average Revenue per Piece
(2009 dollars)

Initial Volume	**2009 177.5 B**	**150 B**	**125 B**	**100 B**	**75 B**
Adjusted* Breakeven Revenue/Income	$70.7 B	$67.1 B	$60.0 B	$53.1 B	$46.7 B
Adjusted* Average Revenue per Piece	40.9¢	49.0¢	55.2¢	65.3¢	84.2¢

***** After taking into account price elasticities and raising prices to breakeven

b. Major functions

Declining volumes will have a significant impact on the relative cost of the major functions as shown in Table 6. It can be seen that mail processing declines almost proportionately with volume. Transportation has more fixed cost, so it does not decline as much. As volume declines, delivery will decline comparatively slowly as it is mostly fixed. The remaining costs will grow as a percentage of total costs as the major functions shrink. This has important implications for the network configuration and related transportation, the organization of delivery routes, investment and R&D expenditures.[27]

[27] For example, as volume drops, variable costs on delivery routes will drop, allowing each carrier to cover more stops. As mail processing activity declines, facilities will be consolidated so that they continue to have a critical mass. This in turn will reduce the amount of transportation runs that are needed. As single-piece volumes decline, less window service will be needed. Finally, as mail processing, transportation and window service decline, there will be much less need to conduct R&D in these areas.

Table 5
Base Case Adjusted Function Cost
(2009 dollars)

Initial Volume	177.5 B	150 B	125 B	100 B	75 B
Mail Processing	$ 21.2 B	$ 16.4 B	$ 12.7 B	$ 9.3 B	$ 6.4 B
Transportation	5.9	5.4	4.1	3.0	2.1
Delivery	28.8	25.8	23.4	21.2	19.3
Retail-Window Service	3.8	3.4	3.1	2.8	2.6

c. Fixed costs and the USO

Almost half of the Postal Service's fixed costs are in the Postmaster segment (6.4 percent) and the street portion of the City and Rural Delivery segments (39 percent). They are the main costs underlying the Universal Service Obligation (USO) of access to window service and delivery frequency. Thus, reducing these fixed costs means reducing the USO which is politically unpopular and requires the explicit (or at least implicit) approval of Congress. The authors have pointed out in a previous paper that a profit maximizing U.S. Postal Service would be able to save about $6 billion annually if it were allowed to reduce delivery to three days per week and substitute rural carrier retail service for the 8,600 CAG K&L post offices.[28] This is about 13 percent of the estimated $53 billion in revenue that the Postal Service would require to breakeven at 100 billion pieces. Reducing the USO burden of the Postal Service would greatly lessen the impact of declining volumes on rate payers. The fixed costs that underlie the USO are conceptually easy but politically very difficult to cut.

d. Street time

Delivery includes both the largely variable in-office and the largely fixed street components. As volume declines, the in-office portion drops because it is almost all variable. In contrast, the street portion is largely fixed and so it becomes a larger percentage of delivery costs. This means that street time will become by far the largest function. This in turn means that it should become

[28] See "Estimates of the Current Cost of the USO in the U.S.," Robert Cohen and Charles McBride, *Study on Universal Service and the Postal Monopoly*, George Mason University School of Public Policy, November 30, 2008 http://digilib.gmu.edu:8080/dspace/handle/1920/3477. The CAG (cost ascertainment group) level of a post office indicates how much revenue it generates. CAG K&L post offices bring in the smallest amount of revenue.

the focus of research on how to reduce its cost. Improved delivery vehicles could help, but it seems mostly to be an industrial engineering problem.

Table 6
Base Case Street Time vs. In-Office Time

Initial Volume	2009 177.5 B	150 B	125 B	100 B	75 B
In-office	29%	27%	25%	23%	20%
Street	71%	73%	75%	77%	80%

11. Sensitivity Analyses

In every complex analysis about events which have not taken place, assumptions have to be made about the value of variables used in the analysis. In this section, we present the sensitivity of the base case results to different values of the most important variables so that their relative importance can be seen. In addition, the reader may be interested in seeing the base case results with different values for these variables, and these sensitivity analyses should assist in these calculations.

a. Total factor productivity

In spite of the fact that volume has experienced an overall decline of 12 percent during the recent decade (ending in 2009), total factor productivity (TFP) improved at an average annual rate of 1.1 percent or 10.7 percent cumulatively. It is unclear if improvements in TFP will continue at this rate, especially if volume continues to decline. In the previous decade, the average annual growth of TFP was only 0.2 percent for a cumulative total of 2.1 percent.[29] This small increase occurred during a decade of steadily improving volume.[30]

[29] The cumulative total increase for TFP in the 1980s was 0.3 percent and in the 1970s it was 6.9 percent.

[30] Cumulative volume growth was 26 percent for the decade. Volume was negative during this decade only in 1991 in response to a 25 percent rate increase.

In this study, TFP is assumed to remain unchanged in the base case. To see how sensitive the base case result is to this assumption, TFP is allowed to increase and decline by a total of 3 percent[31] over the period from 2009 to 2020. The results are shown in Table 8.

Table 7
Sensitivity of Base Case Result to
Cumulative 3 Percent Negative and Positive Changes in Cumulative TFP

Initial Volume (billions)	-3% TFP Costs ($ 2009)	-3% TFP Breakeven Increase Above CPI	Base Case Costs ($ 2009)	Base Case Breakeven Increase Above CPI	+3% TFP Costs ($ 2009)	+3% TFP Breakeven Increase Above CPI
150	$68.5	28.7%	$67.1	24.3%	$65.7	19.9%
125	61.2	44.9	60.0	39.9	58.7	34.8
100	54.3	71.6	53.1	65.5	51.9	59.3
75	47.8	121.6	46.7	113.4	45.6	105.2

Obviously, the growth of TFP would be very important to the financial sustainability under these reduced volume scenarios. If it were to decline even at the low compound rate that we have used, the breakeven price increase becomes much larger, but the Postal Service remains financially sustainable under our criterion for the 150 and 125 billion piece cases. The 100 billion piece case falls outside of the range specified in our criterion of sustainability by a small margin, but the 75 billion piece case falls outside the range by a large margin. In contrast, improving TFP by a total of 3 percent over the 11-year forecasting period would greatly reduce the price increases that would be required for the Service to break even financially.

b. Fixed costs

Forty percent of total Postal Service costs were fixed in 2009. The GMU Rollforward Model reduces variable costs as volume declines and does not change the fixed costs. Consequently, fixed costs grow as a percentage of total costs. It is likely that management would make strong efforts to reduce fixed costs if volume declined to the levels modeled in this paper. It was noted above that 40 percent of all fixed costs are in the street portion of the delivery function. These costs are difficult, but not impossible, to reduce. Administrative and higher level supervision are also fixed, and most postmaster costs are largely fixed. To show the sensitivity of the base case

[31] This is 0.296 percent compounded annually over the period.

results to reductions in fixed cost, we reduce them by a cumulative 10 percent. The results are shown in Table 9 below.

Table 8
Sensitivity of Base Case Result to
Cumulative 10 Percent Reduction in Fixed Costs

Initial Volume (billions)	Base Case Costs ($ 2009)	Base Case Breakeven Increase Above CPI	Fixed Cost as a Percent of Total Cost	Costs with 10% Fixed Cost Reduction ($ 2009)	Breakeven Increase Above CPI with 10% Fixed Cost Reduction
150	$67.1	24.3%	40.3%	$65.0	17.9%
125	60.0	39.9	45.3	57.8	31.6
100	53.0	65.1	51.6	50.8	54.0
75	46.7	113.4	59.2	44.3	96.0

It can be seen that the reduced fixed costs become a larger portion of total cost as volume falls. Thus, the effect on the required price increase also increases as volume declines. At 100 billion pieces the required price increase drops by 21 percentage points when fixed costs are reduced by 10 percent.

c. Own price elasticity

A recent paper by the econometrician Heikki Nikali of Finland Post concludes that the further substitution has progressed, the lower price sensitivity will be.[32] *Lower* elasticities would, of course, lower the required rate increases in our base case. Nevertheless we examine the sensitivity of the base case results to *higher* elasticities in Table 10. It can be seen that if elasticities were 50 percent higher than the ones we used, the price increases required by the 100 and 75 billion piece scenarios would both be greater than our financial sustainability criterion.

[32] "Allocating costs between universal services and services outside the scope of universal service" Heikki Nikkali, Kari Elkala, Pekka Leskinen, Pavi Rokkanen and Peter Karlsson; Ch 13 of "Multi-modal Competition and the Future of Mail"; ed. by Crew and Kliendorfer; 2012 Edward Elgar Publishing Limited, Cheltenham, UK (and Northampton, MA.)

Table 9
Sensitivity of Base Case Result to a
50 Percent Decrease and Increase in Price Elasticities

Initial Volume (billions)	Base Case Breakeven Increase Above CPI	Breakeven Increase Above CPI with 50% Decrease in Price Elasticities	Breakeven Increase Above CPI with 50% Increase in Price Elasticities
150	24.3%	23.5%	28.0%
125	39.9	37.8	47.7
100	65.1	60.2	82.3
75	113.4	99.9	151.9

d. Retail function cost

The Postal Service retail function represents 11 percent of total costs or $6.5 billion in 2009. The U.S. Postal Service Office of Inspector General (OIG) recently published a paper on the Postal Service's retail function that finds that substantial savings could be obtained without degrading service.[33] Consequently, we examine the sensitivity of the base case results to savings in the retail function. Table 11 shows that a 33 percent reduction in retail costs at 150 billion pieces could reduce the required breakeven price increase by 4.5 percentage points. At 75 billion pieces the breakeven price could be reduced by 12 percentage points. This raises the issue of whether there is a need for much retail presence at the lower volume levels, since they represent scenarios in which there would be very little single piece letter mail. We have seen that UPS and FedEx can accommodate household parcels by using a combination of their own retail stores, retail store agents and drop boxes. Moreover, the USPS has begun to use letter carriers to accept Priority Mail parcels on their delivery rounds. Thus it would seem that very substantial savings in the retail function could be obtained at the lower levels of volume that we have examined.

[33] U.S. Postal Service Office of Inspector General, "Analyzing the Postal Service's Retail Network Using an Objective Modeling Approach," Report No. RARC-WP-10-004, June 14, 2010.

Table 10
Sensitivity of Base Case Result to
a 33 Percent Reduction in Retail Costs

Initial Volume (billions)	Base Case Breakeven Increase Above CPI	Breakeven Increase Above CPI with 33% Reduction in Retail Costs
150	24.3%	19.8%
125	39.9	34.1
100	65.5	57.5
75	113.4	101.4

e. Mail processing variability

There has been a long running technical disagreement between the Postal Service and the PRC over the impact of volume changes on mail processing costs. Essentially the dispute boils down to the degree of economies of scale that exist in the mail processing function. The Postal Service has done analyses that show that mail processing costs grow about 8.3 percent when volume increases 10 percent (a volume variability of 83 percent). The PRC claims that cost grows about 9.7 percent when volume increases 10 percent (a volume variability of 97 percent). In short, the Postal Service finds that the mail processing function has about 13 percent fixed costs and the PRC finds that fixed costs are only about 3 percent. Interestingly, this disagreement is based on econometric analyses using data obtained during periods when volume was increasing. It would seem that their respective findings should be the same whether volume is increasing or declining. The more costs are fixed, the less costs will drop when volume declines.

The Postal Service and the PRC have agreed to use a 94 percent volume variability percentage for mail processing and this is what the GMU Model uses for the base case. However, to test the sensitivity of the base case results we compare them to the results using the Postal Service's 83 percent figure. Table 12 below shows the breakeven price increases for the 83 percent variability case in comparison with the base case.

Table 11
Sensitivity of Base Case Result to
83 Percent Variability in Mail Processing

Initial Volume (billions)	Base Case Breakeven Increase Above CPI	Breakeven Increase Above CPI with 83% Mail Processing Variability
150	24.3%	24.9%
125	39.9	41.4
100	65.5	68.6
75	113.4	119.6

f. Delivery frequency

A number of posts in the developed world deliver only five days a week. In this country Congress controls the number of days a week that the Postal Service must deliver through an appropriations rider that has been approved continually since 1983. Postal management has proposed that the Postal Service be allowed to reduce delivery frequency by one day per week and estimates that it would produce $3.1 billion in annual savings.[34] So far, Congress has not acquiesced. In this section we examine the sensitivity of the base case results to the estimated savings from reducing delivery frequency. Table 13 shows that the required breakeven price increase is reduced considerably as compared to the base case. It is reduced by about 30 percent at 150 billion pieces.

[34] The GMU study on Universal Service cited above calculated that the savings from reduced delivery frequency would be about two thirds of Postal Service management's estimate.

Table 12
Sensitivity of Base Case Result to
Five Day a Week Delivery

Initial Volume (billions)	Base Case Breakeven Increase Above CPI	Breakeven Increase Above CPI with 5 Day a Week Delivery
150	24.3%	17.5%
125	39.9	31.0
100	65.5	53.3
75	113.4	94.9

g. Salaries

The base case assumes that the Postal Service's average productive hourly wage is unchanged in real (inflation-adjusted) terms. This comports with recent history, and given the financial difficulties facing the Service, it is not an unreasonable assumption. The recent history is presented in Table 14. The outsized increase in 2009 was due to oil prices skyrocketing in 2008 which caused the CPI to increase significantly through July. It just so happens that July is the end of the period that determines the cost-of-living adjustment (COLA) that went into effect not long after the beginning of FY 2009.

Table 13
Postal Service Average Productive Hourly Wage

Year	Nominal Increase	Real Increase
2005	3.1%	-0.3%
2006	3.8	0.0
2007	1.8	-0.4
2008	2.4	-2.3
2009	5.7	6.6

Depending on the craft, salaries make up about 70 to 75 percent of the productive hourly wage. Table 15 presents the sensitivity of the base case assumption to a cumulative change of plus

3 percent and minus 3 percent in employee salaries. At most of the volume levels, the effect is less than 10 percent of the base case breakeven volume increase. Even with a 3 percent cumulative increase, the 100 billion case is above our criterion by only a small margin.

Table 14
Sensitivity of Base Case Result to Cumulative 3 Percent Positive and Negative Changes in Postal Service Salaries

Initial Volume (billions)	+3% Breakeven Increase Above CPI	Base Case Breakeven Increase Above CPI	-3% Breakeven Increase Above CPI
150	27.3%	24.3%	21.3%
125	43.3	39.9	36.4
100	69.7	65.5	61.2
75	119.0	113.4	107.9

h. Time period over which volume decline takes place

The base case assumes that the volume levels examined in this study would obtain in 2020. It is probably unrealistic that volumes would drop so rapidly, especially for the 100 and 75 billion piece volume levels. The nonvolume work load measures, especially carrier stops which grow with household formations, must be estimated for a particular year as must retiree health care costs. We have estimated the base case for the year 2030 to show the effect of time on the base case results by projecting nonvolume workload costs and retiree health care cost to that year. Table 16 presents the results. It can be seen that changing the time period has little effect on the costs or breakeven rate increase.[35] Thus, the model is virtually atemporal and independent of the number of years that it would take to achieve the volume levels examined. However, the annualized price increase would be reduced due to the longer forecast period.

[35] In part, this is due to the coincidence that the increase in nonvolume workload costs in 2030 was almost exactly matched by a retiree health care cost decrease in 2030.

Table 15
Sensitivity of Base Case Result to
Changing the Forecast Year from 2020 to 2030

Initial Volume (billions)	Base Case Costs ($ 2009)	Base Case 2020 Breakeven Increase Above CPI	Costs in 2030 ($ 2009)	2030 Breakeven Increase Above CPI
150	$67.0	24.3%	$67.1	24.3%
125	60.0	39.9	60.0	39.9
100	53.1	65.5	53.1	65.5
75	46.7	113.4	46.7	113.5

i. Retiree health care costs

As noted earlier, we assumed in the base case that the 2020 retiree health care costs would be $7.3 billion in 2020 dollars as estimated in GAO Report GAO-10-455, April 2010.[36] We estimate this payment is a combination of the normal health care costs of about $4.3 billion and an amortization amount of about $3 billion. Given the Postal Service's current financial condition, there is considerable uncertainty about possible legislative changes that would affect future health care payments. We tested the sensitivity of our results to an alternative scenario, in which we assumed that the Postal Service had no remaining health care liability in 2020. Thus the Postal Service would only pay its projected normal health care costs of $4.3 billion.

We examine the sensitivity of the base case results to the lower retiree health care payment case in Table 17 below. It can be seen that the assumed retiree health care reduction would keep the required breakeven price increases at the 150, 125 and 100 billion volume levels below our financial sustainability criterion.

[36] As described in the base case section, we convert the 2020 retiree health care costs to 2009 dollars using an assumed 3.0 percent annual inflation rate.

Table 16
Sensitivity of Base Case Result to
a $3 Billion Reduction in Retiree Health Care Costs

Initial Volume (billions)	Base Case Breakeven Increase Above CPI	Breakeven Increase Above CPI with $3 B Decrease in Retiree Health Care Costs
150	24.3%	19.8%
125	39.9	34.1
100	65.5	57.5
75	113.4	101.4

j. Volume mix

In addition to widespread concerns about total volume declines in the postal community, there have also been major concerns that a disproportionate amount of the decline would take place in First-Class Mail, which has a higher current profit per piece than any other major category of mail.

To examine the sensitivity of our results to alternative volume mixes (especially with respect to First-Class Mail), we compared the base case BCG mix results with two other volume mix cases. The first is the base case with the FY 2009 CRA volume mix, scaled for the 150, 125, 100 and 75 billion piece total volumes. This case has considerably more First-Class Mail than the BCG mix because of the BCG assumption that First Class would decline by about 4 percent annually in the FY 2009-2020 period. As an example, for the 150 billion piece BCG mix case and the corresponding FY 2009 CRA mix case, First-Class volumes would be 49 billion and 65 billion pieces respectively. The second case is more extreme in that it assumes a 50 percent cut in First-Class volume for the 150 to 75 billion subcases, with the BCG mix for the remaining mail classes scaled up by a constant factor to attain the desired total volume.[37] In this second

[37] This case is not intended to be realistic, but simply to investigate how sensitive the results are to the level of First-Class volumes.

scenario, First-Class volume would only be 24 billion pieces. Results for these cases are shown in Table 18 below.

Table 17
Sensitivity of Base Case Result to
Changes in 2020 Mail Mix

Initial Volume (billions)	BCG Mail Mix Breakeven Increase Above CPI	FY 2009 CRA Mail Mix Breakeven Increase Above CPI	50% Cut in BCG First-Class Breakeven Increase Above CPI
150	24.3%	22.4%	31.5%
125	39.9	38.6	47.6
100	65.5	65.0	74.4
75	113.4	113.9	124.6

It can be seen that using the FY 2009 CRA mail mix results in only minor changes in the 2020 breakeven price increases, even though First-Class volumes are 25 percent higher than in the BCG (base case) mix. Furthermore, even in the extreme case of assuming a 50 percent cut in First-Class Mail, breakeven percentages only increase by about 7 to 11 percentage points for all volume levels. While these results may not seem to agree with intuition, the explanation is straightforward. Higher First-Class volumes in a mix mean that the breakeven price increases will be lower in all classes than otherwise. However, with little First-Class Mail in a mix, breakeven prices in the other classes of mail will have to rise enough so that they too will be high-profit products. The own price elasticities in the other classes, while generally higher than those of First-Class Mail, are not so high that sufficient additional profit cannot be achieved by raising their prices.

12. Generalizing the GMU Model for Use with Other Posts

In this section, we describe our efforts to modify the GMU Cost Rollforward Model for the U.S. Postal Service to estimate the effect of major volume changes in other posts. We assume that the

major in-office and out-of-office activities in a post are quite similar due to the fact they all perform the same basic activities on the same types of mail. For the same reason, we assume the empirically-estimated cost elasticities (variability of cost with respect to volume) of most activities in other posts are similar to their U.S. Postal Service counterparts. In other words, we believe it is reasonable for the cost elasticity of mail processing, highway transportation, higher level supervision, retail clerks, postmasters, equipment maintenance, etc., to be similar across posts in developed countries. To be sure, there are also some differences such as non-volume workload (primarily the increase in the number of delivery stops due to population growth.), but these changes have a minimal effect on total costs. The mix of volume (e.g., by shape, worksharing level, service standard) also varies among posts, but as described above in the USPS volume mix sensitivity analysis, the effect of these differences on total costs is small.

Posts have different ratios of fixed and variable costs in large part owing to the widely different volumes per capita and that influences the relative percentage of total costs belonging to the delivery function. The street (or out-of-office) portion of delivery is largely fixed with respect to volume changes (consisting primarily of the time needed to travel between stops and the time needed to travel from the office to the beginning of the route and then from the end of the route back to the office.) The other functions such as transportation and mail processing are largely variable with respect to volume changes. Thus, posts with a smaller volume per capita will have delivery functions whose costs are a larger percentage of total costs. This in turn will mean that their total costs contain a greater percentage of fixed costs. Because of the large volume per capita of the U.S. Postal Service, almost all posts will have a greater percentage of fixed costs than it does. The percentage of total costs of posts that are fixed is generally not known publicly except for the USPS. Consequently, we have made runs with the GMU Cost Rollforward Model using this percentage as a parameter to illustrate the effect of fixed costs on the price increases needed to breakeven under declining volume scenarios. For this purpose, we use values of 40, 50, and 60 percent fixed costs. The 40 percent fixed cost/total cost value matches the U.S. Postal Service, while the other values are intended to cover the range expected for lower volume per capita posts.

Figure 4 displays the results, which are also listed in more detail in Table 19. The x-axis displays the ratio of test period (2020) to initial period (2009) volume, with 100 percent representing no change. The y-axis displays the annual increase in average real revenue per piece required for the post to break even assuming that it was breaking even at the 100 percent initial point. The three curves represent three different percentages of initial-period total costs that are fixed (40, 50, 60 percent). It can be seen from Figure 4 that posts with a higher percentage of fixed costs would have to increase prices more to maintain a breakeven condition when volume declines substantially.

Figure 4
Breakeven Annual Percent Real Price Change vs. Volume Change Ratio for 40%, 50%, & 60% 2009 Fixed/Total Cost Ratios (2009-2020)

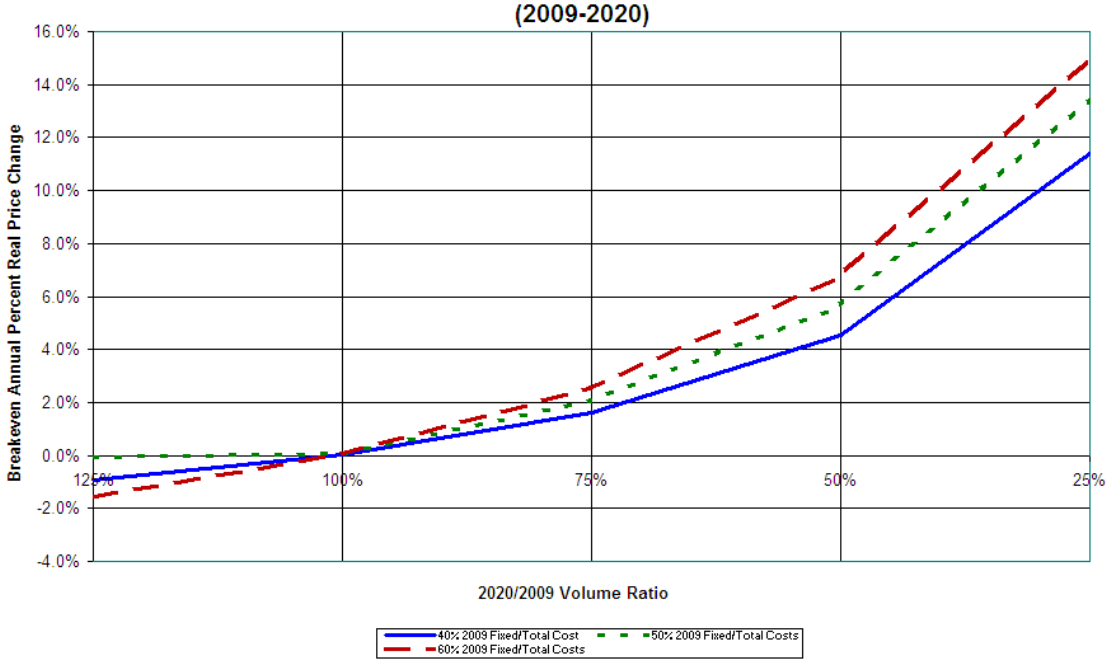


Table 19
GMU Model Results for 40%, 50%, & 60% Fixed/Total Cost Ratios

Case #	Fixed/Total Cost %	2020/2009 Volume %	Adj 2009-2020 BkEv Price Increase	Adj Annual BkEv Price Increase	% Fixed Costs
1	40%	125%	-9.8%	-0.9%	34.4%
2	40%	100%	0.5%	0.0%	40.3%
3	40%	75%	19.4%	1.6%	48.4%
4	40%	50%	62.9%	4.5%	59.8%
5	40%	25%	228.4%	11.4%	75.3%
6	50%	125%	-0.6%	-0.1%	35.6%
7	50%	100%	0.7%	0.1%	50.2%
8	50%	75%	25.6%	2.1%	58.3%
9	50%	50%	83.2%	5.7%	68.5%
10	50%	25%	301.3%	13.5%	80.4%
11	60%	125%	-16.0%	-1.6%	54.2%
12	60%	100%	0.9%	0.1%	60.3%
13	60%	75%	32.2%	2.6%	67.5%
14	60%	50%	104.5%	6.7%	75.6%
15	60%	25%	350.0%	15.0%	85.0%

Table 19 presents the exact numerical values used to construct Figure 4. In addition, the table presents the *total* price increase required to achieve breakeven for the entire 12-year period 2009-2020.[38] For example, it can be seen that when 2020 volume drops by 25 percent to 75 percent of 2009 volume, the breakeven price increases required are 19, 26, and 32 percent for the 40, 50, and 60 percent fixed cost cases, respectively. The average annual real price increases are 1.6, 2.1, ad 2.6 percent, respectively.

Of course, prices don't necessarily have to be increased to maintain breakeven in the face of a large decline in volume. Other short run options include increasing total factor productivity and cutting back on the USO. In all likelihood a post would use all three approaches. That is what we have seen in the United States. The Postal Service has reduced workhours at a rate faster than would be expected from the decline in volume. In doing so, total factor productivity has increased substantially. The scope of the USO is in the hands of Congress, but the Postal Service

[38] The first column has the share of fixed costs before the volume decline and the last column has the share of fixed cost after the volume decline.

has asked the Congress to allow it to close thousands of retail facilities and to eliminate Saturday delivery. In addition, it proposes to close about half its processing plants and to eliminate overnight service for single piece First-Class mail.

The relatively large percentage of fixed costs in posts means that relying on price increases alone would require them to be raised very substantially if they are to maintain their former level of profitability. Increases in prices ranging from 40 to more than 60 percent would certainly raise concerns about the affordability of postal services. Further, we don’t know how consumers would react to such substantial price increases when the Internet provides a convenient means for substitution.

Appendix A: Description of GMU Cost Rollforward Model

A-1. Background and Purpose

The GMU Cost Rollforward Model was developed for use in the OIG study of the Postal Service's future financial sustainability. It provides the means for calculating future costs, revenues, and volumes for the various "what-if" scenarios described in the main paper. The model relies heavily on the Cost Rollforward Model developed by the Postal Service in the late 1970's. However, it extends the capability of the Cost Rollforward Model by adding the ability to: 1) calculate new prices for mail and special service categories that allow revenues to match estimated costs for a future year; 2) estimate the effect of those price increases on volumes for the future year; and 3) calculate new breakeven costs and revenues for that year based on the new prices and volumes. Finally, a new user interface was developed to provide a convenient means for running scenarios with different inputs and storing the summary results for a large number of scenarios in the same workbook.

This appendix presents the results for all scenarios (cases) used in this study and the sources for the input data. It also describes the GMU Rollforward Model and how it was used to estimate financial results for the scenarios described in the main paper. Finally, it provides instructions for using the model to allow the OIG staff to investigate a wide variety of other scenarios by adding new cases or changing the inputs for the current cases.

The GMU Model programs are written in the Excel-based Visual Basic for Applications (VBA) programming language, which uses Excel workbooks and worksheets as model inputs and outputs. It is designed for use by analysts who are familiar with Excel and at least somewhat familiar with the standard public Postal Service reporting systems, such as the annual Cost Segments and Components, CRA and RPW Reports. Some familiarity with a standard programming language such as Basic, FORTRAN, or C would be useful if changes in the VBA code are desired, but knowledge of computer programming languages is not required to use this model.

It should be noted that any forecast of the Postal Service's financial condition 11 years in the

future is subject to many uncertainties, including future economic conditions, further improvements in and increased usage of technological substitutes, and future legislative changes. The value of this study lies in the results comparing future USPS financial results assuming a variety of "what-if " future conditions.

A-2. Overview of GMU Cost Rollforward Model

a. Cost Rollforward Model

The Cost Rollforward Model was originally developed by the Postal Service for use in its testimony for PRC omnibus rate cases, starting in the R80-1 rate proceeding. This forecasting model produces detailed forecasts by "Cost Segment" (18 broad categories of postal costs, such as Postmasters and Rural Carriers) and more detailed "Cost Components" (about 170 cost sub-categories such as "Postmasters EAS 23 and below" and "Rural Carrier Equipment Maintenance Allowance"). Several forecasting steps (called effects) are used to "roll forward" the cost components from one fiscal year to the next. These effects include: cost level changes, mail volume changes, nonvolume workload changes (such as delivery points or number of post offices), cost reduction programs, and several categories of system-wide cost changes (such as worker's compensation and retiree health care costs).

The first version of the Postal Service Cost Rollforward Model was written for a mainframe computer system in the Cobol programming language. This early version of the model was very difficult for the PRC staff and the parties to understand, modify, and use. For the R80-1 rate proceeding, one of the authors of this paper converted the USPS Cobol Cost Rollforward Model to the more common Fortran computer language, which made it possible for the PRC staff and others to replicate the Postal Service cost forecast and to make changes in the inputs for the model based on results of the formal discovery process. In later years, the PRC version of the model was again rewritten by one of the authors, first in the C programming language and then in the Excel-based VBA language, both or which could be run on early IBM PC's. The PRC Excel version of the model introduced in 2003 and first used in the R2005-1 rate case made it possible to use simple spreadsheets for the inputs and outputs of the Cost Rollforward Model, which made the mechanics of the forecasting process much more accessible. In 2005, the Postal

Service followed suit by converting its 30-year-old Cobol-based model to the Excel/VBA language for use in the R2005-1 rate proceeding.

In spite of the many versions of the Cost Rollforward Model that have been created and used over time, the basic algorithms for forecasting costs starting with a "base year" (with known data) to a near-term future "test year" have remained virtually unchanged. Also, all versions of the model produce identical results given the same input data. This is remarkable, since the model has been subjected to intensive review and critiques by the PRC staff and the parties over a long period of time. We believe this long history of successful use justifies using the Cost Rollforward Model as the foundation of the GMU Forecasting Model. In this paper, we use the PRC Excel/VBA version of the Cost Rollforward Model from the R2006-1 omnibus rate proceeding.[39]

b. Adjusting Volumes, Revenues, and Costs for Own-Price Elasticity Effects

For this study, substantial volume declines are anticipated in the future. This means that real costs would drop, but real revenues would drop even more, resulting in the need for substantial price increases to achieve financial breakeven.[40] The Cost Rollforward Model described above calculates future costs resulting from a specified set of forecasted mail and special service category volumes. However, we also need to calculate a set of future rates by category that would allow the Postal Service to achieve financial "breakeven" in a given future year.

Determining breakeven prices requires several steps. First, the future real (FY 2009 dollars) revenues that would result from the future volumes at current rates[41] are calculated. The percentage increase in prices[42] required to produce revenues that equal forecasted costs is also

[39] A companion model has been used in rate cases called the "CRA Model." This model updates the distribution of longer run costs in the output cost matrix created by the Cost Rollforward Model. It was not necessary to use this model in this study because the longer-run costs are considered volume variable over the 11-year forecast period.

[40] Revenues and volume-variable costs decline proportionally with volume, but fixed costs stay the same, causing costs to exceed revenues.

[41] The rates in effect during FY 1999 are used as current rates for this study.

[42] For this study, the same percentage price increase is assumed to apply to each mail and special service category. This approximation seems reasonable given that the future time period of interest is at least 10 years from the present time. However, it is recognized that statutory requirements (e.g., nonprofit categories) would likely result in price increases that vary by category.

calculated at this point in the process. These steps result in what we call "initial" or "unadjusted" volumes, revenues, costs, and the estimated price increases required to break even. In reality, these initial price increases would not be sufficient to break even because of price elasticity effects – that is, volumes would decrease further due to higher prices, which would cause a further revenue shortfall.

To calculate the price elasticity effects, several new VBA modules and worksheets were added to the GMU Model along with those required by the Cost Rollforward Model. The calculation procedure is an iterative process that starts with a set of own-price elasticity values[43] for each mail/special service category (product) provided by the Postal Service to the PRC[44] each year; in our case, for FY 2009.

Using the initial set of required price increases for each product and the corresponding price elasticities, a starting volume estimate is calculated for each product[45]. Assuming unit volume variable (attributable[46]) costs stay the same, new total attributable costs and revenues are calculated, and the difference between them is the estimate of fixed costs for that stage of the process. If this estimate of fixed costs exceeds the initial value of fixed costs by more than a predefined small amount (about 1 part in 200,000), a new (lower) percentage price increase for the next stage is calculated using a calculus technique for determining solutions of nonlinear equations called Newton's Method.[47] If the estimate of fixed costs is too low, a new (higher) percentage price increase is used. This process continues until the required value of fixed costs

[43] In past rate cases through R2006-1, a more complex volume forecasting process was used that involved product price cross-elasticities. However, in the ongoing R2010-4 rate proceeding, the Postal Service has simplified its volume forecasting process by not considering cross-elasticity effects between product prices. We feel this makes our use of a simpler own-price elasticity approach reasonable.

[44] The own price elasticities for market dominant products are from the January 20, 2010 submission to the PRC by the Postal Service; the competitive product elasticities were furnished on a confidential basis to the OIG by the Postal Service.

[45] It should be noted that the model does not calculate a volume forecast in the usual sense, where many input variables other than price are used. Rather, it takes an existing volume forecast that is based on all the input variables, and adjusts it only for price changes.

[46] Most attributable costs are considered volume-variable.

[47] See the Wikipedia reference for this method at http://en.wikipedia.org/wiki/Newton's_method.

agrees with the estimated value within the given tolerance. Experience with this method has shown that the process converges within the required tolerance in about 5-15 iterations.

There is one more factor to consider. Unit attributable costs will not actually stay constant as volumes change, because not all attributable costs vary directly with volume. In addition, changing one mail category volume and leaving the others constant results in changes in attributable costs not only for the changed-volume category, but also for all other categories, although by smaller amounts. Thus, the GMU Model must be run again with the new volumes and prices to calculate new unit costs. Given the new unit costs, the Newton's method technique is used to find new prices and volumes that converge to achieve the original value of fixed costs. Then the GMU Model is run yet again to start another iteration of the process, then the Newton's method approach is used, and so on, until breakeven revenues and costs with the correct fixed costs are achieved within a specified error tolerance. Five iterations of this process produce breakeven revenues and costs to an accuracy of about 1 part in 200,000. This final set of product costs, revenues, and volumes are called "price-adjusted" or simply "adjusted" values.

Appendix B: Changes Made to GMU Model to Reflect Other Posts

As described above, the GMU Rollforward Model was modified in several ways for use in estimating volume-related breakeven price changes for posts with different fixed/total cost ratios. (See Figure 4). As a first step, the assumed 2020 changes related solely to the USPS were removed from the model. These included legislatively-mandated changes in USPS payments to the retiree health benefits fund. The remaining forecasted changes are related only to volume and non-volume workload (primarily delivery point growth).

Next, the 2009 starting point for the model forecasts was revised to reflect a break-even situation instead of the actual USPS $4 billion loss in 2009. The cost model was used to estimate price increases and adjusted volumes for 2009 that would result in parity between USPS costs and revenues.

With the price-adjusted 2009 USPS model, the fixed/total cost ratio was 40.0%. The cost model was then used to estimate simulated 2009 USPS break-even price increases and volumes that would result in fixed/total cost ratios of 50% and 60%. These three versions of the 2009 model were used as starting points to calculate the three break-even price increase curves shown in Figure 4. Finally, simulated 2020/2009 volume change ratios of 125%, 100%, 75%, 50%, and 25% were applied to each of the three 2009 models to generate the remaining points on the three curves.