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POSTAL RATE AND FEE CHANGES, 2001

Docket No. R2001-1

DIRECT TESTIMONY
OF
PETER BERNSTEIN
ON BEHALF OF
UNITED STATES POSTAL SERVICE

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AUTOBIOGRAPHICAL SKETCH

My name is Peter Bernstein. I am vice-president of RCF Economic and Financial Consulting, Inc., where I have been employed since 1992. As vice-president, I have major responsibilities in RCF's forecasting, econometrics, and quantitative analysis activities. Recently, I have been focusing my activities on the analysis of the impacts of technological developments on postal volumes. I have submitted testimony on Ramsey pricing in R97-1 and R2000-1 and in the MC97-2 parcel classification reform case. I have also assisted Dr. George Tolley, President of RCF, in the development of his testimony for Docket Nos. R94-1, MC95-1, MC96-2, R97-1, and R2000-1.

In addition to my responsibilities at RCF, I have been a faculty member of the department of economics at DePaul University of Chicago since 1992, where I have taught courses in economics, finance, and econometrics. I was a faculty member of the department of economics at Loyola University of Chicago from 1987 to 1991, and also taught classes at the University of Chicago Graduate School of Business in 1987.

In 1985, I earned a Master's Degree in Finance and Economics from the University of Chicago Graduate School of Business and I have completed all course work and examinations toward a Ph.D. from the University of Chicago. I received a B.A. in Economics from the University of Chicago in 1981.

I. Purpose and Scope of This Testimony

This testimony addresses the impact of technological diversion on the Postal Service. Technological diversion is defined as the reduction in the volumes of postal mail due to the use of technological alternatives. This testimony focuses on recent technological developments generally related to the spread of the Internet such as E-mail and Internet advertising, as well as non-Internet technological alternatives to the mail such as the use of electronic funds transfers and fax machines. The testimony does not address impacts of past technological developments such as the telephone or cable-TV, though the experience of previous occasions of technological growth are worth considering. In fact, during the 1980s, technological gains probably contributed to postal volume as computers made direct marketing less costly and more effective. But recent evidence shows that recent technological advancements are having negative impact on the volumes of First-Class and Standard Mail, and this diversion of mail is the primary focus of my testimony.

The replacement of letter mail by new technologies has been occurring for many years. The telephone, and indeed the telegraph, have served to reduce mail volumes to some degree. More recently, fax messaging and electronic alternatives to paying bills by mail have emerged. These impacts have been occurring somewhat slowly and are part of the many longer-term influences on mail volumes. The R2000-1 testimony of George Tolley discussed these and other technological alternatives to the mail.

In the two years since the filing of the R2000-1 case, Internet usage has grown rapidly, both in terms of the number of users and the types of uses. The spread of Internet access, the increases in transmission speeds, and the passing of the Y2K computer problem without major incident have all served to change the landscape considerably in a relatively short period of time. Whereas in R2000-1, the Internet was

seen as one of many technological alternatives to the mail, it has now become one above many. It is for that reason that its influences on mail volumes are given special attention in this testimony. Similarly, the econometric testimony of Thomas Thress (USPS-T-8) and the volume forecast testimony of George Tolley (USPS-T-7) both include the Internet as a separate influence on past and future mail volumes.

This testimony acts in parallel with those of witnesses Tolley and Thress, and provides a detailed analysis of technological diversion. The focus of this testimony is on technological diversion of First-Class and Standard Mail, though technology affects other mail classes as well. The volume testimony of George Tolley discusses the impacts of technology on the volumes of Periodicals, Package Services mail, and the Special Services.

The remainder of this testimony is organized as follows. Chapter II reviews earlier discussions of mail diversion presented in the testimonies of Dr. George Tolley. Chapter II also makes reference to econometric analysis of mail volumes by Thomas Thress in the R97-1 and R2000-1 rate cases.

Chapter III discusses recent developments which have changed the nature of technological diversion, principally the rapid spread of the Internet which has occurred in the last two years.

Chapter IV discusses empirical analysis of mail diversion. A general framework for assessing diversion impacts on mail is developed. Different possible metrics that can be used to measure diversion are considered. The chapter then focuses on two specific measures of Internet activity that been used in the econometric analysis of the volumes of single-piece letters and Standard mail. These two variables are household expenditures on Internet Service Providers (ISPs) and Internet advertising expenditures. Time-series data for both of these variables are reviewed and forecasts

of future values are developed. These forecasts are used as inputs into the volume forecasts presented in the testimony of George Tolley.

Chapter V focuses on the technological diversion of First-Class Mail. Much of the attention of chapter V is on single-piece letter mail, but the diversion of workshare letters is also discussed. Chapter VI provides a similar discussion of the diversion of Standard Mail.

Chapter VII addresses the rate-making implications of technological diversion. Diversion affects the rate-making process in at least two ways. First, by reducing volumes, diversion reduces revenues and contribution, weakening the Postal Service's financial position. Consequently, diversion of mail makes rate cases more frequent or makes rate increases larger than they would otherwise be. A second rate-making impact of diversion is the degree to which the spread of technological alternatives changes the price sensitivity (elasticity) of mail products. These two rate-making issues are addressed both conceptually and empirically. The chapter includes a comparison of after-rates Test Year prices based on the Postal Rate Commission's R2000-1 recommend mark-ups and those based on an application of the Ramsey pricing formula.

Two library references accompany this testimony. LR-J-133: Projections of Future Values of Internet Variables consists of several Excel spreadsheets used to analyze historical data on household expenditures on Internet Service Providers and Internet advertising revenues and to make projections of future values of these variables. LR-J-134: Bernstein Pricing Models consist of several Excel spreadsheets used to calculate illustrative Test Year after-rates prices based on the Postal Rate Commission's recommended mark-ups in the R2000-1 case and based on application of the Ramsey pricing formula. The library reference also presents a calculation of the

gains to mailers (change in consumer surplus) that could result from the Ramsey-based prices.

II. Review of Past Testimony on Technological Diversion

As far back as his R87-1 testimony, Dr. George Tolley addressed the impact of technology on First-Class letter volumes. "Computers have impacted First-Class letter mail positively and negatively." (USPS-T-2, page 40, lines 17 and 18, Docket No. R87-1). Dr. Tolley went on to explain that computerization served to increase First-Class advertising mail and to make letter writing less costly. At the same time, computers were seen as having negative impacts on letter volume through the introduction of electronic funds transfers and the emergence of electronic mail. Dr. Tolley concluded his discussion with the following:

> The various effects of computers on First-Class letter volume that have been discussed cannot be quantified reliably at this time. The discussion does suggest, however, that the impact so far has been positive rather than negative, mainly because of the impetus given to advertising.
>
> USPS-T-2, page 44, lines 4-8, Docket No. R87-1

In his R90-1 testimony, Dr. Tolley introduced the term "electronic diversion," citing a Postal Service study, "Looking to the 1990s: History of and Prospects for Electronic Diversions of Mail." In the R90-1 testimony, Dr. Tolley examined the role of fax as a direct competitor to the mail and the fact that personal computers were then introducing fax capabilities to small businesses and households. E-mail was also given some attention, though it was seen as a future factor far more than a factor affecting volumes in the recent past. The testimony also addressed electronic banking and other non-mail methods for bill payments such as electronic funds transfers (EFT), and electronic data interchange (EDI). At that time, Dr. Tolley concluded that in the future, the negative impacts on volume would outweigh the positive impacts, and he accounted for this expectation by including a small negative net trend in his forecast of First-Class letter mail.

In R94-1, Dr. Tolley focused his discussion of electronic diversion on four key technologies: fax, E-mail, EDI, and EFT. He noted that alternatives to the mail have been available for some time.

> The impact of telephone, private couriers, and delivery services is well entrenched in mail volumes, and there is no evidence of changing trends in their usage in relation to the mail. The use of electronic alternatives however has clearly been increasing and is likely to continue to increase.
> USPS-T-2, page 53, lines 5-9, Docket No. R94-1

As part of this testimony, Dr. Tolley introduced the concept of a diversion ratio which measures the number (or fraction) of mail pieces diverted for each use of an electronic alternative. For illustrative purposes, a diversion ratio for fax of 10 percent was suggested, meaning that for every ten fax messages, one letter was diverted. Based on this diversion ratio and estimates of the total number of fax messages sent, Dr. Tolley estimated that from 1988 to 1992, the diversion of letter mail due to fax increased from 250 million pieces to between 600 and 900 million pieces. Dr. Tolley was quick to note however that, "in view of the lack of definite information on this topic, this figure should be interpreted only as a suggestive order of magnitude." [USPS-T-2, page 57, lines 2-4, Docket No. R94-1]

Dr. Tolley put forth similar analysis for E-mail, EDI, and EFT, applying estimates of diversion ratios to estimates of total number of messages for each of the technologies. Using these results, he ventured the estimate that

> [F]ax, E-mail, EDI, and EFT diverted 822.2 million letters in 1988. For 1992, the estimate is 2,447.9 million letters. For the Base Year of 1993, the estimate is 2,692.6 million letters, and for the 1995 Test Year, the estimate is 3,269.8 million letters. Nevertheless, it should be recognized that the growth in electronic communication is not unrelated to the increase in financial transactions, a factor which serves to increase First-Class letter volume.
> USPS-T-2, page 66, lines 11-16, Docket No. R94-1

In sum, Dr. Tolley concluded that the "electronic alternatives to the mail are downward volume influences, whereas financial transactions, advertising, cable and bills associated with telephone usage are upward influences." [page 68, lines 16-18]. He concluded, based on analysis of recent forecast errors, that the influences have been approximately offsetting.

In R97-1, the analysis of the First-Class letter subclass was decomposed into separate volume demand equations for single-piece and workshared letters, based on the econometric work of Thomas Thress. The equation for single-piece letters included a negative time trend, which was seen as largely reflecting the shift of volume into workshare letters due to declining user costs. Similarly, the workshare letter equation had a positive trend term.

Beyond these effects, Dr. Tolley expanded on his R94-1 discussion of the offsetting influences on letter volume. The growth in financial transactions and advertising were seen as strong positive influences, while electronic diversion was seen as a negative. This testimony also included the first direct reference to the "Internet." Still, most of the technology discussion centered around the spread of the home computer, which grew from 7 percent of households in 1988 to 25 percent in 1994. Projections by International Data Corp. were cited, stating that by 1999, over 50 percent of households would have computers with "35 percent of households, or 36 million, subscribing to at least one online service by the end of the decade." [USPS-T-6, page 52, lines 24-25, Docket No. R97-1]

Again, Dr. Tolley saw the positive influences as offsetting the negative influences for total First-Class letters. However, forecast error analysis did indicate a small negative net trend for single-piece letters and a small positive net trend for workshare letters. This suggested that the negative influences on single-piece letters were

predominant, while the positive influences were more important in workshare letters.

In R2000-1, a similar econometric approach was used for single-piece and workshare letters, but the disparate impacts of the negative and positive influences were given more focus. The negative trend effect in single-piece letters was seen as encompassing the effects of declining user costs, electronic diversion, and the gradual decline in mail sent by households. The electronic diversion discussion was greatly expanded, with detailed looks at the four key technologies affecting the mail: fax, E-mail, EFT, and EDI. Though the Internet was given considerable attention, it was seen as being one among many influences on mail volume. Of the four technologies affecting the mail, only E-mail is necessarily linked to the Internet. Fax messages are sent over ordinary phone lines. Electronic funds transfers are computer-related but do not require the Internet. Electronic data interchanges between large businesses are traditionally done electronically, but using the Internet, though it has now become possible for firms of all sizes to conduct these transactions online. In general, this diversion was relatively long-standing with fax messaging and electronic funds transfers predating the widespread use of the Internet. Therefore, most of the diversion that existed at the time of the filing of the R2000-1 case was not Internet related. This is consistent with the fact that as late as mid-1999, household Internet access was still relatively low.

Dr. Tolley's R2000-1 testimony also discussed the degree to which one type of technology may be replacing another, leaving mail volume unaffected. For example, fax was seen as having a waning influence, while E-mail was viewed as more significant than in the past, reflecting the idea that E-mail was beginning to serve as a substitute for fax. Similarly, one type of electronic bill payment might replace another. Still, electronic alternatives were seen as being an important negative influence on mail

volume, particularly on single-piece letters.

The econometric analysis in R2000-1 supported the view that single-piece letters were subject to growing electronic diversion. The negative econometric trend term, and a small negative trend due to non-econometric factors, were estimated to have reduce single-piece volume by nearly 14 percent. This compares to an approximate 12 percent decline from these combined effects estimated in the R97-1 case.

Analysis Since R2000-1

Much has changed in the relatively short time period since the filing of the R2000-1 case. The Internet has spread to more than half of all households and can no longer be considered simply one among many influences on mail volume. Faster connection speeds allow for the transmission of information that was prohibitively costly just a few years ago. Large data files, advanced graphics, videos, and music are now commonly sent across the Internet. The passing of "Y2K" without major problems, the emergence of Internet advertising and online banking, and the greater attention paid to Internet security have all changed the landscape to a greater degree than in previous years.

At the same time, the non-Internet diversion that Dr. Tolley discussed in earlier testimonies still exists. Electronic funds transfers and other non-mail, non-Internet alternatives to the mail continue to grow, as will be documented later in this testimony. Fax messaging, though of relatively less importance due to the advent of E-mail with text attachment, is still likely to have a negative influence of mail volumes.

This testimony expands on Dr. Tolley's earlier analysis of diversion. The term "electronic diversion" is replaced with the more general term "technological diversion." The present testimony gives special attention to the impact of the Internet, in addition to

the non-Internet sources of diversion that have been going on for many years. In addition to Dr. Tolley's past work on diversion, this testimony also draws upon the econometric work of Thomas Thress.

III. Technology Review

A. Examples of Technological Diversion

Technological diversion can be classified as being Internet based or non-Internet based. Table 1 presents an overview of some examples of technological diversion. The non-Internet based sources of diversion are fairly long-standing, as are some of the Internet-based sources such as E-mail. Others are fairly new and may have only a small impact on mail volumes at present (e.g. EBPP).

Table 1
Examples of Technological Diversion

Type of Mail	Internet Based Sources of Diversion	Non-Internet Based Sources of Diversion
Correspondence	• E-Mail	• Fax
Bill Payments, Presentments, and Financial Statements	• Online Banking and other Financial Activities • EBPP	• EFT • Automatic Debit • Bill Pay by Phone
Business Transactions	• Small Firm Use of EDI • E-Filing of Taxes and other documents	• Large Firm Use of EDI
Advertising	• Online Advertising • E-Marketing	
Periodicals	• Online Information	

B. Drivers of Technological Diversion

There are many drivers of technological diversion, and the table above shows that not all of these are directly related to the expansion of the Internet. Still, the Internet is uniquely important. Prior to the Internet, there were basically two ways to transmit individual information across the country, the telephone and the mail. The Internet has become a third national communication network.

In addition, Internet access is subject to network effects, sometimes called network externalities. This is the feature that as the number of participants in a network increases, the number of possible connections increases by almost the square of the increase in network participation. As more people and businesses have online connections, the importance of the Internet grows, and more and more opportunities become available online. It is now taken for granted in many circles that individuals have E-mail accounts, perhaps even more than one. Correspondence by E-mail is often assumed to be possible today, whereas in the past it was not. In fact, for the technologically more experienced, the word "mail" refers to E-mail, not postal mail. The spread of E-mail might have the result of opening the door to other forms of non-mail communication. Thus, many of the drivers of technological diversion discussed below are linked, either directly or indirectly, to the Internet.

1. Household Computer Ownership

Household computer ownership is one of the important drivers of technological diversion. Table 2 shows the growth in the percentage of households with a personal computer and a modem from 1990 through 2001. More than half of all households now have this technology, nearly twice the level just three years ago. Moreover, the computers of today are faster and more powerful than in the past, allowing for a wider

range of activities. Though much of this development has little to do with traditional uses of the mail (e.g. high-definition graphics for computer-gaming), high powered computers are a key input into the use of many alternatives to the mail.

Table 2
Percentage of Households with Personal Computer and Modem
Household Diary Study Data (1990 - 2001)

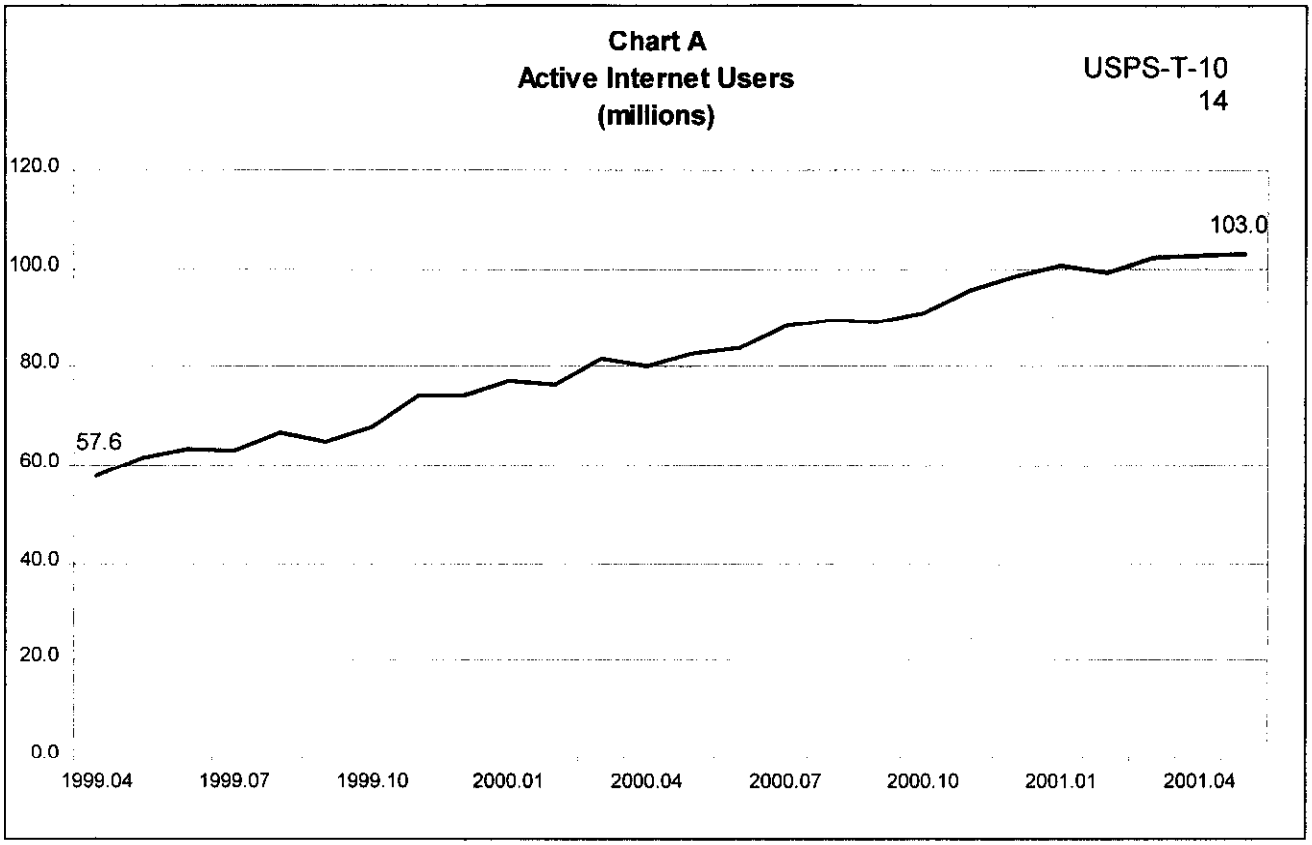
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
5.2	6.4	7.2	8.9	11.2	14.4	19.1	22.1	28.8	35.3	46.5	55.5

2. Online Population

A second key driver of technological competition is the online population. According to Nielsen Net Ratings, as of July 2001, 165.2 million Americans had at-home Internet access, or approximately 58 percent of the population. [US Internet Audience Up 16 Percent in Past Year, CyberAtlas, August 13, 2001] The article reports that "Fifty eight percent of all Americans had Internet access in their homes in July 2001, compared to 52 percent last year. In July 1999 only 39 percent of all Americans (106.4 million people) had access to the Web."

The Nielsen numbers for 2001 represent a tremendous increase in the online population over the last few years. Jupiter Media Metrix reports that just 37 million Americans were online in 1996 and 83 million online in 1998, meaning that the online population has doubled in the past three years.

Still, many people with access rarely use the Internet. A more telling figure than the online population (defined as those with access to the Internet) is the number of active users, defined by Nielsen as those who have used the Internet at home over the past 30 days. Chart A shows monthly active Internet users from April of 1999 through May of 2001, during which time active users at home increased from 57 million to 103 million.



A related measure is the number of households subscribing to Internet services. According to a census from Telecommunications Reports International (TRI), there were 70.7 million household subscribers to Internet services in the second quarter of 2001. This compares with 50.3 million subscribers in the first quarter of 2000, which was itself an 11 percent increase from the fourth quarter of 1999. [CyberAtlas, "Number of US Households Online Grows in Second Quarter," August 8, 2001 and CyberAtlas, "5 Million US Customers Go Online in Q1," May 2, 2000]

In addition to the number of people online, the length of Internet experience is also important. Typically, the longer that a person has a computer and Internet access, the greater his or her range of uses. Household Diary Study data reveals that one in six Internet users have at least five years experience and two-thirds of users have at least two years experience. A related metric is time spent online. According to Nielsen, time spent

per active user at home increased from seven hours per month in April of 1999 to more than 10 hours per month in July of 2001.

3. Broadband Technology

A third driver of technological diversion is the spread of broadband technology. Broadband technology allows access to the Internet that is up to 25 times faster than through traditional dial-up modems using either cable wires or DSL (digital subscriber lines) connections. Not only is broadband faster, but it is also gives the user constant connection without dial-up waiting and without occupying a phone line. The increased speed has many advantages, one of which is faster display of graphical content such as scanned bills from an EBPP service. It also allows for what is known as "streaming video" which is considered a potential medium for future online advertising.

Nielsen/NetRatings reported that in December 1999, there were 4.7 million household broadband subscribers. By December 2000, that number had increased to 11.7 million. ["Study: Broadband Access Soars," CyberAtlas, February 8, 2001] The Strategis Group's January 2001 report, "Residential High-Speed Internet: Cable Modems, DSL, and Fixed Wireless," stated that 6.1 million households had broadband technology in 2000, up from less than 2 million in 1999. Strategis further projected 11.6 million households will be broadband households in 2001 and 36 million in 2005. [Note that Strategis is citing household numbers whereas Nielsen was citing numbers of individuals.] J.D. Power and Associates' report, "2001 Internet Service Provider Residential Customer Satisfaction Survey," reported 17.7 million broadband users in July of 2001 as compared with 8.0 million in July of 2000.

One drawback of broadband is that it is more expensive than traditional dial-up Internet service, with monthly subscription rates typically being $40 to $50. However, as more and more users move to higher speed, higher cost Internet service, they are likely

to use the Internet for higher valued applications such as managing their finances. T.S. Kelly, director and principal analyst at Nielsen/NetRatings explains, "As early Internet adopters upgrade to broadband, the faster connections are changing their online habits. Faster speeds improve the overall online experience, encouraging broadband surfers to explore more sites and spend more time online. All this added activity benefits advertisers, E-commerce sites and content players." ["Move to Broadband Changes How the Web is Surfed," CyberAtlas, August 22, 2001]

4. Business Internet Usage

By today, all large and medium sized businesses are connected to the Internet. Many of these have installed high-speed networks for faster and more reliable Internet access. There has also been considerable growth in Internet penetration among small businesses. According to a report by International Data Corp., "Internet Services to Small Businesses: Profiles of Portals, Aggreportals, Destinations," [Summarized in CyberAtlas' August 6, 2001 article, "Small Business Embraces Net, Shuns E-Commerce"], 5.0 million small businesses were online in 2000, up from 3.9 million in 1998. The number of small businesses with home pages increased from about 1.2 million to 2.1 million over the same period. The article also cites an Emarketer study, stating that in 2001, "78 percent, or 5.9 million, of all small businesses are connected to the Internet and nearly half have active purposeful Websites."

C. Factors Limiting Technological Diversion

Several factors serve to slow the adoption of technological alternatives. The first is that for the most part, the Postal Service works. Mail is delivered, as it always has, at a cost that has not risen any more than prices in general. Each year, trillions of dollars of payments move through the mail system. Businesses have extensive investments in maintaining detailed computer databases with information sorted by mailing address. As

such, there is a "if it ain't broke, don't fix it" view toward the mail and many Americans do not see a glaring need for electronic alternatives.

Second, many Internet activities have not yet been proven to be profitable. The economic landscape is littered with dot.com companies that have failed to deliver their promised new paradigm. Online advertising, for example, is not yet proven to be cost effective. Certainly, there is an awareness of the vast opportunity for marketing via the Internet, but the response rate for online advertising remains lower than for direct mail.

Related to the above is the fact that many of the projections of future technological activity are made by firms that may have a vested interest in hyping the very technologies they are analyzing. Consequently, using their information requires great caution. A firm's projection that, say, "streaming media" is the next big thing may be based as much in the desire to sell streaming media analysis services as it is a sober assessment of the future.

Third, while computer and Internet penetration are rising, they are not yet universal as is the mail. One reason is cost, and Internet access among lower income households, though growing, remains below that of middle- and upper-income households. A second reason why Internet penetration is less than universal is that some people simply do not want it, regardless of cost. As a consequence, some people will never use electronic bill payment, never send or receive an E-greeting, or make an online purchase. And as long as there remains a sizable non-connected population, most businesses will have to continue to use the mail for at least some of their customers.

Fourth, even among those connected to the Internet, many will not use it to transmit personal or financial information. Concerns about the privacy and security of Internet transmissions are common. According to a recent survey by Statistical Research, Inc. (SRI), three-quarters of respondents were concerned about the information they provide online being shared in unauthorized ways, though 60 percent said that the existence of a

Web site privacy statement/policy would reduce their concerns. The Pew Internet Project's survey of Americans with and without Internet access found that 87 percent of respondents were concerned about credit card theft online and 70 percent were worried about computer viruses that could wipe out personal computer files.

But in response to these concerns, firms are focusing on privacy and security issues, with security issues receiving the most attention. The Gartner group estimates that over the next decade there will be a ten-fold increase in the share of business revenues dedicated to information security. International Data Corp. (IDC) projects that worldwide revenue in the Internet security software will rise from less than $4 billion in 1999 to $11 billion in 2004. Whether these specific projections ever materialize in unclear, but it is important to remember that the industry has already proven that it is willing and able to commit significant resources to solving technology problems which would otherwise hinder acceptance of computer and Internet usage.

D. Y2K Impacts

A seemingly distant memory now, the Y2K computer problem captured the attention of businesses, consumers, and the media through much of 1999. The concern that there would be mass failures of computer systems due to difficulty with the change from year 1999 to year 2000 proved largely unfounded. People were not sent 100-year phone bills, electrical systems did not fail, banks did not lose all account records. As a consequence, many consumer fears were allayed regarding the reliability of computers. Had Y2K been associated with any of these calamities, consumer acceptance of online bill-paying and other computer-related financial activities would have been significantly delayed. Instead, the year 2000 appears to have provided a pent-up demand for these services by at least some consumers. Simply put, December 1999 was not the time to start online bill paying. To some extent, the growth in computer bill paying in 2000 seen in Household Dairy Study

data (shown in the next section of this testimony) confirms that consumers are increasingly ready to use computers and the Internet for financial activities.

Another important, perhaps even more important, aspect of the passing of Y2K is that it has freed up tremendous amounts of resources for businesses to focus on post-Y2K activities. With that task accomplished, firms have resources that can be used to deal with security and privacy issues, as well as developments in online banking, advertising, and other Internet applications. Thus, the passing of Y2K set the stage for further expansion of technological alternatives to the mail.

E. Electronic Bill Presentment and Payment (EBPP)

1. Technological Methods for Bill Payment

A potentially important source of technological diversion is the use of the Internet as a means for receiving and paying bills. Electronic bill presentment and payment (EBPP) has been considered the "next big thing" for several years. At this time, it has not generated as much interest as its proponents had hoped and, consequently, it has not had much of an impact on mail volumes to date.

Nonetheless, other technological alternatives have been growing, and is some cases quite rapidly. These alternatives include bill payment by an automatic funds transfer, (AFT), by ATM, by phone, as well as by computer. Household Diary Study data provide evidence of the growing popularity of technological alternatives to bill payments by mail. Table 3 shows the percentage of households using various methods of bill payment from 1995 through 2000, based on Household Diary Study data.

Table 3
Percentage of Households Using Different Methods of Paying Bills

Payment Method	1995	1996	1997	1998	1999	2000
Mail	96.2%	96.5%	97.2%	95.7%	95.8%	93.6%
In Person	39.3%	36.9%	38.3%	35.4%	34.0%	37.1%
Phone	1.3%	1.5%	1.6%	1.7%	1.8%	5.8%

Computer	0.2%	0.5%	0.8%	1.8%	1.5%	4.4%
ATM	0.8%	0.8%	0.6%	0.6%	0.8%	2.5%
AFT	16.7%	17.7%	19.1%	21.2%	19.3%	33.0%

Table 3 shows that over the past five years, all the technological methods gained in popularity. According to the Diary Study, one third of households use automatic funds transfers (AFTs) for at least some of their bill paying. Payment by computer is also shown to have increased noticeably in the last few years.

A second measure of the acceptance of technological alternatives for bill paying is the share of bills paid by each method. This provides a look at how intensively people are using each alternative, e.g., whether they make one bill payment automatically each month or several. Table 4 shows the share of bills paid by each method from 1995 to 2000, again using Household Diary Study data.

Table 4
Share of Household Bills Paid by Each Method

Payment Method	1995	1996	1997	1998	1999	2000
Mail	85.33%	81.27%	84.64%	83.70%	80.35%	79.37%
In Person	10.85%	12.28%	10.37%	9.72%	12.31%	9.50%
Phone	0.40%	0.55%	0.72%	0.46%	0.69%	1.28%
Computer	0.26%	0.44%	0.49%	1.07%	1.09%	2.21%
ATM	0.14%	0.13%	0.13%	0.19%	0.26%	0.34%
AFT	3.03%	5.33%	3.65%	4.86%	5.31%	7.31%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Sub-Total Technological Share	3.82%	6.45%	4.99%	6.58%	7.35%	11.13%

Table 4 shows that over the past five years, the share of household bills paid by mail has declined from over 85 percent to under 80 percent. The share paid in-person has also declined, although the data are somewhat choppy. In contrast, the share paid using technological alternatives has increased, rising from 3.82 percent in 1995 to 11.13 percent

in 2000.

Still, Table 4 shows that the share paid by computer remains quite low, barely more than two percent in 2000. The computer payment share is important because bill-paying by computer opens up a host of other possible avenues for mail diversion. Bills can be viewed (received) instead of mailed. Financial statements can also be viewed online instead of mailed. And should households begin receiving a large portion of their financial information across the Internet instead of the mail, it is likely that advertising mail would follow. Thus, it is easy to understand why EBPP represents a key threat to the Postal Service. But despite its promise, EBPP has not been widely accepted. Why?

2. The Promise of EBPP

Electronic Bill Presentment and Payment (EBPP) is a process that enables bills to be created, delivered, and paid over the Internet. Analysts have been promoting, even hyping, EBPP for several years. EBPP was touted as a win-win situation for billers and bill payers. Billers would save money because Internet-delivered bills would cost just half, or less, of what it costs to create and send a bill through the mail. Bill payments would also be cheaper to process than mailed paper checks. For bill payers, EBPP promised convenience -- no more licking stamps, no more writing checks, no walk to the mailbox -- just a click of a button and the payment is made. PayMyBill.com and Paytrust are two services that offer to collect bills from any creditor, post them on a Web site accessed only through a secure PIN number, and authorize payments directly from the customer's bank account.

Forecasts of EBPP usage, both in terms of number of users and number of bills, have been overly optimistic, to say the least. A January 1999 study by the GartnerGroup projected that more than 15 million households would receive their bills online by 2002. A major study by Jupiter Communications, "Online Bill Presentment," released in early

2000, projected that 6.8 million households would be using online bill presentment by 2002, and that number would grow to 40.2 million households by 2005. Earlier, in December 1998, Jupiter had projected that 1.4 billion bills would be presented online in 2002. Other analysts have made similar projections.

3. The Reality of EBPP

In reality, EBPP adoption has been much slower than projected. TowerGroup, a financial services technology research firm, counted 1.7 million households currently receiving an average of 2 e-bills per month in 2001, for a total of only 41 million e-bills presented for the entire year. There are many reasons for its slow adoption. First, the cost savings from EBPP are often over-stated because while per bill costs of electronic billing are low, there are potentially large start-up costs. For bill-payers, receiving and paying only a few bills per month is neither particularly inexpensive or particularly convenient. Both billers and bill payers enjoy an existing network for presentment and payment, the United States Postal Service. Without a large number of E-billers, and E-bill recipients, the economies of scale necessary to make EBPP cost effective are lacking.

A second reason why EBPP's promise has failed to materialize is that many people are wary of having financial information transmitted over the Internet. A study by GartnerGroup noted that only 17 percent of online consumers (and, thus, about 10 percent of all consumers) would like to have their bills presented through the Internet. Many consumers did not like receiving and paying bills through a third party (referred to as a consolitdator). As a result, the EBPP activity that has developed is predominantly biller direct activity, in which a customer pays a bill at a company Web site. The drawback of direct bill paying, however, is that customers must go from Web site to Web site to pay each individual bill, as opposed to using a single consolidator to pay all their bills.

Still, despite its slow growth, it would be a mistake to say the EBPP is dead. In the fall of 2000, there were more than 7.5 million people paying some of their bills online, most of them using the direct biller approach. ["Bill Presentment and Payment: Time to E-Pay the Bills," InternetWeek, October 23] Banks and other financial institutions are entering the field as well. According to the "2000 Year in Review," of the Online Banking Report, in 1995, there was only one financial institution in the world with Web banking; in 2000 that number reached 3,000. And, perhaps most importantly, there remains the potential for large benefits to whoever can develop a popular EBPP application. The TowerGroup estimates that the current annual expenditures for billing and bill payment total $86 billion across the five major stakeholders – banks, billers, third-party vendors, consumers, and the US Postal Service. [TowerGroup Research Shows Move to Electronic Presentment & Payment Could Save US Billers $5.5 Billion a Year, Consumers $4.4 Billion, Rueters Web Site, November 13, 2000]

4. Online Banking

While EBPP remains in its infancy, online banking has become increasingly popular. Online banking, broadly defined, involves any banking activity done over the Internet. In many cases this does not involve bill paying, but simply checking account balances or transferring money between accounts. In June 1999, International Data Corporation released a report, "Online Banking Forecast, 1998 - 2003: On the Money." The report predicted that the number of online banking customers would rise from the then current level of 6.5 million to 32 million by 2003. They listed four primary drivers of this growth: 1) proliferation of low-cost PCs and other networking devices in the home market; 2) surge in the number of Internet users; 3) alleviation of Internet security fears; and 4) increasing number of banks offering Internet-based banking services. For the most part, these four

drivers have occurred, although there still remain some concerns about Internet security despite the relatively uncomplicated passing of the Y2K problem.

Online banking, in itself, does not necessarily divert mail, as people may be using it only to gather real-time account information. However, as people become increasingly familiar with the Internet as a financial information tool, they may begin to increase their use of the Internet as a financial transaction tool. Another consideration is that online banking may acts as a complement to other technological alternatives to bill-paying by mail. For example, one drawback of automatic funds transfers, in which monthly bills are automatically deducted from the payer's checking account, is that it becomes more difficult for the payer to keep track of his or her bank account balance. Online banking, even if it is used only to check account balances, makes it easier for people to adopt automatic funds transfers.

IV. Measuring Technological Diversion

A. Conceptual Framework

Having described some key technological developments, it is time to create a framework for analyzing diversion. One way to understand technological diversion is to consider the activity of a single mailer. Suppose that in 1996, this mailer sent and received 300 pieces of First-Class letter mail. Further suppose that this mailer already makes use of some technological alternatives to the mail. A few faxes are sent or received instead of letters being mailed and a few bills are paid by phone or through an electronic funds transfer instead of being mailed. Altogether, suppose that these alternatives have reduced this mailer's volume of sent and received letters by 20. In other words, in the absence of these technological alternatives, the mailer would have sent and received 320 pieces of letter mail.

A first result, then, is that for this mailer, the "base volume" has been reduced from 320 to 300 pieces. Therefore, in the absence of any further technological uses, and for the sake of simplicity, in the absence of any changes in postal rates, economic activity or other drivers of mail volume, this mailer's 1997 volume of letter mail would also be 300 pieces. Thus, past diversion has already reduced 1997 volume from what it would have otherwise been.

It is possible that in 1997, the mailer would make less use of technological alternatives. Correspondences that were faxed in 1996 could be mailed in 1997, in which case technological diversion would be reduced and volume in 1997 would be greater than 300 pieces. But the reality is that technological use tends to grow over time. More correspondences are faxed as more and more people, businesses, and government agencies gain fax capabilities. More bills are paid electronically because more businesses accept electronic payment. In this typical case, the mailer would make greater use of

technological alternatives in 1997 than in 1996. Ignoring other positive influences on volume, then this mailer may send and receive only 290 letters in 1997.

Thus, there are two measures of diversion in 1997 – the incremental diversion that occurred between 1996 and 1997 (10 pieces) and the cumulative diversion through 1997 (30 pieces consisting of the 20 that were diverted through 1996 and the ten additional diverted pieces in 1997).

Diversion is likely to grow over time for a given mailer, but this is not the only impact of technological alternatives on mail volume. A second impact is that over time, more and more mailers begin using technological alternatives. A second mailer, unaffected by diversion up through 1996 and sending and receiving 320 pieces of mail in that year begins using technological alternatives in 1997, reducing volume sent and received to 310. Therefore, incremental diversion for these two mailers in 1997 is 20 pieces and cumulative diversion through 1997 is 40 pieces.

Add to this process the rapid penetration of the Internet into households and businesses. E-mail becomes a substitute for correspondence mail. And as more and more households and businesses acquire Internet access, the impact is leveraged. Already "connected" individuals make greater use of E-mail as there are more other users with which to communicate. In addition, new users begin diverting letter mail as well. Finally, consider how computer/Internet access allows for greater range of technological uses, from downloading information that might otherwise be mailed, to E-filing of tax returns, to online banking, to the receipt of Internet advertising instead of direct mail. Businesses began to communicate over the Internet, reducing business-to-business correspondence, invoices, financial records, receipts, bills, and bill payments.

Diversion is therefore a function of both the "width" of penetration (number of users) and the "depth" of penetration (number of different uses or intensity of use).

Eventually, the diversion process will be largely completed. At some future date, all the people who will be using technological alternatives will be using technological alternatives to their fullest and all the mail that will be diverted has been diverted. At this point, incremental (new) diversion is zero, but cumulative (total historical) diversion is quite large. This is likely to have been true for the telephone, which over a long period of time reduced letter volume, but at present has little additional negative impacts on the mail. In terms of the volume forecasting process, the diversion effects of the telephone need not be considered because the historical cumulative diversion is already present in (or more correctly, missing from) the base volume and there is no new incremental diversion to be considered.

In contrast, for technologies that are fairly new, in terms of the number of and past experience of current users, incremental diversion is large relative to cumulative diversion. While cumulative diversion is also present in (missing from) the base volume, future incremental diversion is not, and this diversion must be considered in the volume forecast.

Naturally, there are many other factors that affect mail volume and this is why volume demand equations rely on sophisticated econometric techniques designed to isolate the individual impacts of each factor. The key question is: where are we on the diversion process with respect to recent technological developments, most notably the Internet? Has most of the mail that will be diverted already been diverted, or are we at the beginning, or somewhere in the middle? This is ultimately an empirical question.

B. Possible Variables that Measure Technological Diversion

1. Number of Uses

One measure of technological diversion is the number of uses of various technological alternatives, e.g., the number of fax messages sent in a given year. This was the approach discussed in Dr. Tolley's testimonies in R2000-1 and earlier. Estimates of

the number of faxes, E-mails, EFTs, and EDIs were combined with estimates of the diversion ratio -- e.g. the number of pieces of mail diverted for each use of a technological alternative -- to derive an estimate of diversion due to each technology.

Diversion ratios are a useful way of thinking about the problem. Importantly, diversion ratios are typically less than one, reflecting the understanding that not every electronic message replaces mail. But from an empirical standpoint, diversion ratio analysis has several drawbacks. First, reliable estimates of the number of electronic messages are difficult, if not impossible, to obtain. Various estimates of the number of E-mail messages sent in a year are found to differ by a factor of ten. Second, diversion ratios are difficult to estimate and earlier attempts to quantify these ratios were based on limited surveys and judgment. Given the large number of E-mail messages sent, small changes in the assumed diversion ratio could have large impacts on the estimated volume loss.

A third drawback of diversion ratio analysis is that it focused on individual technologies, i.e., a diversion ratio for E-mail, a diversion ratio for fax, a diversion ratio for electronic funds transfers, etc. The drawbacks of this approach are two-fold. First, from the standpoint of the mail, it hardly matters which technology has caused the diversion. It is of little consequence whether a piece of mail was diverted by a fax or an E-mail message. Second, many technologies replace other technologies, as opposed to replacing the mail. E-mail with attachment replaces fax messaging, for instance. As such, increases or decreases in the level of fax messaging may not have any direct impact on the mail.

Thus, diversion ratio analysis represented a valuable first step in assessing the impact of technology on mail volumes, but it was too limited a tool for econometric analysis of past volumes, nor could it be formally integrated into the forecasts of future volumes. Instead, diversion ratio analysis always relied heavily on judgment, and ultimately was tied to observations based on actual mail volume data. To the extent that the diversion was

adversely affecting mail volumes, the impacts would be seen in the econometric analysis, either through the presence of a negative econometric trend or through the appearance of consistently negative residuals (also referred to as a negative mechanical net trend).

2. Number of Users

A second possible measure of technological diversion is the number of users of certain technologies, as for example, the number of Internet users. Data on Internet users can be obtained with some reliability and could be included in the econometric equations to estimate the impact of increases in users on mail volume. But while the number of users measures the "width" of use, it does not measure the "depth" of use. In other words, a model including users as an explanatory variable would have the result that once the number of users stops growing (reaches its saturation level), diversion stops as well. This is not likely because individual users will tend to make greater use of technological alternatives over time. To claim otherwise is to suggest that once a individual becomes a user of a technology, all of the mail diversion occurs in the year of initial use, with none occurring in future years, which is clearly not the case. Accordingly, number of users is not the right variable to measure technological diversion.

3. Dollars of Use

It is posited here that the most useful measure available at this time for analyzing the impact of technological diversion is dollars of technological use (expenditures). Dollars spent reflect both changes in "width" (number of users) and "depth" (intensity of use). Accordingly, two Internet expenditure measures are included in the econometric analysis of mail volumes. Household expenditures on Internet Service Providers are included in the demand equation for single-piece letters (as well as First-Class cards and Periodicals Regular mail, which are not the subjects of this testimony). Internet advertising

expenditures are included in the demand equations for Standard Regular and Standard ECR mail.

There are some possible drawbacks to using expenditures variables. Expenditures are a price times quantity variable and changes in these two components of expenditures could have different effects on mail volume. For example, Internet advertising expenditures could decline because less Internet advertising is bought or because the price of Internet advertising has declined. However, following the principle that "you get what you pay for," the expenditure measure still serves its purpose. A decline in the price of Internet advertising is likely to result from a decline in the medium's effectiveness which, in turn, would make it less attractive relative to direct mail. For the same reasons, increases in expenditures due to price increases would be expected to increase technological diversion on the grounds that people are paying more to get more. And expenditure measures have one key advantage; they allow for aggregation across different products using a common measure – the dollar.

C. Household Expenditures on Internet Service Providers

1. Overview

Thomas Thress' (USPS-T-8) econometric analysis of First-Class single-piece letters includes a variable capturing aspects of technological diversion. The variable, household expenditures on Internet Service Providers (ISP) is a broad measure of technological activity. It has recently been included in the set of economic variables reported by DRI, obtained from the US Department of Commerce. Monthly levels of ISP spending, expressed at an annual rate, are reported beginning in January 1988. As of April of 2001, the last monthly value used in the volume forecasts presented in this case, household ISP expenditures had climbed to an annual rate of $25 billion, or about $2 billion per month.

Internet Service Providers are companies that provide Internet access, most notably America Online (AOL), Microsoft Network (MSN), Earthlink and Compuserve. According to the Online Census from Telecommunications Reports International (TRI), the total number of US subscribers to Internet Services rose to 70.7 million in the second quarter of 2001, a figure which is also reported as the number of households subscribing on the grounds that there is usually only one "subscriber" per household. In other words, several household members may be sharing a single subscription, although the distinction between households and individuals is not always made clear.

Increases in household ISP expenditures capture many of the technological developments discussed in the previous chapter. First, growth in expenditures reflects growth in the online population. Second, it reflects increases in dollars spent per person online (also referred to as a "user"). Growth in dollars per user reflects movements toward higher cost, higher speed connections (such as broadband) as well as increased value-added features that provide, among other things, increased reliability and security. Increases in dollar per user also reflect a greater intensity of use since many ISPs have different rate structures based on monthly usage, with the highest monthly fees being charged for unlimited monthly access. Thus, increases in ISP spending are reflective of increases in the number of users, increases in the quality of their service, and increases in their time spent online.

The ISP expenditure variable has some drawbacks as an explanatory factor for mail volumes. First, there is the basic issue of the degree to which Internet activity diverts mail volume, an issue that will be addressed presently. Beyond this fundamental question, there are issues related to the ISP variable as a measure of Internet activity. First, not all Internet users are paid subscribers to online services. Some people have free Internet service, though the number of free services is shrinking rapidly. According to TRI, the

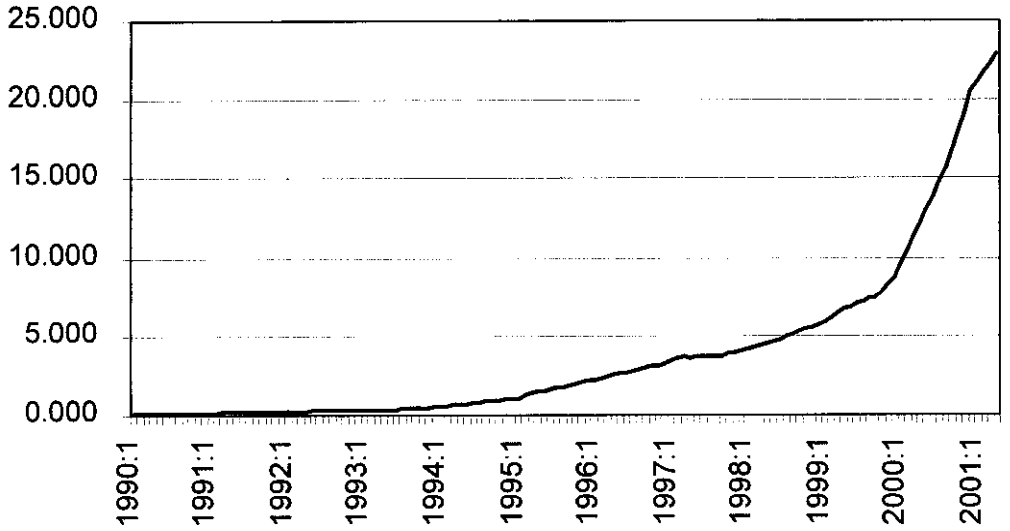
number of free Internet subscribers declined 11 percent from quarter 1 to quarter 2 of 2001, and now number barely one in ten total subscribers. For the most part, then, ISP expenditures captures Internet activity by households.

The ISP variable does not measure Internet service expenditures by nonhouseholds. Nonetheless, it seems likely that growth in household ISP expenditures correlates closely with increases in business Internet expenditures, perhaps with a lag reflecting the somewhat slower adoption of the Internet by households as opposed to businesses. Still, it is probably the case that increases in household ISP expenditures correlate with increases in Internet activity in the nonhousehold sector, and therefore the variable serves as a proxy measure of nonhousehold Internet activity.

Taken a step further, ISP expenditures may serve as a measure of overall technological acceptance in the US. The growth in Internet use is not an isolated development. It is interwoven with a general growth in the use of technology by individuals, and the expansion of networking between individuals, businesses, and the government.

The foregoing issues aside, the main issue is the extent to which household ISP expenditures are a measure of technological diversion. At one level, this issue is addressed empirically, and the econometric analysis of Thomas Thress (USPS-T-8) clearly shows that increases in ISP expenditures have a statistically significant negative relation to mail volumes. Conceptually, this seems reasonable since access to the Internet provides users with new alternatives to the mail. Correspondence mail can be replaced by E-mail, and while the level of household-to-household correspondence mail is not large, E-mail is also used as an alternative to correspondence between households and nonhouseholds. Internet access also allows for greater opportunities to divert financial mail, including bill payments and presentments, along with financial statements. As people have the ability to check their financial accounts online, there is less of a need for mailed

Chart B
Household Expenditures on Internet Service Providers
($ billions)



information. Third, increases in ISP expenditures may reflect a general trend toward greater technological activity, activity that is not necessarily directly related to the Internet, but is consistent with the greater household acceptance of technology, and with that, greater use of technological alternatives to the mail.

2. Looking at the Data

Chart B presents household ISP expenditures from January of 1988 to April of 2001.Growth has been rapid. It was not until 1994, that ISP expenditures reached an annual rate of $1 billion. Expenditures quadrupled by 1998, reaching $4 billion, and have since increased by a factor of five, now running at a rate of more than $20 billion per year. Closer examination of Chart B shows that in mid-1999, ISP expenditures began a rapid period of growth, somewhat distinct from the prior period.

3. Modeling ISP Expenditures

This testimony develops projections of ISP expenditures that are used in the volume forecasts of George Tolley (USPS-T-7). Projected expenditures are modeled as being equal to the product of two key drivers of ISP spending – increases in the number of active Internet users and increases in the number of dollars spent per user. The ISP expenditure model does not include macro-economic variables such as real changes in GDP or consumption. This is not to say that overall economic conditions have no influence on ISP spending, indeed they do and the impact may be large. It is merely an acceptance of the fact that a variable that has increased by a factor of ten over the past five years, and quadrupled over the past two years, is not well-modeled by economic variables that typically grow less than five percent per year.

ISP expenditures are modeled using monthly data beginning in April 1999. This is done for two reasons. First, it is around this time that there occurred a break in the data, and ISP expenditures began to increase substantially. Second, in April 1999, Nielsen/ NetRatings began reporting a monthly series on "active Internet users" defined as people who were online in the prior month. As discussed earlier, this is a better measure than the total population with Internet access, since many people with access rarely connect to the Internet. It is also important to recognize that while use within the past month might seem a low standard for being an "active" user, the typical user is in fact quite active, with average hours of usage ranging from seven to ten hours per month over the sample period.

Conceptually, one could use "ISP subscribers" as opposed to "active users" in this analysis. However, subscriber data is not presented on a monthly basis and there is, as mentioned earlier, some uncertainty regarding whether "subscribers" refers to individuals

or households. The Nielsen numbers are monthly measures of individuals who are active users of the Internet at home.

Chart A showed active users from April 1999 to May 2001. Active users increased from 57.6 million to 103.0 million. Growth was fairly steady, averaging nearly two million new users each month.

4. Statistical Model of Active Users

a. Bass Curve Model

Active users are modeled by estimating a Bass curve also known as a market penetration curve or product diffusion curve. A Bass curve is a line showing how much of a potential market has adopted a new product as a function of time and the number of previous adopters.[1] The formula is given below:

$$N_T = N_{t-1} + p(-N_{t-1}) + q\left(\frac{N_{t-1}}{m}\right)^{\delta}(m - N_{t-1})$$

where N is the number of adopters at time "t" or in the previous period (depending on the time subscript), ***p*** is a parameter for the force of outside or exogenous factors affecting adoption (i.e. factors independent of the number who have adopted the innovation previously, sometimes referred to as the coefficient of innovation), **q** is the parameter for the force of previous adopters in creating new adopters (e.g. by word of mouth, sometimes called to coefficient of imitation), ***m*** is the maximum size of the market or ceiling value, and

[1] Mahajan, V., Miller, E., Bass, F.M., "New Product Diffusion Models in Marketing: A Review and Directions for Research," *Journal of Marketing* **54**, 1 (January 1990), pp. 1-26.

δ is a parameter creating a non-linear effect in the number of previous adopters.[2] The Bass equation models adoption as a function only of time given these parameter values.

The logic of the Bass curve is that there are two channels for the diffusion of information that prompts people to adopt a new product. One is the exogenous influence, such as advertising or an increase in demand through greater numbers of complementary products. Regardless of the number of people currently using the product, a certain number will adopt in each time period due to these influences. The second influence is the endogenous effect, which is the effect of the previous adopters. By word of mouth, or by greater usefulness if the products interact positively (for instance telephones, which are more useful the more other people own one), demand for the new product increases as the number of users itself increases. Product diffusion never ceases, but diminishes to insignificance as the ceiling ***m*** is approached. This parameter allows for the existence of permanent non-adopters, that is the ceiling can be less than total population. It should be noted that no other factors influence the adoption rate in this simplified model; product price, for instance, is not included. Therefore, among the total population of potential adopters (defined by ***m***), the percentage of people who adopt in a given period, given that they have not yet adopted, is proportional to the percent of people who have already adopted.

Given a set of parameter estimates, the number of adopters can be forecast for the next time period, and this number can be used to solve for the number in the following period, giving an extrapolation as far into the future as is desired. The pattern generated by the Bass curve is an "S curve," with an initial period of exponential growth, followed by continuously diminishing growth rates with an asymptotic approach to the ceiling value.

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[2] δ is commonly used as a modifier to the traditional Bass equation, which had no such parameter. Differently put, δ was implicitly one in the original.

A Bass Curve is estimated for the historical data on active users, with monthly values beginning in April 1999 through May 2001, a total of 26 observations. The parameters are obtained using the Excel "solver" program which is given the goal of minimize the error sum of squares (ESS) of the difference between the actual and fitted values. The resulting Bass curve parameters are presented below in Table 5.

Table 5
Estimated Bass Curve Parameters for Active Internet Users

Bass Curve Parameter	Estimated Value
m (ceiling on active users)	306.70 million
p (coefficient of innovation):	0.006322
q (coefficient of imitation):	0.002059
δ (non-linearity factor)	0

LR-J-133 presents the Excel file containing the input data, the parameter estimates, the fitted values, a comparison between fitted and actual values, and forecasted values of monthly active users.

Reviewing the statistical results presented above, the ceiling on active users is estimated to be 306.70 million people. At first, this result seems unreasonable – US population today is about 280 million people. But the ceiling is a future value, acheived years into the future when US population will be much greater. More generally, then, the high ceiling value merely suggests that at some time Internet access may become universal within the US, much like the telephone or the television. (In fact, eventually the Internet may be your television).

More relevant for the current case is the value of active users in the next few years. Table 6 shows active users in May of 1999, 2000, and 2001, with projections in May of 2002, 2003, 2004, and 2005. Annual growth rates are also presented, which show the gradual slowing of growth that is typical of market penetration curves.

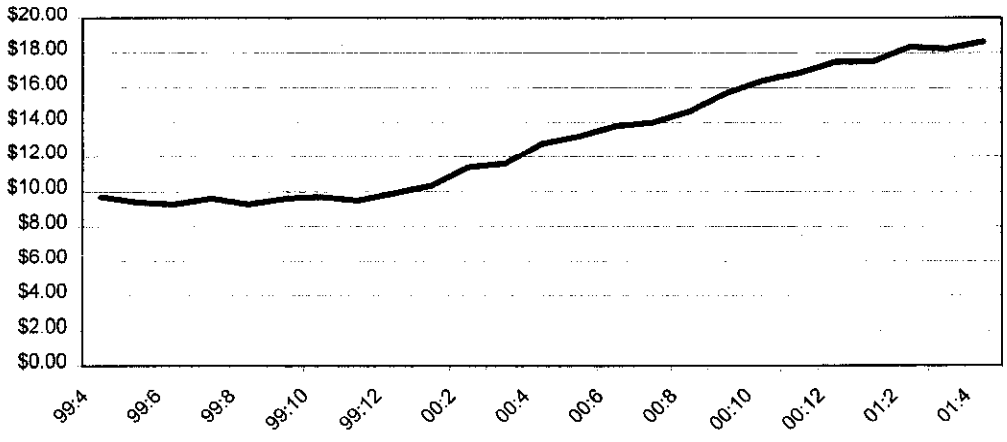
Table 6
Actual and Projected Values of Active Internet Users

Month	Active Users	Annual Growth
May 1999	61.40 million	
May 2000	82.70 million	34.7%
May 2001	103.01 million	24.6%
May 2002	*122.06 million*	*18.5%*
May 2003	*139.27 million*	*14.1%*
May 2004	*154.84 million*	*11.2%*
May 2005	*168.90 million*	*9.7%*

5. Dollars Per Active User

The second part of modeling household ISP expenditures is to model dollars spent per active user, which when multiplied by projections of active users will yield a projection of

Chart D
Dollars per Month of ISP Expenditures per Active Internet User



total ISP spending. Dollars (of ISP expenditures) per active user are calculated by dividing ISP expenditures by 12 (to convert the annual rate to a monthly value) and then dividing the result by the number of active users. Historical data on dollars per user are presented in Chart D from April 1999 through April 2001, a total of 25 observations. Chart D shows that dollars per active user approximately doubled over a two year period, rising form $9.67 per month in April of 1999 to $18.61 per month in April of 2001. In fact, from April through December 1999, dollars per user was roughly constant, with the strong growth beginning in January 2000. This is consistent with the view presented earlier that the passing of the Y2K computer problem without major incident may have contributed to the public's desire for greater technological activity.

Dollars per user are modeled as a simple time trend, using all 25 monthly observations as follows:

$$\$/\text{User} = \alpha + \beta \bullet t + \mu$$

where α is the intercept (value at time zero), β is the estimate time trend value, t is month running from 0 to 24, and μ is the regression residual. The regression results, including estimated coefficients, standard errors, and t-statistics are presented in Table 7 below, as well as in LR-J-133.

Table 7
Results of Regression of Dollars per Active User per Month

Observations	25		
Adjusted R-squared	0.9830		
F-Statistic	364.2		
Coefficient Estimates	Value	Standard Error	T-Stat
Intercept	$7.5985	0.3339	22.76
Time Trend	$0.4551	0.0239	19.08

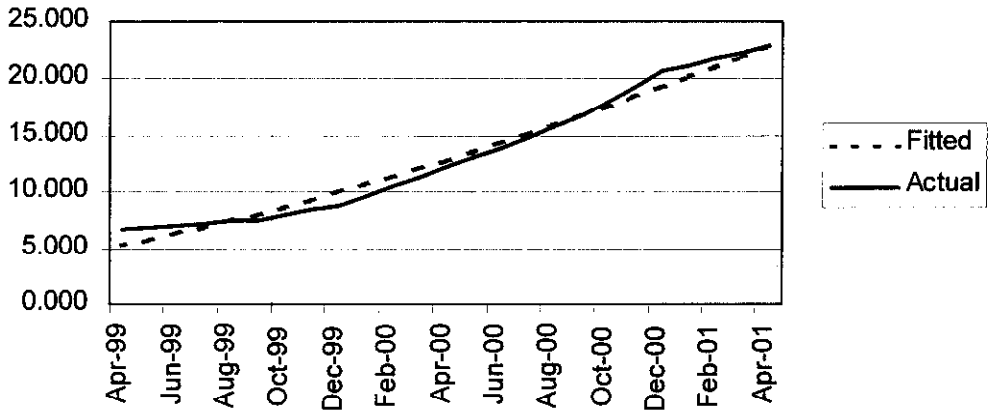
The regression results show that the average monthly increase in ISP spending per active user is about 45.5 cents. A constant monthly increase will have the effect of resulting in a declining percentage increase. Table 8 shows actual and projected monthly values from April of 1999 through April of 2005. Annual percentage changes are also presented, which show the eventually declining growth rate that is expected to occur.

Table 8
Actual and Projected Monthly ISP Spending per Active Internet Users

Month	Active Users	Annual Growth
April 1999	$9.67	
April 2000	$12.69	31.2%
April 2001	$18.61	46.7%
April 2002	*$24.07*	*29.3%*
April 2003	*$29.53*	*22.7%*
April 2004	*$35.00*	*18.5%*
April 2005	*$40.46*	*15.6%*

Table 8 shows that by April of 2005, active Internet users are projected to spend about $40 per month on Internet services. This is somewhat more than twice the average monthly expenditure in April of 2001 and is consistent with the view that over time more and more users will be switching to higher speed, higher cost Internet services that include many value-added features such as enhanced security and greater reliability.

Chart E
Comparison of Actual and Fitted ISP



6. Comparison of Actual with Model of ISP Expenditures

Multiplying ISP expenditures per active user per month by monthly active users yields estimates of total monthly ISP expenditures.[3] These estimates (or fitted values) are compared to actual values from April 1999 through April 2001 in Chart E. The data are also presented in LR-J-133. Analysis shows that the fitted values closely match the actual values, particularly in the last year of data. Thus, the modeling of past ISP expenditures can be used to make future projections.

7. Projections of Future ISP Expenditures

Future ISP expenditures are projected by multiplying projections of expenditures per active user per month by projections of the number of active users. These monthly projections are presented in LR-J-133 and serve as inputs into the volume forecasts of

[3] Monthly expenditures are multiplied by 12 to create expenditures at an annual rate, consistent with how the ISP expenditure variable is reported.

George Tolley (USPS-T-7). Historical and projected values for the month of April in 1999 through 2005 are presented below in Table 9. Table 9 also presents the annual percentage change in ISP expenditures.

Table 9
Actual and Projected Values of Household ISP Expenditures

Month	ISP Expenditures	Annual Growth
April 1999	$6.686 billion	
April 2000	$12.224 billion	82.8%
April 2001	$22.885 billion	87.2%
April 2002	*$34.822 billion*	*52.2%*
April 2003	*$48.875 billion*	*40.4%*
April 2004	*$64.503 billion*	*32.0%*
April 2005	*$81.456 billion*	*26.3%*

The projection is that household ISP expenditures will rise from $22.885 billion per year in April of 2001 to $81.456 billion per year in April of 2005. It should be recognized that this future number is both a quantity and quality value. In other words, it is projected that households will purchase the equivalent of $81.456 billion worth of ISP services in 2005. To put this in perspective, one might have looked at increases in household spending on computers and concluded that households would be spending twice as much on computers in 2001 than in 1998. In fact, the price of a home computer has actually declined since that time. But, in terms of purchasing power, spending has doubled in that the $1,500 computer of today has twice the power of a $1,500 computer purchased in 1998. A similar result might occur with ISP spending. However, for the purposes of the analysis presented in this case, which include impacts based on historical estimates of ISP spending, the values projected above are viewed as reasonable.

D. Internet Advertising Expenditures

1. Overview

In the past few years, the Internet has emerged as an advertising medium. Spending on Internet advertising would be expected to divert some direct mail advertising. The conceptual relation between the Internet and Standard mail volume is more direct than in the case of the relation between ISP spending and single-piece mail. Whereas the latter reflects a broad range of technological developments, the Internet's impact on Standard Mail is consistent with the diversion ratio approach presented by Dr. Tolley in earlier testimonies. Specifically, advertising dollars spent on the Internet are advertising dollars that cannot be spent on other media, direct mail included. The extent to which Internet advertising replaces, or diverts, Standard mail is an empirical question. The econometric equations for both Standard Regular and Standard ECR mail measure this diversion directly, through an estimated elasticity of volume with respect to Internet advertising. This differs from the diversion ratio concept presented in earlier cases in which diversion ratios were selected based on judgment.

2. Looking at the Data

Table 10 presents quarterly Internet advertising expenditures, as reported by PriceWaterhouseCoopers (PWC), in association with the Internet Advertising Bureau (IAB).

Table 10 shows the tremendous growth in Internet advertising over the past five years, rising from $266.4 million to $8,225.0 million. Annual growth rates have been very high, with the 2000 total nearly 80 percent greater than the 1999 total. At the same time, quarterly data show the much-discussed slowdown in Internet advertising. Spending actually fell from 2000Q2 to 2000Q3, and were essentially flat throughout all of 2000. The slowdown was due to many factors, among them the sharp decline in the stock market capitalization of many companies that had, in the past, made heavy use of Internet

advertising, questions about the effectiveness of Internet advertising relative to other media, and a general slowdown in economic activity in general and advertising activity in particular which continues to the present day.

Table 10
Quarterly and Annual Internet Advertising Expenditures
(in millions of dollars as reported by PWC/IAB)

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Annual Growth
1996	29.9	51.9	75.6	109.0	266.4	
1997	129.5	214.4	227.1	335.5	906.5	240.3%
1998	351.3	423.0	491.0	655.6	1,920.9	111.9%
1999	693.0	934.4	1,200.0	1,777.0	4,604.4	139.7%
2000	1,953.0	2,124.0	1,986.0	2,162.0	8,225.0	78.6%

It should be noted that the PWC/IAB measures of Internet advertising have been subject to some criticism. Other analysts estimate somewhat lower values. For example, McCann-Erickson WorldGroup estimated that 1999 Internet advertising revenues were about $2 billion, or less than half the level presented by PWC/IAB. PWC/IAB argues that their numbers are more accurate, as they reflect spending on all Internet-advertising activities. A second advantage of the PWC/IAB numbers are that they are reported on a quarterly basis, as opposed to McCann-Erickson's annual numbers, which make them particularly useful for quarterly postal volume analysis.

3. Modeling Internet Advertising

a. What is Internet Advertising?

The Internet offers a variety of ways to entice potential and existing customers. These methods include web sites, banner ads, sponsorships, interstitials, and e-mail advertising. As is well-known, *web-sites* contain information about a company or organization that users of the Internet can browse. Many earlier web sites were developed

along the lines of brochures and magazine ads, but recent innovations in Internet programming allow the use of animations, videos, and music that greatly enhance the quantity and quality of information contained on the web site. *Banner* ads are one-inch bands that appear at the top or side of web pages. The Internet user will go to the web site of the advertiser by clicking on the banner. The cost of the banner ad will often depend on the number of Internet users who click on the banner to go the advertised web site. *Sponsorships* work in a manner similar to newspaper or magazine advertising. An advertiser pays for a section of another company's or organization's web page or e-mail newsletter. For sponsorships, the advertiser is typically charged a flat fee. *Interstitials* are advertisements that appear as their own smaller web page as the Internet user waits for another page to load. *E-mail advertising* are e-mails sent to Internet users that advertise some product or service. Some e-mail is sent to users who have agreed to receive such messages (*op-in e-mail*). Unsolicited e-mails are called *spam*.

According to the IAB Internet Advertising Report for 2000, released in April 2001, banner ads accounted for 48 percent of total revenues in 2000, sponsorships claimed 28 percent of total revenues, classified ads accounted for 7 percent of total revenues, while E-mail accounted for 3 percent of total revenue. The remaining 14 percent of revenues were from a variety of other ad types including interstitials and so-called "rich media." Comparing 2000 with 1999, it is found that banner ads declined in terms of their share of total Internet advertising; in 1999, they accounted for 56 percent of total. This movement away from banner ads is consistent with evidence that they have not been particularly effective in drawing responses from Internet users. "Click rates" which measure the percentage of users who view a banner ad and then click on it to be moved to a link with greater information, are estimated to be below one percent and falling.

In terms of industries, the IAB report states that 31 percent of Internet advertising is for consumer products, 18 percent for computers, 14 percent for financial services, 9 percent for business services, 8 percent for media, and the remaining divided among many different industries. Internet advertising is particularly concentrated, according to the IAB, with the ten leading companies accounting for 71 percent of fourth quarter revenues in 2000. This might explain why Internet advertising has grown so much in such a short period of time.

b. Internet as a Share of Total Advertising

In 2000, Internet advertising accounted for 3.5 percent of the $238 billion of total advertising expenditures in the US.[4] Table 11 shows annual advertising shares of some key media from 1995 through 2000.

Table 11
Advertising Expenditures Shares by Media

Media	1995	1996	1997	1998	1999	2000
Direct Mail	20.2	19.7	19.6	19.6	19.1	18.7
Newspapers	22.3	21.9	22.1	21.9	21.4	20.8
Magazines	5.3	5.1	5.2	5.2	5.1	5.0
Television*	20.1	20.6	19.6	17.7	17.2	16.6
Cable-TV	3.1	3.7	4.0	4.1	4.5	4.7
Radio	7.0	7.0	7.2	7.4	7.8	7.7
Internet	0.0	0.2	0.5	0.9	2.1	3.5
Other	22.0	21.8	21.8	23.2	22.8	23.0

* Television, excluding cable-TV

[4] Total advertising expenditures are obtained from McCann-Erickson, with the exception that the PWC/IAB Internet revenues are substituted.

A review of Table 11 shows that from 1995 to 2000 the Internet's share of advertising expenditures has increased from essentially zero to 3.5 percent of total advertising. Table 11 suggests that much of this increase in Internet advertising has come at the expense of direct mail. The decline in advertising share experienced by newspapers and non-cable television are part of long-term trends that pre-date the Internet. In 1980, for example, newspapers earned 27.6 percent of total advertising expenditures and television 21.3 percent. In contrast, direct mail's share of total advertising expenditures in 1980 was only 14.2 percent, and it climbed steadily to 20.2 percent in 1995 before beginning its decline at the same time that Internet advertising began.

c. Similarities with Cable-TV

As an advertising medium, the Internet has many similarities to cable-TV. Both have attained a large, but not universal, penetration among American households. According to the 2000 Statistical Abstract, 67.2 percent of households subscribed to cable-TV in 1998. A second similarity is that both the Internet and cable-TV are financed through a combination of subscription revenues and advertising revenues. A third similarity is that they provide relatively diffuse forms of content. There are scores of different cable-TV networks and thousands of different programs, each of which have differing audiences that can be targeted by advertisers. A final similarity is that both command a growing, but still relatively small share of total advertising expenditures. Table 11 showed that cable-TV share in 2000 was 4.7 percent, up from 3.1 percent in 1995.

One difference between cable-TV and Internet advertising is that Internet advertising growth has been much more rapid. McCann-Erickson data show steady, but slow growth

in cable-TV advertising share, as opposed to the much faster growth of Internet advertising. Table 12 illustrates this point.

Table 12
Year in Which the Internet and Cable-TV Attained Certain Advertising Shares

	0.2	0.5	0.9	2.1	3.5
Internet	1996	1997	1998	1999	2000
Cable-TV	1981	1983	1985	1991	1996

The slower growth of cable-TV advertising share is consistent with its slower penetration among US households.

4. Projections of Future Values

Future Internet advertising expenditures are projected as a share of future total advertising expenditures, based on the similarities between the Internet and cable-TV. It is projected that the Internet share of total advertising will reach 4.4 percent in 2005, somewhat lower than the current share for cable-TV. Total advertising expenditures are projected to grow by 1.5 percent from 2000 to 2001 and then increase at the same rate as personal consumption expenditures. Table 13 presents these projections, which can also be found in LR-J-133.

As Table 13 shows, Internet advertising expenditures are projected to increase from a $8,225.0 million in 2000 to $13,165.8 million in 2005, a total increase of 60.0 percent. Annual growth rates vary from 6.7 percent to 13.4 percent, with an average annual growth of 9.9 percent. This is much slower than has occurred historically, but is consistent with the experience of the last year in which Internet advertising revenues slowed considerably.

Table 13
Projections of Future Internet Advertising Expenditures
(in millions of dollars)

	2000	2001	2002	2003	2004	2005
Total Advertising Expenditures	237,875	241,443	254,214	268,121	282,326	298,112
Internet Share	3.5%	3.6%	3.7%	3.9%	4.2%	4.4%
Internet Expenditures	8,225.0	8,775.4	9,398.5	10,443.9	11,841.8	13,165.8
Percent Change from prior year	78.6%	6.7%	7.1%	11.1%	13.4%	11.1%

5. Comparisons with Other Analysts

The projections of Internet advertising revenues can be compared with those made by other analysts. A difficulty arises because different analysts rely on different measures of Internet advertising, and therefore direct comparisons are often misleading. A forecast that is consistent with the PWC/IAB measure of Internet advertising is presented in The Economist.Com [Banner-ad blues, February 22, 2001]. The article cites a projection by Veronis Suhler of 9.0 billion in advertising revenues in 2001, somewhat greater than projection presented in Table 13 above. Myers Group forecasts 10 percent online growth in 2001, but only to a total of $4.73, underscoring the difference of opinion regarding the current level of advertising. [Online Advertising to See Growth in 2002, CyberAtlas, August 16, 2001]

Jupiter Media Metrix projects that Internet advertising will grow from $6.9 billion in 2000 to $7.7 billion in 2001, a growth rate of a little more than ten percent. [Ad Spending to Rebound, Digital Marketing to Soar, CyberAtlas, August 8, 2001]. Jupiter projects that

digital marketing initiatives such as coupons, promotions, and E-mail, will rise from $1.5 billion to $2.0 billion. Digital marketing might be viewed as being particularly competitive with direct mail. Moreover, Jupiter projects that total Internet advertising (equal to the sum of online advertising and digital marketing) will reach $26.7 billion by 2005, with over half of that total consisting of digital marketing.

Other forecasts are presented in E-Marketer's Online Advertising Report (August 2001). They project that "E-advertising" will climb from 2.91 percent of total advertising in 2000 to 8.24 percent in 2005, with the 2000 share being lower than the share based on the PWC/IAB numbers and the 2005 share being greater than projected in this testimony. Their report also includes a list of various analysts projected growth rates for 2002, understanding again that the percentage increases may be based on different starting numbers for each analyst. The reported projections range from a 25 percent increase projected by Zenith Media to a 59 percent increase reported by Morgan Stanley. EMarketer projects 36 percent growth. Nine of the 15 analysts listed project growth rates between 30 and 40 percent.

More pessimistic projections are presented by Merrill Lynch's Henry Blodget, an early champion of the Internet in general. [Merrill: Big Firms Fueling Better-Than-Expected Year, InternetNews-Advertiisng Report, September 4, 2001] Blodget projects Internet advertising revenues to decline in 2001 and be relatively flat in 2002 before growing again in 2003 and beyond.

In sum, projecting Internet advertising expenditures is hazardous, as one would expect it to be in an infant industry. The projections presented in this testimony are

relatively conservative, particularly in terms of Internet advertising growth from the Base Year until the Test Year.

V. Technological Diversion of First-Class Letter Mail

A. Single-Piece Letters

1. Technologies Affecting Single-Piece Letters

Single-piece letter volume is subject to technological diversion from many sources. Some of these sources are directly related to the Internet, others are not. Internet-based sources of diversion include the use of E-mail as a substitute for correspondence, including not only correspondence between households, but also correspondence between households and nonhouseholds (business and government), and correspondence between nonhouseholds. E-mail is also used as a means for transmitting financial information, such as bank, stock, or mutual fund account records, insurance information, tax forms, as well as college applications, resumes, invitations, announcements, advertising, holiday and birthday greetings. In fact, E-mail can act as an alternative for most types of single-piece letter mail, and its impact goes well beyond the diversion of personal correspondence between households.

In addition to E-mail diversion, single-piece letter mail is also subject to diversion through the use of online bill payments and bill presentments, also known as EBPP. Though this technology is not widely used, as was noted in Chapter 3 of this testimony, there is some EBPP activity and therefore some diversion of single-piece letter mail. Other financial mail is diverted by Internet-EDI, which is used by businesses as a means of transmitting invoices and other records .

Other forms of technological diversion do not involve the Internet. Fax messaging replaces some letter mail as do various forms of non-Internet electronic bill payment methods such as payment by phone, by automatic deduction, or by ATM. Again, this

diversion affects both households and nonhouseholds, as for example when the government directly deposits a benefit check into a recipient's bank account.

2. Past Impacts of Technology on Volume

a. Contribution Analysis

In the present case, the volume equation for single-piece letters includes household expenditures on Internet Service Providers as an explanatory variable. The econometric work of Thomas Thress (USPS-T-8) shows that this variable has a statistically significant negative impact on the volume single-piece letters. Beyond the issue of statistical significance, there is the question of the magnitude of the impact of ISP expenditures on single-piece letter volume. The estimated impact of this variable on single-piece letter volume over the past five years is presented in Table 2 of Dr. Tolley's volume forecast testimony (USPS-T-7). This table is reprinted below:

Dr. Tolley's Table 2 shows that over the five-year period ending in 2001Q3, single-piece letter volume declined 3.80 percent. Table 2 also shows that increases in ISP expenditures were responsible for an 8.57 percent decline in single-piece letter volume.

TABLE 2

CONTRIBUTIONS TO CHANGE IN
SINGLE-PIECE FIRST-CLASS LETTERS VOLUME
FOR THE FIVE YEARS ENDING IN 2001Q3

Variable	Percent Change In Variable Observed Over Last 5 Years	Elasticity	Estimated Effect of Variable on Volume
Own Price	-7.1%	-0.311	2.32%
Cross Prices			
Workshare Discount	22.3%	-0.027	-0.54%
Single-Piece Cards	-8.8%	0.004	-0.04%
Income			
Permanent	10.2%	0.512	5.10%
Transitory (Lag 3)	-2.6%	0.099	-0.26%
ISP Expenditures		-0.498	-8.57%
MC95-1 Rule Change			3.58%
Adult Population	4.5%	1	4.50%
Other Factors			-8.86%
Total Change in Volume			-3.80%

Source: Testimony of George Tolley, USPS-T-7

b. Reasonableness of Estimated Diversion

Any estimate of diversion implies a certain "but for" mail volume, i.e., the volume that would have occurred in the absence of diversion. One check on the reasonableness of an estimate of diversion is to consider the reasonableness of the "but for" mail volume. An estimate that diversion reduced mail volume by, say, 25 percent over five years is only

reasonable if it can be asserted that in the absence of diversion, volume would have been 25 percent higher. If 25 percent more volume is unreasonable, in that it would reflect an unexplained acceleration of volume growth over the recent five-year period, then the diversion estimate can be seen as unreasonably large.

According to Dr. Tolley's Table 2, ISP expenditures reduced single-piece letter volume by 8.57 percent over the past five years. In the absence of this diversion, then, volume would have been approximately 8.57 percent greater in the four quarters ending in 2001Q3. This implies that instead of declining by 3.80 percent over the past five years, single-piece letter volume would have grown about five percent over this period. This is equal to about one percent annual growth, close to growth in adult population over this same time period. In other words, the contribution analysis of Dr. Tolley implies that in the absence of diversion captured by the ISP expenditure variable, single-piece letter volume would have grown at about the same rate as adult population. This result is reasonable and so the diversion estimate passes the reasonableness test.

c. Incremental and Cumulative Diversion

The contributions in Table 2 are obtained by making a forecast, using as a base volume the volume in the four quarters beginning five years ago. From this base volume, the impacts of changes in different variables are calculated by applying the estimated elasticities to the changes in each factor found to affect volume. Therefore, the negative impact of ISP spending is a five-year incremental diversion – it measures the additional diversion that occurred over the past five years – understanding that diversion that occurred up until that five-year period is already included in the base volume used in that forecast.

Specifically, the volume of single-piece letters in the four quarters ending in 1996Q3 was 53,404 million pieces, a volume total that already reflected diversion up until that time. Dr. Tolley's Table 2 shows that over the five-year period ending in 2001Q3, increases in ISP expenditures were associated with an 8.57 percent decline in single-piece letter volume. Applying this percentage decline to the volume in the year ending 1996Q3 gives the result that incremental diversion over the past five years was almost 4.6 billion pieces.

d. Impact of Other Factors

In addition to the effects captured by ISP spending, Table 2 also shows that "Other Factors" were responsible for an 8.86 percent decline in single-piece volume over the five-year period ending in 2001Q3. This is slightly greater than the estimated impact of ISP expenditures. The volume testimony of Dr. Tolley notes that this decline is explained by a negative econometric time trend. The testimony further notes that the decline is a function of three main negative influences on single-piece letter volume. The first is declining user costs, which have caused mailers to increase their use of presorted and automated mail and therefore led to a shift of single-piece mail into workshare mail. A second factor explaining the negative trend is a continuation of a long-term decline in household-generated mail due to, among other things, reductions in telephone rates as well as cultural changes that have reduced letter-writing. This decline is probably largely complete, but is part of the historical trend in single-piece letter volume that is measured in the econometric equation.

A third factor contributing to this trend term is non-Internet technological diversion. This reflects the type of diversion that was given the most attention in Dr. Tolley's earlier

testimonies, and reflect the decline in single-piece letter volume due to fax, EFT, and non-Internet EDI.

It is difficult to separate the individual impacts of declining user costs, long-term declines in household mail, and electronic diversion not captured by increases in ISP spending. Because some of the trend impact reflects diversion, the results of Table 2 suggest that the overall impact of technology on single-piece letters has been to reduce volume by something more than the 8.57 percent decline attributed to ISP expenditures.

3. Projections into the Future

Between the Base Year and the Test Year, ISP expenditures are projected to increase from about $20.4 billion to $48.3 billion. This increase is projected to reduce single-piece volume by about 7.8 percent over a period of slightly more than two years. In addition, the negative trend terms is projected to reduce volume by about 4.2 percent. Thus, in the forecast period, the impact of Internet expenditures is nearly twice that of the long-term trend, in contrast to the most recent five years of historical data in which the impacts were roughly equal. The result also shows that diversion attributed to ISP spending is not near its ceiling level, and is in fact increasing at least through the Test Year.

B. Workshare Letters

Workshare letters may also be subject to technological diversion. Regular bills and other financial information sent by businesses, much of it workshared mail, can also be sent by E-mail. Workshare advertising mail is also subject to some diversion due to the Internet. Government mailings, which often have the size and density to qualify for workshare discounts, could be diverted by various technological alternatives.

Nonetheless, there is no direct econometric evidence of technological diversion of workshare letters. The volume demand equation for workshare letters does not contain the ISP spending variable as it was not found to have a statistically significant impact on workshare letter volume. Moreover, the econometric trend term that is included in the equation is positive. The positive trend term effect is reflective of the long-term growth in workshare letter volume, growth above and beyond what is due to changes in population, economic activity, and postal rates. According to Table 3 of Dr. Tolley's testimony, "Contributions to Change in Workshare First-Class Letters Volume For The Five Years Ending in 2001Q3," workshare letter volume increased 21.15 percent over the past five years. "Other Factors," primarily a positive econometric trend, were responsible for an increase of 9.11 percent over this same period.

On the surface then, it appears that workshare letters have not been subject to technological diversion. But diversion may be occurring, the econometric evidence merely states that any negative impacts of diversion have been more than offset by other positive influences. Dr. Tolley's testimony discusses these influences, including shifts from single-piece letters due to declining user costs, increases in advertising mail, and increases in credit card mailings.

Below the surface, there is some evidence of technological diversion. First, volume growth for workshare letters is slowing. Table 3 of Dr. Tolley's R2000-1 testimony showed that over the five-year period ending in 1999, workshare volume grew 25.38 percent as opposed to the 21.15 percent growth that occurred over the most recent five years. Table 3 of Dr. Tolley's R97-1 testimony showed that in the five-year period ending in 1996, workshare letter volume increased 37.93 percent. Thus, there is clear evidence of

declining growth in workshare volume. What is not clear is the extent to which this volume growth decline is due to growing technological diversion or due to a reduction in the magnitude of the various positive influences on workshare volume, most notably a reduction in the shift of single-piece letters into workshare letters.

Further suggestive evidence of technological diversion of workshare letters is found in the Forecast Error Analysis of workshare letters, presented in Dr. Tolley's Technical Appendix. This analysis shows that over the past five years, there has been an unexplained decline in workshare letter volume of about one percent. But as Dr. Tolley explains in his testimony, there is insufficient evidence to conclude that the small unexplained negative impact is part of a permanent trend in workshare letter volume.

C. Summary of Technological Impacts on Total First-Class Letters

Table II-1 of the testimony of Tom Thress (USPS-T-8) shows the cumulative impacts of some key variables on the volumes of single-piece and workshare letters. The table is reprinted below. Witness Thress identifies four variables that have pronounced trend effects on volumes: a negative trend term in single-piece, ISP expenditures in single-piece, a positive trend in workshare, and a positive trend due to changes in worksharing.

Technological changes play a key role in explaining these trends. ISP spending in a measure of diversion due to expansion of the Internet and other related technological advances. The negative trend term reflects some non-Internet diversion. It also reflects the shift of mail from single-piece to workshare due to declining user costs. Declining user costs are themselves a function of technological advancements.

In workshare letters, the positive trend term also has a technological source. The aforementioned decline in users costs is one such impact. The other is the growth in letter

advertising, which is related to improvements in database marketing. The discount ratio effect is related to increases in worksharing discounts, which are driven by automation advances at the Postal Service.

Table II-1
Impact of Time Trends in First-Class Letters Equations
(millions of pieces, cumulative since 1987)
Source: USPS-T-8

	Single-Piece			Workshared			Total Letters
	Logistic	Internet	Total	Logistic Trend	Discount Ratio	Total	
1988	(541.155)	(101.801)	(642.956)	880.449	317.813	1,198.261	555.305
1989	(1,213.630)	(283.145)	(1,496.775)	1,770.062	646.508	2,416.570	919.795
1990	(1,988.646)	(398.350)	(2,386.996)	2,629.041	948.618	3,577.659	1,190.664
1991	(2,848.052)	(602.992)	(3,451.044)	3,477.897	1,288.771	4,766.668	1,315.625
1992	(3,727.396)	(769.491)	(4,496.886)	4,325.526	1,619.045	5,944.570	1,447.684
1993	(4,650.356)	(891.858)	(5,542.214)	5,159.388	1,606.382	6,765.770	1,223.557
1994	(5,618.229)	(1,210.991)	(6,829.220)	5,971.865	1,925.003	7,896.869	1,067.649
1995	(6,597.245)	(1,763.106)	(8,360.351)	6,804.419	2,273.462	9,077.881	717.531
1996	(7,569.847)	(2,404.782)	(9,974.630)	7,650.155	2,505.051	10,155.20	180.577
1997	(8,561.754)	(2,895.681)	(11,457.435	8,459.731	2,430.423	10,890.15	(567.281)
1998	(9,567.222)	(3,252.560)	(12,819.782	9,255.657	2,730.599	11,986.25	(833.526)
1999	(10,568.597	(3,938.613)	(14,507.210	10,054.725	3,031.737	13,086.46	(1,420.748)
2000	(11,563.617	(5,240.705)	(16,804.322	10,861.872	3,320.445	14,182.31	(2,622.005)
2001*	(12,531.732	(7,480.088)	(20,011.819	11,674.613	3,601.853	15,276.46	(4,735.353)

* 2001Q4 is forecasted

Therefore, much of the impacts shown in Table II-1 are driven, directly or indirectly, by technological advancements. With this interpretation, the combined impacts of these variables on total letter volume can be seen as a net impact of technology on volume. Through 1996, the impact was a net positive. From 1997 onward, it has had a growing net negative impact, with the estimate that total letter volume has been reduced by 4.7 billion pieces through 2001.

Coincidentally or not, this is approximately equal to the incremental diversion over the 1996 to 2001 period due to increases in ISP spending. [1996: ISP Impact = 2.4 billion pieces. 2001: ISP Impact = 7.5 billion pieces. Incremental diversion is 5.1 billion pieces. This is greater than the diversion over the past five years ending in 2001Q3 (addressed in Dr. Tolley's Table 2), because projected diversion in 2001Q4 is greater than measured diversion in 1996Q4.]

VI. Technological Diversion of Standard Mail

A. Standard Mail

1. Technologies Affecting Standard Mail

Standard Mail, both Regular and ECR, is affected by Internet advertising for the simple reason that advertising dollars spent on the Internet cannot be spent on other advertising media, including direct mail. Because Internet advertising is so new, and its effectiveness remains unproven, it is unclear to what extent it competes more heavily with the mail than with other advertising methods. E-marketing, that is, E-mail advertising, might be considered particularly competitive with the mail, but at present, E-marketing and other forms of direct Internet marketing are relatively small. Thus, it appears that the primary impact of Internet advertising on the mail is through reallocation of advertising budgets as many companies expanded their Internet presence at the expense of other advertising, the mail included. It also seems reasonable that ECR mail might be hit harder than non-ECR mail, since the latter is more targeted, and presumably more effective, advertising that would be less likely to be replaced by an unproven medium such as the Internet.

2. Evidence of Past Diversion

a. Contribution Analysis

Evidence of past diversion is presented in Dr. Tolley's Table 10, "Contributions to Change in Standard Regular Mail for the Five Years Ending 2001Q3" and in his Table 11, "Contributions to Changes in Standard ECR for the Five Years Ending in 2001Q3." According to Table 10, Internet advertising reduced the volume of Standard Regular mail volume by 7.46 percent over the past five years. According to Table 11, Internet

advertising reduced Standard ECR mail volume by 12.42 percent. Virtually all of these reductions are incremental diversion over the five-year period in that there was virtually no Internet advertising prior to this most recent five-year period.

b. Reasonableness of Estimated Diversion

Dr. Tolley's Table 10 shows that over the five year period ending in 2001Q3, Internet advertising was responsible for a 7.46 percent decline in the volume of Standard Regular mail. Applying this percentage decline to the volume of Standard Mail in the four quarters ending in 1996Q3 (29,748 million pieces), yields the result that Internet advertising reduced Standard Regular volume by somewhat more than 2.2 billion pieces over five years. Dr. Tolley's Table 11 shows that over the same five year period, Internet advertising reduced the volume of Standard ECR mail by 12.42 percent. Applying this percentage decline to the volume of Standard ECR in the four quarters ending in 1996Q3 (29,503 million pieces), yields the result that Internet advertising reduced ECR volume by about 3.7 billion pieces. Taken together, the overall volume decline was about 6 billion pieces. This indicates that empirically, the rapid growth in Internet advertising had a substantial impact on Standard Mail volume.

Corroborating evidence is found in the examination of changes in advertising shares across different media, shown in Table 11 of this testimony. From 1995 to 2000, direct mail share of total advertising revenues fell from 20.2 to 18.7 percent, a decline in the share of 1.5 percent. Adding in the pieces diverted by Internet advertising would show that share increasing slightly, consistent with the trend toward growing direct mail share that existed prior to the arrival of Internet advertising.

3. Projections of Future Diversion

Chapter IV of this testimony included projections of Internet advertising expenditures. Dr. Tolley has incorporated these projections into his forecasts of Standard Regular and Standard ECR mail volumes. Because Internet advertising expenditures are not expected to continue their rapid pace of growth over the past five years, the impact on future volumes of Standard mail is relatively small. From the Base Year to the Test Year, increases in Internet advertising are projected to reduce Standard Regular volume by 0.77 percent and reduce Standard ECR volume by 1.31 percent. These reductions are about one-tenth the size of the reductions that occurred over the previous five-year period.

B. Summary of Technological Impacts on Standard Mail

In contrast to the impact of the Internet on single-piece letter volume, the impact of the Internet on Standard Regular volumes is largely complete. Most of the effect is reflected in current base volumes that are lower than they would otherwise be. Volumes were reduced because over a five year period advertisers threw considerable amounts of money at the Internet, and reduced their spending on direct mail as a consequence. However, barring some unexpected breakthrough that substantially increases the effectiveness of Internet advertising, future growth in Internet advertising will be relatively modest and the future growth rate of Standard Regular mail will be only slightly reduced.

At the same time, Standard Regular mail still enjoys some of its past benefits from technological advancements. This is particularly true for noncarrier-route mail which has grown, in part at the expense of ECR mail, due to improvements in database marketing which have allowed advertisers to target customers more effectively.

VII. Pricing Implications of Technological Diversion

A. Overview of Postal Pricing

1. Some General Principles

Postal pricing is a complicated business, governed by the nine rate-making criteria established in Section 3622(b). The complications arise because many of the criteria are subject to different interpretations and, in some cases, seem to contradict each other. Nonetheless, there are a few pricing concepts with which most people involved in these proceedings would agree.

i. *Prices must generate break-even in the Test Year.*

Break-even is a rate case requirement, although there are disagreements as to what constitutes break-even.

ii. *Prices must satisfy the incremental cost test*

The incremental cost test requires that postal prices generate revenues at least equal to the incremental costs of each product. The incremental cost of a product is the cost that the Postal Service would save if the product were entirely eliminated. If revenues are less than incremental costs, a loss results, and users of other products are subsidizing this loss through prices that are higher than necessary.

In addition to protecting against cross-subsidy by other users of the mail, the incremental cost test also protects private competitors and their customers. If postal prices are below incremental costs, then these prices could exclude a competitor that was equally or more efficient than the Postal Service. Postal prices that are below the incremental costs of a less efficient private firm are not economically efficient, although it is recognized that this remains a contentious issue.

iii *Demand elasticities matter*

A third important price concept is that demand elasticities matter. There is disagreement over how much weight demand elasticities should have in price-setting, but it is well understood that the volume response to price increases must be considered in the price-setting process. This occurs if for no other reason than the fact that the volume impact of price changes must be calculated to determine whether break-even is achieved. Beyond that, it is recognized that large price increases for more price sensitive products cause large volume reductions. Ramsey pricing makes explicit use of the differing volume responses of various mail products. Other pricing strategies take demand elasticities into consideration in different ways.

B. Technological Diversion and Postal Pricing

What implications does technological diversion have on the above pricing concepts? First, diversion makes it harder for the Postal Service to satisfy its break-even requirement. Volume losses due to diversion reduce revenues, and since products are priced so that revenues exceed costs, these volume reductions also reduce net revenue, or contribution. Therefore, diversion leads to rate cases occurring either more frequently, with greater increases, or both.

The incremental cost test would prevent the Postal Service from engaging in aggressive price cutting to exclude a technological competitor. This would seem to be an unlikely response, in any event, since most technological competitors appear to have

prices that are lower than the Postal Service, i.e., electronic check payment is less costly than mailed checks.[1]

A third issue is the impact on postal price elasticities resulting from technological diversion and the emergence of technological alternatives to the mail. It seems possible that new alternatives to some postal products could make those products more price sensitive. As such, increases in the prices of those products would produce larger volume losses, and less revenue increases, than would be the case if the price elasticity had not increased.

Demand-based, or Ramsey pricing, argues that mark-ups (the excess of price over marginal cost) should be inversely proportional to product own-price elasticities. Therefore, less elastic products should have higher mark-ups because large mark-ups on more elastic products is an ineffective way of raising net revenue, due to the large volume losses that result. Following this principle, a product that becomes more price elastic (due to technological competition or for any other reason), should have lower mark-ups than if it were less price elastic.[2]

Thus, there are potentially two opposing pricing implications for a product that faces technological alternatives. The first, the reduction in net revenue due to diversion, requires rates to be higher. The second, increases in the price elasticity, suggests that rates of those products could be lower.

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[1] If anything, it seems more likely that the technological competitors engaged in a form of cross-subsidy, with many Internet firms operating at prices that generate losses instead of profits, subsidized by essentially free money provided by an apparently overinflated equity market.

[2] The logic here depends on the assumption that the initial mark-ups are demand-based.

1. The Case of First-Class Letters

Technological diversion has been shown to have reduced First-Class letter volume. This, in turn, reduces net revenue and requires rates to be increased relative to the increase that would have been required in the absence of technological diversion. The effect is not small. It has been estimated that over the past five years, single-piece letter volume has been reduced by about 4.6 billion pieces. At current rates and costs, this results in a decrease in contribution in the Base Year of about $700 million. Moreover, this is only the effect in a single year, the Base Year, and does not include reductions in net revenue that occurred in prior years or that will occur between the Base Year and the Test Year. Thus, it is clear that recent volume losses due to technological diversion is one of the key factors driving the current rate case.

While technological diversion is reducing the First-Class letter contribution, it may also be increasing the price sensitivity of letter volume to rate increases. If this were the case, economic theory would argue for a lower increase on letter prices than might occur if the elasticity had not increased. A key question is: what has happened to the elasticity of First-Class letters as a result of the emergence of new technological alternatives?

At the subclass level, the answer is: not much. In my R2000-1 testimony, I calculated the volume-weighted own-price elasticity of the First-Class letter subclass. At that time, it was equal to -0.229. In the current case, the volume-weighted elasticity of the First-Class letter subclass is -0.197. Thus, at the subclass level, the current own-price elasticity of First-Class letters is actually slightly lower (in magnitude) than it what is the previous rate case.

While the subclass elasticity is somewhat lower, the estimated own-price elasticity of single-piece letters is somewhat higher than in the previous case. The current estimated elasticity is -0.311, whereas in the last case is -0.262. Since single-piece letters are the category of First-Class letters most directly affected by diversion (the ISP variable is included in the single-piece letters demand regression equation), one could argue that these new alternatives have indeed made single-piece letters more price sensitive.

The difficulty with the above argument is that the single-piece and workshare own-price elasticities are not own-price elasticities in the usual sense, since the volume demand equations also include the workshare discount as an explanatory variable. Raising the own-price of single-piece letters will also cause the discount to increase, so that the total impact on volume is the combined effects of the own- and discount-elasticity effects. [This is the advantage of looking at the subclass elasticity because the discount elasticity effect -- the shift of mail between single-piece and workshare due to changes in discounts -- is offsetting and only the net effect on subclass volume is considered].

In sum, then, the evidence that technological alternatives are changing price elasticities is mixed. Overall, First-Class letters appears to be no more, perhaps even a little less, price sensitive. Single-piece letters may be a bit more price sensitive, depending on what one assumes about changes in the discounts that would accompany any changes in the single-piece price. All in all, though, these differences are relatively minor and there is no evidence that, as of yet, technological alternatives are fundamentally changing the price responsiveness of mail products.

Therefore, it appears that the primary impact of technological diversion is that it reduces contribution from affected products, requiring rate increases that are either more frequent or in greater magnitude than would be occur in the absence of diversion.

C. Pricing Models Presented in this Testimony

Two sets of after-rates Test Year prices are presented in this testimony. The first is based on the Ramsey pricing formula, which minimizes the harm to mailers (loss of consumer surplus) that results from the need to set postal prices above postal marginal costs. The Ramsey pricing formula is presented in my R97-1 testimony (USPS-T-41, Docket No. R97-1). The second set of prices are based on the Postal Rate Commission (PRC) recommended mark-ups from their R2000-1 opinion. Both sets of prices generate the same level of net revenues as results from the Postal Service proposed after-rates prices in this case, thereby leaving the Postal Service's net financial position unchanged. The two sets of prices are compared, and the aggregated gain to mailers that would result from a move to the Ramsey-based prices from the PRC-based prices is calculated.

Prices are calculated for a total 16 products, presented below in Table 14. Note that the products are somewhat different than those presented in my R2000-1 testimony. Specifically, all three subclasses of outside county Periodicals mail (Regular, Nonprofit, and Classroom) are aggregated into a single product. Similarly, Standard Regular and Standard Regular Nonprofit are aggregated, as are Standard Regular ECR and Standard Nonprofit ECR. Media mail and Library rate mail are also combined.

D. Calculating the Net Revenue Requirement

Test Year after-rates prices must generate revenue equal to projected Test Year costs, thereby satisfying the Postal Service's break-even requirement. Postal costs are categorized as being volume variable or non-volume variable. Volume variable costs change as volumes change, while non-volume variable costs do not. If prices of each product were set at each product's volume variable cost per piece (also referred to as the product's marginal cost) revenues would not be sufficient to also cover the agency's non-volume variable costs. Therefore, prices must be marked-up above volume variable cost to achieve break-even. The excess of revenues above volume variable costs is referred to as net revenue, or contribution. Therefore, the Ramsey-based prices and the PRC-based prices must generate sufficient net revenue for the Postal Service to break-even in the Test Year.

Break-even is assumed to be achieved if prices generate the same level of net revenue as produced by the Postal Service's proposed after-rates prices. Table 14 presents the Postal Service after-rates revenues, volume variable costs, and net revenues for the products included in the pricing models presented in this testimony. Table 14 shows that for the product's considered in this pricing exercise, after-rates net revenues at proposed Postal Service prices is $31,870.848 million. Therefore, both the Ramsey-based and PRC markup-based prices will be required to generate $31,871 million in the Test Year.

Table 14
Derivation of Net Revenue Requirement
(In Millions)

Mail Product	After-Rates Revenue	After-Rates Variable Cost	After-Rates Net Revenue
First-Class Letters	$37,852.572	$17,863.203	$20,009.369
First-Class Cards	$1,119.814	$705.507	$414.307
Priority Mail	$6,200.084	$3,567.994	$2,632.090
Express Mail	$1,133.705	$494.819	$638.886
Periodicals In-County	$82.526	$78.785	$3.741
Periodicals Other	$2,511.600	$2,313.219	$198.381
Standard Regular	$12,706.841	$8,690.374	$4,016.267
Standard ECR	$5,880.866	$2,770.724	$3,180.142
Parcel Post	$1,202.568	$1,040.238	$162.330
Bound Printed Matter	$695.754	$542.200	$153.554
Media Mail	$320.767	$279.052	$41.715
Registry	$98.550	$79.597	$18.953
Insured	$144.397	$114.194	$30.203
Certified	$696.629	$454.204	$242.425
COD	$17.700	$12.608	$5.092
Money Order	$303.574	$180.181	$123.393
Total			**$31.970.848**

Source: Exhibit USPS-28B

E Ramsey Price Calculations

1. Ramsey Pricing Formula

The Ramsey pricing formula, presented below as equation (1) is derived in my library reference LR-H-164, Docket No. R97-1.

$$\sum_{j=1}^{N} \frac{P_j - M_j}{P_i} E_{ji} \frac{V_j}{V_i} = -k, \quad \textit{for all } i. \qquad (1)$$

where there are N products, P indicates product price, M is product marginal cost, Eji is the elasticity of the volume of product j with the price of product i (Eii is the own-price elasticity), Vj is the volume of product j, Vi is the volume of product i, and k is the Ramsey leakage factor. Both my R97-1 and R2000-1 testimonies included lengthy discussions of the mathematical and theoretical aspects of Ramsey pricing and any reader interested in these issues is encouraged to review those past testimonies.

In the case of only two products, i and j, the above equation can be re-written as:

$$\begin{aligned} \frac{P_i - M_i}{P_i} E_{ii} + \frac{P_j - M_j}{P_i} E_{ji} \frac{V_j}{V_i} &= -k \\ \frac{P_j - M_j}{P_j} E_{jj} + \frac{P_i - M_i}{P_j} E_{ij} \frac{V_i}{V_j} &= -k \end{aligned} \qquad (2)$$

The prices of products i and j, P_i and P_j, respectively, must both satisfy the above equation.

When there are no cross-price elasticities, the Ramsey pricing formula simplifies to what is known as the Inverse Elasticity Rule (IER):

$$-k = \frac{(P_i - M_i)E_{ii}}{P_i} \qquad (3)$$

The Inverse Elasticity Rule states that the mark-up of price over cost should be inversely related to the product's own-price elasticity of demand. Therefore, relatively less elastic products will have higher mark-ups than relatively more elastic products.

When there are cross-price elasticities, the full Ramsey pricing model must be used. Note that in the full Ramsey pricing model, prices depend on volumes (V_i and V_j are part of the pricing formula). These volumes are the volumes that occur at the Ramsey prices, where the Ramsey prices themselves depend on the volumes. In my R97-1 and R2000-1 testimonies, I explained that this calculation required a somewhat complex iterative procedure in which prices were calculated first, and then new volumes were calculated, and then prices were re-calculated at those new volumes, and so on and so on until there occurred an exact consistency between the Ramsey prices and the Ramsey volumes.

The Ramsey pricing model used in this case is a simplified version of the model presented in R97-1 and R2000-1. The calculations are done entirely within an Excel program, with interconnected sheets providing input data, necessary data manipulations, price and volume calculations, and output. One drawback of this approach is that Excel cannot handle the complex iterative calculations discussed above. Instead, the Excel program uses the USPS after-rates volumes in the calculations of the cross-price impact on the Ramsey prices. This change is the only difference with the original -- and technically more accurate -- Ramsey pricing model, and given the generally small values of most cross-price elasticities, the difference in the resulting prices is trivial.

Other than the small change discussed above, the Excel version of the Ramsey pricing calculations are performed the same as in earlier cases. Specifically

a. Ramsey prices are calculated (subject to constraints discussed shortly), by choosing a starting value of k (the Ramsey leakage factor) and applying the Ramsey pricing formula to the products' marginal costs. The Ramsey prices are calculated based on the products' long-run own and cross-price elasticities.

b. Given these Ramsey prices, Test Year volumes are calculated (using the Test Year own and cross-price elasticities).

c. Given volumes and prices, Test Year net revenues are then calculated, equal to the Ramsey price less the product marginal cost, multiplied by the Ramsey volume.

d. Net revenue is summed over all the products and compared to the Net Revenue Requirement. If net revenues are less (more) than the requirement, a higher (lower) k value is chosen, which results in a new set of Ramsey prices. Volumes and net revenues at these new prices are calculated and compared to the net revenue requirement. The process continues until the k value is found that produces Ramsey prices that generate the exact net revenue requirement, ensuring that break-even has been achieved.

2. Ramsey Input Data

The Ramsey price calculations require information product price elasticities (own and cross), as well as product marginal costs and a set of prices and volumes from which to base the Ramsey price and volume calculations. USPS after-rates volumes and prices (with prices equal to average revenue per piece) are used as the starting points in the Ramsey calculations. This information is presented in Table 15 below. The spreadsheet used to calculate values for aggregated mail products (e.g., outside-county Periodicals) is presented in LR-J-134.

Table 15
Data Used in Ramsey Price Calculations

Mail Product	After-Rates Test Year Volume (millions)	After-Rates Price (revenue per piece)	After-Rates Marginal Cost	Long-Run Own-Price Elasticity*	Test Year Own-Price Elasticity*
First-Class Letters	98,187.484	$0.3857	$0.1819	-0.1974	-0.1638
First-Class Cards	5,266.679	$0.2126	$0.1340	-1.1452	-0.8113
Priority Mail	1,178.757	$5.2598	$3.0269	-0.7542	-0.5715
Express Mail	69.911	$16.2164	$7.0778	-1.4924	-1.0779
Periodicals In-County	853.535	$0.0967	$0.0923	-0.1573	-0.1573
Periodicals Other	9,108.973	$0.2757	$0.2539	-0.1488	-0.0809
Standard Regular	59,179.108	$0.2147	$0.1468	-0.3567	-0.2842
Standard ECR	36,362.086	$0.1617	$0.0743	-0.7223	-0.3373
Parcel Post	371.533	$3.2368	$2.7999	-1.1940	-1.1180
Bound Printed Matter	588.557	$1.1821	$0.9212	-0.2312	-0.1490
Media Mail	185.688	$1.7275	$1.5028	-0.1444	-0.0771
Registry	7.089	$13.9018	$11.2282	-0.1330	-0.1330
Insured	60.543	$2.3850	$1.8862	-0.1104	-0.0579
Certified	302.882	$2.3000	$1.4996	-0.1765	-0.0675
COD	3.100	$5.7097	$4.0671	-0.5326	-0.2450
Money Order	228.243	$1.3300	$0.7894	-0.5145	-0.2509

* Long-run and Test Year cross-price elasticities are presented in LR-J-134

1. The after-rates Test Year volume is obtained from the testimony of George Tolley (USPS-T-7). Volumes of some products have been aggregated to match the products presented in Table 14.

2. After-rates Test Year prices are measured as average revenue per piece, calculated by dividing USPS proposed after-rates Test Year revenue (shown in Table 14) by after-rates Test Year volume.

3. After-rates Test Year marginal costs are equal to after-rates volume variable costs per piece, calculated by dividing USPS proposed after-rates Test Year volume variable cost (shown in Table 14) by after-rates Test Year volume..

4. Long-run price elasticities are obtained from the testimony of George Tolley (USPS-T-7) and include own-price and cross-price elasticities. These elasticities are obtained from the econometric work of Thomas Thress (USPS-T-8)

5. Test Year elasticities are the elasticity response of volumes in the Test Year calculated in LR-J-134.

Test Year elasticities are calculated using the estimated lag structure of the long-run elasticities discussed above. Price lags reflect the fact that mailers' responses to changes in postal rates do not occur immediately, but may occur over a period of several quarters. Because after-rates prices are assumed to take effect at the beginning of the 2003 Test Year, the response of mailers in the Test Year will be somewhat less than the full response that occurs over a longer period of time. Therefore, Test Year price elasticities are typically lower than the long-run price elasticities.

3. Ramsey Price Constraints

The Ramsey prices presented in this testimony are not pure Ramsey prices, but are instead prices that are based on the Ramsey pricing formula subject to two types of price constraints. The first price constraint is related to the incremental cost test. The second set of price constraints is judgmental. Each of these constraints is discussed in turn.

a. Incremental Cost Constraint

The incremental cost of a product is the cost that the Postal Service would save if the product were eliminated entirely. In addition to covering the product's volume variable

costs, postal prices (Ramsey or otherwise) should generate sufficient revenues to cover the product's incremental cost. If not, the Postal Service and other mailers would be better off if the product were discontinued.

Ramsey prices are calculated as a mark-up over marginal cost. Marginal costs are equal to volume variable costs divided by volume. In many cases, volume variable cost is less than incremental cost. Therefore, the total revenues from the product at the Ramsey prices are compared to the product's incremental cost. If these total revenues are less than incremental cost, the price must be marked up above the Ramsey price until revenues cover incremental costs. Express Mail has a Ramsey price that generates revenues below incremental costs. Consequently, the price of Express Mail is constrained to be 50 percent above marginal cost so that revenues cover incremental costs.

b. Judgmental Constraints

A second type of constraint imposed on the Ramsey prices is a limit on the mark-up of products with particularly low price elasticities. A pure mathematical application of the Ramsey pricing would result in large increases in the price of certain products. These increases have two key results. First, they result in increases in net revenue from a few products that are unreasonable, and have the consequence of weakening the informational value of the Ramsey pricing exercise. Second, substantial rate increases for some products could result in changes in the products' own-price elasticities. This might be true if large postal rate increases encouraged entry by private firms, as could happen with Periodicals Mail. Entry of new competitors could, in turn, raise the price sensitivity of Periodicals Mail or other products that experience substantial rate increases. Therefore, the mark-ups on Periodicals mail is set at 75 percent. Other low elasticity mail products

given constrained mark-ups are Media mail, Registered, Insured, and Certified, all of which had constrained mark-ups set at 125 percent.

F. PRC-Based Prices

1. Mark-Up Pricing Formula

Mark-up pricing establishes rates for the current case based on the mark-ups recommended by the Postal Rate Commission in the R2000-1 case. The PRC recommended mark-ups used in this pricing formula are different from the ones presented in the PRC R2000-1 opinion. First, they are expressed as mark-ups over R2000-1 USPS after-rates marginal cost, presented in the testimony of Nancy Kay, USPS-T-21, Docket No. R2000-1. These mark-ups were calculated by dividing the PRC recommended price by the USPS R2000-1 Test Year volume variable costs per piece, and then subtracting 1 to express the result as a mark-up. A second adjustment involves the incremental cost test, discussed shortly.

PRC mark-ups were recalculated as mark-ups over USPS after-rates marginal costs to be consistent with both the Ramsey rates (which use marginal cost in their calculation) and the Postal Service's R2001-1 proposed after-rates prices (which use marginal cost in the calculation of net revenues).

Mark-up prices for the current case are calculated as follows:

a. The adjusted R2000-1 mark-ups are applied to the Test Year after-rates marginal costs to create an initial set of Test Year after-rates prices.

b. Given these prices, Test Year after-rates volumes are calculated using the Test Year own- and cross-price elasticities

c. Given these prices and volumes, Test Year net revenue is calculated

d. Net revenue is summed over all the products and compared to the Net Revenue Requirement. If net revenues are less than the requirement, all mark-ups are increased by a proportionality factor X, so that the new mark-ups equal the old mark-ups multiplied by (1+X). If net revenues are greater than the requirement, all mark-ups are decreased by a proportionality factor X, where X in this case would be negative. For example, suppose that the initial mark-ups are two products are 100 percent and 50 percent. If these mark-ups, applied to Test Year marginal costs, generate net revenues that are less than the net revenue requirement, then a positive value of X is used. As an illustrative example, suppose X is equal to 0.1. Then the new mark-ups of these two postal products become 110 percent (100 x 1.1) and 55 percent (50 x 1.1), so that the relative mark-ups remain unchanged, i.e., the first product has twice the mark-up as the second product. The new proportionate set of mark-ups yields a new set of Mark-up prices. Volumes and net revenues at these new prices are calculated and compared to the net revenue requirement. The process continues until the X value is found that produces Mark-up prices that generate the exact net revenue requirement, ensuring that break-even has been achieved.

2. Mark-Up Pricing Input Data

Table 16 shows the data used in the Mark-up pricing model which include the same after-rates Test Year volume, after-rates price, after-rates marginal cost, and Test Year elasticities that are used in the Ramsey calculations. In addition, the Mark-up model includes the adjusted R2000-1 Postal Rate Commission recommended mark-ups.

Table 16
Data Used in Mark-Up Price Calculations

Mail Product	After-Rates Volume (millions)	After-Rates Price (revenue per piece)	After-Rates Marginal Cost	Test Year Own-Price Elasticity*	R2000-1 Mark-ups (Adjusted)
First-Class Letters	98,187.484	$0.3857	$0.1819	-0.1638	91.2%
First-Class Cards	5,266.679	$0.2126	$0.1340	-0.8113	40.3%
Priority Mail	1,178.757	$5.2598	$3.0269	-0.5715	71.1%
Express Mail	69.911	$16.2164	$7.0778	-1.0779	124.7%
Periodicals In-County	853.535	$0.0967	$0.0923	-0.1573	1.3%
Periodicals Other	9,108.973	$0.2757	$0.2539	-0.0809	1.3%
Standard Regular	59,179.108	$0.2147	$0.1468	-0.2842	32.8%
Standard ECR	36,362.086	$0.1617	$0.0743	-0.3373	91.1%
Parcel Post	371.533	$3.2368	$2.7999	-1.1180	12.4%
Bound Printed Matter	588.557	$1.1821	$0.9212	-0.1490	11.1%
Media Mail	185.688	$1.7275	$1.5028	-0.0771	0.3%
Registry	7.089	$13.9018	$11.2282	-0.1330	7.0%
Insured	60.543	$2.3850	$1.8862	-0.0579	2.3%
Certified	302.882	$2.3000	$1.4996	-0.0675	17.9%
COD	3.100	$5 7097	$4.0671	-0.2450	20.2%
Money Order	228.243	$1.3300	$0.7894	-0.2509	52.7%

* Test Year cross-price elasticities are presented in LR-J-134

2. Mark-Up Price Constraints

As was the case with the Ramsey prices, the Mark-up prices are constrained, if necessary, to ensure that they satisfy the incremental cost test. Applying the R2000-1 mark-ups of PRC recommended price over Postal Service volume variable cost per piece resulted in several products (Periodicals in-county, Periodicals out-of-country, Media Mail, and Registry) having revenues that were less than Test Year 2003 incremental costs. For these products, the R2000-1 recommended prices were replaced with prices equal to Test Year 2003 incremental cost per piece. Mark-ups were then calculated based on prices that satisfied the incremental cost test. The calculations are detailed in LR-J-134.

G. Comparison of PRC Mark-Up and Ramsey-based Prices

1. Summary Results

Table 17 presents a comparison of the PRC Mark-up and Ramsey based after-rates prices for the 2003 Test Year. In addition to the two sets of prices, Table 17 also shows the resulting mark-ups, volumes, revenues, costs, and net revenues. Both sets of prices generate net revenues of $31,871 million, equal to the net revenues generated from these products by the Postal Service's proposed after-rates prices in this case.

Before considering product by product differences, some summary results warrant examination. First, the Ramsey prices have a system-wide mark-up of 78.6 percent, as compared with the PRC-based prices which have a system-wide mark-up of 81.6 percent. Second, volume under Ramsey pricing is greater, 220.1 billion pieces as compared to 212.1 billion pieces, a difference of about four percent. Third, the table shows that Ramsey prices generate an aggregated gain to mailers of $1,003 million relative to the PRC Mark-up prices. This gain will be discussed later in this section.

Table 17			R2001-1 After-Rates Prices Based on PRC R2000 Mark-Ups					
MAIL PRODUCT	Own-Price Elasticity	Marginal Cost	PRICE	MARK-UP	VOLUME (millions)	REVENUE ($millions)	COST ($millions)	NET REVENUE ($millions)
First-Class Letters	-0.197	0.1819	$0.3911	115.0%	97,928.081	$38,298.1	$17,816.0	$20,482.1
First-Class Cards	-1.145	0.1340	$0.2021	50.9%	5,500.130	$1,111.5	$736.8	$374.8
Priority Mail	-0.754	3.0269	$5.7418	89.7%	1,121.194	$6,437.7	$3,393.8	$3,043.9
Express Mail	-1.492	7.0778	$18.2034	157.2%	61.722	$1,123.5	$436.9	$686.7
Periodicals In-County	-0.157	0.0923	$0.0938	1.6%	857.591	$80.5	$79.2	$1.3
Periodicals Other	-0.149	0.2539	$0.2580	1.6%	9,158.110	$2,362.6	$2,325.7	$37.0
Standard Regular	-0.357	0.1468	$0.2076	41.4%	59,756.949	$12,406.6	$8,775.2	$3,631.4
Standard ECR	-0.122	0.0743	$0.1596	114.9%	36,525.176	$5,829.4	$2,712.8	$3,116.5
Parcel Post	-1.194	2.7999	$3.2380	15.6%	386.914	$1,252.8	$1,083.3	$169.5
Bound Printed Matter	-0.231	0.9212	$1.0505	14.0%	599.000	$629.2	$551.8	$77.4
Media Mail	-0.144	1.5028	$1.5082	0.4%	187.642	$283.0	$282.0	$1.0
Registered	-0.133	11.2282	$12.2198	8.8%	7.196	$87.9	$80.8	$7.1
Insured	-0.110	1.8862	$1.9408	2.9%	61.260	$118.9	$115.5	$3.3
Certified	-0.176	1.4996	$1.8765	25.1%	306.377	$574.9	$459.4	$115.5
COD	-0.533	4.0671	$5.1013	25.4%	3.187	$16.3	$13.0	$3.3
Money Orders	-0.515	0.7894	$1.3142	66.5%	228.930	$300.9	$180.7	$120.1
Totals			$0.3344	81.6%	212,082.510	$70,913.9	$39,042.9	$31,871.0

Table 17 (Cont.)

R2001-1 Ramsey-based After-Rates Prices

MAIL PRODUCT	Own-Price Elasticity	Marginal Cost	PRICE	MARK-UP	VOLUME (millions)	REVENUE ($millions)	COST ($millions)	NET REVENUE ($millions)
First-Class Letters	-0.197	0.1819	$0.4130	127.0%	96,925.082	$40,032.9	$17,633.5	$22,399.3
First-Class Cards	-1.145	0.1340	$0.1501	12.0%	7,062.295	$1,059.9	$946.0	$113.9
Priority Mail	-0.754	3.0269	$3.6588	20.9%	1,447.888	$5,297.5	$4,382.6	$914.8
Express Mail	-1.492	7.0778	$10.6168	50.0%	110.367	$1,171.7	$781.2	$390.6
Periodicals In-County	-0.157	0.0923	$0.1615	75.0%	787.328	$127.2	$72.7	$54.5
Periodicals Other	-0.[illegible]9	0.2539	$0.4444	75.0%	8,764.008	$3,894.8	$2,225.6	$1,669.2
Standard Regular	-0.357	0.1468	$0.2140	45.7%	59,281.578	$12,687.9	$8,705.4	$3,982.5
Standard ECR	-0.722	0.0743	$0.0876	18.0%	44,713.186	$3,917.8	$3,321.0	$596.8
Parcel Post	-1.194	2.7999	$3.1771	13.5%	320.143	$1,017.1	$896.4	$120.8
Bound Printed Matter	-0.231	0.9212	$1.7580	90.8%	554.774	$975.3	$511.1	$464.2
Media Mail	-0.144	1.5028	$3.3813	125.0%	176.314	$596.2	$265.0	$331.2
Registered	-0.133	11.2282	$25.2635	125.0%	6.478	$163.7	$72.7	$90.9
Insured	-0.110	1.8862	$4.2439	125.0%	59.039	$250.6	$111.4	$139.2
Certified	-0.176	1.4996	$3.3741	125.0%	291.861	$984.8	$437.7	$547.1
COD	-0.533	4.0671	$5.1262	26.0%	3.183	$16.3	$12.9	$3.4
Money Orders	-0.515	0.7894	$1.0042	27.2%	244.919	$245.9	$193.3	$52.6
Totals				78.6%	220,143.0	$72,439.5	$40,568.5	$31,871.0

Estimated Gain to Mailers from Ramsey Pricing = $1,003.4

2. Key Product by Product Differences

Table 18 presents a comparison of the USPS proposed, PRC Mark-up and Ramsey-based after-rates prices for the Test Year. These prices are average revenue per piece and may not conform to price measures presented by other witnesses in this case. Table 18 also presents the product-by-product change in consumer surplus that would result from a move from the PRC Mark-up prices to the Ramsey-based prices. This gain will be discussed further in the next section. Note that the PRC Mark-up prices are not a prediction nor a suggestion regarding the prices that the PRC will ultimately recommend.

Reviewing Table 18, the general result of Ramsey pricing, seen in my earlier testimonies, is shown again, namely, that relatively less price elastic products have higher Ramsey prices that PRC Mark-up prices and relatively more price elastic products have lower Ramsey prices. This is evident with the Ramsey price of First-Class letters, which is about two cents greater than the PRC Mark-up price. Interestingly, the PRC Mark-up price is slightly greater than the USPS proposed price. This result is evidence of the predominant impact of technological diversion on postal rates – the loss of net revenue caused by diversion forces prices up.

Other relatively inelastic products that have Ramsey prices that are higher than PRC Mark-up prices include Periodicals mail, Package Services mail (aside from parcel post), and most of the special services. Relatively more elastic products that have lower Ramsey prices include First-Class cards, Priority Mail, Express Mail, and Standard ECR mail.

Table 18
Comparison of After-Rates Test Year Prices
(Average Revenue per Piece)

Mail Product	USPS Proposed	PRC Mark-Up	Ramsey	Change in Consumer Surplus (millions)
First-Class Letters	$0.3857	$0.3911	$0.4130	($2,138.0)
First-Class Cards	$0.2126	$0.2021	$0.1501	$326.7
Priority Mail	$5.2598	$5.7418	$3.6588	$2,675.8
Express Mail	$16.2164	$18.2034	$10.6168	$652.8
Periodicals In-County	$0.0967	$0.0938	$0.1615	($55.7)
Periodicals Other	$0.2757	$0.2580	$0.4444	($1,670.6)
Standard Regular	$0.2147	$0.2076	$0.2140	($381.5)
Standard ECR	$0.1617	$0.1596	$0.0876	2,923.7
Parcel Post	$3.2368	$3.2380	$3.1771	$21.5
Bound Printed Matter	$1.1821	$1.0505	$1.7580	($408.1)
Media Mail	$1.7275	$1.5082	$3.3813	($340.9)
Registry	$13.9018	$12.2198	$25.2635	($89.2)
Insured	$2.2850	$1.9408	$4.2439	($138.5)
Certified	$2.3000	$1.8765	$3.3741	($448.0)
COD	$5.7097	$5.1013	$5.1262	($0.1)
Money Order	$1.3300	$1.3142	$1.0042	$73.5
Total Change in Consumer in Consumer Surplus				$1,003.4

For some products, the Ramsey price and the PRC Mark-up prices are close. In letters, the difference is only 5.6 percent, though it recognized that 5.6 percent is a meaningful difference for this major mail subclass. Beyond letters, however, the Ramsey and PRC Mark-up prices are similar for Standard Regular mail (3 percent difference) and parcel post (two percent difference).

Examining the USPS proposed after-rates prices, it is found that the proposed price (expressed as an average revenue per piece) of First-Class letters is quite close to the PRC Mark-up price. The same holds true for Periodicals Mail and Standard ECR. The proposed prices for Standard Regular and parcel post are quite close to both the Ramsey and the PRC Mark-up prices. The USPS proposed prices for Priority Mail, Express Mail, Periodicals Mail, bound printed matter, media mail, Registry, Insured, and Certified are between the Ramsey and PRC Mark-up prices.

3. Gains to Mailers

Ramsey pricing produces aggregated gains to mailers because it seeks to minimize the loss of consumer surplus resulting from the need to satisfy the break-even requirement by setting prices above marginal costs. My R2000-1 and R97-1 testimonies include lengthy discussions of the concept of consumer surplus. In short, when the Ramsey prices are lower than the PRC Mark-up prices, Ramsey pricing produces a gain to consumers relative to the PRC Mark-up prices. When the Ramsey prices are higher, Ramsey pricing produces a loss to consumers. The gains are volume weighted, to take account of the fact that a penny gained (or lost) in a category with high volume is more important than a penny gained (or lost) in a category with low volume.

The formula for calculating the change in consumer surplus that is used in this testimony is the same as in my previous testimonies,

$$\tfrac{1}{2}(V_R + V_0)\cdot(P_0 - P_R) \qquad (4)$$

where V_R is the Ramsey volume, V_0 is the PRC Mark-up volume, P_0 is the PRC Mark-up price and P_R is the Ramsey price.

Table 18 shows the results of this calculation across the 16 mail products considered in this testimony. The net result is that consumers (mailers) as a group would gain $1,003.4 million from a move from the PRC Mark-up rates shown in Table 18 to the Ramsey-based rates also shown in Table 18. Large consumer gains result in Priority Mail, Express Mail, and Standard ECR while large losses result in First-Class letters and Periodicals Mail. In other words, Ramsey pricing could raise the same net revenue as the PRC Mark-up prices while imposing less of a collective burden on users of the mail.

Returning, briefly, to the topic of technological diversion, the main impact of diversion is to impose net costs on all users of the mail, with the burden distributed differently depending on the price setting strategy employed. A potential secondary impact is that diversion can reallocate the burden from users of one postal product to users of another. Under Ramsey pricing, this reallocation occurs if technological diversion alters the relative price elasticities of the various postal products so that products that have become more price elastic would bear relatively less burden. Other pricing strategies may opt to reallocate the additional burden differently.