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**U.S. Department of  
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# **Study Of Airline Computer Reservation Systems**

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## I. EXECUTIVE SUMMARY

Airline-owned computer reservation systems (CRSs) play an important role in the air travel industry. Travel agents are able to use the information provided by these systems to advise customers about flights and fares, make reservations, write tickets, and issue boarding passes.

Two factors are primarily responsible for the increasing role of CRSs in the air travel industry. First, airline deregulation has prompted a proliferation of fare and service offerings. Computers are the most efficient way this vast amount of rapidly changing information can be made available to travel agents and the traveling public. Second, computer technology has continued to develop at a rapid rate, thereby increasing the capability of computers to store, process, update, and retrieve the large amounts of data contained in CRSs quickly and efficiently.

The CRS industry in the United States is composed of five major systems. American Airlines owns the SABRE system; the Covia Corporation, a subsidiary of the Allegis Corporation, which also owns United Airlines, markets APOLLO<sup>1</sup>; SYSTEMONE Holdings, a subsidiary of the Texas Air Corporation, which owns Eastern Air Lines and Continental Airlines, owns SYSTEMONE (formerly SODA); the PARS Marketing Corporation, which is owned by Trans World Airlines and Northwest Airlines, owns and markets PARS; and Delta Air Lines owns the DATAS II system.

The CRS vendors participate in two basic markets. In one market, the vendors provide reservation services for the airlines, hotels, car rental companies, and other firms that participate in their CRSs. Airline and non-airline participants agree to pay a fixed fee for each reservation booked. In the other market, the vendors provide equipment, training, and support services to travel agents and other subscribers, for which vendors charge monthly or annual fees. Contracts between vendors and subscribers and between vendors and participating airlines specify these services, the fees charged, and the terms governing vendors' relationships with participants and subscribers.

Since the early 1980s, public policy makers have been aware that CRSs and their vendors' business practices may influence the structure and performance of the airline industry. Chapter II reviews previous studies on the CRS industry, which concluded that the vendors exercised market power, and that they used this power to affect airline competition adversely. For example, it is generally believed that flights ranked closer to the top of the CRS display are suggested to consumers more often by travel agents and

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<sup>1</sup> The Allegis Corporation recently announced its plan to sell 50 percent of APOLLO to USAir, British Airways, Swissair, KLM, and Alitalia.

selected by consumers more frequently than lower-ranked flights. Since vendor airlines ranked their own flights higher on these displays, they gained a competitive advantage over rival air carriers. Biased screen displays and other allegedly anticompetitive practices resulted in the Civil Aeronautics Board (CAB) issuing rules in 1984 to govern airline-owned CRSs.

Despite the issuance of the CRS rules, controversy about the effect of CRSs on airline competition has not abated. A major point of contention is the level of booking fees -- fees that are paid by airlines to the vendors each time a travel agent uses a CRS to book a reservation. Non-vendor airlines argue that these fees are excessive, while the vendors respond that the fees are reasonable and below the cost a participating airline would incur to provide similar services internally. Given the complexity and arbitrary nature of apportioning various CRS-related costs, a 1985 Department of Justice (DOJ) study was unable to conclude whether the booking fees charged by the vendors were above competitive levels. The 1985 DOJ report did find that the vendors still possessed market power, although they were no longer able to exercise this power through display bias.

A 1986 study prepared by the General Accounting office (GAO) called upon the Department of Transportation (DOT) to study the extent to which the CRS vendors obtain incremental revenues and whether booking fees charged by vendors were above competitive levels. A major objective of this study is to estimate vendor revenues, costs, and the financial benefits of CRS ownership in order to shed light on the reasonableness of their booking fees.

In response to the concerns raised by several members of Congress and various parties in the aviation community, the DOT issued an Information Directive (Order 87-2-1) on February 2, 1987, requiring the CRS vendors to provide the Department with information, data, and analyses bearing on their CRS-related costs and revenues, incremental revenues, market shares, and liquidated damages clauses in their subscriber contracts. This study is based largely on that information.

Chapter III discusses the structure of the CRS industry. During 1986, American Airlines' SABRE was the largest vendor, with 35.1 percent of travel agency locations (42.9 percent of air travel revenues booked through a CRS); Allegis's APOLLO had 26.4 percent of agency locations (32.4 percent of industry revenues); Texas Air's SYSTEMONE had 17.3 percent of agency locations (9.6 percent of industry revenues); TWA/Northwest's PARS had almost 13 percent of agency locations (10.4 percent of industry revenues); and Delta's DATAS II had eight percent of agency locations (and 4.9 percent of industry revenues). In 1986, approximately 94 percent of all travel agencies subscribed to only one CRS. Eighty percent of all travel agency locations operated fewer than six CRS terminals. SABRE and APOLLO agencies were, on average, larger than agencies that used other reservation systems.

The vendors incur substantial expenses to convert agents from other systems or to ensure that subscribers continue to use their systems. In the last few years, the smaller vendors -- particularly SYSTEMONE and DATAS II -- have devoted considerable resources to automating previously non-automated agencies and to converting agencies that use another vendor's CRS. Of the

24,693 agency locations at the end of 1986, 8,022 had renewed their contracts during the year, 3,978 were newly automated during the year, and 1,107 had converted from the use of one CRS to another.

Chapter III also discusses the nature of entry barriers in the CRS industry. While the financial commitment necessary to enter the CRS industry is not so large as to preclude entry by itself, the substantial sunk costs that would have to be incurred to develop a competitive CRS, the economies of scale and scope that the largest vendors appear to enjoy, and the time and expense it would take to acquire a critical mass of subscribers reduce the likelihood of entry into the CRS industry. This is particularly true for non-airline potential entrants. The fact that CRSs evolved from airline internal reservation systems and the benefits that airlines derive from a CRS make it unlikely that a non-airline will attempt to enter the CRS market in the future.

Chapter IV presents our estimates of the financial benefits an air carrier receives from owning a CRS. Two types of measures of these financial benefits are developed. The first is the economic rate of return, which is the most accurate method for evaluating these benefits. The economic rate of return is defined as the discount rate at which the present value of the sequence of future returns generated by an investment equals the outlays entailed in making the investment. The second measure is the traditional accounting return on investment, which suffers from serious conceptual and technical limitations but which still conveys important financial information once appropriate adjustments are made to the data.

The financial benefits received by the airline owner of a CRS consist of four components: (1) the booking fees it charges airline and non-airline participants; (2) the fees it receives from travel agents and others who subscribe to its CRS; (3) the value of reservation services the CRS and its network of subscribers provide to its owner's airline operations; and (4) any increase in the earnings of the airline's passenger-carrying operations that result from travel agents' use of its CRS.

A major financial benefit a vendor airline receives from its investment in a CRS is the increase in the number of passengers that travel on its flights as a result of travel agents' use of its reservation system. In fact, CRSs were developed to enhance the financial viability of their airline owners' passenger-carrying operations. Some CRS systems originally did so by presenting travel agents with rankings of flight alternatives that displayed the owner airline's flights more prominently. By biasing the presentation of information on flight alternatives on the computer displays used by CRS-equipped travel agents, it is commonly believed that vendor airlines were able to divert passengers to their own flights from those operated by competitors.

The CAB sought to eliminate carrier-specific display bias with its 1984 CRS rules, and the vendors' responses to the Department's CRS Information Directive indicate that bias has been eliminated. Accordingly, our estimates of the financial benefits accruing to vendor airlines from their ownership of CRSs include the estimated value of increased passenger volumes from display bias only through November 1984, when the CAB's rules became effective.

Travel agents may also have been induced to book more passengers on a CRS-owning airline's flights as a result of that airline's maintenance of supportive business relations with its network of subscribers. This "halo effect" may persist even in the post-rule environment. A travel agent may choose to affiliate with a particular CRS vendor for a variety of reasons: one vendor airline may be preferred by many of the agent's customers (perhaps because of its presence in the market where the agent is located), the agent may judge a particular system to have superior performance, or the financial benefits offered to the agent to affiliate with a system may be greater.

The increase in airline ticket revenues a CRS-owning airline receives from increased passenger bookings on its flights by travel agents is referred to as "incremental revenues." Incremental revenues are the added revenues an airline receives from increases in passenger volumes on its flights due to both display bias (during the pre-rule period) and whatever halo effect is created by its relations with travel agents who subscribe to its CRS.

Estimating the value of this component of an airline's return on its CRS investment also requires estimating the fraction of any incremental revenues that is translated into higher airline earnings. If these additional passenger volumes serve to raise load factors on existing flights, and can thus be accommodated at little additional cost, then a substantial fraction of any incremental revenues may be reflected in higher airline earnings. However, if these additional passenger volumes are sufficiently large or distributed over airlines' route networks and schedules so as to require additional flights to accommodate them, the contribution of incremental revenues to airline operating profits may be much more modest.

The most common estimate used by the vendor airlines is that 80 percent of these incremental revenues results in increased operating earnings. This figure implies that airline managers believed that any additional airline traffic generated by automating travel agents with its CRS could be accommodated with existing airline capacity, and thus at little additional cost. When CRSs were first developed, this assumption may have been realistic. However, the large numbers of passengers that vendors later estimated were being diverted to their airline owners' flight by travel agents equipped with their CRSs would almost certainly have affected their aircraft investment decisions and thus the cost of transporting these incremental passengers. If so, the 80 percent figure may overestimate the financial benefit to an airline from the diversion of large numbers of passengers from competitors' flights to its own flights through the CRS. Thus, while we employ vendors' own estimates of the fraction of these increased passenger revenues that are reflected in increased airline operating profit, we also examine the sensitivity of the resulting measures of CRS financial benefits from this source to more conservative estimates of this fraction.

In order to produce estimates of incremental revenues accruing to CRS-owning airlines that are both conservative and consistent among vendors, we use their internal analyses to measure incremental revenues assuming that agents equipped with each vendors' CRS would otherwise remain non-automated. This approach produces smaller estimates of incremental revenues than would the



assumption that agents would have been automated by a rival CRS vendor if they had not chosen to affiliate with the vendor in question. Under the latter assumption, the estimated size of incremental revenues generated by any one CRS would be larger, since it would include airline passenger revenues that would otherwise be lost to a rival vendor airline. Nevertheless, when most of the internal studies of incremental revenues reported by vendors were conducted, it was apparently assumed that if a vendor did not automate a particular agent, that agent would continue to operate without any CRS.

Both the estimated financial contribution by each CRS to its airline owner and the estimated returns on that airline's CRS investments, which incorporate this contribution, reflect the hypothetical existence of only this pro-host CRS influence. Thus, what these incremental revenues measure is the advantage a carrier derives by reason of the halo effect flowing from its ownership of a CRS, in comparison to its competitive position if the agents it has automated were not automated. Where multiple airline-owned CRSs operate, each vendor's contribution is offset in varying degrees by whatever bias and halo-generated influences on booking patterns are exercised by travel agents equipped with competing systems. Thus, the sum of each CRS's separate contributions to the earnings of its owner airline cannot be interpreted as an increase in the domestic airline industry's total earnings stemming from the existence of five airline-owned CRSs. Similarly, it is improper to interpret the reported cash flows for the five systems as an estimate of the rate of return on investment for the "CRS industry," since their simultaneous pro-host influences on their respective subscribers' booking patterns would in varying degrees offset one another. Finally, these estimates of the financial benefits of CRS ownership should not be used to determine the value of any particular system to potential non-airline owners if vendors were required to divest their systems, since a non-airline owner could derive no incremental airline passenger revenues from its ownership of a CRS.

In Chapter V, we assess the relationship of the fees charged to the costs incurred by the vendors for services provided to subscribers and participating airlines. Participating airlines' ability to influence the level of bookings fees charged by the vendors appears to be limited because non-CRS owning airlines have no mechanism to influence their passengers to patronize travel agents equipped with CRSs that charge lower booking fees, or to persuade travel agents to equip themselves with such systems. Thus, while airlines (and ultimately consumers) pay the booking fees imposed by vendors, travel agents choose which CRS they will use to generate passenger bookings on those airline flights.

Based on our estimates of the economic costs of providing reservation and subscriber services under alternative allocations of joint costs, it appears the vendors recover approximately 80 to 85 percent of subscriber-related costs from agents. The largest vendors, however, charge participating airlines booking fees that appear to exceed their costs for providing reservation services. Under the most likely allocation of joint costs, SABRE, APOLLO, and SYSTEMONE appear to charge participating air carriers roughly twice their average unit cost per passenger segment booked.

## II. PREVIOUS STUDIES OF THE COMPUTER RESERVATION SYSTEMS INDUSTRY

### A. Introduction

Since the early 1980s, public policy makers have been aware that airline-owned CRSs have the potential to influence competition in the airline industry. This report builds upon past efforts to understand the role of CRSs in the air travel industry and their influence on airline competition. This chapter is not intended to provide the reader with an in-depth review of past studies on the CRS industry. Its goal, rather, is to acquaint the reader with the principal findings of earlier studies and to describe the federal regulations that now govern airline-owned CRSs.

A computer reservation system consists of a periodically updated central database that is accessed by subscribers (primarily travel agents) through computer terminals.<sup>1</sup> CRSs provide subscribers with up-to-date information on airline fares and services and allow them to make reservations and issue tickets.<sup>2</sup> Travel agents generally lease the necessary computer terminal and ticketing equipment from a vendor, thereby establishing a contractual relationship between the vendor and the subscriber. There is also a contractual relationship between the vendor and each airline that chooses to have information about its services and fares displayed in that vendor's CRS.

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<sup>1</sup> The major component of a CRS is one or more mainframe computers that process messages received from travel agents, city ticket offices, and the airlines' internal reservation personnel. These messages are relayed to the central computer. By prompting a computer terminal keyboard, the user is able to review up-to-date information on air fares, rules, schedules, seat availability, and certain non-airline services, such as rental cars or hotel rooms.

<sup>2</sup> Beginning in the late 1960s, several airlines began investing substantial amounts of money to acquire the computer hardware and to develop the software that would upgrade their internal reservation systems and allow them to manage larger and more complex data bases. These systems soon became an indispensable management tool -- essential for operating the airline and for acquiring detailed information about the airline marketplace. It was also becoming apparent that travel agents could benefit significantly from greater automation; accordingly, the American Society of Travel Agents began to take an active role in promoting the development the development and diffusion of computer technology for the travel industry.  
(footnote continued on next page)

The CRS industry is composed of five major systems -- SABRE, APOLLO, PARS, SYSTEMONE, and DATAS II. These systems are owned by several large air carriers -- American, United, TWA/Northwest, Continental/Eastern, and Delta.<sup>3</sup> Two factors are primarily responsible for the increasing role of CRSs in the air travel industry. First, airline deregulation brought forth a proliferation of fare and service offerings. Computers are really the only way this vast amount of rapidly changing information can be made available in a cost-effective manner to agents and the traveling public. Second, rapidly developing computer technology has increased the capability of computers to store, process, update, and retrieve large amounts of data quickly and efficiently.

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(footnote 2 continued)

Between 1967 and 1976, there were several attempts to develop and market a neutral, industry-wide CRS. However, because of insufficient participation by some airlines, a lack of funding, and the concerns that were raised by the DOJ and the CAB over potential anticompetitive behavior, an industry system was never developed. In 1967, for example, the Donnelly Official Airline Reservation System ("DOARS") was established; it failed because of a lack of financial support. In 1969, the Automated Travel Agency Reservation System ("ATARS") was formed by several carriers, but was subsequently challenged by DOJ because the project was structured in such a way as to raise antitrust concerns. (The ATARS project also gave rise to a CAB investigation on the competitive implications of an industry-wide CRS.) The Joint Industry Computerized Reservation System (JICRS) was the third attempt to develop an industry system. After United Airlines and American Airlines announced their intentions to market their proprietary systems, this project also failed. Finally, in 1979, the CAB approved an agreement among 12 airlines, the American Society of Travel Agents, and American Express to develop the multi-access reservation system (MAARS). Because the CAB refused to grant the parties antitrust immunity, however, the group subsequently disbanded.

<sup>3</sup> Several CRSs operate under corporate subsidiaries. SYSTEMONE Holdings, a subsidiary of the Texas Air Corporation, which includes Continental Airlines and Eastern Air Lines, markets SYSTEMONE (or SODA). The Covia Corporation, which markets APOLLO, is a wholly owned subsidiary of the Allegis Corporation, (formerly UAL, Inc.). However, Allegis has announced plans to sell APOLLO to a joint venture, Covia Partnership, in which Covia Corporation will retain a 50 percent interest. USAir, Swiss Air, KLM Royal Airlines, and Alitalia will divide the other 50 percent. PARS is marketed by PARS Travel Information Systems, which operates as a separate corporate entity and is owned by Trans World Airlines and Northwest Airlines. The largest CRS vendor, SABRE, is controlled by American Airlines. DATAS II is owned by Delta Air Lines.

Travel agents value CRSs because they increase their productivity and lower the costs of doing business. The benefits of operating CRSs are overwhelming. It is generally believed that more than 95 percent of all agents are now automated.

The following section reviews the CAB's 1983 Advance Notice of Proposed Rulemaking (ANPRM). This ANPRM sought comments as to whether regulation of the CRS industry was necessary to preserve competition among air carriers. The next section reviews the Department of Justice's (DOJ's) response to this rulemaking proceeding. Following this, the rules promulgated by the CAB to govern CRS operations and vendor practices are reviewed. With the abolition of the CAB, the Department of Transportation (DOT) is now responsible for the enforcement of these rules. Next, we review a December 1985 study prepared by the DOJ on the CRS industry. Finally, we review a May 1986 report prepared by the General Accounting Office (GAO) on the CRS industry, as well as the events that led up to the DOT undertaking this study.

#### B. The CAB's Proposal to Conduct An Informal Rulemaking

On September 9, 1983, the CAB issued an ANPRM requesting comments on the need for federal action and the nature of appropriate remedial rules to deal with the alleged competitive problems arising out of the CRS vendors' business practices.<sup>4</sup> The ANPRM discussed four ways in which CRSs appeared to influence airline competition: (1) carrier identity was one factor used to rank flight information on computer displays; (2) the terms, conditions, and fees imposed by the vendors on participating airlines were alleged to be unreasonable and discriminatory; (3) the vendors allegedly delayed loading into their CRSs critical information regarding their competitors' flights in order to gain an unfair competitive advantage; and (4) the vendors' prior access to competitors' marketing information provided them with an unfair competitive advantage.

Carrier identity was one of several criteria used by vendor airlines to rank their flights on computer displays, and CRS-owning airlines accorded their own flights a higher ranking on their CRSs. Since flights listed closer to the top of the first screen are believed to be suggested more frequently by travel agents and chosen more frequently by travelers, preferential ranking can provide a vendor airline with a competitive advantage. Such systematic display preference ("bias") interferes with the efficient functioning of air travel markets. If a competing airline whose flights are subject to such bias does nothing, it will lose business to the vendor airline. If it

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<sup>4</sup> EDR-466 (September 9, 1983), 48 Fed. Reg. 41171 (September 14, 1983).

chooses to counteract this misinformation, it must expend additional resources (e.g., through advertising or the payment of incentive commissions to travel agents), raising its costs and thereby making it less competitive.

The major vendors did not deny that their display screens were biased; instead, they argued that display bias was appropriate given the large financial risks they assumed to develop these systems. These vendors also alleged that display bias could be overcome relatively easily (e.g., by non-vendor airlines paying additional commissions to travel agents). In addition, most vendors argued that bias was relatively minor -- that is, it did not significantly influence the display position of flights and could be easily overcome by agents.

The terms and conditions the CRS vendors exacted from other airlines for access to their systems were also a matter of concern. For example, the fees imposed by the vendors for each flight segment booked varied, often significantly, among air carriers serving the same markets. Without offsetting cost differences, different prices for similar services are usually viewed as discriminatory and are indicative of market power. It was, moreover, alleged that vendors sometimes denied co-host status (i.e., a contractual arrangement to give another air carrier enhanced display or other services) to airline rivals because they competed with vendor airlines in important air travel markets.

It was also alleged that the vendors sometimes delayed loading information about changes in competitors' fares and schedules into their CRSs. Consumers were thereby denied up-to-date information about alternative flights, fares, and services. The CAB was also concerned about the vendors' ability to use marketing information from scheduled bookings to achieve an unfair competitive advantage.

The structure of the CRS industry, according to the CAB, served to preserve the vendors' market power. At the national level, the CRS industry was concentrated, while concentration was even higher in important regional markets. Entry barriers were also judged to be substantial: the cost of developing a reservation system *de novo* was great; moreover, the importance of incremental revenues (i.e., additional airline revenues that result because an agent adopts the vendor airline's CRS in lieu of another system) earned by the CRS vendors, and the fact that most travel agents were already automated and had signed exclusive, long-term contracts with established vendors, made it difficult for potential entrants to develop the necessary networks of travel agent subscribers. In its ANPRM, the CAB sought information on the CRS industry and suggestions as to how the competitive and consumer-related issues it had identified could be resolved.

### C. DOJ's Comments in Response to the ANPRM

In response to the CAB's ANPRM, the DOJ provided a comprehensive overview of the CRS industry and the competitive consequences of vendor practices.<sup>5</sup> The DOJ's analysis focused largely on the business practices of the two major CRS vendors, SABRE and APOLLO. The DOJ concluded that CRS vendors had market power, that certain vendor business practices had adversely affected competition in the airline industry, and that regulations were necessary to govern these systems in order to protect airline competition.

From its analysis of the CRS industry's structure, the DOJ found a high level of market concentration; indeed, the four largest vendors collectively accounted for 84 percent of domestic air travel revenues booked by travel agents.<sup>6</sup> In its analysis of important air travel markets, the DOJ found that one or two reservation systems were often dominant: SABRE had a market share of 40 percent or more in 17 large urban markets, APOLLO had a similar market share in 10 markets, and PARS was the dominant vendor in four major markets. The DOJ also found that one or two CRSs dominated many of the 233 smaller metropolitan areas it examined. According to the DOJ:

The regional strength of a CRS enables that CRS to exercise market power over carriers that seek to serve passengers in that region. In many urban areas, competition among CRSs is not likely to protect airlines from the exercise of market power. A carrier with a substantial number of flights serving a major area has little choice but to purchase access to each CRS to which a major share of the travel agents in a region subscribe. If it is not listed in any such CRS, a sizeable block of agents in the area simply will not book flights on the carrier. No carrier can afford to give up the chance to sell tickets to the customers of

<sup>5</sup> Comments and Proposed Rules of the Department of Justice Before the Civil Aeronautics Board, November 17, 1983, and Reply Comments of the Department of Justice, December 16, 1983.

<sup>6</sup> At the time DOJ prepared its analysis, there were six CRS vendors. Using data for the last two quarters of 1982 and the first two quarters of 1983, DOJ estimated that 43 percent of domestic air travel revenues generated by travel agents was booked on SABRE, 27 percent was booked on APOLLO, 10 percent was booked on PARS, four percent was booked on SODA (now SYSTEMONE), two percent was on DATAS II, and two percent was booked on Tymshares' MARS PLUS. Eastern has since acquired the MARS PLUS contracts. At that time, an estimated 12 percent of domestic air travel revenues was booked by non-automated agents.

the agents booking a large portion of the revenues in a region it serves.

Like the CAB, the DOJ concluded that significant economic barriers discouraged new entry into the CRS industry. For instance, the ability of a vendor carrier to earn substantial incremental revenues from the placement of its CRS with travel agents made it unlikely that a non-airline CRS vendor could provide these services at a profit:

Incremental revenue opportunities enable carriers who market CRS systems to price their CRSs to agents below costs and still profit from offering their CRSs. American and United can offset insufficient revenue from agents by incremental revenues from diverted passengers and thus earn an immediate return on their investment. A new or expanding CRS vendor trying to convince travel agents to switch away from SABRE and APOLLO must offer prices at least competitive with SABRE and APOLLO. If the charges by SABRE and APOLLO do not cover the systems' costs, however, it will be difficult for a new entrant to cover its costs solely from revenue earned by charging the agents.<sup>8</sup>

Also, the exclusivity and duration of CRS contracts with travel agents made it difficult for other vendors -- either potential entrants or existing vendors -- to sign up subscribers. Understandably, travel agents were also reluctant to incur the substantial start-up costs of switching CRSs.

In its Comments, the DOJ also showed how the vendors could disadvantage competitors -- by biasing flight displays, establishing fees that were above competitive levels, and manipulating information about a competitor's flights and fares. The DOJ's Comments provided evidence that the ranking of flights on a computer display had a direct effect on sales for air transportation.<sup>9</sup> The vendor airlines, moreover, had the technical capability to bias flight information on a market-by-market basis. Therefore, a vendor airline which biased the ranking of flights on the screen in its favor was able to divert passengers away from its competitors,

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<sup>7</sup> DOJ Comments, 44.

<sup>8</sup> DOJ Comments, 50.

<sup>9</sup> According to DOJ: "In a December 1981 analysis, American Airlines determined that 53 1/2 percent of all SABRE sales come from the first line of the first screen displayed, and almost 92 percent of all sales come from the first screen." DOJ Comments, 81.

thus capturing substantial incremental revenues. The DOJ also found that excessive booking fees raised competitors' costs; and the manipulation (or suppression) of information on flights, fares, and services placed rivals at a competitive disadvantage. Overall, the most important effect of these examples of market power was to deter potential airline rivals from competing against vendor airlines in certain markets.

In its Comments, the DOJ provided detailed information on how United and American exercised market power through the provision of CRS services. For instance, for a period of several months in late 1981 and early 1982, American deleted information on its SABRE system about certain Continental Airlines "supersaver" fares; Frontier Airlines, a major competitor of United, was denied co-host status in the APOLLO system, which resulted in its flights receiving an inferior display ranking; and American listed New York Air's flight far down on the SABRE display after that carrier began serving the New York-Detroit market in competition with American.

With regard to the access fees charged by the vendors, the DOJ concluded that "... prices were neither determined by costs nor significantly constrained by competition from other CRSs."<sup>10</sup> The DOJ also found that the major CRS vendors engaged in discriminatory pricing: air carriers that competed against a vendor airline were sometimes charged higher fees to have information about their services displayed in that vendor's CRS.

The DOJ recommended that the CAB adopt rules to limit display bias and rules to assure that all actual and potential CRS vendors have full access to all other vendors' flight information. The DOJ recommended against the CAB's adoption of a pricing rule, arguing that such a rule could undermine the CAB's efforts to eliminate display bias.<sup>11</sup>

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<sup>10</sup> DOJ Comments, 131.

<sup>11</sup> The DOJ was concerned that the CAB's proposed pricing rule -- unlimited but nondiscriminatory fees -- would encourage vendors to raise their access fees significantly. If a carrier chose not to pay these higher fees, under the CAB's proposed rules, vendors were free to impose display bias against that carrier.



#### D. The CAB's Rules Governing CRSs

Shortly before the CAB's remaining regulatory functions were transferred to the DOT, it promulgated rules to govern the operation of airline-owned CRSs offered to travel agents.<sup>12</sup> These rules are listed in Appendix I. In adopting the rules, the CAB sought to alleviate unfair competitive practices, while avoiding any unnecessary intrusion on the vendors' freedom to continue to improve their systems and profit from their investments. The major provisions of the rules are:

- o The criteria by which flights are ranked in primary displays are to be constructed on the basis of objective, unbiased, and published criteria.<sup>13</sup>
- o In ranking flights, the vendors cannot use any factors relating to carrier identity.
- o Participation in the various CRSs must be open to all carriers.
- o A minimum of nine alternative connecting points must be considered upon participants' request in constructing itineraries, and these connecting points must be selected by objective criteria.

<sup>12</sup> 14 CFR Part 255, 49 Fed. Reg. 32540, August 15, 1984. The final rules became effective on November 14, 1984. The CAB had adopted the rules under its authority under section 411 of the Federal Aviation Act of 1958, 49 U.S.C. 1381. Section 411 granted the CAB (now DOT) the authority to prohibit unfair or deceptive methods of competition. United Airlines sought review of the CAB's rules on the grounds that section 411 did not authorize the CAB to regulate unfair and deceptive methods of competition, that the CAB could not adopt CRS rules without first holding a formal hearing, and that the CAB had no rational basis for regulating such CRS vendor practices as bias, discriminatory fees, and discrimination against carriers sharing the same two-letter designator code. Other parties expressed concerns over other aspects of the CAB's rules. On July 31, 1985, the Seventh Circuit Court of Appeals (in United Airlines, et al. vs. CAB, 766 F.2d 1107 (7th Cir. 1985)) unanimously affirmed the CAB's rules.

<sup>13</sup> Since the CAB was concerned that travel agents have access to unbiased information, the rules applied only to primary displays. Additional displays, such as the vendors' internal reservation systems, could remain biased. The DOJ argued that by limiting the rule to primary displays, the CAB created an incentive for the vendors to encourage agents to use alternative displays, which is what occurred. Shortly after the rules went into effect, the major vendors introduced a "switch" on their CRSs that made it easy for agents to access a biased secondary screen. The DOT resolved the secondary screen problem by voluntary agreement with each vendor, not by a new rule.

Nor did the DOJ endorse new rules to govern other aspects of the CRS industry. Given the difficulties of establishing "reasonable" prices and the adverse efficiency consequences that often result from detailed price regulation, the regulation of access fees was viewed as undesirable. The DOJ also argued "...that the costs of the various divestiture alternatives are very high, and the possibility of service disruption is great."<sup>21</sup>

#### F. 1986 GAO Report on the CRS Industry

In March 1985, United Airlines and American Airlines presented their estimates on the profitability of their respective CRSs before the Subcommittee on Aviation, Senate Committee on Commerce, Science, and Transportation. United estimated that for the period 1975 to 1987, it would earn an internal rate of return of five percent on its APOLLO system.<sup>22</sup> American estimated that SABRE would earn an internal rate of return of 18.8 percent between 1976 and 1990. American and United argued that such rates of return were consistent with what firms in other industries earned for investment projects of similar risk.

Shortly after these profitability estimates were presented, several non-vendor airlines commissioned a study to review American's and United's profitability estimates.<sup>23</sup> This study concluded that because they failed to account for incremental revenues and certain cost savings, American's and United's estimates were seriously understated. Based on an alternative methodology and different revenue and cost assumptions, the contractor study concluded that United's and American's internal rates of return were, respectively, 160.5 percent and 65.7 percent.<sup>24</sup>

In an effort to resolve these differences, Senator Kassebaum and Congressmen Mineta and Hammerschmidt requested that the GAO review the various CRS

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<sup>21</sup> Report, 75.

<sup>22</sup> The internal rate of return is the discount factor that reduces to zero the net present value of the cash flows associated with an investment project.

<sup>23</sup> William J. Duffy, Analysis of American's and United's Statements Regarding the Profitability of SABRE and APOLLO, Simat, Helliesen, and Eichner, May 1985.

<sup>24</sup> The Duffy study also used net income to calculate the vendors' rate of return on their CRS-related investments. By contrast, the vendors based their profitability calculations on net cash flow, which is the accepted methodology for calculating an investment's profitability or rate of return.

profitability analyses in order to assess the profitability and the competitiveness of the CRS industry.<sup>25</sup> In brief, the GAO

... found that the CRSs are more profitable than estimated by United and American, primarily because their analyses did not include revenues from additional ticket sales due to their ownership of CRSs (called incremental revenues). However, a study sponsored by non-CRS-owning airlines probably overstates profits, and we believe the available data are insufficient for us to develop our own profitability estimate.<sup>26</sup>

The GAO called upon the DOT to study (1) the extent to which CRS vendors obtain incremental revenues, and (2) whether CRS booking fees are above competitive levels.

In a May 21, 1986, letter to former Secretary of Transportation Elizabeth Hanford Dole, Senator Kassebaum and Congressmen Mineta and Hammerschmidt requested that the Department study these issues. At the direction of Secretary Dole, Departmental staff met informally with interested parties during the summer of 1986 to discuss the feasibility of conducting the requested study. On October 9, 1986, Secretary Dole informed Senator Kassebaum and Congressmen Mineta and Hammerschmidt that the Department would study the state of competition in the CRS industry. On February 2, 1987, the DOT issued an Information Directive (Order 87-2-1) requiring the airline vendors of computer reservation services to provide the Department with information, data, and analyses bearing on their CRS costs and revenues, incremental revenues, market shares, and liquidated damages clauses in their subscriber contracts. This study is largely based upon the information provided to DOT by the CRS vendors.

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<sup>25</sup> United States General Accounting Office, Airline Competition: Impact of Computerized Reservation Systems, Washington, D.C., May 1986.

<sup>26</sup> GAO Report, 1-2.

### III. THE COMPUTER RESERVATION SYSTEMS INDUSTRY: AN OVERVIEW

#### A. Introduction

This chapter describes the CRS industry. Section B presents information on the size of the industry and the vendors' relative market shares. Section C discusses the nature of barriers to entry into the CRS industry. Section D describes the most important service features of CRSs. Section E describes the relationship between CRS vendors and travel agents. (The contractual relationships between vendors and agents, especially the liquidated damages provisions in agency contracts, are discussed in Chapter VI.) Finally, Section F describes the commercial relationship between vendors and airlines that choose to have information about their flights displayed in a CRS.

#### B. The Structure of the CRS Industry

Market structure is a term that describes the environment within which firms conduct their business. An industry's structure is influenced by the number and relative sizes of the firms in the industry, the nature and extent of entry barriers into that industry, the industry's basic technological conditions, and the demand for the good or service being produced.

Table 3.1 presents information on the number of travel agencies using a CRS, domestic air transportation revenues booked through CRSs, terminals in operation, and passenger segments booked by CRS-equipped travel agents. In 1986, CRSs were being used at 24,693 U.S. travel agency locations. Travel agents booked \$21.6 billion in domestic air transportation at these locations. (From the data provided to the Department by the CRS vendors, it was impossible to estimate the number of non-automated agencies, although it is generally believed that more than 95 percent of agencies are now automated.) SABRE is the largest CRS vendor; it was the primary vendor (i.e., the greatest number of bookings was made through a SABRE terminal) at 35 percent of all agency locations during 1986. Almost 43 percent of domestic air transportation revenues booked through a CRS was booked through SABRE, and almost 41 percent of terminals in operation were SABRE terminals. APOLLO was the second largest vendor, accounting for 26 percent of CRSs located at travel agencies, 32 percent of domestic air transportation revenues booked through a CRS, and 27 percent of all CRS terminals in operation.<sup>1</sup>

<sup>1</sup>According to Travel Weekly (December 10, 1987), at the end of 1987, there were 34,684 agency locations operating 152,547 terminals. SABRE's market share of locations was 34 percent (36.9 percent of terminals and 39.2 percent of bookings), APOLLO had a 24.5 percent market share (27.5 percent of terminals and 25.8 percent of bookings), SYSTEMONE had an 18 percent market share (15.9 percent of terminals and 15 percent of bookings), PARS had 14.5 percent of locations (12.5 percent of terminals and 14.6 percent of bookings), and DATAS II had nine percent of locations (and 7.2 percent of terminals and 5.4 percent of bookings). To the best of our knowledge, Traffic Weekly solicited this information directly from the vendors.

TABLE 3.1

COMPUTER RESERVATION SYSTEMS: MARKET SHARE DATA  
(INCLUDING SATELLITE TICKET PRINTERS)  
CALENDAR YEAR 1986<sup>1</sup>

CRS Vendors	AGENCY LOCATIONS <sup>2</sup>		REVENUE (\$000)		TERMINALS		SEGMENTS BOOKED (000)	
	Number	%	Amount	%	Total	%	Total	%
SABRE	8,677	35.1%	\$ 9,280,784.9	42.9%	47,339	40.9%	126,358.8	41.3%
APOLLO	6,511	26.4%	7,017,262.9	32.4%	31,446	27.2%	100,612.9	32.9%
SYSTEMONE	4,271	17.3%	2,083,864.0	9.6%	16,820	14.5%	32,199.3	10.5%
DATAS II	2,045	8.3%	1,056,796.4	4.9%	7,856	6.8%	15,462.0	5.1%
PARS	3,189	12.9%	2,208,146.3	10.2%	12,288	10.6%	30,985.4	10.1%
	24,693	100.0%	\$21,646,854.5	100.0%	115,749	100.0%	305,618.2	100.0%

Source: Vendor-supplied data tapes, domestic only; excludes military installations. Revenue data provided by Airlines Reporting Corporation.

1. The computer tapes submitted by the CRS vendors in response to Item 7 of DOT's Information Directive contained a total of 37,527 records. Approximately 7,900 records were eliminated because of invalid agency codes or because the data pertained to international or military installations. Another 2,300 records were eliminated because they contained data errors (e.g., negative bookings). Finally, roughly 660 records were merged because a vendor double counted the number of installations. As a result of these adjustments, the data base contained 26,547 records representing 26,547 installations (i.e., a vendor's equipment at an agency) at 24,693 agency locations. Many of the tables in this chapter, the statistical analysis presented in Chapter V, and the market share statistics presented in Appendix IV were derived from this data base.
2. Some agencies operate more than one CRS. In these situations, we have grouped agencies by vendor based on which CRS was used to make the greatest number of domestic bookings.

Table 3.2 presents information for 1986 on the average number of bookings at all CRS installations that were made for travel on flights operated by the vendor airlines, total bookings, and the average number of terminals operated at these installations. As Table 3.2 indicates, the typical SABRE and APOLLO installation made more bookings than did SYSTEMONE, PARS, or DATAS II installations. This relationship partly reflects the fact that typical SABRE and APOLLO installations were larger, operating an average of 5.2 and 4.6 terminals, respectively.

Table 3.3 presents information on the number of bookings per terminal. It shows that SABRE and APOLLO installations were, on average, more productive (a higher average number of bookings) than were SYSTEMONE, PARS, and DATAS II installations. In addition, Table 3.3 shows that a typical terminal operated at an APOLLO, SYSTEMONE, or DATAS II installation was used to book more segments on the host airline than was the case for a terminal operated at a SABRE or PARS installation.

### C. Entry Into the CRS Industry

Firms exercise market power when they have the ability to raise prices for a good or service or restrict the introduction of new technology because they do not face competition from actual or potential rivals and because consumers lack reasonable alternatives for that good or service. To assess whether a firm has market power, economists evaluate the likely behavior of other incumbent firms and potential entrants if an established firm sought to raise its prices by restricting output (or by producing an inferior product). The ability of potential competitors to constrain the market power of established firms depends on whether there are entry barriers that provide incumbent firms with long-term competitive advantages. Barriers to entry have been defined "... as factors or conditions of the market that give the incumbent firm a persistent advantage over new entrants, so that entrants will not be attracted even though the incumbent earns economic profits."<sup>2</sup> As Fisher *et al.* make clear, however, not every advantage an incumbent firm enjoys should be characterized as an entry barrier. In fact, an entry barrier only exists when an entrant is not able to reproduce an incumbent firm's advantages (whether they be low unit costs, a superior product, or a reputation for excellent service) with an investment, in both time and money, comparable to that made by the incumbent.

<sup>2</sup> Franklin M. Fisher, John J. McGowan, and Joen E. Greenwood, Folded, Spindled, and Mutilated: Economic Analysis and U.S. v. IBM, MIT Press, 1983, 165. In a 1979 article, Fisher states that, "An economically relevant barrier to entry is one in which unnecessary high profits are not bid away by entry. That is, a situation in which society would be benefited by entry but in which the attractiveness of entry from the point of view of society is not the same as the attractiveness from the point of view of the entrant." Franklin M. Fisher, "Diagnosing Monopoly," Quarterly Review of Economics and Business, April 1979, 24.

TABLE 3.2

AVERAGE BOOKINGS IN 1986  
ALL INSTALLATIONS (INCLUDING SATELLITE TICKET PRINTERS) AND  
AVERAGE NUMBER OF TERMINALS PER AGENCY LOCATION

<u>CRS Vendors</u>	<u>Bookings On Host Airline</u>	<u>Total Bookings</u>	<u>Average Number Of Terminals</u>
SABRE	1,941	13,998	5.2
APOLLO	3,349	14,851	4.6
SYSTEMONE	1,581	6,893	3.6
DATAS II	1,370	6,616	3.4
PARS	903	8,292	3.3

Source: Vendor-supplied data tapes.

TABLE 3.3

AVERAGE BOOKINGS PER TERMINAL IN 1986  
ALL INSTALLATIONS (INCLUDING SATELLITE TICKET PRINTERS)

<u>CRS Vendors</u>	<u>On Host Airline</u>	<u>Total Bookings</u>	<u>Percent on Host Airline</u>
SABRE	370	2,669	13.9
APOLLO	722	3,200	22.6
SYSTEMONE	439	1,914	22.9
DATAS II	408	1,968	20.7
PARS	275	2,522	10.9

Source: Vendor-supplied data tapes.

It is also important to recognize that potential entrants are attracted by the possibility of earning economic profits on their investments, i.e., they will seek to enter the industry if incumbent firms are earning a rate of return on their investments that is greater than their cost of capital (adjusted for the level of risk associated with those investments). As described in Chapter IV, it appears that the major CRS vendor airlines have earned substantial financial benefits from their ownership of CRSs, although there has been no new entry into the CRS industry. This suggests, but does not prove, that economic and institutional barriers may have impeded entry into the industry.

There is general agreement among economists that several factors play an important role in determining the degree to which entry barriers reduce the likelihood of entry into an industry and therefore the threat of potential competition.<sup>3,4</sup> The first factor is whether established firms enjoy substantial economies of scale and scope.<sup>5</sup> If established firms enjoy lower unit costs than do potential entrants, then a potential entrant will be at a competitive disadvantage if it attempts to enter the industry. The greater this cost disadvantage, the more discretion established firms have to raise prices above competitive levels. Entry on a large scale is also more likely to encourage established firms to reduce prices once entry occurs, thus making it more difficult for an entrant to become financially viable.

Some economists believe that scale economies do not constitute an entry barrier. Under this line of reasoning, unless incumbent firms operated efficiently (earning no economic profit), a potential entrant could, hypothetically, enter the industry. This argument assumes that it is possible for an entrant to make the investment necessary to enter a market, engage in "hit-and-run" pricing, and, then, exit the market costlessly. These conditions do not exist in the CRS industry.

Table 3.4 presents data that suggest that there may indeed be economies in the provision of CRS services. SABRE and APOLLO appear to enjoy lower unit

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<sup>3</sup> The Department has neither attempted to identify potential entrants into the CRS industry nor queried hypothetical entrants as to what economic factors have influenced their decision not to enter the industry.

<sup>4</sup> Steven C. Salop, "Measuring Ease of Entry," Antitrust Bulletin, Summer 1986, 551-570, and Fisher, et al., 165-191.

<sup>5</sup> Economies of scale exist when a firm's costs increase less than proportionately to an increase in its output. Economies of scope exist when one firm can produce two or more products at a lower cost than can two or more specialized firms. Of course, the concept of economies of scale as an entry barrier -- and therefore its influence on the behavior and performance of incumbent firms -- is only meaningful when such economies are considered in relation to the size of the market. A large market may support numerous firms, all of which enjoy economies of scale, that engage in competitive rivalry.



TABLE 3.4  
APPARENT EFFECTS OF SCALE AND LEARNING ECONOMIES ON CRS EXPENSES

	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>DATAS II</u>	<u>SYSTEMONE</u>
Average 1986 Reported Expense per Booking	\$1.81	\$1.62	\$1.74	\$2.64	\$2.36
Total Reservations Processed During 1986 (millions)	113.3	144.1	46.6	20.3	36.9
Total Years of Commercial CRS Operation Through 1986	11	11	8	5	5
Cumulative Reservations Through 1986 (millions)	545.5	637.1 <sup>1</sup>	108.6 <sup>1</sup>	53.9	81.1 <sup>2</sup>

Source: Estimated from vendors' responses to DOT Information Directive, Items 3, 4, and 13.

1. For period 1980-1986; reservations activity not reported for years prior to 1980.

2. For period 1983-1986; reservations activity not reported for years prior to 1983.

costs than do the smaller vendors. Moreover, the number of reservations processed since SABRE and APOLLO began operating is several times the number processed by DATAS II, PARS, and SYSTEMONE. While these data are by no means conclusive, they suggest that the provision of CRS services may be subject to both scale economies and learning curve effects -- lower unit costs that stem from a vendor's larger scale of operation or from its greater cumulative experience in producing CRS-related services.

A second factor influencing the likelihood of entry is the financial risk that potential entrants face if they are unsuccessful. If an entrant incurs substantial sunk costs -- investments that lose all or a significant portion of their value if the entrant is forced to withdraw from the market -- then it will face greater financial risk and may be more reluctant to enter the industry. Put simply, if a firm is unable to recover the investment it must make to enter an industry, it is less likely that it will attempt to enter the industry. Of course, the longer it takes for an entrant to establish a production, distribution, and marketing network, the greater the financial returns the entrant must earn to make its investment profitable.

Table 3.5 presents estimates of the remaining unamortized value of non-recoverable investments that CRS vendors had made through 1986. While it is impossible to determine before the fact whether a firm's investments would

TABLE 3.5

ESTIMATED UNAMORTIZED VALUE OF NON-RECOVERABLE INVESTMENTS BY  
CRS VENDORS REMAINING AT END OF 1986 (\$ MILLIONS)

<u>Type of Investment</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>DATAS II</u>	<u>SYSTEMONE</u>	<u>PARS</u>
Programming and Other Product Development Costs	\$43.7	\$41.7	\$38.3	NR	NR
CRS Marketing Expenses	59.7	49.1	31.6	24.0	17.8
Subscriber Conversion, Retention, and System Use Incentives	16.4	18.2	19.2	7.1	3.1
Subscriber Training and Support	91.2	89.2	12.6	17.9	NR
Total Non-Recoverable Investment	\$211.0	198.2	\$101.7	49.0	20.9

Source: Estimated from CRS vendors' responses to Information Directive, Items 13 and 16.

NR indicates that the item cannot be estimated from information reported by vendor.

lose all or a significant portion of their value if that firm withdrew from the market, the investments listed in Table 3.5 are indicative of the magnitude of the sunk costs that a potential CRS vendor would have to incur to enter the industry on a significant scale.

Finally, if an entrant faces an absolute cost disadvantage (i.e., the entrant's costs remain a certain percentage above those of established firms, even after taking into account the effect of economies of scale and scope), or consumers display a continued preference for the products or services of established firms despite the fact that the entrant's products have the same quality attributes and are sold at comparable prices, then the entrant will encounter problems in becoming a successful competitor.

To summarize, barriers to entry into an industry are higher when (1) incumbent firms enjoy pronounced economies of scale and scope, (2) a potential entrant faces significant financial exposure and risk, (3) an entrant takes a long time to establish itself in an industry, and (4) an entrant must overcome substantial absolute cost or consumer preference disadvantages.

Several of these potential entry barriers appear to be present in the CRS industry. For example, the computer software that operates CRSs was originally designed to operate the vendor-airlines' internal reservation systems. Accordingly, if a non-airline company sought to enter the CRS industry, it would have to incur substantial expense to develop and test its software, as well as to market its system. If the entrant subsequently failed and was forced to withdraw from the market, it might not be able to recover all of its investment.

Further, while we have not attempted to estimate precisely the cost advantage that established CRS vendors enjoy because of economies of scale and scope, in all likelihood such advantages are not trivial and could be an important entry barrier if an entrant sought to enter the industry at less than minimum efficient size.

Finally, certain provisions of the contractual relationship between vendors and travel agents would make it more difficult for a potential entrant to capture market share without incurring substantial costs to buy agents out of their current CRS contracts -- costs that established vendors generally have not incurred. In addition, a non-airline vendor would not be able to capture incremental airline revenues and would not have the benefit of an internal reservation system capability on which to build a CRS. Also, since there are substantial start-up costs for agents in learning to operate a new CRS, agents would probably not adopt a new system without receiving some financial incentive from an entrant (e.g., discounts on equipment or cash payments). As a result, the entrant would be compelled to incur costs that an established CRS vendor did not incur.

A firm may also engage in strategic behavior to raise a rival's costs, thereby making it less competitive.<sup>6</sup> Such behavior can be directed against other established firms and prospective entrants. To the extent that the vendors' liquidated damages clauses contained in their travel agency contracts exceed the actual damages the vendor would suffer if these contracts were terminated, these clauses have the effect of making it more expensive for a rival vendor to induce an agent to switch systems.

Thus, while the financial commitment necessary to enter the CRS industry is certainly not so large as to preclude entry, the substantial sunk costs that would have to be incurred to develop a competitive CRS, the economies of scale and scope that the largest vendors probably enjoy, and the time and money it would take to acquire a critical mass of subscribers reduce the likelihood of entry into the CRS industry.

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<sup>6</sup> Steven C. Salop and David T. Scheffman, "Raising Rivals' Costs," American Economic Review, May 1983, 267-271.

#### D. CRS Features and Enhancements

The CRS vendors compete vigorously with each other to provide subscribers with state-of-the-art computer software and enhancements.<sup>7</sup> According to the agents contacted during the course of this study, the different CRSs are now closely competitive in terms of their basic service features. Every CRS, for example, informs subscribers about schedules, fares, and seat availability, issues tickets, and records bookings. All the systems, moreover, have advance seat selection capabilities, can issue boarding passes, maintain waiting lists, display preferred airlines (or classes of service), search for the lowest fare or the first available flight, and calculate fares for complex domestic and, to a lesser degree, international itineraries. Appendix II describes the algorithms used by the different systems to rank flights for display to travel agents.

Automated reservation systems also are used to book reservations for other services -- hotel and car rentals, cruises, railways, tours, boat charters, theatre and sporting events, as well as to issue traveler's checks, exchange currency, write insurance, transact duty-free sales, and order flowers. Other functions include the maintenance of information in the computer for general messages or bookings that cannot be processed immediately, telex and telemail, credit card approval, information on weather conditions, ski conditions, visa requirements, and health regulations. Computer reservation systems also store and retrieve information on customers -- their airline, dietary, and seating preferences, as well as their addresses, telephone numbers, and credit card numbers. Booking information can also be combined with stored passenger records so that itineraries can be mailed to clients along with their tickets.

Ordinarily, messages are transmitted between a CRS and the internal computers of participating carriers through the switching system operated by Aeronautical Radio, Inc. (ARINC). Because delays in receipt of messages may be substantial, especially during peak periods, airlines are often forced to anticipate bookings not yet received. In certain circumstances, booking requests may be rejected on the assumption that other travelers are already in the queue for tickets/seats, although these reservations may not yet have been made. Also, seats that show up as "available" on a travel agent's terminal may have already been sold by the time an agent's delayed booking message is received.

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<sup>7</sup> The vendors receive flight-related information from three sources: (1) the Airline Tariff Publishing Company, which collects information on airline fares; (2) the Official Airline Guide, which compiles information on airline schedules; and (3) the airlines' in-house computers, which provide up-to-date information on seat availability. Seat availability is determined by the air carrier, not the vendor. When sales of a particular class of seats reach a level that has been predetermined by an airline, its internal reservation system sends out a "closing" message to all other carriers. If the carrier wishes to sell the last seats, this predetermined level of capacity may be below the actual number of available seats.

To provide the agent with an additional source of information about seat availability, several means of direct, computer-to-computer linkage have been developed as adjuncts to the primary integrated display. One approach is "direct access," which permits travel agents to read seat inventory and other information directly from an airline's internal reservation system. Whenever possible, commands are entered in the CRS control language and automatically translated to the program language used by a particular airline's computers.

Bookings are then recorded in the CRS for subsequent transmission to the reservation computer of the airline on which they were made. Therefore, while the agent is assured of the latest information on seat inventory, it is still possible for bookings to be lost in transmittal or be rejected when they arrive after seats have been sold in the meantime to other travelers. All vendors charge an additional booking fee for direct access participants. Table 3.6 lists direct access participants in each CRS.

While airlines are required to honor bookings recorded by a CRS in which they participate, another enhancement is offered by some CRSs to allow agents to withdraw seats directly from an airline's inventory and receive confirmation from that airline's own internal reservation system. The ability of a system to confirm reservations by reference to an airline's seat inventory is termed "last seat availability." Such "read/write" access is offered by SABRE, APOLLO, and PARS. Direct access functions can and do improve the quality of information that a subscriber obtains on the services of participating airlines. Nevertheless, one CRS vendor has indicated to us that it believes CRSs still provide more comprehensive services and reliable information for bookings on a vendor airline's own flights.

A set of enhancements that is beginning to have an effect in the air travel industry is associated with the new, more powerful personal computers. (Personal computers, and their impact on the CRS industry, are discussed in Chapter VII.) For example, except for PARS, which has adopted the Altos Personal Computer, all vendors have started to promote systems based on the IBM Personal System/2. This computer system will allow agencies the capability to automate functions performed previously by hand or by CRS central processors. Subscribers also will have available the conventional range of microcomputer functions -- accounting software, spreadsheets, word processing, calendar and calculator, notepad, reminder, and data base management capability. APOLLO will soon market a split-screen technology that will permit the flights of three airlines to be displayed in one quadrant; in the other three quadrants information on fares, schedules, and seat availability will be displayed for each of the three airlines.<sup>8</sup>

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<sup>8</sup> A service feature now being offered by all vendors is the placement of remote terminals and ticket printers in the offices of travel agencies' corporate customers. In place of the special code that now must be mastered to operate agency CRSs, these corporate systems will guide the booking process by a "plain-language" menu; reservations will then be queued to travel agents for correction, and the tickets printed in the customer's office.

TABLE 3.6  
PARTICIPANTS IN CRS DIRECT ACCESS  
(As of December 1, 1987)

<u>AIRLINE</u>	<u>SABRE</u>	<u>APOLLO</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
American	H	D	D	D	D*
United	T	H	T	D	D*
TransWorld	T	T	H	D	D
Eastern	T	T	D	H	D*
Delta	T	T	D	D*	H
Continental	T	D	D	D	
Northwest	T	D	H*	D	D
Pan American	T	T	D	D	
USAir	T	T	D	D	D
Piedmont				D	
Alaska Air	T				
Gulf Air	T*				
Rocky Mountain		D			
San Juan		T			
Aspen Air		T			
Westair		T			
Air Wisconsin		T			
British Airways	T	T		D	
Air France	T		D*	D	
Varig	T			D	
Iberia	T			D	
KLM	T	T	D	D	
Canadian Pacific				D	
British Cal.				D	
SAS		D	D	D	
Aer Lingus				D	
Qantas				D	
Argentinas				D*	
Swissair				D*	
Sabena				D*	
Ecuadoriana				D*	
Faucett				D*	
Viasa				D*	
Aeroperu				D*	
Philippine				D*	
Avensa				D*	

Source: CRS vendors.

H = Host  
D = Direct Access  
T = Last Seat or Read/Write Access  
\* = Prospective

### E. The Vendor-Agent Relationship

The advances in computer hardware and software over the past 20 years have enhanced the productivity and effectiveness of travel agents. Before CRSs became an integral part of the travel business, agents were required to search through the Official Airline Guide for flight information, review airline tariff summaries for information on fares, and then telephone an airline to determine seat availability and to confirm other pertinent data. Once the reservation was confirmed, the agent would then write a ticket manually for his or her customer. The legal status of travel agents was governed for many years by the Air Traffic Conference (ATC), an accreditation system that was approved by the CAB and administered by the airlines. The ATC prescribed the conditions under which agents operated and the terms of their compensation; it also established a mechanism for airlines and travel agents to exchange funds. A major feature of the ATC agreement was the "exclusivity" provisions, which prohibited non-ATC accredited agents from selling airline tickets.

After a comprehensive investigation in 1979, the CAB found that many of the ATC's rules governing travel agents were objectionable.<sup>9</sup> The rule that prevented airlines from dealing only with agents that had been accredited by the ATC was discarded, as was the rule that prohibited agents from rebating a portion of their commissions to customers. Even before the investigation was completed, the CAB voted to eliminate fixed, industry-wide commissions. Airlines were also allowed to negotiate discounts, rebates, and commissions directly with firms providing ticketing services, not just travel agents. Today, agents receive commissions based on the value of the tickets they sell; they also receive volume incentives ("override" commissions) from air carriers. Table 3.7 provides information on the commissions paid to travel agents by each major air carrier. Commission expenses for the major airlines totaled \$3.34 billion in 1986, up from \$691 million in 1976. During this period, commission expense increased from 4.4 percent of the major airlines' operating expenses to 8.7 percent by 1986.

Table 3.8 provides information on the number of CRSs subscribed to by travel agencies in 1986. At that time, 93.5 percent of automated travel agencies subscribed to one CRS, while 5.7 percent subscribed to two CRSs, and the remainder (less than one percent) to three or more systems.

Table 3.9 provides information on the average number of terminals operated per agency. In 1986, almost 80 percent of all travel agencies operated five or fewer terminals, another 14.7 percent operated six to ten terminals, and the remaining 5.4 percent operated more than ten terminals.

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<sup>9</sup> The Civil Aeronautics Board, "Investigation into the Competitive Marketing of Air Transportation," Docket 36595, Order 79-9-64.

TABLE 3.7  
TRAFFIC COMMISSIONS

	1976		1986	
	Traffic Commissions (\$000)	Percent of Total Op. Expense	Traffic Commissions (\$000)	Percent of Total Op. Expense
American	76,451	3.8	443,890	8.1
Braniff	26,504	4.3	--	--
Continental	17,863	3.5	160,343	8.4
Delta	50,378	3.4	379,257	8.9
Eastern	69,725	4.0	349,485	7.8
Northwest <sup>1</sup>	86,090	6.2	515,116	11.2
Pan American	128,434	6.3	245,974	7.9
Piedmont	2,887	2.0	93,583	6.2
Trans World <sup>2</sup>	89,389	4.5	266,370	7.4
United	99,621	3.8	677,329	10.1
USAir	12,736	3.0	120,987	7.5
Western	27,205	4.7	88,538	7.2
Total	\$691,710	4.4%	\$3,340,874	8.7%

Source: Airline-submitted Form 41 Schedules.

1. In 1976 commission expenses for North Central, Southern, and Hughes Air West have been included under Northwest; in 1986, commission expense for Republic is included.

2. Includes commission expense data for Ozark.

TABLE 3.8  
DISTRIBUTION OF TRAVEL AGENCIES BY NUMBER  
OF CRSs SUBSCRIBED TO FOR CALENDAR YEAR 1986

<u>Number of CRS Vendors</u>	<u>Agency Locations</u>	<u>Percent Distribution</u>
1	23,090	93.5%
2	1,410	5.7%
3	147	0.6%
4	34	0.1%
5	12	0.05%
Total	24,693	100.0%

Source: Vendor-supplied data tapes. After these tapes were edited and corrected there were 26,547 CRS installations (i.e., a location where a vendor's equipment was being used) and 24,693 agency locations in operation in 1986.



TABLE 3.9  
 DISTRIBUTION OF TRAVEL AGENCIES BY NUMBER OF  
 CRS TERMINALS FOR CALENDAR YEAR 1986

<u>Number of CRS Terminals</u>	<u>Agency Locations</u>	<u>Percent Distribution</u>
1	1,950	7.9%
2	5,602	22.7%
3	5,544	22.5%
4	4,324	17.5%
5	2,287	9.3%
6-10	3,635	14.7%
11-15	679	2.7%
16-25	400	1.6%
26-50	182	0.7%
51-75	50	0.2%
76-100	20	0.1%
Over 100	20	0.1%
Total	<u>24,693</u>	<u>100.0%</u>

Source: Vendor-supplied data tapes. After these tapes were edited and corrected, there were 26,547 CRS installations and 24,693 agency locations in operation in 1986.

The fees charged to travel agents by vendors for the installation and use of equipment are negotiated. Although it is possible to purchase equipment from CRS vendors, subscribers generally lease it. The costs of the lease to the subscriber depends upon the type of equipment operated, the number of terminals, and a host of other factors. Equipment charges usually diminish with multiple units; for example, the installation charge for the first terminal may be \$500, but each additional terminal may cost only \$100. Typically, the vendor will offer a subscriber a choice of terminals, ticket printers, boarding pass printers, and other peripherals. Vendors may also provide agents with personal computers, expansion boards, plotters, converters, cartridges, diskettes, keyboards, modems, and back-office software.

Most vendors appear to devote considerable resources to retaining, recruiting, and converting subscribers to their CRSs. Internal corporate reports gathered in the course of this investigation as well as press reports indicate that the vendors are presently engaged in a "conversion war."<sup>10</sup> The smaller vendors, in particular, have made major commitments to

<sup>10</sup> Nadine Godwin, "DATAS II Banks on Conversions in Bid to Climb in Vendor Ranks," Travel Weekly, April 28, 1987. Delta is described as "... pushing conversions of agencies from other systems with extra vigor."

upgrading the capability of their systems and acquiring new subscribers. In order to convert an agent or to ensure that subscribers continue to use a vendor's CRS, all vendors dispense generous financial inducements to certain agents. In 1986, the vendors made over \$42,000,000 in direct cash payments to their subscribers. The vendors also incurred substantial non-cash obligations, including free travel on the vendor airline, hotel accommodations, seminars, luncheons, equipment discounts, and the free use of equipment. Table 3.10 presents information on these expenses.

TABLE 3.10  
PAYMENTS PROVIDED IN 1986 TO INDUCE AGENTS TO SUBSCRIBE  
OR REMAIN SUBSCRIBERS TO THE HOST'S SYSTEM

	<u>Cash</u>	<u>Non-Cash</u>
SABRE	\$ 2,500,000	\$142,400,000 <sup>1</sup>
APOLLO	6,109,417	3,874,595
SYSTEMONE	3,221,576	185,837 <sup>2</sup>
PARS	30,000,000	1,318,141
DATAS II	697,808	3,938,305
	<u>\$42,518,801</u>	<u>\$151,716,878</u>

Source: Information Directive, Item 16.

1. Up to October 1986. According to SABRE, these non-cash obligations are to be amortized over a five-year period.
2. Includes only free airline tickets to travel agents. Each vendor employs a different method for computing the non-cash expenses it incurs to convert or retain subscribers.

Table 3.11 provides information on the number of agency locations, conversions, newly automated subscribers, and contract renewals. In 1986, 8,022 subscribers renewed their existing contracts, there were at least 3,978 newly automated agency locations, and there were 1,107 conversions.

A travel agent may select a CRS because of the vendor airline's reputation for superior service. In those markets where the vendor airline is the dominant carrier and where travelers -- particularly business travelers -- regard that airline as their first choice, it may make good business sense for the agent to use that airline's CRS. Further, a vendor airline that has a significant air transportation presence in a market is in a position to offer travel agents in that market more valuable inducements -- free travel on the vendor airline, class-of-service upgrades, bonuses for the vendor airline's frequent flyer program, cooperative advertising, or greater commissions.

TABLE 3.11  
 SUBSCRIBERS' RENEWAL AND CONVERSION ACTIVITY DURING 1986

	<u>NEW SUBSCRIBERS</u>			
	<u>Agency<sup>1</sup> Locations</u>	<u>Conversions<sup>2</sup></u>	<u>Newly<sup>3</sup> Automated</u>	<u>Contract Renewals</u>
SABRE	8,677	269	1,378	3,730
APOLLO	6,511	290	1,018	994
SYSTEMONE	4,271	340	531	1,462
PARS	3,189	121	702	650
DATAS II	<u>2,045</u>	<u>87</u>	<u>349</u>	<u>1,186</u>
TOTAL	24,693	1,107	3,978	8,022

Source: Information Response, Items 7 and 33; vendor-supplied data tapes.

1. This number reflects only those locations where the vendor is either the only vendor or the primary vendor (accounting for the largest number of bookings). Vendors try to maintain one contract per location, although it is possible for one contract to cover several locations. The number of locations is taken from the vendor-supplied data tapes.

2. Total new subscribers through conversions exceeds the vendor-reported total of subscribers lost through conversion and expired contracts. In some cases where agencies are small and partially automated, some vendors count new subscribers as either newly automated or as conversions. Also, where some vendors counted a new subscriber as a converted agency, the vendor losing the contract may have counted the agency as an expired contract or a canceled contract rather than a contract lost to conversion.

3. SABRE estimated the number of newly automated agents in 1986.

Also, agencies may adopt a CRS because of the superior technical support a vendor provides for the maintenance of its system. Adequate training of agency personnel is an important consideration in deciding which system to adopt; the agent must be confident that the vendor will continue to provide the technical support and training necessary to get maximum productivity from its CRS. Moreover, a travel agent may benefit financially through free upgrades of terminals, ticket printers, or other equipment -- in addition to promotional incentives, such as cash payments, equipment discounts, or free travel. All of these factors contribute to the development of a long-term business relationship between a travel agent and a CRS vendor.

#### F. Vendor-Carrier Relationship

Airlines contract individually with CRS vendors to have their schedules, fares, rules, and other flight-related information displayed and to have tickets issued. If a passenger is booked by a vendor airline or its CRS subscriber, the participating airline is charged a booking fee.<sup>11</sup> The CRS vendors charge different booking fees, depending on whether the CRS displays the airline's seat availability and whether the CRS accesses the airline's computer to verify seat availability. The vendors' current booking fees are presented in Table 3.12.

TABLE 3.12  
COMPARATIVE BOOKING FEES

<u>CRS Vendor</u>	<u>Schedule &amp; Fare Display Only; Reservations Via Telex</u>	<u>Schedule &amp; Fare Display Only; Reservations Via CRS</u>	<u>Seat Availability and Confirmation</u>	<u>Direct Access</u>
SABRE	\$1.00	\$1.50	\$1.85	\$2.10
APOLLO	1.00	1.40	1.85	2.10
SYSTEMONE	NP	1.00	1.85	2.10
PARS	1.00	1.50	1.85	2.10
DATAS II	NP	1.50	1.85	2.00

Source: CRS vendors.

NP = Service not provided.

<sup>11</sup> A booking is the recording of a passenger's name at the time of departure of each confirmed segment in the passenger's itinerary. For example, one passenger on a direct flight is counted as one booking; one passenger on a two-segment connecting flight is counted as two bookings.

Prior to adoption of the CAB's rules in 1984, vendors discriminated among air carriers in terms of booking fees they charged. For example, airlines that provided "feed" traffic to the vendor airline were charged relatively low booking (or access) fees, while new entrant and other competing air carriers were charged higher fees. The CAB imposed a non-discriminatory fee restriction on CRS vendors as part of its 1984 rules, requiring that all carriers be charged a uniform but otherwise unconstrained fee for access to CRS services. The relationship between a CRS vendor and each participating airline in its system is governed by contract.

In order to ensure that all subscribers receive the same information, under the terms of their contracts, participating air carriers are required to provide vendors with current information on schedules, interim schedule changes, fares, fare quotations, and other relevant flight-related data. For instance, if an air carrier elects to have seat availability information displayed, this information must be for each flight, and it must be on a segment or "first-closing" basis.<sup>12</sup> Finally, participating carriers are required by their contracts with CRS vendors to accept for transportation any passenger carrying a ticket bearing an "OK" status issued through a CRS. This requirement applies even if a record of the reservation does not exist in the participating carrier's internal reservation system, and even if denied boarding compensation may have to be paid.

Travel agents want to be able to select seats and issue boarding passes for their customers. As discussed previously, agents are able to do this if there is a direct communications link between a vendor's computer and a participating air carrier's in-house computer. Each automated reservation system also contains a Direct Reference System (DRS). This system allows participating carriers to provide agents with carrier-specific marketing information. Table 3.13 provides information on the fees charged by the vendors for their DRS offerings.

The vendors do not charge a separate fee for each boarding pass issued; instead, they provide specialized equipment to participating airlines that provide a "hook up" capability, as well as boarding pass printers to subscribers. The fee for the boarding pass, therefore, is an established charge for the use of this equipment and is similar to the equipment leasing arrangements made with subscribers for computer terminals, printers, and other equipment.

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<sup>12</sup> Participating carriers must ensure that their internal reservation systems comply with the interline reservation policies procedures and message formats set forth in "Standard Interline Passenger Procedures" and "ATC/IATA Reservations Interline Message Procedures".

TABLE 3.13  
MONTHLY DRS CHARGES

<u>Vendor</u>	<u>Basic Charge</u>	<u>Extra Pages</u>
SABRE	\$2,500	No charge
APOLLO	\$2,500 for a "Block"	\$1,500 per additional "Block"
SYSTEMONE	No charge	No charge
PARS	\$1,000 for 88 pages	No additional pages, unless another 88 are bought
DATAS II	\$500 for 50 pages	\$10 per page over 50 pages

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Source: Contracts between participating airlines and vendors.

Participating carriers can also acquire market information from the vendors' CRS data bases. The charge for providing this information ranges from \$50,000 to \$100,000 per year, for which vendors provide a monthly computer tape containing information on bookings made by their subscribers through their CRSs. The tapes are considered proprietary, and participating carriers must agree not to describe to third parties any information, material, or data contained on the tapes.<sup>13</sup>

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<sup>13</sup> Source: Information Directive, Item 8.

#### IV. THE FINANCIAL BENEFITS OF AIRLINE OWNERSHIP OF COMPUTER RESERVATION SYSTEMS

##### A. Introduction

One of the major controversies surrounding CRSs concerns the financial benefits vendor airlines receive from their ownership of these systems. If the vendors are able to charge participating airlines fees that exceed the costs of providing reservation services, they may affect the pattern or intensity of competition among airlines. Similarly, subscriber fees that exceed the costs vendors incur in equipping, training, and supporting travel agents may reduce the service they provide to airline travelers.

In the next section, we discuss previous estimates of the systems' financial benefits. In Section C, we discuss the conceptual issues involved in measuring the financial benefits of CRS ownership. Section D discusses the technical complications that arise in measuring these financial benefits. Section E measures the financial benefits of airlines' CRS investments. In Section F, we measure the accounting rates of return on the vendor airlines' CRS investments. Finally, we provide a brief summary of the major findings reported in previous sections.

##### B. Previous Estimates of the Financial Benefits of CRS Ownership

Although previous analyses have estimated the economic returns on some vendors' CRS investments, these estimates have been produced either by the vendors themselves or by non-vendor airlines seeking legal or regulatory redress for alleged competitive abuses of CRS systems. Not surprisingly, their resulting estimates have varied widely. For example, in 1985 American Airlines and United Airlines reported that they expected to earn rates of return of 19 percent and five percent, respectively, on their CRS systems through 1990, even with the significant booking fee increases imposed in response to the CAB's 1984 rules.<sup>1</sup> In arriving at these estimates, the vendors assumed that substantial investments in developing and marketing their systems would continue, that their systems' equipment and other assets would have no remaining value after that period, and that CRSs made no contribution to the profitability of their airline operations even prior to the CAB rules prohibiting display bias.

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<sup>1</sup> Robert L. Crandall, Chairman and President, American Airlines, Inc., Statement Before the Aviation Subcommittee of the Senate Committee on Commerce, Science, and Transportation, March 19, 1985; Jerome E. Hass, National Economic Research Associates, "The Profitability and Pricing of SABRE Computer Reservation Services," March 19, 1985; and Statement of Richard J. Ferris Before the Aviation Subcommittee of the Senate Committee on Commerce, Science, and Transportation, March 19, 1985.

Yet by reducing the size of the continuing investments slightly, by including a residual value that reflected the systems' continued potential for profitable operation beyond 1990, and by including their estimated contributions to the profitability of their respective airline hosts, a second study estimated that SABRE and APOLLO would earn, respectively, economic rates of return as high as 66 percent and 161 percent over their lifetimes.<sup>2</sup> While the magnitude of the systems' contributions to the profitability of their airline owners is the primary source of divergence between these estimates, it is also the most controversial and difficult-to-measure component of the actual rates of return they earn.

In assessing the returns earned by airlines' CRS investments, it is important to recognize that the 1984 CAB rules altered both the sources of CRS profits and the investment strategies of their airline owners. From their advent during the mid-1970s until 1984, the vendor airlines used their CRSs as marketing devices capable of diverting passengers from other airlines to their own flights, thereby increasing load factors on scheduled flights and the resulting earnings of their airline operations. To achieve these marketing benefits, vendors presented CRS-equipped travel agents with screen displays that biased rankings of departure alternatives in favor of their own flights, thus influencing some passengers who would otherwise have traveled by competing airlines to travel instead on flights operated by the vendor airline.<sup>3</sup>

For example, a 1984 analysis of 1,000 city-pair markets conducted by United Airlines showed that a United flight was displayed first in response to an APOLLO user's request almost 50 percent of the time. In total, United flights averaged 2.3 of the flights listed on the first computer "screen" presented to an APOLLO user in response to a request for flight information (most CRS displays list up to six direct flights or three connecting flights on each individual screen). Yet this analysis reported that when American's SABRE system was queried for flight information in those same 1,000 markets, a United flight appeared first in the display ranking less than 30 percent

<sup>2</sup> William J. Duffy, Analysis of American's and United's Statements Regarding the Profitability of SABRE and APOLLO, May 1985. A more recent analysis that arrives at similarly high profitability estimates is reported in Expert Testimony of Peter B. Frank in re Air Passenger Computer Reservation Systems Antitrust Litigation, USAir, Inc. et. al., Plaintiffs, v. American Airlines, Inc., and United Air Lines, Inc., Defendants, CV 86-0697-ER (Mcx).

<sup>3</sup> Vendors also "sold" preferential display position to selected air carriers who became co-hosts. Generally speaking, the cohost preference was somewhat less than what the vendor reserved for itself.



of the time, while the average number of United flights listed on the first screen presented was less than one.<sup>4</sup>

The difference in the treatment accorded to United flights presumably represented the combined effect of APOLLO's display bias in favor of United flights (and against American's flights), together with SABRE's tendency to favor flights operated by its owner, American Airlines, where they competed with United flights. A separate analysis conducted by American estimated that the effect of preferential display of American's flights by its SABRE system was to increase the number of passengers booked on those flights by SABRE-equipped travel agents by almost 20 percent. At the same time, this analysis estimated that the combined effect of pro-American and anti-United bias in ranking flights for display in the SABRE system may have been to reduce bookings by SABRE agents on United flights by as much as one-third.<sup>5</sup>

By prohibiting display bias, and thus reducing the vendors' ability to use their systems as airline marketing tools, the 1984 CAB rules moved CRSs toward becoming commercial reservation service subsidiaries of their airline owners. In contrast to the pre-rule situation, CRS systems now profit directly by charging participating airlines for each passenger reservation generated by their extensive networks of computerized travel agents, as well as from fees charged to subscribers for equipment installation, training, and other services. Moreover, most CRS vendors have begun to charge their airline owners their standard booking fee. Nevertheless, some CRSs may continue to enhance the earnings of their owners' airline operations even in the post-rule environment, if the business relationships between vendors and subscribers (plus enhancements available through a vendor's CRS) create a halo effect that induces travel agents to book a disproportionate share of passengers on their respective vendors' flights.

The CAB's 1984 rules prompted major new investments by vendors in purchasing dedicated CRS computers and facilities, developing advanced features such as real-time access to seat availability, and marketing their systems to potential new subscribers, including agents already subscribing to another CRS. Another consequence of the CAB rules has been rapid evolution in the roles played by CRSs within the airline organizations that own them. Most vendors apparently began to treat their CRSs as separate profit centers, either somewhat before or immediately after those rules were issued. Today, most owner airlines pay their CRS subsidiaries the standard booking fee.

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<sup>4</sup> Reported in "Automation - Impact on Agency Shares," December 1984, document submitted by United Airlines in response to USDOT Information Directive, Item 20, 005176.

<sup>5</sup> Reported in "Scenarios for Disposition of Bias in Industry Automated Systems," August 1983, document submitted by American Airlines in response to USDOT Information Directive, Item 20, 20-0016.

Because the CAB rules altered the nature of CRS investments and the sources of returns they earn, this analysis investigates the financial benefits of CRS ownership in the post-CAB rule environment, as well as their benefits as airline marketing instruments.

### C. Conceptual Issues in Measuring the Financial Benefits of CRS Ownership

The financial benefits received by the airline owner of a CRS consist of four components: (1) the booking fees it charges participating airlines; (2) the fees it receives from travel agents and others who subscribe to its CRS; (3) the value of reservation services the CRS and its network of subscribers provide to its airline owner; and (4) any increase in the revenues and earnings of the airline's passenger-carrying operations stemming from travel agents' use of its CRS.

An airline that owns a CRS thus receives financial benefits in the form of cash revenues from the reservation services it provides to airlines and other participants in its system (such as hotels and car rental firms), as well as in return for the equipment, training, and support services it provides to CRS subscribers. While cash revenues received from participants and subscribers can be measured, each CRS-owning airline also receives two benefits that are more difficult to measure because they take the form of services provided by the CRS to its airline owner. Although conceptual and technical problems arise in estimating the value of these services, they must be included among the financial benefits of CRS ownership in order to estimate the returns generated by airlines' investments in developing their CRSs.

The first non-cash financial benefit received by a CRS-owning airline is the reservation services it receives through the network of travel agents equipped with its own CRS. Each system's subscribers book a significant number of passengers for travel on flights operated by its airline owner. During 1986, for example, the share of total bookings made by subscribers to each of the five CRSs that were for travel on flights operated by its vendor airline ranged from 14 to 23 percent.

Because no booking fees were paid by a system's airline owner to its CRS before 1987, in response to our Information Directive the vendors reported no cash revenue comparable to that received from participating airlines. (As mentioned, most owner airlines now pay their CRS affiliates their standard booking fee.) Thus, no direct cash measure of the value of this additional financial benefit of CRS ownership to an airline was available for the time frame we have examined. Nevertheless, the investments reported by each system's airline owner include expenses for producing the reservation services it receives through its own CRS; accordingly, it is necessary to include some estimate of the value of these services among the financial returns generated by these investments.

It is important to note that these services are distinct from the computerized reservations services provided to the host airline by its joint use of the CRS as an internal reservations system. In that capacity, the system is used by reservation agents employed by the airline, rather than by

travel agents who subscribe to the commercial CRS vended by the same airline. The CRS vendors have made detailed efforts to separate the costs of this internal use of their systems from the costs incurred in offering commercial CRS services, and they report only the latter costs in their expense accounts.<sup>6</sup>

In the early years of CRS promotion, when only a small fraction of travel agents were equipped with CRSs, the correct measure of the imputed value of this additional source of income would have been the difference between the cost to the airline of producing these reservation services internally and the cost at which they could be produced with a CRS.<sup>7</sup> A number of complications arise, however, in estimating this measure of the value of CRS services provided to the airline host.

First, if screen display bias and the halo effect do increase the fraction of bookings through travel agents equipped with a vendor's CRS that are for travel on flights operated by the host airline, the volume of those bookings overstates the reduction in internal reservations activity that has been transferred to the CRS and on which cost savings presumably occur.

Second, much of the cost of producing host airline reservation services externally as part of its CRS activity is already reflected in the cash outlays reported by vendors. Thus, it is necessary to determine the

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<sup>6</sup> TWA reports detailed total expense accounts for PARS as well as their allocation between internal reservations services and commercial CRS services, which are clearly identified as such; only the latter are included in the analyses reported in this chapter.

<sup>7</sup> An alternate procedure would be to reduce all CRS-related investment outlays and operating expenses by the proportion of passenger bookings made by travel agents using the CRS that entail travel on the host airline. This would approximate the savings in internal reservations system expenses that vendor airlines realize as a result of their CRS activities, while adding that amount to the estimated returns earned on their investments in developing the capability to act as CRS suppliers. Although this procedure should produce a more realistic estimate of the value of CRS activities to the airlines that operate commercial reservations systems, its accuracy depends on comparability between the costs of operating reservations systems for internal use and external sale. This requires not only that the average costs for producing internal and commercially saleable reservation services be closely comparable, but also that this comparability be unaffected by a substantial transfer of reservations activity from an airline's CRS system to its internal reservations system. Unfortunately, evidence on this question is scarce, and what is available suggests that airlines face very different average costs for producing internal computerized reservations services and commercial CRS capabilities.

expenses the airline would have incurred to produce these services using its internal system and employees, and to report these savings as a form of income generated by the CRS, rather than simply to estimate the amount by which this expense exceeds that for processing an equivalent volume of reservations activity through the CRS. The Department's Information Directive, however, requested vendors to omit expenses for operating their internal reservations systems from their reported outlays.

Third, the remaining expenses for externally generating reservations using a vendor's CRS, which are paid in the form of commissions to travel agents (who generate reservations that otherwise would have been made by airline-employed reservation agents), are recorded as expenses to the owner airline, rather than appearing on the accounts of its CRS. Expenses associated with equipping, training, and supporting these travel agents are reported for the CRS, but these are partly or completely offset by revenues generated by the various fees charged to its travel agent subscribers.

Finally, an airline developing a CRS in a non-automated environment would regard the alternative as incurring the costs of processing reservations internally. When all agents are automated, however, the relevant alternative becomes that of incurring the obligation to pay booking fees to other vendors. Thus, the appropriate basis of comparison changes over time. Therefore, we have elected to employ the average booking fee charged by each vendor to its participating carriers as an approximate measure of its estimated cost savings from reducing the volume of internally processed reservations. Prior to the CAB rules, for strategic considerations, vendors charged different booking fees to each participant in their systems; therefore, the relationship of each vendor's average booking fee to the savings per reservation made is unclear.

Since raising their booking fees, vendors have argued that booking fees understate the costs participating airlines would incur in producing the same reservations services through their respective internal systems.<sup>8</sup> Assuming that all airlines face roughly similar costs for such internal reservations activity, we can infer that booking fees represent a minimum estimate of the savings to a CRS-owning airline from transferring reservations activity from the airline itself to the CRS. In addition, as these systems became separate profit centers and began charging their airline affiliates standard booking fees, the rationale for imputing CRS

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<sup>8</sup> See, for example, Testimony of Michael A. Buckman, President, SABRE Travel Information Network, Before the Subcommittee on Antitrust, Monopolies, and Business Rights, Committee on the Judiciary, December 10, 1987, 16; and Statement of United Airlines/COVIA Corporation Before the United States Senate Judiciary Committee, December 10, 1987, 11.

income from its parent airline at the same booking fee charged to participating airlines was strengthened.<sup>9</sup>

The second form of non-cash financial benefit that may be generated by an airline's investment in a CRS is an increase in the number of passengers that travel on its flights as a result of travel agents' use of its reservation system. In fact, CRSs were developed to enhance the financial viability of their airline owners' passenger-carrying operations. Some CRS systems originally did so by presenting travel agents with rankings of flight alternatives that displayed the owner airline's flights more prominently. By biasing the presentation of information on flight alternatives on the computer displays used by CRS-equipped travel agents, it is commonly believed that vendor airlines were able to divert passengers to their own flights from those operated by competitors. The CAB sought to eliminate such display bias with its 1984 CRS rules, and vendors' responses to the Department's CRS Information Directive indicate that carrier-specific bias has been eliminated from the procedures used to rank flights for CRS displays. Accordingly, our estimates of the financial benefits accruing to vendor airlines from their ownership of CRSs include the estimated value of increased passenger volumes from display bias only through November 1984, when the CAB's rules became effective.

Travel agents may also have been induced to book more passengers on a CRS-owning airline's flights as a result of that airline's maintenance of supportive business relations with its network of subscribers. This halo effect may persist even in the post-rule environment. A travel agent may choose to affiliate with a particular CRS vendor for a variety of reasons: one system's vendor airline may be preferred by many of the agent's customers (perhaps because of its presence in the local airline market), the agent may judge a particular system to have superior performance, or the agent may receive greater financial incentives from affiliating with one vendor.

Moreover, even with direct access features, some CRSs may still offer better services for booking and ticketing the owner airline's flights than for other carriers' services. Not all CRSs, for example, provide equal capabilities for issuing boarding passes. Officials of at least one vendor have indicated that they consider this difference in capabilities to be a significant source of the halo effect. The magnitude of the halo effect would be determined by the specific combination of factors that influence each individual agent to subscribe to a particular CRS and to book passengers on the vendor airline. Although we have estimated the halo effect for each carrier, we have not attempted to apportion those totals among their various sources.

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<sup>9</sup> The financial estimates rely on data for CRS operations through 1986. No vendor recorded booking fee payments to its affiliated CRS in that time frame. Therefore, the imputation of such revenues as value of services is appropriate.

Table 4.1 (continued)

	1980	1981	1982	1983	1984	1985	1986
	PARS						
Cash Revenues							
Participant Fees <sup>1</sup>	0.0	0.1	2.3	8.1	14.7	45.9	52.8
Subscriber Fees	4.7	9.5	11.9	13.6	20.2	24.2	23.0
Total Cash Revenues	4.7	9.6	14.2	21.7	34.9	70.1	75.8
Cash Expenditures							
Operating Expenses	11.9	16.4	19.9	24.6	32.1	37.0	45.5
Equipment Investments	29.9	9.1	14.0	13.8	15.3	7.3	11.9
Development Expenses <sup>2</sup>	NR	NR	NR	NR	NR	NR	NR
Subscriber Network <sup>3</sup>	10.7	6.9	4.7	6.0	6.2	10.8	11.5
Total Cash Expenditures	52.5	32.4	38.6	44.4	53.6	55.1	68.8
Net Cash Flow <sup>4</sup>	(47.8)	(22.8)	(24.5)	(22.7)	(18.7)	15.0	7.0
	SYSTEMONE						
Cash Revenues							
Participant Fees <sup>1</sup>	0.0	0.8	2.7	2.7	5.6	20.4	56.1
Subscriber Fees	0.0	2.2	7.5	7.5	14.9	20.6	32.4
Total Cash Revenues	0.0	3.0	10.2	10.2	20.5	40.9	88.5
Cash Expenditures							
Operating Expenses	0.0	2.9	6.6	6.6	7.4	13.5	22.9
Equipment Investments	0.3	6.1	26.5	26.5	24.6	24.5	21.8
Development Expenses <sup>2</sup>	NR	NR	NR	NR	NR	NR	NR
Subscriber Network <sup>3</sup>	0.2	2.5	6.8	6.8	12.4	18.9	33.1
Total Cash Expenditures	0.5	11.5	39.5	39.5	44.4	56.9	77.7
Net Cash Flow <sup>4</sup>	(0.5)	(8.5)	(29.3)	(29.3)	(23.9)	(16.0)	10.8

Table 4.1 (cont inued)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
DATAS II					
Cash Revenues					
Participant Fees <sup>1</sup>	0.1	1.0	2.7	13.3	19.2
Subscriber Fees	0.3	5.0	11.7	22.6	28.0
Total Cash Revenues	0.4	6.0	14.4	35.9	47.2
Cash Expenditures					
Operating Expenses	1.8	6.7	11.3	13.2	15.8
Equipment Investments	12.1	16.6	30.8	18.4	15.9
Development Expenses <sup>2</sup>	6.8	8.1	9.9	6.8	6.7
Subscriber Network <sup>3</sup>	0.9	5.7	11.4	21.9	23.5
Total Cash Expenditures	21.6	37.1	63.4	60.2	61.8
Net Cash Flow <sup>4</sup>	(21.3)	(31.1)	(49.0)	(24.3)	(14.6)

Source: Reported by CRS vendors in response to USDOT Information Directive, Items 12 to 17.

1. Includes booking fees and charges for sales of marketing data and other CRS-generated products to participants.
  2. Includes computer programming, software acquisition, and other expenses for developing the capacity to generate and store computerized reservation records.
  3. Includes expenditures for marketing CRS services to current and prospective subscribers, installing and servicing equipment at subscriber locations, and training and supporting subscriber personnel.
- MR indicates that the data were not identifiable or not reported as a separate expense category.
4. The cash flow computations shown in Table 4.1 differ from the conventional accounting method in two ways. First, the normal accounting computation of cash flow includes depreciation among operating expenses, but subsequently "adds back" its value to net income, thus implicitly recognizing that depreciation is not a cash expense. In contrast, the computations shown in Table 4.1 do not include depreciation among the expenses reported, so that it is not necessary to follow this procedure. Second, Table 4.1 includes equipment investments and other capital outlays directly as cash expenses, rather than following the conventional accounting procedure of deducting capital expenditures from net income to determine cash flow.

booking fees in response to the CAB's 1984 rules. Some vendors also reported revenues from the sale of marketing data and other CRS-generated products to other airlines, although this appears to be a small and sporadic source of income.

Table 4.1 classifies vendors' CRS-related cash outlays during this period into four major categories, the first of which includes expenses for operating the computer and communications systems used to create and store passenger reservation records. Second, vendors make substantial outlays for central computer facilities, communications equipment, and the terminals, ticket printers, and ancillary equipment they supply to their travel agent subscribers. Third, CRS development expenses include the costs of developing and acquiring the computer software that enables travel agents to generate, store, and modify passenger reservation records (CRS Development Expenses were not identifiable as a separate expense category for PARS and SYSTEMONE). Finally, subscriber network expenses include those for marketing CRS systems to potential users, installing and servicing equipment at subscriber locations, and training and supporting travel agents in the use of the systems.

During the early years of each system's operation as a commercial enterprise, many of these expenses were incurred jointly with its vendor's development and operation of an internal computerized reservations system. As a consequence, vendors' expenses associated with their commercial CRS activities have been estimated by allocating joint outlays (particularly those for central computer facilities, computer programming, and communications networks) between internal airline purposes and CRS operations. The vendors appear to have made careful efforts to perform these allocations, and no attempts have been made to adjust their reported expenses other than to assign them to the four categories of CRS-related expenses that are reported in Table 4.1.

As the table indicates, estimated cash flows generated by the five airline CRS systems during the pre-rule period were predominantly negative, with only a single vendor, SABRE, reporting positive cash flows before 1984. In late 1984, most vendors raised their booking fees, producing the substantial increases in CRS cash revenues reported in Table 4.1. Thus, despite major increases in their cash outlays for equipment investments and marketing of their systems to potential new subscribers during 1985 and 1986, only Delta



Airlines' DAFAS II system failed to generate positive cash flows during those years.<sup>14</sup>

During the pre-CAB rule period, the primary return on vendors' CRS investments apparently consisted of their contributions to the earnings of their owners' airline operations. Greater airline revenues and earnings stemmed from the combined effect on passengers' choices among carriers of CRS display bias and travel agents' increased tendency to book passengers on flights operated by the airline owning the CRS to which they subscribe, often referred to as a halo effect.<sup>15</sup> Table 4.2 reports estimates of the contributions made by each reservation system to the earnings of its

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<sup>14</sup> Table 4.1 does not follow the normal accounting procedure of deducting a provision for income taxes in determining the cash flows generated by airline-owned CRSs. This omission has an extremely complicated effect on estimated cash flows and their associated rates of return. First, most CRSs generated negative accounting profits through 1984, since booking fees were not raised to current levels until after the CAB rules went into effect in November of that year. By themselves, these systems would not have increased the income tax liability of their airline owners during that period, and probably would have reduced it. As Table 4.2 indicates, however, these systems apparently contributed substantially to the earnings -- and thus presumably to the tax liability -- of their airline owners at the same time.

After 1984, most CRSs were profitable on a tax-accounting basis, while they also continued to contribute to the financial benefits received by their airline owners. Some airlines also began to operate their CRSs as independent subsidiaries during this time, so that their income tax liability was determined independently. Nevertheless, such a system's net effect on the overall tax liability of the two enterprises still consists of the sum of its independently determined tax liability, plus any increase in its host airline's tax liability stemming from whatever improvement in the latter's profitability is contributed by the CRS. Because of the extremely complex nature of this net effect, we have not attempted to estimate the effect of tax considerations on their cash flows and associated rates of return.

<sup>15</sup> Although the 1984 CAB rules sought to eliminate display bias, these rules did not seek to reduce or eliminate the halo effect on CRS-equipped travel agents' booking patterns. Any such effect results from the maintenance of ongoing, mutually supportive business relationships between a vendor and its travel agent subscribers. Such relationships, and their associated effect on sales patterns, are common in industries characterized by strong "vertical" linkages between producers of a product and its distributors or retailers.

respective vendor-owner's airline operations through 1986. These contributions are estimated from measures of airline passenger revenue sold through CRSs, and vendors' estimates of the fraction of this figure that is attributable to bias in CRS screen displays and each system's halo effect on its subscribers' sales patterns.

Where it was not reported by vendors, the historical pattern of passenger revenue sales through CRSs was estimated using measures of this figure for 1986 and historical growth in the number of travel agency locations reported by vendors in their responses to the DOT Information Directive. Because vendors probably automated their largest revenue-producing agencies first, this procedure may understate subscriber activity that was subject to bias and halo effects during the early years of each CRS's operation and, as a result, its contribution to the financial benefits received by its airline owner during that period. Because the cash flows generated by a CRS during these early years have a pronounced effect on its estimated rate of return, this procedure produces conservative estimates of the effect on those rates of return of including CRSs' contributions to the earnings of their vendor airlines.<sup>16</sup>

The magnitude of display bias and halo effects indicated in Table 4.2 are derived from internal documents submitted by each vendor. Appendix III provides a discussion of the methods used to construct estimates of incremental revenue generated by each system's display bias and halo effect from information submitted by its vendor airline.

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<sup>16</sup> Recently, representatives of American and United have argued that a substantial fraction of the estimated ticket revenue reportedly sold through CRS-equipped travel agents represents tickets purchased at travel agencies by passengers who initially booked reservations directly through these airlines' sales outlets. These sales, they argue, are not subject to pro-host bias or halo effects, since their purchasers' behavior reveals that they have already decided to travel on those airlines. However, this practice does not affect the accuracy of our estimates of incremental revenues, since these were constructed from vendors' own studies of the fraction of total revenues sold through their CRSs that represented incremental revenues. Appendix III provides a detailed discussion of this issue.

The CRS vendor airlines' own estimates reflect their belief that these increased passenger volumes raised their airline earnings substantially. The most common estimate contained in documents submitted by vendors appears to be that 80 percent of increased revenues stemming from display bias and any halo effect was translated into increased airline earnings, reflecting vendors' implicit assessment that the additional passengers resulting from these effects are accommodated with relatively minor expansion of flight schedules.<sup>17</sup>

Because of the critical nature of this assumption, the table also reports the magnitude of these contributions under the more conservative assumption that only 40 percent of bias- and halo-generated passenger revenue was translated into higher airline earnings. However, even the 40 percent figure may represent an overestimate of the fraction of incremental revenues that was ultimately translated into higher airline earnings. Accommodating large additional passenger volumes almost surely entailed additional operating expenses by CRS-owning airlines that were closer to their actual average cost per passenger carried than to the much lower figures that are implicit in the assumption that 80 percent, or even 40 percent, of incremental revenues represented additional airline earnings. To reflect this possibility, Table 4.2 also reports the estimated effects of CRSs on their parent airline earnings assuming that the same percentage of CRS-generated incremental revenues was ultimately reflected in operating earnings as was the case for all sources of airline revenue combined. For most CRS vendors, this amounted to assuming that three to six percent of

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<sup>17</sup> See, for example, "Marketing Automation Economics," August 1983, document submitted by American Airlines in response to DOT Information Directive, Item 20, 20-0002 to 20-0023, for use of the 80 percent figure, and "S.O.D.A. Revenues," October 18, 1985, document submitted by Eastern Air Lines in response to DOT Information Directive, Item 20, 50-51, which applies a figure of 70 percent to incremental revenues to estimate incremental profits. The 80 percent figure was used by TWA in considering capital appropriation requests for expansion of PARS and to evaluate the possible sale of PARS to NIBS, Documents TWA 20-1 through 20-3, 20-6, 20-7, and 20-13. For a discussion and references to vendors' use of the 80 percent figure, see Civil Aeronautics Board, Notice of Proposed Rulemaking, EDR-466C, 49 FR11644, March 27, 1984, 11650.

Table 4.2

Estimated Financial Contributions of Computer Reservation System to Owner Airline  
Using Vendor Estimates of Bias and Halo Effect  
(Amounts in \$Millions)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
APOLLO											
Airline Passenger Revenue <sup>1</sup>	2200.4	2458.9	2984.7	2751.0	3743.9	3837.2	4012.8	4538.8	5198.7	4258.6	5086.5
Percent Sold Through APOLLO <sup>2</sup>	0.8%	1.9%	3.8%	6.0%	13.3%	18.5%	22.6%	26.2%	29.8%	35.6%	39.0%
Revenue Sold Through APOLLO	17.6	46.7	113.4	165.1	497.9	709.9	906.9	1189.2	1549.2	1516.1	1983.7
% Attributable to Bias & Halo <sup>3</sup>	15.3%	15.3%	15.3%	15.3%	15.3%	15.3%	15.3%	15.3%	14.9%	13.8%	13.8%
Revenue from Bias and Halo	2.7	7.1	17.4	25.3	76.2	108.6	138.8	181.9	230.8	209.2	273.8
CRS Contribution to Owner Airline:											
@ 80% of Bias & Halo Revenue	2.2	5.7	13.9	20.2	60.9	86.9	111.0	145.6	184.7	167.4	219.0
@ 40% of Bias & Halo Revenue	1.1	2.9	6.9	10.1	30.5	43.4	55.5	72.8	92.3	83.7	109.5
@ 5.1% of Bias & Halo Revenue <sup>4</sup>	0.1	0.4	0.9	1.3	3.9	5.5	7.1	9.3	11.8	10.7	14.0
SABRE											
Airline Passenger Revenue <sup>1</sup>	1548.4	1756.0	2035.3	2383.4	2741.0	3138.0	3156.2	3603.0	4034.6	4584.8	4488.4
Percent Sold Through SABRE <sup>2</sup>	0.0%	3.6%	7.3%	12.2%	18.4%	29.8%	35.0%	41.0%	41.8%	40.0%	39.2%
Revenue Sold Through SABRE	0.0	63.2	148.6	290.8	504.3	935.1	1104.7	1477.2	1686.4	1833.9	1759.5
% Attributable to Bias & Halo <sup>5</sup>	0.0%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	21.0%	15.0%	15.0%
Revenue from Bias and Halo	0.0	15.0	35.2	68.9	119.5	221.6	261.8	350.1	354.2	275.1	263.9
CRS Contribution to Owner Airline:											
@ 80% of Bias & Halo Revenue	0.0	12.0	28.2	55.1	95.6	177.3	209.4	280.1	283.3	220.1	211.1
@ 40% of Bias & Halo Revenue	0.0	6.0	14.1	27.6	47.8	88.6	104.7	140.0	141.7	110.0	105.6
@ 5.6% of Bias & Halo Revenue <sup>4</sup>	0.0	0.8	2.0	3.9	6.7	12.4	14.7	19.6	19.8	15.4	14.8

Table 4.2 (continued)

1980 1981 1982 1983 1984 1985 1986

PARS

Airline Passenger Revenue <sup>1</sup>	2003.0	2030.5	1826.1	1729.7	1830.5	1851.1	1768.4
Percent Sold Through PARS <sup>2</sup>	13.2%	16.3%	19.6%	25.3%	29.4%	32.3%	34.6%
Revenue Sold Through PARS	263.8	330.6	358.5	437.2	537.7	598.2	611.9
% Attributable to Bias & Halo <sup>6</sup>	11.8%	11.8%	11.8%	11.8%	11.8%	11.8%	11.8%
Revenue from Bias and Halo	31.1	39.0	42.3	51.6	63.5	70.6	72.2
CRS Contribution to Owner Airline:							
@ 80% of Bias & Halo Revenue	24.9	31.2	33.8	41.3	50.8	56.5	57.8
@ 40% of Bias & Halo Revenue	12.4	15.6	16.9	20.6	25.4	28.2	28.9
@ 0% of Bias & Halo Revenue <sup>4</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SYSTEMONE

Airline Passenger Revenue <sup>1</sup>	2003.2	3293.5	3514.3	3818.0	4197.8	3860.4
Percent Sold Through SYSTEMONE <sup>2</sup>	0.0%	2.6%	6.7%	9.9%	13.6%	17.0%
Revenue Sold Through SYSTEMONE	0.0	85.9	236.6	379.2	573.0	656.3
% Attributable to Bias & Halo <sup>7</sup>	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%
Revenue from Bias and Halo	0.0	7.8	21.5	34.5	52.1	59.7
CRS Contribution to Owner Airline:						
@ 80% of Bias & Halo Revenue	0.0	6.3	17.2	27.6	41.7	47.8
@ 40% of Bias & Halo Revenue	0.0	3.1	8.6	13.8	20.9	23.9
@ 3.2% of Bias & Halo Revenue <sup>4</sup>	0.0	0.3	0.7	1.1	1.7	1.9

Table 4.2 (continued)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Airline Passenger Revenue <sup>1</sup>	3247.1	3493.9	3982.6	4143.8	3923.9
Percent Sold Through DATAS II <sup>2</sup>	1.5%	8.4%	14.2%	17.7%	17.8%
Revenue Sold Through DATAS II	50.2	293.8	566.4	734.4	698.5
% Attributable to Bias & Halo <sup>8</sup>	10.0%	10.0%	10.0%	10.0%	10.0%
Revenue from Bias and Halo	5.0	29.4	56.6	73.4	69.8
CRS Contribution to Owner Airline:					
@ 80% of Bias & Halo Revenue	4.0	23.5	45.3	58.7	55.9
@ 40% of Bias & Halo Revenue	2.0	11.8	22.7	29.4	27.9
@ 4.1% of Bias & Halo Revenue <sup>4</sup>	0.2	1.2	2.3	3.0	2.9

## DATAS II

1. Revenue from scheduled domestic passenger service only. Source: "Air Carrier Financial Statistics," CAB and DOT, various issues.
2. Estimated from data reported by CRS vendors in response to USDOT Information Directive, Items 2 and 6.
3. Estimated from "Automation-Impact on Agency Shares," document provided by United Airlines in response to USDOT Information Directive, Item 20, 5163-5199. See Appendix III for further discussion.
4. Average actual percent of airline's domestic passenger revenue that was ultimately translated into airline operating profit over the period since its CRS became commercially operational. Source: "Air Carrier Financial Statistics," CAB and USDOT, various issues.
5. Estimated from documents provided by American Airlines in response to USDOT Information Directive, Item 20, 20-0016 to 20-0017. See Appendix III for further discussion.
6. Estimated from "Statistical Analysis of Agency Automation Efforts," February 1979, May 1981, and May 1982, and "Value of 'Halo' Bias: Top Thirty Districts," 1st and 2nd Quarters, 1985, documents provided by TWA in response to USDOT Information Directive, Item 20, documents 20-16, 20-17, 20-19, and 20-21. See Appendix III for further discussion.
7. Estimated from "Exhibit II: S.O.D.A. Revenues," document provided by Eastern Airlines in response to USDOT Information Directive, Item 20-1, 00025-00064.
8. Estimated from "Halo Effect," memo from Systems Manager, Information Services to Assistant Vice-President, Information Services, January 8, 1986, document provided by Delta Airlines in response to USDOT Information Directive, Item 20, 20001-20002. See Appendix III for further discussion.

incremental revenues was translated into increased airline operating earnings during most years, as the figures reported in Table 4.2 suggest.<sup>18</sup>

As Table 4.2 indicates, the contributions of these systems to the airline operating earnings of their owners during the pre-rule period may have been extremely large, perhaps approaching as much as \$200 million during some years for APOLLO and SABRE. Even under the more conservative assumption that 40 percent of incremental revenues was ultimately retained as increased earnings, these revenues are more than sufficient to offset the negative cash flows reported in Table 4.1 in all but the earliest years of each system's operation as a commercial enterprise.

Because they rely on documentation submitted by the vendors, the higher values are consistent with vendors' own estimates of the financial benefits of these systems to their respective airlines during this period. Nevertheless, the lower range of values reported in the table may represent a more realistic appraisal of the systems' contributions to the earnings of their airline owners.

Table 4.3 illustrates the process used to impute the additional income for each vendor's use of its own system's reservation services, which we measure by the booking fees its vendor airline would have paid as a participant in its own CRS. This additional income is estimated by multiplying the average revenue received per booking from its airline participants by the total number of bookings for travel on the vendor airline's flights generated by travel agents who subscribe to its CRS. The imputed value of CRS services used by their airline owners increases the estimated CRS cash flows

<sup>18</sup> This procedure corresponds to that suggested in testimony on the proper measurement of reduced profits stemming from traffic losses by non-CRS owning airlines in then pending lawsuits against American and United. Specifically, American's expert witness states that, "The true incremental profit ... is best approximated as the difference between average total revenue per passenger and average cost for: flying operations, maintenance, passenger service, aircraft and traffic servicing, depreciation and amortization, and promotion and sales [expenses]." For two non-CRS owning airlines claiming lost profits, American's witness calculates that these expenses ranged from 81 percent to 98 percent of average total revenue per passenger during the period 1980 to 1986, suggesting that incremental profit per additional passenger would have amounted to between two percent and 19 percent of incremental revenue. However, the corresponding figures for some CRS-owning airlines would probably have fallen toward the upper end of this range, since they operated somewhat more profitably during this period than did the two non-CRS owning carriers for which these figures were calculated. See Identification of Peter Max as Expert Witness for Defendant American Airlines, Inc., In Re Air Passenger Computer Reservation Systems Antitrust Litigation, Master File No. MDL 667 ER (Tx), United States District Court for the Central District of California, 37.

Table 4.3

## Estimated Value of Booking Services Provided to Major Airlines by Computer Reservation Systems

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
<b>United Bookings by APOLLO</b>												
Subscribers (Millions)	NR	NR	NR	NR	NR	5.8	7.3	9.3	12.8	21.7	19.6	25.1
Average Booking Fee (\$) <sup>1</sup>	NR	NR	NR	NR	NR	0.14	0.21	0.35	0.65	1.18	1.85	1.85
Value to United (\$ Millions)	0.0	0.0	0.0	0.0	0.0	0.8	1.5	3.3	8.3	25.5	36.3	46.4
<b>American Bookings by SABRE</b>												
Subscribers (millions)	NR	NR	NR	NR	NR	4.3	4.9	6.6	8.9	9.8	16.6	19.2
Average Booking Fee (\$) <sup>1</sup>	NR	NR	NR	NR	NR	0.44	0.37	0.26	0.48	0.84	1.87	1.84
Value to American (\$ Millions)	0.0	0.0	0.0	0.0	0.0	1.9	1.8	1.7	4.3	8.2	31.0	35.2
<b>TWA Bookings by PARS Subscribers (millions)</b>												
Average Booking Fee (\$) <sup>1</sup>						NR	NR	NR	NR	NR	NR	NR
Value of Bookings to TWA (\$ Millions)						0	0.24	0.40	0.55	0.67	1.76	1.75
<b>Eastern Bookings by SYSTEMONE Subscribers (millions)</b>												
Average Booking Fee (\$) <sup>1</sup>						NR	NR	NR	NR	NR	NR	NR
Value of Bookings to Eastern (\$ Millions)						0.0	0.0	0.0	0.0	0.0	6.2	6.1
<b>Delta Bookings by DATAS II Subscribers (millions)</b>												
Average Booking Fee (\$) <sup>1</sup>						NR	NR	NR	NR	NR	NR	NR
Value of Bookings to Delta (\$ Millions)						0.1	1.1	2.6	3.7	4.2	3.7	4.2

Source: Computed from data reported by CRS vendors in response to USDOT Information Directive, Items 3, 4, and 12.

1. Actual average booking fee paid by airline participants; derived from airline booking revenue divided by total bookings on participating airlines. NR indicates that one or both of these data items was not reported.



reported in Table 4.1 by its full amount, since the expenses for producing host-utilized reservation services were already included among the CRS cash expenses reported in that table.<sup>19</sup> As Table 4.3 indicates, this imputed income adds significantly to the cash flows generated by most CRS systems.<sup>20</sup>

Table 4.4 combines the three sources that together make up the cash flows to vendors generated by CRSs: (1) the cash flows resulting from CRS fee revenues and expenses (Table 4.1); (2) the estimated annual additions made by each system to the earnings of its airline owner (Table 4.2); and (3) the imputed values of the reservation services each CRS supplies to its airline owner (Table 4.3). The result is an estimate of the cash flow generated by each airline's investment in its CRS during each year of its lifetime through 1986. In contrast to the cash flows reported in Table 4.1, total cash flow would have been positive for most systems before 1984, ranging from at least \$100 million to perhaps as high as \$250 to \$350 million for the two largest systems during 1986, if the vendors were correct in their assumption that 80 percent of incremental revenues became potential airline earnings.

Table 4.4 also reports an estimate of the remaining value of the physical equipment assets of each system (computer and communications equipment and facilities) at the end of 1984 and 1986. These estimates are constructed from the vendors' cumulative reported investment outlays from each system's initial year through 1984 or 1986, less accumulated depreciation on equipment and other physical assets reported during the same time period. The residual value of each system's physical assets enters the computation of economic rates of return on CRS investments because it is assumed to represent a supplemental cash inflow that occurs during the last year under consideration, exactly as if these assets were sold for their depreciated value at that time. No attempt has been made to estimate or include the value of intangible assets accumulated by these systems, such as their networks of trained subscribers or the ongoing value of their CRS enterprises.

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<sup>19</sup> These savings also reflect any economies in producing reservation services jointly for internal use and external sale, although it is difficult to determine whether such economies are significant. In effect, this procedure includes any savings to its airline owner from acquiring those reservation services generated by subscribers to its own system at the costs of producing them internally, rather than purchasing them from another vendor at prices that may exceed those costs.

<sup>20</sup> Table 4.3 also indicates that some vendors failed to report bookings by subscribers on their own flights for early years of their systems' operation. However, the value imputed to these bookings using the procedure adopted in Table 4.3 would have been minimal. In early years, "low" booking fees may have been a "subsidy" the vendors incurred to keep other carriers in their systems so that travel agents would subscribe to them. Nevertheless, because we have assigned a zero value for these years, Table 4.3 probably understates the value of the CRS services provided to the vendor's airline operations.

Table 4.4

Estimated Total Cash Contributions Generated<sup>1</sup> by Airline Computer Reservation Systems  
(Amounts in \$Millions)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
APOLLO												
Net CRS Cash Flow	(1.7)	(3.2)	(6.3)	(14.8)	(15.4)	(48.9)	(41.9)	(37.0)	(38.7)	(24.1)	21.6	44.0
CRS Contribution to Owner Airline:												
@ 80% of Bias & Halo Revenue	0.0	2.2	5.7	13.9	20.2	60.9	86.9	111.0	145.6	184.7	167.4	219.0
@ 40% of Bias & Halo Revenue	0.0	1.1	2.9	6.9	10.1	30.5	43.4	55.5	72.8	92.3	83.7	109.5
@ 5.1% of Bias & Halo <sup>1</sup>	0.0	0.1	0.4	0.9	1.3	3.9	5.5	7.1	9.3	11.8	10.7	14.0
Imputed Value of CRS Services to Host Airline	0.0	0.0	0.0	0.0	0.0	0.8	1.5	3.3	8.3	25.5	36.3	46.4
Total Cash Contribution:												
incl. 80% of Bias & Halo	(1.7)	(1.0)	(0.6)	(0.9)	4.8	12.9	46.5	77.3	115.2	186.1	225.3	309.4
incl. 40% of Bias & Halo	(1.7)	(2.1)	(3.4)	(7.8)	(5.3)	(17.6)	3.1	21.8	42.4	93.7	141.6	199.9
incl. 5.1% of Bias & Halo	(1.7)	(3.0)	(5.9)	(13.9)	(14.1)	(44.2)	(34.8)	(26.6)	(21.1)	13.2	68.6	104.4
Residual Asset Value <sup>2</sup>										92.4		140.7
SABRE												
Net CRS Cash Flow	(6.3)	(15.9)	(32.9)	(40.2)	(36.3)	(18.7)	(14.6)	5.5	39.0	67.0	84.0	
CRS Contribution to Owner Airline:												
@ 80% of Bias & Halo Revenue	0.0	12.0	28.2	55.1	95.6	177.3	209.4	280.1	283.3	220.1	211.1	
@ 40% of Bias & Halo Revenue	0.0	6.0	14.1	27.6	47.8	88.6	104.7	140.0	141.7	110.0	105.6	
@ 5.6% of Bias & Halo Revenue <sup>1</sup>	0.0	0.8	2.0	3.9	6.7	12.4	14.7	19.6	19.8	15.4	14.8	
Imputed Value of CRS Services to Host Airline	0.0	0.0	0.0	0.0	0.0	1.9	1.8	1.7	4.3	8.2	31.0	35.2
Total Cash Contribution:												
incl. 80% of Bias & Halo Revenue	(6.3)	(3.9)	(4.7)	14.9	61.2	160.4	196.5	289.8	330.5	318.1	330.4	
incl. 40% of Bias & Halo Revenue	(6.3)	(9.9)	(18.8)	(12.6)	13.4	71.8	91.8	149.8	188.9	208.0	224.8	
incl. 5.6% of Bias & Halo Revenue	(6.3)	(15.1)	(30.9)	(36.3)	(27.7)	(4.5)	1.7	29.4	67.0	113.4	134.0	
Residual Asset Value <sup>2</sup>										63.1		132.0

Table 4.4 (continued)

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
<b>Net CRS Cash Flow</b>	(47.8)	(22.8)	(24.5)	(22.7)	(18.7)	15.0	7.0
<b>CRS Contribution to Owner Airline:</b>				PARS			
@ 80% of Bias & Halo Revenue	24.9	31.2	33.8	41.3	50.8	56.5	57.8
@ 40% of Bias & Halo Revenue	12.4	15.6	16.9	20.6	25.4	28.2	28.9
@ 0% of Bias & Halo Revenue <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Imputed Value of CRS Services to Host Airline</b>	0.0	0.0	0.0	0.0	0.0	6.2	6.1
<b>Total Cash Contribution:</b>	(22.9)	8.4	9.4	18.6	32.1	77.4	70.9
incl. 80% of Bias & Halo Revenue	(35.4)	(7.2)	(7.5)	(2.0)	6.7	49.4	42.0
incl. 40% of Bias & Halo Revenue	(47.8)	(22.8)	(24.5)	(22.7)	(18.7)	21.2	13.1
<b>Residual Asset Value<sup>2</sup></b>					40.4		35.2
<b>SYSTEMONE</b>							
<b>Net CRS Cash Flow</b>	(0.5)	(8.5)	(8.5)	(29.3)	(23.9)	(16.0)	10.8
<b>Contribution to Owner Airline:</b>							
@ 80% of Bias & Halo Revenue	0.0	6.3	6.3	17.2	27.6	41.7	47.8
@ 40% of Bias & Halo Revenue	0.0	3.1	3.1	8.6	13.8	20.9	23.8
@ 3.2% of Bias & Halo Revenue <sup>1</sup>	0.0	0.3	0.3	0.7	1.1	1.7	1.9
<b>Imputed Value of CRS Services to Host Airline</b>	0.0	0.0	0.0	2.0	3.2	7.0	19.2
<b>Total Cash Contribution:</b>	(0.5)	(2.2)	(2.2)	(10.1)	6.9	32.7	77.8
including 80% of Bias & Halo Revenue	(0.5)	(0.5)	(5.3)	(18.7)	(6.9)	11.8	53.9
including 40% of Bias & Halo Revenue	(0.5)	(8.2)	(8.2)	(26.6)	(19.6)	(7.4)	31.9
<b>Residual Asset Value<sup>2</sup></b>					38.1		47.3

Table 4.4 (continued)

1982      1983      1984      1985      1986

## DATAS II

Net CRS Cash Flow	(21.3)	(31.1)	(49.0)	(24.3)	(14.6)
CRS Contribution to Owner Airline:					
@ 80% of Bias & Halo Revenue	4.0	23.5	45.3	58.7	55.9
@ 40% of Bias & Halo Revenue	2.0	11.8	22.7	29.4	27.9
@ 4.1% of Bias & Halo Revenue <sup>1</sup>	0.2	1.2	2.3	3.0	2.9
Imputed Value of CRS Services to Host Airline	0.1	0.3	0.7	3.6	4.8
Total Cash Contribution:					
including 80% of Bias & Halo Revenue	(17.2)	(7.3)	(2.9)	38.0	46.0
including 40% of Bias & Halo Revenue	(19.2)	(19.1)	(25.6)	8.7	18.1
including 4.1% of Bias & Halo Revenue	(21.0)	(29.6)	(45.9)	(17.7)	(7.0)
Residual Asset Value <sup>2</sup>			51.4		58.1

Sources: Tables 4.1, 4.2, and 4.3.

1. Average actual percent of airline's domestic passenger revenue that was ultimately translated into airline operating profit over the period since its CRS became commercially operational. Source: "Air Carrier Financial Statistics," CAB and USDOT, various issues.
2. Year-end remaining depreciable value of computer equipment only, estimated from equipment investment and depreciation reported by CRS vendors.

The vendors have continued to make large investments in developing and enhancing their reservation systems. In order to estimate the returns likely to be earned on these investments, we have attempted to project the cash flows that will be generated by the five airline CRSs during the period from 1987 to 1992.

In projecting these cash flows, we have made assumptions about trends in air travel and its distribution, CRS pricing, the vendors' market shares, and the costs the vendors incur to provide CRS services. Total domestic airline passenger travel is assumed to grow by 4.5 percent annually between 1987 and 1992, in accordance with the most recent FAA forecast, while each CRS vendor's share of domestic passenger travel is assumed to remain at its 1987 level. The fraction of domestic airline travel (measured by passenger segments flown) booked by CRS-equipped travel agents is assumed to continue rising (although considerably more slowly than in recent years) from its 1986 figure of 86.5 percent, reaching 90 percent by 1992. Thus, we foresee no major innovation in the channels through which domestic airline travel is distributed during the next five years. Consistent with this assumption, we also project that the number of domestic CRS-equipped travel agency locations will continue to grow slowly, from slightly under 25,000 in 1986 to approximately 30,000 by 1992.

In order to project revenues for each system during this period, we assume first that the five vendors' shares of travel agent subscribers and of passenger bookings will continue to change according to the trends that have prevailed since the composition of the industry stabilized at its present membership. Table 4.5 summarizes the projected 1992 CRS market shares of subscribers and passenger bookings and compares them to the actual shares prevailing during 1986 and 1987. Airline booking fees are projected to increase from the \$1.85 currently charged by the largest vendors, reaching \$2.00 by 1990 and remaining at that level through 1992, while non-airline booking fees are assumed to remain at their 1986 levels -- typically \$2.00 to \$3.00 per booking -- throughout this period. Similarly, the average annual revenue per subscriber received by each vendor, which ranged from roughly \$8,000 to \$12,000 during 1986, is projected to remain at that level through 1992.

Finally, we assume that vendors' investments in computer capacity, communications equipment, and remote terminals will rise over this period in proportion to increases in the number of bookings generated by each system. Expenses for operating and maintaining each CRS's computer facilities and communications network are also assumed to rise over this period in proportion to growth in its booking activity. Outlays for continuing development and enhancement of each system's capabilities are assumed to remain constant at the high levels that prevailed during 1985 and 1986, when vendors made major modifications and enhancements to their systems. Outlays for marketing each system are projected to increase over this period in proportion to growth in the total number of travel agents in the United States, reflecting the recently intensified competition among vendors to extend their subscriber networks by converting agents who subscribe to competing CRSs.

Table 4.5

Actual and Projected CRS Market Shares  
of Travel Agents and Domestic Passenger Bookings

CRS	Travel Agent Shares <sup>1</sup>			Booking Shares <sup>2</sup>		
	1986	1987	1992	1986	1987	1992
SABRE	35.1%	34.0%	32%	41.3%	39.2%	38%
APOLLO	26.4%	24.5%	23%	32.9%	29.5%	27%
PARS	12.9%	14.5%	15%	10.1%	14.6%	15%
SYSTEMONE	17.3%	18.0%	20%	10.5%	11.3%	15%
DATAS II	8.3%	9.0%	10%	5.1%	5.4%	5%

Sources: Estimated from information reported by CRS vendors in response to USDOT Information Directive, Item 7; Travel Weekly, December 10, 1987; and letter of Michael A. Buckman, President, SABRE Travel Information Network, to Senator Howard Metzenbaum, Chairman, Subcommittee on Antitrust, Monopolies, and Business Rights, U.S. Senate, January 12, 1988.

1. Percent of travel agency locations.
2. Percent of passenger segments booked for domestic travel.

Tables 4.6, 4.7, and 4.8, which are analogous to Tables 4.1, 4.2, and 4.3, project each of the three components of CRS cash flows for the 1987 to 1992 period. Table 4.6 reports anticipated cash revenues, expenses, and the resulting net cash flows generated by the various CRS systems during this period, projected using the aforementioned assumptions regarding total booking activity, CRS market shares, booking and subscriber fees, and CRS expenses. As in Table 4.1, revenues consist of booking fees, other charges paid by participants for related products, and subscription fees paid by travel agents. Cash outlays include CRS operating expenses, equipment investments, product development outlays, and expenses for extending and servicing each system's network of subscribers. As Table 4.6 indicates, each of the five systems is projected to generate increasing cash flows over the 1987 to 1992 period, primarily due to the rapid increases in booking fee revenues that result from more passenger traffic and higher per-segment booking fees.

Table 4.6

Projected Cash Flows Generated by Airline  
Computer Reservation Systems (Amounts In \$Millions)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
APOLLO						
Cash Revenues						
Booking Fees	173.4	191.2	205.1	224.3	238.4	252.0
Other Participant Revenues	2.0	2.0	2.0	2.0	2.0	2.0
Subscriber Fees	95.3	98.3	101.2	104.2	107.2	110.2
Total Cash Revenues	270.6	291.4	308.3	330.5	347.6	364.2
Cash Expenditures						
Operating Expenses	69.5	74.2	77.1	82.1	86.8	91.2
Equipment Investments	47.3	50.5	52.5	55.9	59.1	62.1
Development Expenses	17.4	17.4	17.4	17.4	17.4	17.4
Subscriber Network	95.6	98.6	101.6	104.6	107.6	110.6
Total Cash Expenditures	229.8	240.8	248.7	260.0	270.9	281.3
Net Cash Flow <sup>1</sup>	40.8	50.6	59.6	70.5	76.8	82.9
SABRE						
Cash Revenues						
Booking Fees	250.6	266.7	282.9	307.0	323.6	339.2
Other Participant Revenues	1.6	1.6	1.6	1.6	1.6	1.6
Subscriber Fees	105.5	105.6	105.6	105.5	105.1	104.5
Total Cash Revenues	357.7	373.9	390.1	414.1	430.3	445.3
Cash Expenditures						
Operating Expenses	91.4	96.8	99.6	105.2	110.5	115.4
Equipment Investments	58.4	61.8	63.6	67.2	70.6	73.7
Development Expenses	17.0	17.0	17.0	17.0	17.0	17.0
Subscriber Network	93.1	96.0	98.9	101.8	104.7	107.6
Total Cash Expenditures	259.9	271.5	279.0	291.2	302.7	313.7
Net Cash Flow <sup>1</sup>	97.8	105.6	117.6	133.0	141.3	149.3
PARS						
Cash Revenues						
Booking Fees	83.4	90.5	95.5	103.3	108.4	113.3
Other Participant Revenues	2.0	2.0	2.0	2.0	2.0	2.0
Subscriber Fees	22.7	23.4	24.1	24.8	25.5	26.2
Total Cash Revenues	108.1	115.9	121.6	130.1	136.0	141.5
Cash Expenditures						
Operating Expenses	46.4	49.1	50.6	53.4	56.1	58.6
Equipment Investments	12.1	12.8	13.2	13.9	14.6	15.3
Development Expenses	NR	NR	NR	NR	NR	NR
Subscriber Network	11.5	11.9	12.2	12.6	13.0	13.3
Total Cash Expenditures	70.1	73.8	76.0	80.0	83.7	87.2
Net Cash Flow <sup>1</sup>	38.1	42.1	45.6	50.1	52.3	54.3

Table 4.6 (continued)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
SYSTEMONE						
Cash Revenues						
Booking Fees	70.0	74.2	82.2	87.0	97.8	102.4
Other Participant Revenues <sup>2</sup>	NR	NR	NR	NR	NR	NR
Subscriber Fees	35.5	37.6	39.8	42.1	44.4	45.6
Total Cash Revenues	105.4	111.8	122.0	129.0	142.2	148.0
Cash Expenditures						
Operating Expenses	29.5	31.3	34.6	36.6	41.2	43.0
Equipment Investments	28.1	29.8	33.0	34.8	39.2	41.0
Development Expenses	NR	NR	NR	NR	NR	NR
Subscriber Network	36.2	38.4	40.6	42.9	45.3	46.6
Total Cash Expenditures	93.9	99.4	108.3	144.4	125.7	130.5
Net Cash Flow <sup>1</sup>	11.5	12.3	13.7	14.6	16.4	17.4

## DATAS II

Cash Revenues						
Booking Fees	24.5	30.1	31.8	34.4	36.2	37.8
Other Participant Revenues	2.0	2.0	2.0	2.0	2.0	2.0
Subscriber Fees	30.3	31.3	32.2	33.2	34.1	35.1
Total Cash Revenues	56.8	63.4	66.0	69.6	72.3	74.8
Cash Expenditures						
Operating Expenses	15.3	15.0	15.4	16.3	17.1	17.9
Equipment Investments	15.4	15.1	15.6	16.5	17.3	18.1
Development Expenses	10.0	10.0	10.0	10.0	10.0	10.0
Subscriber Network	23.6	24.3	25.1	25.8	26.5	27.3
Total Cash Expenditures	64.2	64.4	66.1	68.6	71.0	73.2
Net Cash Flow <sup>1</sup>	(7.4)	(1.1)	(0.1)	1.0	1.3	1.6

Source: Projected from data reported in Table 4.1, using assumptions described in text.

1. The cash flow computation shown in Table 4.6 differ from the conventional accounting method in two ways. First, the normal accounting computation of cash flow includes depreciation among operating expenses, but subsequently adds its value to arrive at net income, thus implicitly recognizing that depreciation is not a cash expense. In contrast, the computations shown in Table 4.6 do not include depreciation among the expenses reported, so that it is not necessary to follow this procedure. Second, Table 4.6 includes equipment investments and other capital outlays directly as cash expenses, rather than following the conventional accounting procedure of deducting capital expenditures from net income to determine cash flow.

2. SYSTEMONE did not sell marketing data and other CRS-generated products to participants.



Table 4.7

Projected Financial Contributions of Computer Reservation  
Systems to Owner Airline  
Using Vendor Estimates of Halo Effect  
(Amounts In \$Millions)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
APOLLO						
Airline Pass. Revenue	5418.4	6013.5	6443.0	7038.0	7705.5	8379.3
% Sold Through APOLLO	39.0%	39.0%	39.0%	39.0%	39.0%	39.0%
Rev. Sold Through APOLLO	2113.2	2345.2	2512.8	2744.8	3005.1	3267.9
% Attributable to Halo	13.8%	13.8%	13.8%	13.8%	13.8%	13.8%
Revenue from Halo	291.6	323.6	346.8	378.8	414.7	451.0
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	233.3	258.9	277.4	303.0	331.8	360.8
@ 40% of Halo Revenue	116.6	129.5	138.7	151.5	165.9	180.4
@ 5.1% of Halo Revenue	14.9	16.5	17.7	19.3	21.2	23.0
SABRE						
Airline Pass. Revenue	4695.9	5211.7	5583.9	6099.6	6678.1	7262.1
% Sold Through SABRE	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
Rev. Sold Through SABRE	1840.8	2043.0	2188.9	2391.0	2617.8	2846.7
% Attributable to Halo	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Revenue from Halo	276.1	306.4	328.3	358.7	392.7	427.0
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	220.9	245.2	262.7	286.9	314.1	341.6
@ 40% of Halo Revenue	110.4	122.6	131.3	143.5	157.1	170.8
@ 5.6% of Halo Revenue	15.5	17.2	18.4	20.1	22.0	23.9
PARS						
Airline Pass. Revenue	1086.1	2004.5	2147.7	2346.0	2568.5	2793.1
% Sold Through PARS	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%
Rev. Sold Through PARS	632.1	701.6	751.7	821.1	899.0	977.6
% Attributable to Halo	11.8%	11.8%	11.8%	11.8%	11.8%	11.8%
Revenue from Halo	74.6	82.8	88.7	96.9	106.1	115.4
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	59.7	66.2	71.0	77.5	84.9	92.3
@ 40% of Halo Revenue	29.8	33.1	35.5	38.8	42.4	46.1
@ 0% of Halo Revenue	0.0	0.0	0.0	0.0	0.0	0.0

Table 4.7 (continued)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
SYSTEMONE						
Airline Pass. Revenue	4334.7	4810.8	5154.4	5630.4	6164.4	6703.5
% Sold Through SYSTEMONE	18.6%	19.7%	20.9%	22.1%	23.3	23.9%
Rev. Sold Through SYSTEMONE	807.4	949.8	1076.8	1242.7	1435.3	1604.1
% Attributable to Halo	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%
Revenue from Halo	73.5	86.4	98.0	113.1	130.6	146.0
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	58.8	69.1	78.4	90.5	104.5	116.8
@ 40% of Halo Revenue	29.4	34.6	39.2	45.2	52.2	58.4
@ 3.2% of Halo Revenue	2.4	2.8	3.1	3.6	4.2	4.7
DATAS II						
Airline Pass. Revenue	4334.7	4810.8	5154.4	5630.4	6164.4	6703.5
% Sold Through DATAS II	17.8%	17.8%	17.8%	17.8%	17.8%	17.8%
Rev. Sold Through DATAS II	771.6	856.3	917.5	1002.2	1097.3	1193.2
% Attributable to Halo	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Revenue from Halo	77.2	85.6	91.7	100.2	109.7	119.3
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	61.7	68.5	73.4	80.2	87.8	95.5
@ 40% of Halo Revenue	30.9	34.3	36.7	40.1	43.9	47.7
@ 4.1% of Halo Revenue	3.2	3.5	3.8	4.1	4.5	4.9

Source: Projected from data reported in Table 4.2 using assumptions described in text.

Table 4.8

**Projected Value of Booking Services Provided to  
Vendor Airlines by Computer Reservation Systems**

	1987	1988	1989	1990	1991	1992
<b>United Bookings by APOLLO</b>						
Subscribers (Millions)	26.4	28.0	28.8	30.4	31.9	33.3
Average Booking Fee (\$)	1.85	1.90	1.95	2.00	2.00	2.00
Value to United (\$ Millions)	48.9	53.1	56.1	60.8	63.8	66.7
<b>American Bookings by SABRE</b>						
Subscribers (Millions)	19.7	20.9	21.5	22.7	23.8	24.9
Average Booking Fee (\$)	1.90	1.90	1.95	2.00	2.00	2.00
Value to American (\$ Mill.)	37.5	39.7	41.9	45.4	47.7	49.8
<b>TWA Bookings by PARS</b>						
Subscribers (\$ Millions)	3.7	3.9	4.0	4.2	4.4	4.6
Average Booking Fee (\$)	1.75	1.85	1.95	2.00	2.00	2.00
Value to TWA (\$ Millions)	6.5	7.2	7.8	8.4	8.9	9.2
<b>Eastern Bookings by SYSTEMONE</b>						
Subscribers (Millions)	12.0	12.7	14.1	14.9	16.7	17.5
Average Booking Fee (\$)	2.07	2.07	2.07	2.07	2.07	2.07
Value to Eastern (\$ Millions)	24.8	26.3	29.1	30.8	34.6	36.2
<b>Delta Bookings by DATAS II</b>						
Subscribers (Millions)	3.8	3.7	3.8	4.1	4.3	4.4
Average Booking Fee (\$)	1.50	1.90	1.95	2.00	2.00	2.00
Value to Delta (\$ Millions)	5.7	7.1	7.5	8.1	8.5	8.9

Source: Projected from data reported in Table 4.3 using assumptions described in text.

Table 4.7 uses the same procedure employed in Table 4.2 to project the anticipated contributions of the CRS systems to the passenger revenues and operating earnings of their host airlines. Like Table 4.2, it uses the vendor airlines' own estimates of the percent of airline revenue sold through their CRSs that is attributable to the halo effect. The projected financial benefits of CRS ownership to the host airline reported in Table 4.7 assume that the fraction of each carrier's revenue sold through its CRS remains at its 1986 level, although the previous assumption of a continuing increase in ticket sales through CRS-equipped travel agents would suggest even higher halo-generated airline revenues and earnings than those reported in the table. Nevertheless, even under the assumption that 40 percent of halo-generated revenues are translated into higher airline earnings, these projected internal contributions range from slightly under \$50 million to as high as \$180 million for each of the five CRSs by 1992.

Table 4.8 projects the value of bookings by each CRSs subscribers for travel on its airline owner, using the same method employed in Table 4.3.<sup>21</sup> Finally, Table 4.9 combines the projected components of each system's overall net cash contribution, including its cash flow on CRS operations per se, any contribution it makes to host airline earnings, and the imputed value of reservation services it provides to the host. As it indicates, these figures are projected to reach \$330 to \$340 million by 1992 for the two largest CRSs, even under the assumption that only 40 percent of halo-generated revenue is translated into increased earnings to their parent airlines. Even if as little as five to six percent of halo revenue is translated into airline profit, Table 4.9 indicates that these figures are projected to reach approximately \$200 million by 1992. Table 4.9 also reports the residual value of each system, given each vendor's pattern of projected equipment investments and applying straight-line depreciation over a five-year period for all new equipment.

Table 4.10 reports the economic rates of return associated with the cash flow histories, future projections, and residual asset values of each airline CRS reported in Tables 4.4 and 4.9. These measures of the returns earned by vendors on their investments in developing CRS capabilities explicitly include the systems' contributions to their owners' earnings on airline operations and the value of reservation services they provide to their airline hosts, as well as the booking and subscriber fee revenues they generate. The rates of return shown in Table 4.10 reflect, for each system, different time horizons and the assumptions made about the fraction of incremental airline revenues that is translated into increased airline earnings.

The rates of return reported in Table 4.10 suggest that if the CRS vendors correctly estimated the magnitude of bias- and halo-generated incremental

<sup>21</sup> Because these projections are based on 1986 data, we have continued to impute a value of CRS services to the affiliated airlines. Since no vendor was actually paying fees in 1986, this approach produces valid results, even though some carriers are making such payments.

Table 4.9

Projected Total Cash Contributions Generated by  
Airline Computer Reservation Systems  
(Amounts In \$Millions)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
APOLLO						
Net CRS Cash Flow	40.8	50.6	59.6	70.5	76.8	82.9
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	233.3	258.9	277.4	303.0	331.8	360.8
@ 40% of Halo Revenue	116.6	129.5	138.7	151.5	165.9	180.4
@ 5.1% of Halo Revenue	14.9	16.5	17.7	19.3	21.2	23.0
Imputed Value of CRS Services to Host Airline	48.9	53.1	56.1	60.8	63.8	66.7
Total Cash Contribution:						
incl. 80% of Halo Revenue	323.0	362.7	393.1	434.3	472.4	510.3
incl. 40% of Halo Revenue	206.3	233.2	254.4	282.8	306.5	330.0
incl. 5.1% of Halo Revenue	104.5	120.3	133.4	150.6	161.8	172.6
Residual Asset Value <sup>1</sup>						174.0
SABRE						
Net CRS Cash Flow	97.8	105.6	117.6	133.0	141.3	149.3
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	220.9	245.2	262.7	286.9	314.1	341.6
@ 40% of Halo Revenue	110.4	122.6	131.3	143.5	157.1	170.8
@ 5.6% of Halo Revenue	15.5	17.2	18.4	20.1	22.0	23.9
Imputed Value of CRS Services to Host Airline	37.5	39.7	41.9	45.4	47.7	48.9
Total Cash Contribution:						
incl. 80% of Halo Revenue	356.2	390.4	422.2	465.3	503.1	540.7
incl. 40% of Halo Revenue	245.8	267.8	290.8	321.8	346.1	369.9
incl. 5.6% of Halo Revenue	150.8	162.4	177.9	198.4	211.0	223.0
Residual Asset Value <sup>1</sup>						208.2

Table 4.9 (continued)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
PARS						
Net CRS Cash Flow	38.1	42.1	45.6	50.1	52.3	54.3
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	59.7	66.2	71.0	77.5	84.9	92.3
@ 40% of Halo Revenue	29.8	33.1	35.5	38.8	42.4	46.1
@ 0% of Halo Revenue	0.0	0.0	0.0	0.0	0.0	0.0
Imputed Value of CRS Services to Host Airline	6.5	7.2	7.8	8.4	8.9	9.2
Total Cash Contribution:						
incl. 80% of Halo Revenue	104.3	115.5	124.3	136.1	146.0	155.8
incl. 40% of Halo Revenue	74.4	82.4	88.9	97.3	103.6	109.7
incl. 0% of Halo Revenue	44.6	49.2	53.4	58.6	61.1	63.5
Residual Asset Value <sup>1</sup>						43.2

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	SYSTEMONE					
Net CRS Cash Flow	11.5	12.3	13.7	14.6	16.4	17.4
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	58.8	69.1	78.4	90.5	104.5	116.8
@ 40% of Halo Revenue	29.4	34.6	39.2	45.2	52.2	58.4
@ 3.2% of Halo Revenue	2.4	2.8	3.1	3.6	4.2	4.7
Imputed Value of CRS Services to Host Airline	24.8	26.3	29.1	30.8	34.6	36.2
Total Cash Contribution:						
incl. 80% of Halo Revenue	95.2	107.8	121.2	135.9	155.6	170.4
incl. 40% of Halo Revenue	65.8	73.2	82.0	90.6	103.3	112.0
incl. 3.2% of Halo Revenue	38.7	41.4	45.9	49.0	55.3	58.3
Residual Asset Value <sup>1</sup>						112.4

Table 4.9 (continued)

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
DATAS II						
Net CRS Cash Flow	(7.4)	(1.1)	(0.1)	1.0	1.3	1.6
CRS Contribution to Owner Airline:						
@ 80% of Halo Revenue	61.7	68.5	73.4	80.2	87.8	95.5
@ 40% of Halo Revenue	30.9	34.3	36.7	40.1	43.9	47.7
@ 4.1% of Halo Revenue	3.2	3.5	3.8	4.1	4.5	4.9
Imputed Value of CRS Services to Host Airline	5.7	7.1	7.5	8.1	8.5	8.9
Total Cash Contribution:						
incl. 80% of Halo Revenue	60.0	74.5	80.8	89.3	97.6	106.0
incl. 40% of Halo Revenue	29.1	40.3	44.1	49.2	53.7	58.2
incl. 4.1% of Halo Revenue	1.4	9.5	11.2	13.2	14.3	15.4
Residual Asset Value <sup>1</sup>						51.0

Sources: Tables 4.5, 4.6, and 4.7.

1. Year-end remaining depreciable value of computer equipment only, estimated from equipment investment projections reported in Table 4.6 using straight-line depreciation over five years.

Table 4.10

Estimated Internal Rates of Return Earned by  
Airline-Owned Computer Reservation Systems

<u>Contribution to Airline Earnings</u>	<u>End Year</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
80% of Bias and Halo Revenue <sup>1</sup>	1984	106.6%	128.2%	63.9%	144.4%	47.9%
	1986	108.9%	129.5%	75.2%	137.2%	64.4%
	1992	109.6%	129.7%	81.9%	145.0%	74.5%
40% of Bias and Halo Revenue <sup>1</sup>	1984	43.6%	63.9%	--	--	--
	1986	53.4%	68.7%	19.8%	54.2%	10.6%
	1992	58.1%	70.5%	38.1%	74.1%	31.6%
Actual % of Ticket Revenue <sup>1,2</sup>	1984	--	5.7%	--	--	--
	1986	13.3%	22.8%	--	9.6%	--
	1992	25.5%	31.5%	14.7%	37.8%	--

Source: Computed from historical and projected total cash flows and residual asset values reported in Tables 4.4 and 4.9.

Note: "--" indicates that no positive cash flows were reported during the period indicated, and thus no return was earned on the investment over that period.

1. Including indicated percent of vendors' estimates of CRS contributions to host airline revenues (incremental revenues) from bias and halo effect through 1984, and from the halo effect only after the CAB's rules went into effect.

2. Including same percent of incremental revenues as the percent of domestic passenger revenue actually passed through to airline operating profit during the period of commercial operation for each CRS. These figures are 5.1 percent for APOLLO, 5.6 percent for SABRE, zero percent for PARS, 3.2 percent for SYSTEMONE, and 4.1 percent for DATAS II.



airline revenues and the fraction of those revenues ultimately reflected in airline earnings (80 percent), these investments are extremely remunerative regardless of the time horizon over which they are evaluated. Even under the assumption that only 40 percent of incremental revenues was translated into added airline earnings, the larger systems are still extremely remunerative over any time period considered, while the smaller systems may be moderately remunerative if their present cash flows are sustained through 1992.<sup>22</sup> However, if the fraction of incremental revenue converted into airline profit was no larger than the fraction of all passenger ticket revenue ultimately reflected in airline profits (or even close to it), the estimated rates of return reported in Table 4.10 appear much more modest. Thus, the exact magnitude of this parameter critically influences the estimated financial benefits of the vendors' CRS investments.

The estimated returns reported in Table 4.10 suggest that at least the two largest airline vendors' investments in their CRS systems were financially successful during the period ending with the 1984 CAB rules, when these systems earned primarily indirect returns by increasing the earnings of those airlines. Perhaps more important, however, Table 4.10 also suggests that the vendors' investments to enhance the performance of their systems and extend their travel agent networks since the CAB rules took effect have been at least as remunerative as their pre-rule CRS investments, because the rates of return encompassing this period are actually higher than those through 1984.

Further, the returns calculated to include the projected cash flows through 1992 suggest that these investments will continue to be remunerative during the foreseeable future. Only substantial declines in current booking fees (or, in some cases, subscriber fees) or major innovations in airline information and ticket distribution channels that dramatically reduce the importance of CRS-equipped travel agents as sales outlets for air travel, none of which appears likely within the time horizon used in this analysis, could substantially reduce the estimated returns shown in Table 4.10.

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<sup>22</sup> Although Table 4.10 reports extremely high estimated rates of return for SYSTEMONE under certain assumptions, we believe that these estimates are partly the result of the procedures we used to estimate the capitalized value of equipment leases entered into by Eastern, its original host airline, during the early years of its development. These procedures result in estimated initial capital investments for developing SYSTEMONE (see Table 4.1) that appear small in comparison to those reported by vendors who purchased equipment directly or allocated its estimated value from equipment purchases made by their host airlines. Because the economic rate of return calculation is sensitive to the magnitude of initial cash outlays, relatively modest underestimates of the capitalized value of Eastern's original investment leases may have contributed to the very high estimated rates of return for SYSTEMONE that are reported in Table 4.10.

## F. Accounting Returns on Airline CRS Investments

Although caution must be exercised when interpreting conventional accounting measures of profitability, accounting returns can still provide supplemental information on the profitability of these systems. Accounting measures of profitability are an indispensable management tool for monitoring the returns generated by a firm's investments, and are thus used by firms to allocate their financial resources among projects. Accounting rates of return are also employed in regulatory proceedings to evaluate the reasonableness of prices charged for a wide variety of services, a purpose closely analogous to that of this study. As their widespread use in these situations indicates, the assertion that correctly measured accounting returns fail to reflect the economic rate of return earned by an enterprise is not universally accepted.<sup>23</sup>

Table 4.11 displays estimated operating revenues, operating expenses, net operating income, and net operating income expressed as a percent return on investment in plant and equipment for airline CRSs during 1985 and 1986. The participant revenue entries reported in the table consist of booking fees paid by airline, hotel, auto rental, and other CRS participants in return for each reservation generated by travel agents equipped with that system, together with very small additional amounts from supplemental charges to participants for marketing data and other CRS-generated products. Subscriber revenues include fees paid by travel agents for equipment installation and servicing, as well as training and support services they receive from CRS vendors.

In Table 4.11, vendors' reported expenses have been classified into five categories: (1) salaries and benefits paid to employees; (2) depreciation on central processing, remote terminal, and other CRS equipment; (3) purchases of utility services and lease payments for telephone circuits comprising the communications network; (4) corporate overhead expenses allocated by airline vendors to their CRS activities; and (5) conversion and system use incentives paid to travel agent subscribers. Because CRS vendors were not requested to submit balance sheet information as part of the Department's Information Directive, it was necessary to estimate the value of total invested capital on which profits were earned. The measure used in Table 4.11 is calculated from reported investment in plant and equipment from the initial year of each system's operation through the year indicated,

<sup>23</sup> For a variety of more sanguine views about the usefulness of accounting measures of profitability in assessing monopoly power than those of Fisher and McGowan, see William F. Long and David J. Ravenscraft, "The Misuse of Accounting Rates of Return: Comment," American Economic Review, June 1984, 494-500; Stephen Martin, "The Misuse of Accounting Rates of Return: Comment," American Economic Review, June 1984, 501-506; Gerald L. Salamon, "Accounting Rates of Return," American Economic Review, June 1985, 495-504; Robert Jacobson, "The Validity of ROI as a Measure of Business Performance," American Economic Review, June 1987, 470-478; and Stephen Martin, "Measurement of Profitability and the Diagnosis of Market Power," International Journal of Industrial Organization, forthcoming.

Table 4.11  
Estimated Accounting Profitability of Airline CRS Investments  
(Amounts in \$ Millions)

	APOLLO		SABRE		PARS		SYSTEMONE		DATAS II	
	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986
Operating Revenue										
Participant Revenue	152.6	174.4	199.1	230.9						
Subscriber Revenue	78.8	97.5	93.4	105.7						
Total Operating Revenue	231.4	271.9	292.5	336.6						
Operating Expenses										
Salaries and Benefits	70.6	75.9	61.0	65.7						
Depreciation	28.7	34.2	30.6	35.3						
Purchased Services <sup>1</sup>	28.4	34.1	74.8	94.7						
Allocated Corporate Overhead	27.4	48.0	19.3	22.2						
Subscriber Incentives	8.8	10.0	7.6	6.3						
Total Operating Expenses	163.9	202.2	193.3	224.2						
Net Operating Income	67.5	69.7	99.2	112.4						
Total Invested Capital <sup>2</sup>	101.5	114.0	84.9	105.3						
Net Operating Income as a % of Total Investment	66.5%	61.1%	116.8%	106.7%						
Operating Revenues										
Participant Revenues	45.9	52.8	20.4	56.1	13.3	19.2				
Subscriber Revenues	24.2	23.0	20.6	32.4	22.6	28.0				
Total Operating Revenues	70.1	75.8	41.0	88.5	35.9	47.2				
Operating Expenses										
Salaries and Benefits	18.4	19.8	10.0	16.1	13.7	14.9				
Depreciation <sup>3</sup>	9.4	13.1	16.4	20.7	11.5	14.9				
Purchased Services <sup>1</sup>	16.6	22.4	18.4	30.9	13.4	14.6				
Allocated Corporate Overhead	10.5	11.6	2.0	3.0	0.6	2.0				
Subscriber Incentives	2.4	3.1	2.3	6.4	7.8	8.2				
Total Operating Expenses	57.3	70.0	49.1	77.1	47.0	54.6				
Net Operating Income	12.8	5.8	(8.1)	11.4	(11.1)	(7.4)				
Total Invested Capital <sup>2</sup>	32.3	31.0	46.2	47.3	86.4	94.2				
Net Operating Income as a % of Total Investment	39.6%	18.7%	-17.5%	24.1%	-12.8%	-7.9%				

Source: Estimated from information reported by CRS vendors in response to DOT Information Directive, Items 12 to 17.

1. Includes communications circuit leases and utility expenses.
2. Estimated year-end total value of facility and equipment investments that remain to be depreciated.
3. Entry for SYSTEMONE represents estimated amortization of equipment leaseholds.

less cumulative reported depreciation of those assets through the current year.<sup>24</sup>

As the table indicates, by conventional accounting measures the APOLLO and SABRE systems appear to have been very profitable during 1985 and 1986, generating yearly before-tax returns of 60 to 70 percent (APOLLO) and over 100 percent (SABRE) on their host airlines' CRS investments. The PARS system appears by this measure to have earned returns equal to 20 to 40 percent of invested capital during these two years, while SYSTEMONE was profitable only during 1986. In contrast, Delta's DATAS II system was not profitable in 1985 or 1986.

Since they omit any contribution the systems made to their parent airlines' profits by generating incremental revenues or providing reservation services to their owners, these estimated rates of return may understate the systems' true profitability. In addition, the returns reported in Table 4.11 fail to recognize that certain current expenses actually represent investments in their CRSs. Although the returns on CRS investments reported in Table 4.11 may not reflect the underlying economic profitability of vendors' CRS investments during the post-rule period, the correspondence between the estimated accounting returns on vendor airlines' CRS activities and the underlying economic returns on those investments can be improved in three ways.

First, treating certain outlays such as system development costs and subscriber training expenses as investments in "intangible" assets rather than as current expenses can improve the accuracy with which vendors' total investments in developing and marketing their CRS capabilities are measured. Second, adopting depreciation patterns for these investments that more closely reflect their economic lifetimes, as well as the patterns of decline in their capability to generate returns over those lifetimes, should improve the correspondence between calculated profits and the remaining value of the specific investments that generate them. Third, recognizing additional sources of income, which vendors typically do not report or attempt to estimate because they do not represent cash revenues, can also improve the accuracy of profitability estimates.

Measures of depreciation used for accounting purposes such as those reported by the CRS vendors do not generally reflect the decline in the capacity of an asset to generate returns, the theoretically correct measure of

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<sup>24</sup> The resulting measure corresponds to total invested capital as of the end of each year for which it is reported. Although no provision for working capital is made, any such provision is likely to be small.

depreciation.<sup>25</sup> Accounting measures of depreciation estimate the decline in an asset's value over an arbitrarily assumed lifetime according to a pre-established formula, since this procedure offers historical consistency, is applicable to a wide variety of types of assets, and agrees with methods used to determine tax liability.<sup>26</sup> Yet changes in the demand for the product or production technology, as well as in competition in the marketplace, can change the economic values of various assets without necessarily prompting corresponding adjustments of the values assigned to them for internal accounting purposes. In short, conventional accounting practices employ depreciation methods that do not correspond to the changing economic values of assets.

Unfortunately, adjusting the depreciation estimates reported by CRS vendors (those used in Table 4.11) to reflect the changing values of the systems' physical assets is complicated by the vendors' failure to identify the lifetimes, time profiles, or residual values they employ in constructing these estimates.<sup>27</sup> Thus, to develop estimates of CRS vendors' equipment

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<sup>25</sup> This can be seen from the fact that vendors report a category of annual non-operating income called "Gain or Loss on Sale of Equipment," which represents the difference between sale price and the recorded, depreciated value of assets that are actually sold during a given year. The correction for this difference indicates that the physical assets of airlines' CRS enterprises are typically not depreciated for internal accounting purposes at the same rates as their actual market values decline, and indeed typical accounting practices purposely do not generally do so. Including these gains or losses can partly correct profit estimates that incorporate them for the failure of reported depreciation to correspond to the changing market values of assets. However, this correction is incomplete because it applies only to assets that are actually sold during a given year, which presumably represent only a small share of total assets, as well as because it is not generally applied to non-equipment or intangible assets even when they are subject to market transactions.

<sup>26</sup> For a discussion of these and other sources of inconsistency between accounting and economic measures of income, costs, and profitability, together with some useful suggestions for reconciling these inconsistencies, see George J. Benston, "Accounting Numbers and Economic Values," The Antitrust Bulletin, Spring 1982, 161-215.

<sup>27</sup> Delta reports the assumed lifetimes and residual values used to estimate depreciation on various types of CRS-related equipment. These lifetimes range from six to nine years, over which most equipment assets are assumed to decline to zero or near-zero residual values, but no information on the time profiles of depreciation assumed to prevail over those lifetimes is provided. However, none of the other CRS vendors provides any information regarding the assumptions used to construct reported depreciation estimates for CRS equipment or other capital investments allocated to their CRS activities.

depreciation costs that are more consistent both with actual economic depreciation and with one another, we apply a single procedure to equipment outlays reported by each vendor. Specifically, the values of vendors' investments in central processing, communications, and other equipment are assumed to decline from their reported initial acquisition costs to zero residual value at a constant annual rate (straight-line depreciation) over a five-year period.

This relatively short assumed lifetime is intended to approximate the actual economic lifetime of equipment investments in an environment characterized by rapid innovation in computer services technology and intensifying competition among CRS vendors. The assumption that these assets depreciate to a zero residual value after five years appears to be consistent with vendors' own practices, as well as with the pace of innovation in computer hardware technology. While somewhat arbitrary, the straight-line pattern of depreciation is almost certainly more consistent with the actual pattern of decline in the economic values of these assets than are the various accelerated depreciation schedules used to estimate depreciation for tax accounting purposes. It is perhaps also more consistent with the actual profile of economic depreciation than the changes in asset book values made for internal or public accounting purposes, although vendors provide so little information on the time patterns of depreciation they assume in constructing their reported estimates that this is difficult to evaluate.

Another adjustment intended to improve the accuracy with which vendors' reported expense data measure the economic costs of providing CRS services is to treat certain current expenses reported by vendors as investments in developing intangible assets. These investments include outlays by vendors for computer programming, software acquisition, and related CRS system development activities, all of which are intended to establish and enhance vendors' capabilities to provide automated reservations service. In addition, expenses for marketing these systems to current and prospective subscribers in effect represent investments in developing agents' allegiance to a particular CRS, while the subscriber conversion incentives vendors offer are intended to extend the travel agent networks through which their services are distributed. Thus, like outlays for equipment, these expenditures are intended to produce returns over a period of years rather than solely during the year in which they are made, and thus should be amortized over the duration of that period.

Yet only one CRS vendor appears to treat any of these expenses as investments, and even that exception is limited to the amortization of system development expenses. Thus, in this analysis, reported outlays for these purposes are assumed to decline to zero remaining value over a three-year period, again in straight-line fashion. The extremely short lifetime applied to these non-equipment assets is intended to reflect the ongoing reprogramming efforts required to support vendors' rapid innovation in CRS service features, as well as vendors' own estimates of the typical duration of a travel agent's affiliation with a particular CRS. This procedure corrects the tendency of normal accounting procedures to overstate the costs associated with such investments in the year when they are made, while understating both the costs they impose over their subsequent lifetimes and the current value of investments on which returns are earned during any year of those lifetimes.

A third adjustment is necessary to assess the profitability of CRS investments because as indicated previously, each vendor airline uses a substantial share of the services its CRS system produces. Measured by the fraction of passenger bookings made by subscribers that involve travel on flights operated by the host airline, these shares varied from 14 percent to 23 percent during 1986 for the five airline-operated CRSs. As previously reported in the discussion of Table 4.3, the value of unpriced reservation services to each CRS host can be estimated by applying the average booking fee charged to that system's airline participants by the number of passenger reservations booked by its subscribers for travel on the host's flights. The estimated 1985 and 1986 values of these services to each CRS vendor used in Table 4.12 are those previously reported in Table 4.3.

In this case, the average booking fee charged to other airlines is unequivocally the correct measure of the income that should be imputed to a CRS for the unpriced services it provides to its airline owner. Unlike the earlier examination of the financial benefits of CRS ownership, where it was necessary to evaluate vendors' investments partly on the basis of their financial contributions to the airline services they were originally designed to market, we are attempting here to determine the "stand-alone" profitability of each vendor's CRS investments. In this context, we have not included these systems' contributions to the profitability of their airline owners as an additional source of income to the various CRSs.

These adjustments produce estimates of the stand-alone profitability that would be realized by each vendor's CRS if it operated as a financially independent business enterprise, pricing booking services to its host airline identically to those it supplied to its other airline participants. Table 4.12 presents revised estimates of the accounting returns on airline CRS investments during 1985 and 1986, as measured by net income and its value as a percent of each system's year-end value of total invested capital. As the table indicates, income includes the imputed value of CRS services utilized by the host airline, as well as the cash revenues it receives from participants and travel agents for booking and subscription fees.

Table 4.12 allocates vendors' operating costs among those for operating CRS computer facilities, maintaining the communications network linking those facilities with participants and subscribers, and servicing and support of travel agents. The table also reports the value of depreciation on CRS vendors' equipment investments (adjusted as described previously), together with estimated amortization of CRS product development costs, marketing expenditures, and subscriber conversion incentives. The estimated values of total invested capital reported in Table 4.12 represent the cumulative historical total of investments in both CRS equipment and intangible assets through the end of the current year, less cumulative depreciation and amortization of these investments through that year.

The adjusted rate of return estimates reported in Table 4.12 are roughly comparable to the unadjusted estimates reported previously in Table 4.11. The adjusted annual rates of return on invested capital earned during 1985 and 1986 were approximately 50 to 55 percent for APOLLO, 75 to 90 percent

Table 4.12

## Adjusted Accounting Profitability of Airline CRS Systems

Income, Costs, and Profitability (\$ millions)	APOLLO		SABRE	
	<u>1985</u>	<u>1986</u>	<u>1985</u>	<u>1986</u>
<b>Income</b>				
Participant Revenue	152.6	174.4	199.1	230.9
Subscriber Revenue	78.8	97.5	93.4	105.7
Imputed Income from Host	36.3	46.4	31.0	35.2
Total Income	267.7	318.4	323.5	371.8
<b>Operating Costs</b>				
Computer Operations	26.4	32.9	30.1	34.2
Communications Network	27.2	35.7	35.4	53.0
Subscriber Services	41.4	49.1	45.2	47.4
Total Operating Costs	95.0	117.7	110.7	134.6
<b>Depreciation and Amortization</b>				
Depreciation of Equipment <sup>1</sup>	27.2	35.3	22.1	29.3
Amortization of Other Assets <sup>2</sup>	21.0	28.8	20.6	29.9
Total Deprec. and Amortization	48.2	64.1	42.7	59.2
<b>Total Costs</b>	<b>143.2</b>	<b>181.9</b>	<b>153.4</b>	<b>193.7</b>
<b>Net Income (Loss)</b>	<b>124.5</b>	<b>136.5</b>	<b>170.1</b>	<b>178.1</b>
<b>Total Invested Capital<sup>3</sup></b>	<b>224.7</b>	<b>260.4</b>	<b>187.7</b>	<b>234.1</b>
<b>Net Income as a % of Investment</b>	<b>55.4%</b>	<b>52.4%</b>	<b>90.6%</b>	<b>76.1%</b>



Table 4.12 (continued)

Income, Costs, and Profitability (\$ millions)	PARS		SYSTEMONE		DATAS II	
	1985	1986	1985	1986	1985	1986
<b>Income</b>						
Participant Revenue	45.9	52.8	20.4	56.1	13.3	19.2
Subscriber Revenue	24.2	23.0	20.6	32.4	22.6	28.0
Imputed Income from Host	6.2	6.1	7.0	19.2	3.6	4.8
Total Income	76.3	81.9	48.0	107.7	39.5	52.0
<b>Operating Costs</b>						
Computer Operations	24.2	28.4	3.7	5.0	3.4	4.3
Communications Network	12.8	17.1	9.8	17.9	9.8	11.5
Subscriber Services	NR	NR	10.9	27.5	4.9	3.4
Total Operating Costs	37.0	45.5	24.4	50.4	18.1	19.2
<b>Depreciation and Amortization</b>						
Deprec. of Equipment <sup>1</sup>	12.4	11.9	16.4	20.7	11.9	15.6
Amort. of Other Assets <sup>2</sup>	5.6	7.6	4.2	7.3	12.7	18.1
Total Deprec. and Amort.	18.0	19.5	20.6	28.0	24.6	33.7
Total Costs	55.0	65.0	45.0	78.4	42.7	52.9
Net Income (Loss)	21.3	16.9	3.0	29.3	(3.2)	(0.9)
Total Invested Capital <sup>3</sup>	52.4	56.3	63.5	79.4	98.5	107.6
Net Income as a % of Investment	40.6%	30.0%	4.7%	36.9%	-3.2%	-0.8%

Source: Estimated from information reported by CRS vendors in response to DOT Information Directive, Items 12 to 17.

1. Depreciation of computer, communications, and subscriber equipment. Entry for SYSTEMONE represents estimated amortization of equipment leaseholds.

2. Amortization of expenses for product development, marketing, and subscriber conversion.

3. Estimated year-end total value of outlays for facility, equipment, product development, marketing, and subscriber conversion that remain to be depreciated or amortized. This figure exceeds "total invested capital" reported in Table 4.11 because it includes the remaining value of vendors' investments in intangible assets, in addition to the remaining value of facility and equipment investments.

for SABRE, 30 to 40 percent for PARS and five to 37 percent for SYSTEMONE. Again, Delta Airlines' DATAS II system does not appear to have been profitable during 1985 or 1986, even by this revised measure.

Tables 4.11 and 4.12 report similar returns because the various adjustments of reported income and expenses reflected in Table 4.12 increase the estimated values of both net CRS income and total invested capital, which form the numerator and denominator of the calculated returns on investment, by roughly similar proportions. This occurs primarily because outlays by most vendors for intangible assets are rising rapidly, so that amortizing these expenditures over three years rather than treating each year's outlay as a current expense reduces each system's estimated total expenses during 1985 and 1986. Although this adjustment produces an increase in estimated net income, the remaining unamortized values of vendors' investments in intangible assets also rise as a result, largely offsetting the effect of higher net income on the calculated rate of return. Nevertheless, the fact that the resulting estimates of returns on total investment for the various CRSs are comparable to those originally reported in Table 4.11 provides another indication that the returns currently being generated by some vendors' investments in CRS activities may be quite large.

#### G. Summary

The evidence presented in this chapter suggests that SABRE and APOLLO have been and almost certainly remain extremely remunerative investments for their airline owners. Moreover, the three smaller systems -- PARS, SYSTEMONE, and DATAS II -- may produce unusually high returns on their owners' investments if the cash flows they currently generate persist in the future. Assuming that these systems' vendors correctly estimated the magnitude of their contributions to increased airline passenger revenues from display bias and the halo effect, Table 4.10 suggests that the financial benefits of CRS ownership have been substantial under all but the most conservative assumptions.

Perhaps more important, the analysis of economic returns on CRS investments reported in Section D indicates that vendors' ongoing outlays to enhance the capacity and performance of their CRSs and to extend their travel agent networks, which exceeded \$150 million for each of the two largest vendors during 1986, may continue to be extremely remunerative. This finding suggests that the increased fees for CRS services imposed in response to the 1984 CAB rules have made investments in airline-owned CRSs at least as remunerative since the rules went into effect as they were before 1984. Tables 4.11 and 4.12 provide additional evidence that at least the two largest systems continue to represent extremely remunerative investments in the changed environment fostered by the CAB's 1984 rules, even without considering any contributions they may continue to make to the financial viability of their airline owners.

In the next chapter, we explore the relationship of fees charged by CRS vendors for each of the two basic services they provide -- reservation services to participating airlines and support services to their travel agent subscribers -- to the costs they incur in providing each of these services. It also investigates in more detail the financial benefits of these systems to their parent airlines.

## V. ANALYSIS OF CRS VENDORS' MARKET POWER

### A. Introduction

The CRS vendors participate in two basic markets. In one market, vendors provide reservation services for the airlines, hotels, rental car companies, and other firms that participate in their CRSs. These participants pay a fixed fee per reservation booked. In the other market, vendors provide equipment, training, and support services to travel agents, for which vendors charge agents monthly or annual fees that are specified by the terms of the contracts governing these transactions.

An important question is whether the CRS vendors are able to exercise market power in their dealings with either airlines and other participants in their systems or travel agents who subscribe to their CRSs. As Chapter II indicated, several previous studies of the CRS industry have expressed concern that vendors may exercise market power over competing airlines or travel agents. This chapter attempts to analyze whether the CRS vendors do so.

Section B identifies potential sources of vendors' market power over both airlines and travel agents. Section C examines the relationship of fees charged for the two basic products supplied by CRS vendors (passenger reservations and subscriber services) to the costs vendors incur in supplying them. Section D investigates changes in the vendors' market shares in major urban areas. Finally, Section E analyzes the vendors' ability to influence travel agents to book passengers on host airlines who would otherwise travel by competing airlines.

### B. Potential Sources of Vendors' Market Power

The most common source of a producer's ability to exercise market power over potential customers is the absence of actual or potential competition from suppliers of comparable products. Thus, any ability the CRS vendors have to exert undue bargaining influence over other airlines or travel agents would be expected to stem from a limitation on the number of vendors competing to provide reservation services.

Various impediments to entry into the CRS industry may limit the number of viable competitors. For example, economies of scale in producing reservation services appear to be significant, and a potential entrant would have to incur substantial non-recoverable investments. By limiting the number of potential competitors, entry barriers may confer substantial bargaining leverage on CRS vendors in setting the terms of their transactions with other airlines and travel agents.

The CRS industry consists of five competitors offering products that are increasingly comparable. Each of these five vendors has access to a widespread network of travel agent subscribers. Although not large, in most industries this number of active competitors might be expected to limit the bargaining power of any one vendor, even with the presence of significant barriers to entry into that industry. In today's airline industry, however,

Third, CRS vendors incur substantial ongoing expenses to develop and maintain networks of travel agent subscribers, who generate the passenger reservations that represent the basic service vendors supply to airlines and other CRS participants. These outlays include investments in equipment used by subscribers, various expenses for marketing the vendor's system to current and potential subscribers, and incentives paid to travel agents to induce them to convert to the vendor's CRS or remain subscribers. Finally, vendors provide training in the use of their systems, equipment maintenance, and various other services to subscribers, all of which can be costly to supply to the typical system's extensive, geographically dispersed network of relatively small travel agencies.

Table 5.1 presents the distribution of 1986 expenditures reported by the five airline CRS vendors among these various categories. As the data presented in the table indicate, combined annual investment outlays for computer, communications, and subscriber equipment represented 17 to 22 percent of that year's total outlays for the largest and most mature systems, but ranged up to almost 36 percent of reported expenditures for systems still in the developmental phase. The table also reports that outlays for developing and enhancing the computer programming that allows vendors to process passenger reservations represented 11 percent of total outlays for DATAS II, but accounted for only seven to eight percent of total reported expenses for more mature systems. Nevertheless, the dollar magnitudes corresponding to this latter range (nearly \$17 million each for APOLLO and SABRE) indicate that vendors continue to make significant investments in enhancing the capabilities of their systems.

Table 5.1 also reports that six to 14 percent of each vendor's 1986 expenditures consisted of those for operating the central computers in which reservations are processed, a category that also includes expenses for maintaining the computerized data bases that present schedule, fare, and seat availability information to subscribers. Another 16 to 25 percent of the five vendors' reported outlays in 1986 were for operating the communications network that connects the central CRS computer with participants' internal reservations computers and the system's subscribers, which consists primarily of leased telephone circuits.

During 1986, each of the five CRS vendors spent 11 to 19 percent of total cash expenditures marketing its systems to prospective as well as existing subscribers. Four of the five vendors devoted an additional three to seven percent of total expenditures to inducing new subscribers to switch from other CRSs to their own, or inducing current subscribers to remain users of their systems and to employ their systems' recently added capabilities to make rental car and hotel bookings or to issue boarding passes. Finally, Table 5.1 shows that vendors' outlays for initial training and ongoing support of their travel agent subscribers amounted to the remaining 13 to 26 percent of their total 1986 cash expenditures.

TABLE 5.1

## Distribution of 1986 Vendor-Reported CRS Expenditures by Category

<u>Expense Category</u>	Percent of Total Reported Expenditures				
	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
Computer, Communications, and Subscriber Equipment	20.5%	22.3%	17.2%	35.6%	26.0%
CRS Product Development	7.6%	6.8%	-- <sup>2</sup>	-- <sup>3</sup>	11.0%
Central Computer Operations	14.4%	13.7%	-- <sup>2</sup>	5.7%	7.0%
Communications Network Operation	15.7%	21.2%	24.8%	20.6%	18.7%
CRS Marketing Efforts	11.3%	10.6%	12.1%	18.1%	18.9%
Subscriber, Conversion, Retention, and System Use Incentives	4.4%	2.5%	4.5%	7.4%	0.1%
Subscriber Training and Support	26.1%	22.9%	-- <sup>2</sup>	12.6%	18.3%
Total 1986 Expenses <sup>1</sup> (\$ millions)	\$227.9	\$249.9	\$68.7	\$87.3	\$61.3

Source: Allocation of individual cost items reported in CRS vendors' responses to DOT Information Directive, Items 13 to 17.

1. Cash expenditures only; omits reported depreciation but includes reported investment outlays.

2. Not reported separately; "CRS Product Development," "Central Computer Operations," and "Subscriber Training and Support" together represent 41.4 percent of vendor-reported expenditures.

3. Included in "Computer, Communications, and Subscriber Equipment" category.

Because CRS vendors impose separate fees for the services they provide to participants in their systems and the travel agents who subscribe to them, testing the reasonableness of these fees requires allocating the individual expenditure categories reported in Table 5.1 between those for producing reservation services and those for servicing travel agent subscribers. This allocation process requires distinguishing expenditures that vendors make on behalf of participants in their CRS systems, and thus would expect to recover through booking fees charged for passenger reservations, from those they make to service their subscribers and presumably charge directly to travel agents. Thus, we allocate each individual expenditure category reported in Table 5.1 by assigning to vendors' costs for producing reservations services the fraction of it that vendors would be expected to recover from competitively determined booking fees. In turn, the remainder of each category is assigned to the costs of servicing vendors' subscriber networks.

Table 5.2 presents what we feel are the most likely allocations of the seven expenditure categories appearing in Table 5.1 that result from applying this principle. Three of the expenditure categories are allocated entirely to the costs of producing reservation services: product development outlays, operating expenditures for CRS central computers, and the incentives paid to subscribers. Because expenses for operating the central computer in which reservation records are generated and stored are clearly among those that vendors would be expected to recover from the participants on whose flights passenger reservations are processed, their full amount is allocated to the production of reservation services. Similarly, outlays for developing or acquiring the computer software that provides a CRS's capability to generate, store, and retrieve those reservation records represent costs that in a competitive market would be recovered from booking fees. Although we cannot unambiguously assign subscriber incentives fully to the cash expenditures we expect vendors to recover from booking fees, we believe that this is the correct allocation. Following this same logic, Table 5.2 also shows that the entire amount of vendors' outlays for "Subscriber Training and Support" is allocated to the costs for servicing travel agents, since vendors would be expected to recover their costs for providing these services exclusively through subscriber fees.

The most likely allocation of expenses shown in Table 5.2 partitions each of three expenditure categories, "Computer, Communications, and Subscriber Equipment," "Communications Network Operation," and "CRS Marketing Efforts," between reservation and subscriber services. We refer to these three expenditure categories, together with the subscriber incentives category, as joint expenditures for producing reservation and subscriber services. (After making the various adjustments that are intended to improve the correspondence of vendors' reported expenditures to their actual costs for producing reservation and subscriber services, we refer to these categories as "joint costs.") This reference reflects the fact that unlike the other expenditure categories that appear in Tables 5.1 and 5.2, we cannot confidently assign them entirely to either the production of reservation services or vendors' efforts to service their travel agent subscribers.

TABLE 5.2

**Most Likely Allocation of CRS Expenditure Categories  
Between Reservation and Subscriber Services**

<u>Expenditure Category</u>	Percent Allocated To:	
	<u>Reservation Services</u>	<u>Subscriber Services</u>
Computer, Communications, and Subscriber Equipment	60%	40%
CRS Product Development	100%	--
Central Computer Operations	100%	--
Communications Network Operation	10%	90%
CRS Marketing Efforts	40%	60%
Subscriber Conversion, Retention, & System Use Incentives	100%	--
Subscriber Training and Support	--	100%

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Source: Based on descriptions of individual cost items accompanying CRS vendors' responses to DOT Information Directive, Items 13 to 16. See text for discussion.

In their responses to the Department's CRS Information Directive, most vendors included among their itemized revenue sources receipts from charges for installation, rental, and servicing of remote terminals, printers, and other equipment located at subscribing travel agencies. In addition, vendors typically reported itemized receipts for communications charges assessed to subscribers, as well as for ongoing support and servicing of their subscriber accounts. Thus, we have assumed that competitively determined subscription fees would fully recoup the costs vendors incur in providing these services to travel agents, an assumption that is reflected in the allocations of the "Computer, Communications, and Subscriber Equipment," "Communications Network Operation," and "Subscriber Training and Support" categories reported in Table 5.2.

Analysis of the itemized equipment investment and depreciation figures reported by certain CRS vendors indicates that about 35 percent of a typical system's total equipment investment represents hardware located at subscribing travel agencies. Approximately another 10 percent constitutes equipment that forms part of the communication networks linking subscribers, the vendor, and participants, while the remaining 55 percent represents centrally located computer equipment and facilities. Thus, as Table 5.2 indicates, our most likely allocation assigns 60 percent of the costs associated with these investments to the production of reservation services, consisting of the central site equipment share plus one-half of the share corresponding to communications equipment. These costs are included among the total expected to be recovered from booking fees, while the remaining 40 percent of equipment-related costs is assigned to the total expected to be recovered from charges to subscribers.

Similarly, analysis of the detailed expense records submitted by certain vendors indicates that approximately 90 percent of expenses for operating their CRS communications networks represent those for circuits connecting subscribers to their systems' central computers. Assuming again that subscribers are charged with these expenses, Table 5.2 reports that ten percent of their total is allocated to reservation services, with the remaining 90 percent assigned to costs expected to be recovered from subscribers. Because the conversion, retention, and system-use incentives paid by vendors to travel agents are intended to increase the volume of reservations generated by each system's subscribers, these expenses would also be expected to be recovered from the resulting increase in booking fee revenue received by its vendor. Although we are unsure as to the exact terms on which these incentives are paid, Table 5.2 shows that our most likely allocation assigns their corresponding costs fully to reservation services.

The proper allocation of the remaining expense category, "CRS Marketing Efforts," is more difficult to determine. This is primarily because the category appears to include a combination of activities intended to expand vendors' respective subscriber networks, together with efforts to support current subscribers in enhancing their ability and willingness to employ the CRS as an integral part of their travel agency businesses. Analyzing the expense records submitted by certain CRS vendors suggests that roughly 40 percent of outlays reported as marketing expenses are associated with



vendors' efforts to enlist new subscribers to their systems by acquainting non-subscribing agents with the capabilities of their systems. Such expenditures are analogous to the conversion, retention, and use incentives paid by vendors to new subscribers, in that they are primarily intended to increase the volume of booking fee revenue generated by their systems. Thus, we assign the same fraction of reported marketing outlays to vendors' production of reservation services, since we expect these expenditures to be ultimately recovered from booking fees.

In contrast, where they are itemized and described by vendors in sufficient detail to permit such analysis, the remainder (typically about 60 percent) of outlays classified as marketing expenses appear intended to develop current subscribers' reliance upon -- as well as their loyalty to -- the CRS systems they already employ. We do not know how extensively such efforts by vendors increase subscribers' utilization of their respective CRSs, and are thus indirectly recovered by vendors through the resulting increase in booking fee revenue paid by participants. Alternately, these activities may simply represent another category of the ongoing support vendors provide to subscribers, the costs of which would be expected to be (at least on average) recovered through the basic subscription charges vendors assess. As Table 5.2 indicates, our most likely allocation in effect makes this latter assumption, since it assigns 40 percent of the costs entailed in vendors' marketing efforts to reservation services, and the remaining 60 percent to servicing their subscribers.

Although Table 5.2 reports our best estimates of the correct allocation of these joint expenditures and their corresponding costs between reservation and subscriber services, their correct allocation is simply unknown. Hence the subsequent analysis tests the sensitivity of vendors' estimated costs for reservation and subscriber services, as well as the comparison of these costs to the revenues vendors receive, to different allocations of these joint costs. Specifically, in addition to estimates that employ the most likely allocation of expenditure categories reported in Table 5.2, we report the results of allocating 100 percent of each category of joint expenditures to reservation and subscriber services.

Tables 5.3 and 5.4 illustrate the allocations of the seven expenditure categories that result from these alternative assumptions. Although we view each of these alternate allocations as less likely to be correct than those shown in Table 5.2, we cannot rule them out. Perhaps more important, they establish a range of estimates of vendors' costs for reservation and subscriber services, as well as for the comparison of vendors' revenues to these estimated costs, that almost certainly includes the correct cost estimates and revenue-to-cost comparisons.

Once the allocation of vendors' reported expenditures between those for producing reservations services and servicing travel agents is performed, it is also necessary to adjust vendors' reported cash outlays to correspond more closely to the true economic costs vendors incur in producing these services. The vendors' reported expenditures may not reflect the costs they incur in supplying reservation services and supporting subscribers; this occurs because (for the variety of reasons indicated previously) corporate expense accounting systems such as those used by CRS vendors often fail to measure the economic costs of providing a product or service.

In response to this problem, the following discussion describes adjustments we made to the vendors' reported expenditures -- adjustments that are intended to improve the accuracy with which reported expenditure data measure the economic costs of supplying CRS services. These adjustments parallel those made in Chapter IV for the purpose of adjusting vendors' reported estimates of the accounting returns earned on their CRS investments to reflect more accurately the underlying economic returns generated by those investments. Table 5.5 summarizes the differences between vendors' treatment of expenditures in each of the categories appearing in Table 5.1 and the treatment of these outlays that is adopted in our analysis of CRS costs.

As Table 5.1 reported, one of the major costs faced by CRS vendors is associated with the investments in central computer, communications, and remote terminal equipment necessary to provide the capacity to generate, process, and store passenger reservation records. Most vendors report only a combined annual total for investment in these three types of equipment, which as indicated previously must be allocated between the central site (computer and communications) equipment and equipment located at subscribing travel agencies. Although certain vendors do report estimated depreciation separately for these equipment types, they typically have not disclosed the depreciation policies employed in making these estimates; accordingly, the accuracy and comparability of their reported depreciation estimates are difficult to evaluate.

In addition to depreciation, the economic cost associated with such investments includes the opportunity cost of committing funds to those investments rather than to an alternative income-generating purpose. Because the opportunity cost associated with investments is not commonly reported in accounting statements (which views the return or profit on an investment as a residual between actual revenues and expenses, rather than as a cost of obtaining investment capital), estimates of its magnitude must be constructed. We do so by applying the rate of return vendors could hypothetically have earned on alternative investments to the estimated total value of their investments in CRS equipment.

Thus, in order to develop consistent estimates of the cost associated with vendors' investments in CRS equipment, we first apply the depreciation rule summarized in Table 5.5 to each vendor's reported outlays for equipment investments. We assume (as we did in Chapter IV) that the value of vendors' investments in central processing, communications, and other equipment declines in straight-line fashion from its reported acquisition cost to zero residual value over a five-year period. Again, this short lifetime is intended to approximate the actual economic lifetime of equipment

Table 5.3

Alternate Allocation of CRS-Related Expenditure Categories:  
All Joint Expenditures Allocated to Reservation Services

<u>Cost Category</u>	Percent Allocated to:	
	<u>Reservation Services</u>	<u>Subscriber Services</u>
Computer, Communications, and Subscriber Equipment	65%	35%
CRS Product Development	100%	--
Central Computer Operations	100%	--
Communications Network Operation	100%	--
CRS Marketing Efforts	100%	--
Subscriber Conversion, Retention, and System Use Incentives	100%	--
Subscriber Training and Support	--	100%

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Source: Based on descriptions of individual cost items accompanying CRS vendors' responses to DOT Information Directive, Items 13 to 16. See text for discussion.

Table 5.4

**Alternate Allocation of CRS-Related Expenditure Categories:  
All Joint Expenditures Allocated to Subscriber Services**

<u>Cost Category</u>	Percent Allocated to:	
	<u>Reservation Services</u>	<u>Subscriber Services</u>
Computer, Communications, and Subscriber Equipment	55%	45%
CRS Product Development	100%	--
Central Computer Operations	100%	--
Communications Network Operation	--	100%
CRS Marketing Efforts	--	100%
Subscriber Conversion, Retention, and System Use Incentives	--	100%
Subscriber Training and Support	--	100%

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Source: Based on descriptions of individual cost items accompanying CRS vendors' responses to DOT Information Directive, Items 13 to 16. See text for discussion.

Table 5.5

Comparison of Vendor-Reported and Adjusted Treatment  
of Individual CRS Expenditure Categories

<u>Expenditure Category</u>	<u>Vendor Treatment</u>	<u>Adjusted Treatment</u>
Computer, Communications, and Subscriber Equipment	Depreciated using various lifetimes, time patterns, and residual values	Depreciated completely over five years using straight-line method; 15% annual return on undepreciated portion included
CRS Product Development	Current expense <sup>1</sup>	Amortized completely over three years using straight-line method; 15% annual return on unamortized investment included
Central Computer Operations	Current expense	Current expense
Communications Network Operation	Current expense	Current expense
CRS Marketing Efforts	Current expense	Amortized completely over three years using straight-line method; 15% annual return on unamortized investment included
Subscriber Conversion, Retention, and System Use Incentives	Current expense	Amortized completely over three years using straight-line method; 15% annual return on unamortized investment included
Subscriber Training and Support	Current expense	Current expense

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1. Current expense indicates that the full value of reported expenditures is treated as an expense when those expenditures were recorded. Delta amortizes product development expenses over an undisclosed period.

investments in an environment characterized by rapid innovation in computer-services technology and intensifying competition among CRS vendors. We further assume that the annual opportunity cost associated with equipment investments is equal to 15 percent of their remaining (undepreciated) value during that year, a figure intended to correspond to the annual return that CRS vendors could have earned on capital invested in alternate activities.

In addition to requiring substantial investments in physical capital, Table 5.1 suggests that developing the capability to provide reservation services for sale to a CRS's participants requires substantial capital outlays for developing or acquiring the computer software and programming that provides the capability to create, retain, and access passenger reservation records. Again, however, vendors' reported outlays for this purpose do not correspond to the correct annual economic costs associated with these investments. As Table 5.5 indicates, vendors (with one exception) treat these product development outlays as current expenses, the full value of which is realized in the year that they are made, rather than as investments whose costs and returns are spread over a number of succeeding years.

Like investments in physical facilities, however, these outlays are required to establish, maintain, and enhance the vendors' ability to supply reservation services to CRS participants. They are thus intended to produce income over a period extending well beyond the year in which they are made. Determining the economic cost associated with these investments requires estimating annual values for their depreciation and opportunity costs, just as for vendors' investments in physical capital. Table 5.5 shows that as with vendors' investments to acquire computer and communications equipment, we do so by first assuming that the costs associated with each year's reported outlays for CRS system development are spread evenly over a subsequent three-year period. That is, we assume that the value of each year's investment in product development is amortized at a constant rate over a three-year period. This assumed lifetime appears consistent with the rapid pace of innovation in service features offered by competing CRSs, which quickly diminishes the value of previous investments. In order to account for the forgone potential return on capital invested in developing and enhancing vendors' capabilities to produce reservation services, opportunity costs are again calculated as 15 percent of the remaining value of cumulative historical outlays for CRS software development and related product development activities.

As Table 5.1 indicated, outlays for operating a CRS's central computer and communications network together represent 25 to 35 percent of each vendor's annual expenditures. These outlays include expenses to operate and support the central computer facility in which reservations records are created and stored; to maintain the computerized data bases that present schedule, fare, and seat availability information to subscribers; and to operate the communications network that connects the CRS host computer, internal reservations computers operated by CRS participants, and the system's subscribers. As Table 5.5 indicates, both the vendors and our analysis treat these outlays as current expenses, reflecting the fact that they are directly linked to the volume and timing of passenger reservations that are generated using each CRS; accordingly, their full value is treated as a cost of producing CRS services in the year that it is reported.

A major determinant of the value of a CRS system to its airline owner is the volume of reservations generated by the system, since this determines the magnitude of the revenues fees paid to the vendor by its participants, including the owner airline. The booking activity generated by a CRS system is influenced primarily by the extent of its subscriber and terminal network, and vendors make substantial expenditures to develop subscribers' use of and loyalty to their CRSs. These include the categories identified as "CRS Marketing Expenditures" and "Subscriber Conversion, Retention, and System Use Incentives" in Table 5.1, which together represented roughly 15 to 20 percent of most vendors' reported 1986 outlays.

As with vendors' investments in the central equipment and software that provide the capability to generate reservation services, expenses for developing and extending the subscriber network are intended to generate returns over a multi-year period beginning when they are made. Marketing expenditures and the various incentives vendors offer to travel agents represent investments in what are probably a system's most important intangible assets -- its subscribers' reliance on a CRS as an integral part of their business activities and their allegiance to a specific CRS. Recognizing the similarity of marketing expenditures and incentive payments to the other investments made by vendors, Table 5.5 reports that they are treated like vendors' investments in product development: their estimated annual costs consist of amortization of their initial values, together with opportunity costs equal to the returns that could have been earned on alternative investments.

As the table indicates, vendors' reported annual outlays for CRS marketing and travel agent conversion are amortized over a three-year period. Thus, the economic cost associated with each year's outlays for these purposes is assumed to be spread evenly over a three-year period beginning in the year these expenditures are recorded. Opportunity costs on the remaining unamortized value of these investments in each year are estimated as 15 percent of that value, the same estimate of forgone returns on alternative investments used to estimate the annual opportunity costs associated with vendors' other CRS-related investments.

The final major category of CRS vendors' reported expenditures includes outlays for training travel agents in the use of their systems, installing and servicing equipment at subscriber locations, and providing ongoing support for subscribers in using the vendors' systems. These outlays accounted for roughly 20 to 25 percent of the total 1986 expenditures reported by the various CRS vendors. One component of these expenditures, those for training subscribers in the use of particular CRSs, is analogous to the vendors' other investments, since it is intended to produce returns over a period extending well beyond the year in which it is made. However, because we are unable to separate training expenditures from vendors' other reported outlays for supporting subscribers, Table 5.5 reports that we treat all outlays included in this category as current expenses, in accordance with vendors' practices.

Table 5.6 presents alternative estimates of the average unit costs incurred by each of the five CRS vendors in producing reservation services during 1986. Each of these estimates reflects the various adjustments to vendors' reported 1986 expenditures discussed previously and summarized in Table 5.5. The range of estimates presented for each vendor corresponds to the three different allocations of various categories of costs between reservation and subscriber services that were summarized in Tables 5.2, 5.3, and 5.4.

After making these allocations and adjustments to vendors' reported outlays, each of the resulting alternative estimates of vendors' total 1986 costs for reservation services was divided by total 1986 bookings (including airline passenger segments, which account for 95 to 98 percent of each system's total bookings, as well as hotel, rental car, and miscellaneous other bookings) to produce an estimate of average unit costs for reservation services. As Table 5.6 indicates, the highest estimates of each system's unit costs corresponds to the allocation of all joint costs to the production of reservation services; the lowest estimates reflect the assignment of those joint costs to vendors' efforts to service their subscribers.

The unit cost estimates reported in Table 5.6 have two major implications. First, regardless of which cost allocation is adopted, APOLLO and SABRE appear to be able to produce reservation services at considerably lower average unit costs than their newest and smallest counterpart, DATAS II. As discussed in Chapter III, this apparent cost advantage may reflect their ability to exploit economies of scale in producing reservation services, the influence of learning or cumulative experience on their unit costs, or some combination of these two effects.

Our estimates also indicate that SYSTEMONE has average unit costs for producing reservations that are comparable to those of the largest vendors. However, it is not clear that these estimates represent costs for producing equivalent products, since in 1986 travel agents may have viewed the reservation-making capabilities and performance of SABRE and APOLLO as superior to those offered by competing systems. Further, we are not confident that Eastern has estimated and reported the full costs of developing and operating its CRS. Thus, we feel that the average unit costs estimated for SYSTEMONE in Table 5.6 may be understated.

It is also possible that these apparent cost differences partly reflect variation in the accuracy with which the vendors have been able to isolate the costs associated with their CRSs from those of their respective internal reservations systems. However, we can detect no systematic relationship between the level of effort individual vendors appear to have made to determine and report their CRS-related expenditures and the resulting unit cost estimates reported in Table 5.6.



Table 5.6

## Estimated Average Unit Costs for CRS Reservation Services During 1986

## Average Reservation Service Cost:

<u>Cost Allocation</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
All Joint Costs Allocated to Reser- vation Services	\$1.39	\$1.24	\$2.09	\$1.35	\$2.57
Most Likely Allocation of Joint Costs	\$0.96	\$0.79	\$1.44	\$0.75	\$1.74
No Joint Costs Allocated to Res- ervation Services	\$0.72	\$0.53	\$1.17	\$0.53	\$1.17

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Source: Estimated from CRS vendors' responses to DOT Information Directive, Items 3, 4, and 13. See text for a discussion of how these average unit cost estimates were derived.

The second, and probably more important, implication of the estimates reported in Table 5.6 is that most vendors' average unit costs for producing computerized reservation services were below the booking fees they charged to participating carriers even before the recent increase in booking fees. Further, this conclusion seems to hold for at least the two largest systems (which together accounted for nearly 75 percent of airline passenger segments booked through CRSs during 1986) even when the division of vendors' costs between reservation services and subscriber services corresponds more closely to the allocation that assigns all joint costs to the latter.

Table 5.7 reports the estimated average costs that vendors incurred for servicing their subscribers during 1986. Like the previous estimates of the cost of producing reservation services, these estimates reflect the varying allocations of joint costs discussed above, as well as the adjustments to reported expenditures that were intended to improve the accuracy with which they reflect the true economic costs of the various services vendors provide to travel agents. The table presents average cost estimates for subscriber services both per subscriber location and per CRT in use at a typical subscriber office or location. These estimates thus differ in proportion to the average number of terminals used by each CRS's subscribers (see

Table 3.2), which varied from 3.3 terminals for the typical PARS installation to 5.2 terminals for SABRE installations.

The estimates reported in Table 5.7 indicate that all vendors incur substantial costs to install and maintain equipment at subscribers' offices, as well as to train and support travel agency employees. As with estimated reservation services costs, however, these amounts appear to vary substantially among vendors, with the highest estimated cost per subscriber location well in excess of 200 percent of the lowest value regardless of the specific cost allocation chosen. Although the somewhat narrower range of estimated average costs per CRT in use shown in the lower half of the table suggests that part of this variation is due to differences among systems in the average number of terminals operated per location, these latter estimates still reveal considerable variation among the costs different vendors incur in servicing their subscribers.

Table 5.8 reports average unit revenues by the five CRS vendors from both participants and subscribers during 1986. The average reservation fees paid by airline and non-airline participants in each system were computed by dividing vendors' reported revenue from each of these sources by the number of reservations recorded on participating airlines and for non-airline participants. The average revenue received by most vendors for the airline bookings closely matched their "advertised" booking fees.

Table 5.8 also indicates that the average revenue received by each vendor per non-airline booking or other transaction (again, these primarily represent hotel and rental car reservations) substantially exceeded the average airline booking fee during 1986. As the table reports, these fees averaged approximately \$3.00 for four of the five CRS vendors, and the minimum amount by which any vendor's average revenue per non-airline booking exceeded that received from airline participants was \$1.00. Although these fees appear quite high, the reservations and other transactions for which they are charged may be viewed by non-airline participants as sales that would not otherwise be made through their more traditional outlets, or as sales for which higher prices can be charged. In either case, non-airline participants may view even the apparently high fees charged by vendors for these transactions as acceptable. Perhaps more important, virtually all non-airline CRS participants have other readily available alternatives for distributing their services, thus reducing the importance of airline-owned CRSs as marketing devices and minimizing vendors' potential to exercise market power over them.

Finally, Table 5.8 reports the average revenue received by each CRS vendor during 1986 from subscribing travel agents, expressed both per subscriber location and per reservations terminal in use at those locations. There appears to be substantial variation among the five systems in the average level of charges to subscribers, particularly among the three smaller vendors (PARS, SYSTEMONE, and DATAS II). Because the average costs vendors incur to service their subscribers vary substantially, some variation among

Table 5.7

Estimated Average Unit Costs for CRS Subscriber Services During 1986<sup>1</sup>

## Annual Cost Per Subscriber Location

<u>Cost Allocation</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
All Joint Costs Allocated to Subscriber Services	\$17,755	\$14,837	\$8,440	\$10,888	\$15,248
Most Likely Allocation of Joint Costs	\$14,359	\$11,573	\$6,425	\$ 9,368	\$11,363
No Joint Costs Allocated to Subscriber Services	\$ 8,409	\$ 5,749	\$1,429 <sup>1</sup>	\$ 5,170	\$ 5,650

## Annual Cost per Subscriber CRT in Use:

<u>Cost Allocation</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
All Joint Costs Allocated to Subscriber Services	\$4,062	\$3,379	\$2,516	\$3,461	\$5,131
Most Likely Allocation of Joint Costs	\$3,285	\$2,635	\$1,915	\$2,978	\$3,824
No Joint Costs	\$1,924	\$1,309	\$ 426 <sup>2</sup>	\$1,643	\$1,901

Source: Estimated from CRS vendors' responses to DOT Information Directive, Items 1, 2, and 13.

1. The estimates contained in this table are averages based on DOT's allocation of costs to various activities. Therefore, they may not reflect the actual costs of serving any given location or CRT.

2. Although computed correctly, this estimate is unrealistically low because expenditures for support and servicing of PARS subscribers cannot be separately estimated from the information reported by its vendor; see Table 5.1, footnote 2.

Table 5.8

Average Unit Revenues Received by CRS Vendors<sup>1</sup>  
from Participants and Subscribers During 1986

<u>Unit Revenue Measure</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
<b>Average Reservation Fee Received from Participants:</b>					
Airline Participants	\$1.85	\$1.84	\$1.75	\$2.07	\$1.14
Non-Airline Participants	\$3.14	\$2.84	\$2.96	\$1.44	\$2.87
All Participants	\$1.96	\$1.91	\$1.82	\$2.03	\$1.19
<b>Average Subscriber Revenue:</b>					
Per Subscriber Location <sup>2</sup>	\$11,911	\$9,416	\$5,457	\$6,161	\$9,474
Per Terminal in Use*	\$ 2,725	\$2,144	\$1,626	\$1,958	\$3,188

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Source: Estimated from CRS vendors' responses to DOT Information Directive, Items 1, 2, 3, and 12.

1. The estimates contained in this table are averages based on DOT's allocations of costs to various activities. Therefore, they may not reflect the actual costs of serving any given location or CRT.

2. Subscriber locations and terminals in use on December 31, 1986.

average revenue received from subscribers would be expected. Further, CRS vendors negotiate individually the specific charges they assess each subscriber. Hence, the average subscriber revenue figures reported by each vendor may conceal substantial variation in the revenue actually received from different subscribers, including agencies of comparable size or to which similar levels of service are provided.

Table 5.9 expresses the average unit revenues received by each vendor from airline participants and travel agent subscribers (from Table 5.8) as a percent of its estimated average cost incurred in providing reservation services (Table 5.6) and support to subscribers (Table 5.7). Because three estimates of average unit costs incurred by each vendor in providing reservation and subscriber services (corresponding to the three alternate allocations of joint expenses for producing the two services) were presented, Table 5.9 also reports three estimates of average revenue received as a percent of average unit cost for each vendor's provision of reservation and subscriber services.

Table 5.9 reveals wide variation in the relationship of average airline booking fees to vendors' estimated average cost per reservation, regardless of the particular cost allocation that is adopted. For example, under what we consider to be the most likely allocation of vendors' joint costs between reservation and subscriber services, average booking fee revenue varied from 65 percent to 276 percent of estimated average unit cost per airline passenger segment booked during 1986. Although the recent increases in booking fees announced by vendors -- which equalized basic booking fees at \$1.35, while narrowing the range of fees for bookings made utilizing direct access to between \$2.00 and \$2.10 -- should reduce some of this variation, it is partly accounted for by the variation in vendors' average unit costs.

Table 5.9 also shows that under this most likely allocation of joint costs, booking fees charged by the two largest CRSs appeared to equal 192 percent (APOLLO) and 233 percent (SABRE) of their average unit costs for producing reservations during 1986, while one system (SYSTEMONE) appeared to charge booking fees equal to 276 percent of its average costs. (As discussed previously, these estimated average costs include a 15 percent return on vendors' estimated investments in both the physical capital and the intangible assets that comprise their systems.) Even under the allocation that assigns all joint costs to producing reservation services, APOLLO, SABRE, and SYSTEMONE appeared in 1986 to charge booking fees that exceeded their average unit costs. Finally, if the allocation that assigns all joint costs to subscriber services is the correct one, all vendors except Delta appear to charge booking fees that exceed their average unit costs for producing reservation services.

Finally, Table 5.9 also reports the relationship of each vendor's average subscriber fee revenue to its average cost for servicing travel agents during 1986. These relationships show less variation among vendors than those of booking fees to unit reservation costs (although, as discussed above, these average relationships may conceal substantial variation in the relationship of fees that certain vendors charge certain subscribers to the costs they actually incur in supporting those agents).

Table 5.9

Relationship of Average Unit Revenues Received by CRS Vendors  
to Estimated Average Unit Costs for CRS Services During 1986

<u>Fee-Cost Relationship</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
Average Airline Booking Fee Revenue as a % of Estimated Average Unit Cost for Reservation Services:					
All Joint Costs Allocated to Reservation Services	133%	148%	84%	153%	44%
Most Likely Alloca- tion of Joint Costs	192%	233%	122%	276%	65%
All Joint Costs Allocated to Sub- scriber Services	257%	344%	149%	388%	97%
Average Annual Revenue Received from Subscribers as a % of Estimated Average Unit Costs for Subscriber Services:					
All Joint Costs Allocated to Reserva- tion Services	142%	164%	382% <sup>1</sup>	119%	168%
Most Likely Alloca- tion of Joint Costs	83%	81%	85%	66%	83%
All Joint Costs Allocated to Sub- scriber Services	67%	63%	65%	57%	62%

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Source: Computed from figures reported in Tables 5.6, 5.7, and 5.8.

1. Although computed correctly, this estimate is implausibly high because expenditures for support and servicing of PARS subscribers cannot be separately estimated from the information reported by its vendor; see Table 5.1, footnote 2, and Table 5.7, footnote 1.

Under what we feel is the most likely allocation of joint costs to subscriber services, most vendors appeared to recoup 80 to 85 percent of their costs for supporting travel agents from the subscription, equipment rental, and other fees they assessed during 1986. Under a somewhat less likely but still plausible allocation of joint costs, subscriber fees might have covered as little as 57 to 67 percent of vendors' estimated costs for services provided to travel agents, but it is also possible that fees were set in the range of 120 to 170 percent of these estimated costs, as Table 5.9 indicates. Thus, it appears that all CRS vendors may, at least on average, charge their travel agent subscribers fees that are below the costs they incur in providing equipment installation, maintenance, training, and various other support services to those agents.

Table 5.10 expresses the relationships of vendors' 1986 average airline booking fee revenues to their estimated average unit costs for reservation services as an absolute difference between these two values. Thus, for example, it shows that under the most likely allocation of joint costs, APOLLO's reported average revenue per airline booking (\$1.85, reported in Table 5.8) exceeded its estimated average cost per reservation produced (\$0.96, from Table 5.6) by \$0.89 during 1986. Depending on the allocation of joint costs, this difference ranged from \$0.46 to \$1.13 for APOLLO.

As Table 5.10 also indicates, the lowest estimate of this difference for each vendor (which, as the table shows, is negative for some, meaning that its average reported booking fee revenue is below its average estimated unit cost for producing reservations) corresponds to the allocation of all joint costs to vendors' reservation services activities, since this increases the estimated average cost per reservation. The greatest difference in each vendor's average reported booking fee revenue over its estimated average unit reservation service cost corresponds to the allocation of all joint costs to servicing subscribers.

Although the range of estimated dollar differences presented for each vendor in Table 5.10 is quite wide, it does appear likely that three vendors charged booking fees that exceeded their average unit costs for producing reservations during 1986. The estimated ranges by which they appeared to do so were \$0.46 to \$1.13 for APOLLO, \$0.60 to \$1.31 for SABRE, and \$0.72 to \$1.54 for SYSTEMONE. For two of the smaller vendors (PARS and DATAS II), the range of plausible differentials includes negative values, although only for DATAS II is our most likely estimate of average unit costs actually below average booking revenue received during 1986.

Because the two largest vendors recently increased fees for bookings made using their direct access capabilities, it is difficult to anticipate whether escalation in these vendors' costs for producing reservation services since 1986 is likely to have narrowed these estimated differentials. The booking fee increases (also to the \$1.85 basic level and \$2.10 for direct access bookings) imposed by PARS since 1986, while probably

Table 5.10

Difference Between Average Airline Booking Fee Revenue and  
Estimated Average Unit Cost per Booking During 1986

<u>Cost Allocation</u>	<u>APOLLO</u>	<u>SABRE</u>	<u>PARS</u>	<u>SYSTEMONE</u>	<u>DATAS II</u>
All Joint Costs Allocated to Reser- vation Services	\$0.46	\$0.60	\$-0.34	\$0.72	\$-1.43
Most Likely Alloca- tion of Joint Costs	\$0.89	\$1.05	\$0.31	\$1.32	\$-0.60
No Joint Costs Allocated to Reservation Services	\$1.13	\$1.31	\$0.58	\$1.54	\$-0.03

Source: Computed from figures reported in Tables 5.6 and 5.8.

not large enough to increase its revenue-cost differentials to the range of those estimated for SABRE and APOLLO, may have been sufficient to eliminate any uncertainty that PARS booking fees exceed its unit costs. Unless an allocation that assigns most joint costs to subscriber services is assumed, Delta's DATAS II system may operate at unit cost levels below booking fees, even after its recently announced increases take effect. In contrast, recently announced booking fee increases by SYSTEMONE will almost certainly maintain a substantial difference between its average revenue and average unit cost per booking, even if those costs have escalated rapidly since 1986. In sum, it appears that if vendors are exercising market power to exact above normal profits, they appear to be doing so by targeting participating airlines rather than subscribers.

#### D. Changes in the Vendors' Market Shares

Table 3.1 presented information on the vendors' national market shares. If the vendors enjoy market power, however, it stems from their ability to influence agency booking patterns in specific markets. Thus, national market share data are not particularly useful for analyzing whether the vendors have market power.

This section presents summary data on the vendors' market shares in large metropolitan markets. Appendix IV presents vendors' market share measured by revenues for 26 large hub markets and 31 medium hub markets in 1983 and 1986. Only one other study, the DOJ's 1983 Comments, has attempted to



estimate the vendors' market shares in large urban markets. In preparing our analysis, we have followed the DOJ's procedures in allocating vendor sales to agency locations; therefore, we are able to determine trends in market concentration in major markets since 1983.

Table 5.11 presents data on the vendors' market shares in the ten largest domestic markets. In six of the ten largest markets, SABRE and APOLLO were the two dominant CRSs. Either SABRE or APOLLO was the dominant system at three of the remaining four markets, while SYSTEMONE was the dominant vendor in Miami. Between 1983 and 1986, Table 5.11 shows that the dominant vendors' market share increased at three of the ten largest traffic hubs (Chicago, San Francisco, and Washington, D.C.), decreased at six (New York, Los Angeles, Dallas/Ft. Worth, Atlanta, Miami, and Houston), and remained essentially unchanged in Denver.

Between 1983 and 1986, two-firm concentration declined in eight of the ten largest markets. The decline in concentration was nominal in most cases (between 0.7 and 3.4 percentage points) but was significant in both Atlanta (down 15.3 points) and Houston (down 15.5 points). New York City and Houston were the only markets in the top 10 where one of the two largest vendors was replaced by a competitor. In New York, APOLLO was replaced by PARS, and in Houston SYSTEMONE was replaced by APOLLO. Atlanta and Miami were the only large traffic hubs in the top ten where the dominant vendor in 1983 was not also the dominant vendor in 1986. In Atlanta, APOLLO replaced SYSTEMONE as the dominant vendor, and in Miami SYSTEMONE displaced SABRE. DATAS II increased its market share in Atlanta from 3.6 percent to 21.6 percent, while SYSTEMONE dropped 16.7 percentage points in market share. In Miami, SYSTEMONE increased its market share by 28.3 percentage points while SABRE lost 19.6 percentage points.

Table 5.12 presents summary information on changes in vendors' market shares at the 26 large and 31 medium traffic hubs between 1983 and 1986. Between 1983 and 1986, SYSTEMONE increased its market share at 20 of the 26 large hubs, and at 25 of 31 medium hubs; DATAS II increased its share at 20 large and 19 medium hubs; and APOLLO increased its market share at 19 large hubs and 17 medium hubs. By contrast, PARS lost market share at 15 large hubs and 14 medium hubs, and SABRE lost market share at 21 large hubs and 17 medium hubs. In fact, SABRE's market share declined by more than ten percentage points at ten large hubs: Boston, Honolulu, Houston, Memphis, Miami, Orlando, St. Louis, Salt Lake City, Seattle, and Tampa. SABRE also lost market share of 10 percentage points or more at nine medium hubs: Anchorage, Cincinnati, Nashville, New Orleans, Omaha, Rochester, San Antonio, Syracuse, and West Palm Beach. Appendix IV provides additional information on changes in the vendors' market shares.

While SABRE lost significant market share at several large and medium hubs, APOLLO increased its market share significantly (more than 10 percentage points) at six large hubs (Honolulu, Houston, Memphis, Orlando, Salt Lake City, and Seattle), and at five medium hubs (Anchorage, Omaha, Rochester, Syracuse, and West Palm Beach).

TABLE 5.11

TWO-FIRM CONCENTRATION RATIOS BASED ON AGENCY REVENUES  
TEN LARGEST MARKETS<sup>1</sup>

	1983		1986	
	Primary CRS Vendor <sup>2</sup>		Primary CRS Vendor	
New York City (includes Newark)	SABRE	62.1%	SABRE	61.3%
	APOLLO	<u>16.1%</u>	PARS	<u>13.5%</u>
		78.2		74.8%
Chicago	APOLLO	47.2%	APOLLO	50.5%
	SABRE	<u>45.9%</u>	SABRE	<u>41.8%</u>
		93.1%		92.3%
Los Angeles (includes Ontario)	SABRE	47.9%	SABRE	41.2%
	APOLLO	<u>33.4%</u>	APOLLO	<u>39.4%</u>
		81.3%		80.6%
Dallas/Ft. Worth	SABRE	94.9%	SABRE	91.5%
	DATAS II	<u>2.0%</u>	DATAS II	<u>4.4%</u>
		96.9%		95.9%
Atlanta	SYSTEMONE	43.8%	APOLLO	27.2%
	APOLLO	<u>25.8%</u>	SYSTEMONE	<u>27.1%</u>
		69.6%		54.3%
San Francisco (includes San Jose)	APOLLO	41.5%	APOLLO	42.3%
	SABRE	<u>38.2%</u>	SABRE	<u>39.4%</u>
		79.7%		81.7%
Denver	APOLLO	76.1%	APOLLO	76.0%
	SABRE	<u>19.0%</u>	SABRE	<u>15.9%</u>
		95.1%		91.9%
Washington, D.C.	SABRE	53.1%	SABRE	56.7%
	APOLLO	<u>34.4%</u>	APOLLO	<u>27.6%</u>
		87.5%		84.3%
Miami	SABRE	61.4%	SYSTEMONE	44.8%
	SYSTEMONE	<u>16.5%</u>	SABRE	<u>41.8%</u>
		77.9%		86.6%
Houston	SABRE	86.9%	SABRE	57.5%
	SYSTEMONE	<u>4.5%</u>	APOLLO	<u>18.4%</u>
		91.4%		75.9%

Source: Vendor-supplied data tapes and 1983 DOJ Comments.

1. Based on domestic scheduled passenger enplanements.

2. The primary vendor is defined as the CRS that books the greatest number of total agency bookings.

TABLE 5.12  
 NUMBER OF LARGE AND MEDIUM HUBS AT WHICH CRS VENDORS  
 GAINED OR LOST MARKET SHARE (IN TERMS OF REVENUES)  
 1983 AND 1986<sup>1</sup>

CRS Vendors	DECREASE IN MARKET SHARE		NO CHANGE IN MARKET SHARE	INCREASE IN MARKET SHARE	
	More than 10 Percentage Points	1 to 10 Percentage Points		1 to 10 Percentage Points	More Than 10 Percentage Points
<u>LARGE HUBS<sup>2</sup></u>					
SYSTEMONE	2	--	4	17	3
DATAS II	--	--	6	19	1
APOLLO	--	5	2	13	6
PARS	1	14	6	4	1
SABRE	10	11	--	3	2
<u>MEDIUM HUBS<sup>3</sup></u>					
SYSTEMONE	--	2	4	21	4
DATAS II	--	2	10	16	3
APOLLO	3	9	2	12	5
PARS	4	10	8	9	--
SABRE	9	8	2	8	4

Source: Airlines Reporting Corp. (ARC) "1986 Years Location Sales by Airlines."

1. Air traffic hubs are the cities and Standard Metropolitan Statistical Areas receiving aviation services. Individual communities fall into one of four hub classifications (large, medium, small, and nonhub) as determined by each community's percentage of the total enplaned revenue passengers. Source: Airport Activity Statistics, 1986.

2. A large hub enplanes 1.0 percent or more of total enplaned passengers. In 1986, there were 27 large traffic hubs. Our analysis reflects only 26 large hubs because we have included data for Newark within the New York metropolitan statistical area (MSA).

3. A medium hub enplanes 0.25 to 0.99 percent of total enplaned passengers. In 1986, there were 36 medium hubs. Our analysis reflects only 31 medium hubs because we have included data for Ontario within the Los Angeles MSA and data for San Jose with the San Francisco MSA. We have excluded San Juan, Puerto Rico, and Kahului and Lihue, Hawaii, because data for these hubs did not fall within a designated domestic MSA.

The market share gains achieved by a CRS vendor in a given market do not necessarily mean that a vendor captured or converted agencies from another vendor. In most situations the vendor that gained market share did so by capturing a larger share of an expanding market, including the enrollment of previously non-automated agencies. In some cases, however, (Honolulu, Houston, St. Louis, and Salt Lake City, to name a few), the vendor with the greatest decline in market share also experienced an absolute decline in agency revenues between 1983 and 1986. In sum, between 1983 and 1986, the vendors' market shares in large and medium hubs were far from static. The data indicate that SYSTEMONE was the major winner, followed by DATAS II and APOLLO, while SABRE was the big loser, followed by PARS.

#### E. Halo Effect

The profitability estimates presented in Chapter IV rely upon the vendors' estimates of the size of the halo effect. In this section, we estimate the halo effect using multiple regression analysis, a statistical technique that seeks to quantify the relationship between two or more variables.

Our hypothesis is that the principal determinant of the share of revenues ticketed on a vendor airline by an agency is that airline's share of total scheduled departures from the airports serving the metropolitan area where the agency is located. If no other factors influenced agency booking patterns, the vendor airline's revenue share in that market should be approximately equal to its departure share. Other factors, however, may induce agents to book a greater or less than proportional share of ticket sales on its CRS vendor's airline.

If an unbiased relationship between a vendor airline's departure and revenue shares were depicted by a 45 degree line sloping upward from the origin, a greater than proportional share of bookings would appear as a slope greater than one, at least over some part of the total range of air carriers' departure shares. To estimate the parameters determining the slope and position of a function relating revenue shares sold by travel agents to a vendor's share of local airline departures, while allowing the slope to vary over the range of departure shares, we include both departure share and the square of departure share in our model. No intercept term is appropriate, since there can be no halo effect for an airline that is absent from the relevant market.

When these parameters are estimated from observations on the behavior of agencies subscribing to a given CRS, a systematic tendency to book a disproportionately large share of revenues on the vendor airline can be interpreted as the halo effect, provided that other influences are controlled for. The most important of these influences is override commissions. Unfortunately, we do not know the exact terms of any airline's override agreements with individual agents, nor do we have information on the amount of overrides paid. Although such information would help us refine our estimate of the halo effect, we do not believe that its absence seriously undermines our conclusions regarding its size.

The data obtained from the vendors do include the identity of each agency location receiving overrides in 1986. These data are used to generate binary or "dummy" variables, which take the value of one when an agency receives overrides from a given vendor airline and zero otherwise. (The use of dummy variables is a widely employed statistical technique for representing discontinuous or qualitative data.)

Multiplying these dummy variables by the terms representing the vendor's departure share (linear) and departure share squared (quadratic) in the agent's market area, we generate two "interaction" variables for each vendor paying overrides. These variables are equal to the departure share and the departure share squared, respectively, of an agent's CRS vendor if the agent receives overrides from the airline in question and zero otherwise.

The result of including these variables in the regression is to augment or diminish the coefficients of departure share and departure share squared (still with no intercept), thus shifting the estimated relationship up or down according to whether the override sways agents for or against the vendor airline. The original departure-share and share-squared coefficients are thus purged of override influence and, unless they are influenced by other unidentified factors, express only the vendor airline's market presence and the halo effect.

Our model is:  $Y = b_1X_1 + b_2X_2 + b_3 DA_1 + b_4 DA_2 + b_5 DB_1 + \dots + e$

$Y$  = Vendor airline A's share of the revenue ticketed by an agent subscribing to its CRS.

$X_1$  = Vendor airline A's share of scheduled departures in the agent's metropolitan market.

$X_2 = X_1^2$ ; that is, the square of scheduled departures.

$DA_1$  =  $X_1$  if the agent receives override commissions from vendor airline A and zero otherwise.

$DA_2$  =  $X_2$  if the agent receives override commissions from vendor airline A and zero otherwise.

$DB_1$  =  $X_1$  if the agent receives override commissions from vendor airline B and zero otherwise.

$DB_2$  =  $X_2$  if the agent receives override commissions from vendor airline B and zero otherwise.

$DB_3$  =  $X_1$  if the agent receives override commissions from vendor airline C and zero otherwise.

$DC_2$  =  $X_2$  if the agent receives override commissions from vendor airline C and zero otherwise.

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$e$  = An error term, assumed to be normally distributed.

Each observation in our data set represents an agency location that subscribed to a CRS during 1986 in one of 57 consolidated metropolitan statistical areas containing large and medium hubs.

Five equations were estimated. Each equation included only the observations of those agents who used a given vendor airline's CRS as their primary system, numbering from 1,283 for DATAS II subscribers to 6,571 for SABRE subscribers in these 57 urban areas.

Under our hypothesis, a positive halo effect is shown by a coefficient for  $X_1$  greater than one and a negative coefficient for  $X_2$  -- that is, a curve that would depart from the origin with a slope greater than one and curve downward toward the 45-degree diagonal line. Override commissions from the vendor airline would presumably raise the estimated curve, implying a positive coefficient for  $DA_1$  and a negative coefficient for  $DA_2$ . Override commissions paid by competing carriers would presumably offset the effect of the vendor airline's override commissions, implying a negative coefficient for  $DB_1$  and a positive coefficient for  $DB_2$ .

Our statistical results are reported in Table 5.13. The explanatory power of our regression model is quite high -- between 82 percent and 94 percent of the variation in the dependent variable is explained by our model. Moreover, the signs of the parameters (positive or negative) conform to our expectations. Finally, most of estimated coefficients are statistically significant.

As expected, the vendor airline's share of scheduled departures has a major influence on the share of revenues the vendor airline receives from agents who subscribe to its CRS. The magnitude of the departure share coefficients indicate that subscribers generally book disproportionately large shares of ticket revenues on their vendor airlines. Also, the coefficient of the square of departure share is negative across all equations, confirming our prior expectations that above some departure share further increases in a vendor airline's local departure share do not produce proportional increases in subscriber bookings. We also observe a consistent tendency for override commission payments from the host airline to intensify this effect, and for override payments from competing CRS vendors to reduce it.

Chart 1 depicts the predicted booking patterns of SABRE and APOLLO subscribers over the actual range of departures shares of American and United. As shown, the CRS subscription relationship in isolation is associated in each case with a curve arching above the diagonal that represents a hypothetical neutral booking pattern. If agents in the same locations received overrides only from their vendors, the predicted relationship would be at the highest level shown on the graphs. If SABRE agents were to receive overrides from both American and United, the vendor preference would be partially offset, yielding the intermediate curve in the left graph. For APOLLO subscribers, the estimated effect of American's overrides is so small that it generated no appreciable shift in the curve.

The halo effect implied by these coefficients is quite pronounced. We estimate the halo effect by calculating the difference between a vendor's predicted revenue share (in the absence of any override payments) and its share of departures in that market, expressed as a percent of that vendor's actual share of revenues generated by its subscribers in that market. The revenue-weighted nationwide average halo effects for the five vendor airlines are: American, 39.9 percent; United, 35.7 percent; TWA, 16.4 percent; Eastern, 12.1 percent; and Delta, 35.2 percent. Our estimates of the halo effect for TWA and Eastern are comparable to those inferred from these vendors' internal analyses of the size of the halo effect; our estimates for American, Delta, and United are considerably larger than those we inferred from their internal analyses.

TABLE 5.13  
COEFFICIENTS OF HALO EFFECT REGRESSIONS  
VENDOR-AIRLINE

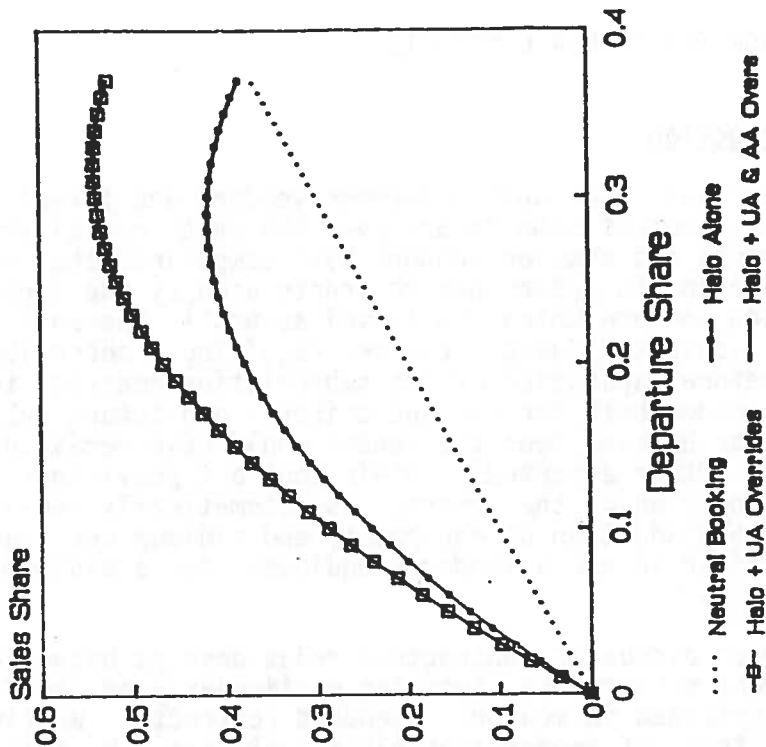
	<u>American</u>	<u>United</u>	<u>TWA</u>	<u>Eastern</u>	<u>Delta</u>
Vendor Departure Share: X1	2.726 (61.8)	2.906 (31.1)	1.982 (34.1)	1.765 (51.8)	2.771 (51.3)
Vendor Departure Share Squared: X1 <sup>2</sup> =X2	-3.934 (-32.2)	-5.049 (-14.1)	-2.047 (-16.7)	-2.343 (-21.1)	-3.535 (-23.8)
American Overrides x X1	0.456 (6.73)	-0.0213 (-0.232)	-0.547 (-4.56)	-0.253 (-2.12)	-1.251 (-6.45)
American Overrides x X2	-0.598 (-3.27)	0.0770 (0.245)	1.594 (6.33)	0.885 (2.68)	3.021 (5.98)
United Overrides x X1	-0.0990 (-1.80)	0.503 (4.81)	-0.0440 (-0.546)	-0.182 (-3.30)	-0.154 (-1.46)
United Overrides x X2	-0.279 (-1.82)	-0.328 (-0.833)	0.154 (0.911)	0.418 (2.46)	0.200 (0.786)
TWA Overrides x X1	-0.306 (-4.77)	0.0484 (0.494)	0.700 (7.38)	-0.0425 (-0.308)	-0.946 (-4.73)
TWA Overrides x X2	0.776 (4.37)	0.0488 (0.144)	-1.299 (-6.44)	-0.180 (-0.358)	2.252 (4.55)
Eastern Overrides x X1	-0.0474 (-0.767)	-0.446 (-5.12)	-0.229 (-2.42)	0.137 (2.55)	0.557 (4.47)
Eastern Overrides x X2	0.114 (0.656)	1.175 (3.72)	0.626 (3.13)	-0.257 (-1.56)	-0.785 (-2.68)
Delta Overrides x X1	0.324 (4.78)	-0.0554 (-0.553)	0.134 (1.16)	-0.0825 (-0.929)	0.155 (1.57)
Delta Overrides x X2	-0.628 (-3.46)	0.470 (1.34)	-0.722 (-2.98)	-0.362 (-1.55)	0.0551 (0.227)
$\bar{R}^2$	0.826	0.885	0.912	0.871	0.943
F	2564	2730	2062	1655	1740
Degrees of Freedom	6472	4241	2386	2939	1269



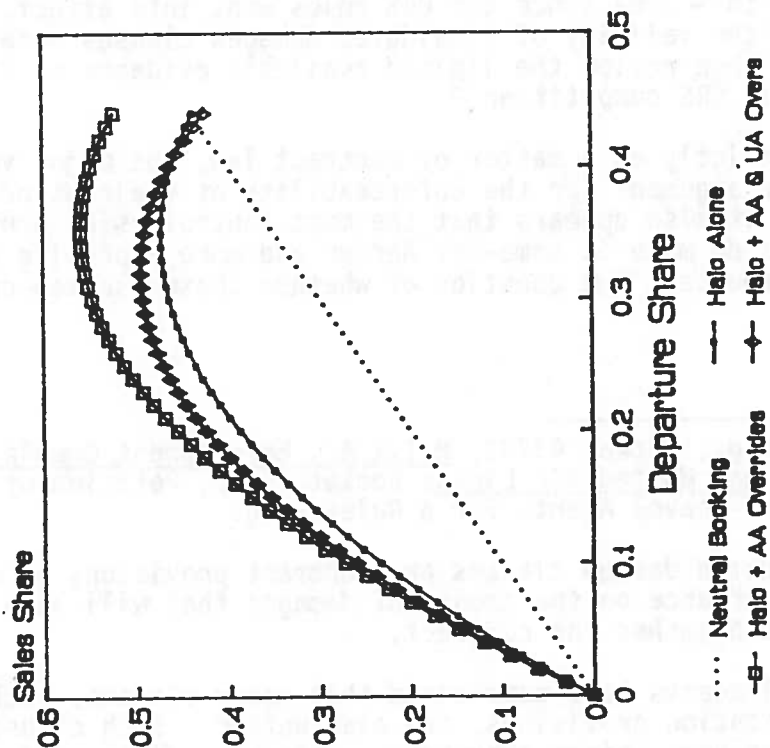
CHART 1

# Halo and Override Effect

## United Airlines



## American Airlines



## VI. VENDOR-SUBSCRIBER CONTRACTS

### A. Introduction

The contractual relationship between vendors and travel agency subscribers has been a focus of some debate over the past several years. Some travel agency groups and smaller vendors have complained that various provisions that appear in the subscriber contracts used by the large vendors impede CRS competition and are unfair to travel agents.<sup>1</sup> The most common complaints focus on liquidated damages clauses requiring a subscriber who switches systems before expiration of its subscription contract to recompense the original vendor both for the subscriber's own future subscription payments and also for booking fees the vendor would have received from participating carriers.<sup>2</sup> Other assertedly unfair contract provisions include rollover clauses, under which the contract is automatically renewed for a five-year term with any addition of equipment, and minimum use clauses, which require the subscriber to use a vendor's equipment for a minimum number of transactions.

This chapter discusses contractual relationships between vendors and their travel agent subscribers, focusing particularly on the liquidated damages clauses contained in vendors' standard contracts. We first discuss the CAB's treatment of vendor-subscriber contracts. We then describe the liquidated damages, rollover, and minimum use clauses that typically appear in vendor-subscriber contracts and review the developments that have taken place in this area since the CRS rules went into effect. Next, we briefly consider the validity of liquidated damages clauses under state contract law. We then review the limited available evidence on the effect of the clauses on CRS competition.<sup>3</sup>

Viewed strictly as a matter of contract law, the major vendors have a plausible argument for the enforceability of their standard contracts. However, it also appears that the most controversial provisions of the contracts do make it somewhat harder and more expensive for other vendors to convert agents. The question of whether these clauses create such barriers

<sup>1</sup> See, e.g., Docket 43202, M.I.T.A., Enforcement Complaint Against American Airlines and United Air Lines; Docket 45140, Petition of the American Society of Travel Agents for a Rulemaking.

<sup>2</sup> Liquidated damage clauses are contract provisions by which the parties agree in advance on the amount of damages that will have to be paid by a party who breaches the contract.

<sup>3</sup> Travel agents have complained that other clauses, such as "one-sided" indemnification provisions, are also unfair. Such clauses are not considered here, since they have no apparent direct effect on airline competition.

to expansion by other vendors that their use is an unfair method of competition is a debatable one. Even more debatable is the question of whether and how action to loosen contractual restrictions on subscriber mobility among systems would impact competition in the airline industry.

## B. The CRS Rules

As discussed in Chapter II, both the CAB and DOJ cited the difficulty of converting subscribers from one system to another as a significant economic barrier to entry or expansion in the CRS industry. In addition to travel agents' reluctance to incur the expense and disruption of switching systems, some vendors were signing agents to contracts containing provisions that, in the CAB's view, unfairly impeded entry by other vendors. Such provisions included lengthy contract terms and prohibitions on the use of more than one system.<sup>4</sup> Restrictions on new entrants' ability to market their systems to agents who were already automated were particularly crucial to the CAB because it considered the travel agent market to be "saturated" -- although 35 percent of all travel agencies were unautomated, those agencies accounted for only 12 percent of the air transportation sold by travel agents.<sup>5</sup> As a consequence, entrants would need to have some ability to "convert" agents from other systems in order to build a viable subscriber base. Concern about entry by new vendors or expansion by smaller vendors was based on the assumption that, in the long run, competition from these sources would restrict the market power of the large vendors.

The general approach chosen by the CAB was to prohibit restrictive subscriber contract provisions, but only those that were "clearly designed to prevent travel agents from switching systems."<sup>6</sup> Thus, it set the maximum contract length at five years because it saw no independent business justification for a longer term, and because it accepted American's argument that shorter terms would undercut subscribers' abilities to obtain the full benefit of investment tax credits.<sup>7</sup> The CAB also decided to prohibit vendors from directly or indirectly precluding a subscriber from obtaining or using any other system (14 C.F.R. 255.6(b)). Finally, because the CAB concluded that ties between air transport dominance and the ability to compete as a CRS vendor could deter entry, it prohibited system vendors from requiring agents to use their systems to book their flights or conditioning the payment of commissions on the use of their CRSs. (14 C.F.R. 255.6(c),(d)).

<sup>4</sup> EDR-466C at 17, 49 Fed. Reg. 11644,11655 (March 27, 1984 "NPRM"); DOJ Comments at 58-61.

<sup>5</sup> NPRM at 16-17.

<sup>6</sup> Regulation ER-1385 at 41, 49 Fed. Reg. 32540, 32556 (August 15, 1984), (Final Rule).

<sup>7</sup> See 14 C.F.R 255.6(a); NPRM at 52; Final Rule at 41.

Although the CAB expressed concern about the possible anticompetitive effects of "excessive" liquidated damages provisions, it decided not to regulate such provisions for several reasons. First, the CAB concluded that state courts applying contract law were better equipped than the CAB to determine whether, in particular circumstances, liquidated damages provisions were excessive. Second, the CAB believed that the potential danger of such clauses was reduced by its limitation of subscriber contracts to a "reasonable" five-year term. Finally, the CAB believed that the prohibition against contract clauses requiring exclusive use of the vendor's system would open the market for entrants.<sup>8</sup>

### C. Vendors' Development of Liquidated Damages Clauses

Each of the vendors has, at one time or another, included some form of liquidated damage clause in its subscriber contracts. However, the vendors vary somewhat in their approach to this issue, and each has revised its contract language over time. This section will describe the categories of damages covered by these clauses. Individual variation among vendors in the way their contracts address each category will be noted.

Liquidated damages clauses in subscriber contracts require travel agents who switch systems or otherwise breach their contracts before their expiration to pay one or more of the following elements of damages:

- a) Remaining subscription fees. Some portion of the monthly lease or installation charges for the remaining term of the contract.<sup>9</sup>
- b) Promotional support. Repayment of all or some portion of any inducements paid to the agency for signing with the vendor. Such inducements typically include waived installation and/or training charges and may also include other "financial support" such as cash payments (including payments to reimburse the agency for liquidated damages it might have owed to a vendor whose system was being replaced), free airline tickets, and advertising support.
- c) Lost booking fees. Replacement of booking fee revenues the vendor would have received from participating carriers if the subscriber had continued to use the vendor's system for the remaining life of the contract. The contracts with such a provision include a formula for calculating the lost booking fees (booking fee x number of CRTs x

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<sup>8</sup> Final Rule at 42.

<sup>9</sup> The SABRE and APOLLO contracts require payment of 80 percent of remaining subscription fees. PARS and SYSTEMONE require 100 percent. The APOLLO contract also requires payment of monthly "variable" charges (i.e., charges for each use of certain system enhancements).

number of months remaining on the contract x some measure of the average number of monthly bookings per CRT<sup>10</sup>).

The standard subscriber contracts of SABRE, APOLLO and PARS have included all of the three elements in their liquidated damages clauses since approximately mid-1985. Subscriber contracts used by these three vendors prior to that time either had no liquidated damages clauses or had clauses that specified only the first two elements described above. SYSTEMONE's standard liquidated damages clause covers the first two elements listed above and has a third provision requiring a subscriber who breaches his contract to pay any other damages incurred by SYSTEMONE as a result of the breach. DATAS II used a liquidated damages clause covering the first two elements of damages listed above in contracts signed between 1982 and January 1985. It states that its current subscriber contracts do not contain a liquidated damages clause. However, in cases where DATAS II has provided promotional support to an agency to induce it to become a subscriber, it requires the agency to sign a side agreement in which it agrees to repay such promotional support if it switches to another system.

During the last half of 1985 and the first half of 1986, SABRE and APOLLO placed a high priority on persuading their existing subscribers to sign contract renewals, offering inducements such as several months' free equipment rental. In addition to commencing new five-year contract terms and introducing the revised liquidated damages provisions, new contracts have included several other new or revised clauses as well. In later versions of their standard contracts, SABRE and PARS have included a rollover clause providing for the automatic renewal of the contract whenever any new equipment (such as an additional reservations or ticketing terminal) was installed.<sup>11</sup> APOLLO has included a rollover clause, triggered by the addition of new locations, in an estimated five to ten percent of its subscriber contracts.<sup>12</sup> The new SABRE and APOLLO contracts also include

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<sup>10</sup> The SABRE standard contract uses the average number of bookings per CRT on a systemwide basis (200). The APOLLO contract uses a "monthly minimum guarantee," defined as 50 percent of the subscriber's average number of bookings for the first six months of its contract. The PARS contract uses the subscriber's average bookings for the twelve months prior to termination of the contract. The DATAS II and SYSTEMONE contracts have no explicit booking fee provisions.

<sup>11</sup> The clause was included in the contracts covering approximately 5000 of SABRE's locations and 939 PARS locations. Responses to Information Directive, Item 31.

<sup>12</sup> These three vendors have recently announced that they would no longer include rollover clauses in new subscriber contracts, and would not seek to enforce such clauses in existing contracts. However, all of the vendors apparently continue their practice of seeking voluntary contract renewals whenever equipment is added.

"minimum use" provisions under which the subscriber guarantees that it will use each piece of equipment for a minimum number of booking transactions each month.<sup>13</sup> Delta has stated that it has recently included a minimum use provision in its standard DATAS II contracts in response to such provisions in other vendors' contracts.<sup>14,15</sup> PARS contracts contain a general provision requiring the subscriber to use its equipment.

The renewal campaigns mounted by the major vendors appear to have been successful.<sup>16</sup> Since mid-1985, a substantial majority of the subscribers to SABRE and APOLLO have been either newly automated, converted, or signed to renewed five-year contracts containing the revised clauses.<sup>17</sup> United reports that as of the end of 1986, over 90 percent of its subscriber locations were covered by some form of liquidated damages clause, and that the "vast majority of existing contracts" contain the new liquidated damages provisions that include a booking fee element.<sup>18</sup> American estimates that, between April 1985 and January 1987, it signed approximately 8,000 subscriber contracts containing a liquidated damages clause with a booking

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<sup>13</sup> SABRE's clause sets the monthly minimum at the greater of 75 percent of the average number of bookings per terminal for the first year of the contract or 100 bookings per month. APOLLO's "monthly minimum guarantee" is 50 percent of the subscriber's average per-terminal bookings during the first six months of the contract.

<sup>14</sup> Docket 45140, Answer of Delta Air Lines, Inc., to Petition for Rulemaking.

<sup>15</sup> During our discussions on the state of competition in the CRS industry, a number of parties have suggested that minimum use provisions violate the prohibition on contract terms prohibiting subscribers from acquiring or using a second system. A travel agent has filed a third party enforcement complaint alleging that Northwest's and PARS' sales practices in Memphis also violate that prohibition. Complaint of Aanover Travel Inc. against Northwest Airlines and PARS Marketing Partnership, Docket 45593.

<sup>16</sup> The vendors' responses are somewhat ambiguous on the question of how many of their subscriber contracts contain the various liquidated damages clauses.

<sup>17</sup> A review of the corporate documents provided by United and American indicates that the two vendors had a relatively inflexible policy of refusing to negotiate contracts of shorter duration or with modified liquidated damages clauses.

<sup>18</sup> It reports that it signed over 5,505 new or renewed subscriber contracts in 1985, with another 2,012 in 1986. United responses to Information Directive, Items 1, 28, 29, and 33.

fee provision.<sup>19</sup> TWA states that in 1985 and 1986 it entered into approximately 2,200 subscriber contracts containing liquidated damages clauses.<sup>20</sup>

#### D. Enforceability of Liquidated Damages Clauses

The new liquidated damages provisions introduced by SABRE, APOLLO and PARS after the CRS rules went into effect have been the subject of a number of lawsuits in various jurisdictions. However, the question of the enforceability of the clauses under state contract law has not been settled definitively.<sup>21</sup> This section discusses the general contract law principles that would be applied by a court in considering whether to enforce or invalidate such a clause, particularly its booking fee element. The circumstances of individual disputes, as well as the details of each state's contract law, can vary.<sup>22</sup> This discussion should therefore not be viewed as a definitive statement on the validity of these clauses.

Liquidated damages clauses appear with some frequency in commercial contracts. Their purpose is to settle in advance possible disputes about the damages to which one party to the contract would be entitled in the event the other party breached the contract. Courts will generally enforce such a clause if actual damages would be difficult to ascertain, and if the clause makes a reasonable estimate of the damages that would result from a breach. Conversely, a clause that is unreasonable, usually because it is excessive, may be viewed as being designed to deter a party from breaching, and to punish the party that breaches despite the deterrence. A court will likely not enforce such a clause which is commonly considered to be a penalty.<sup>23</sup>

<sup>19</sup> American responses to request numbers 1 and 29. It is not clear how many, if any, of the reported renewals were the result of SABRE's automatic rollover clause.

<sup>20</sup> TWA response numbers 1 and 28.

<sup>21</sup> United has obtained a favorable ruling in at least one of the lawsuits where it has sought to enforce the current generation of liquidated damages clauses. See United Air Lines, Inc. v. Austin Travel Corp., 87 Civ. 1262 (MP)(S.D.N.Y., February 24, 1988). It has also received a ruling upholding an earlier liquidation clause that required payment of 80 percent of the agents future subscription payments. See United Air Lines, Inc. v. PMR, Inc. Civ. No. 87-0061-A (E.D.Va., Final Order dated June 17, 1987).

<sup>22</sup> Subscriber contracts typically contain a "choice of law" clause under which the parties agree that the contract will be interpreted under the law of the vendor's home state. Many contracts also contain a clause under which the subscriber consents in advance to submit to the jurisdiction of the courts of the vendor's home state.

<sup>23</sup> See Restatement of Contracts, (Second), §356 (1979) U.C.L.; §§ 2-718, 2-719 (1976).

The question of whether the clauses in CRS contracts are enforceable would largely depend on whether they are a reasonable estimate of the vendors' actual damages.<sup>24</sup> That question would turn on two issues: (1) whether, in principle, the vendor would be entitled to damages in some amount for each element covered by the clause, and (2) for each element, whether the measure contained in the clause is a fair estimate of the vendor's actual damages.

As to the first issue, the major vendors have a plausible argument that they would be entitled to recover some amount of damages for each of the three types of injury covered by their standard liquidated damages clauses. A vendor would clearly be entitled to recover the profits it expected to receive by virtue of the agent's subscription fees. Similarly, the vendor would have a strong claim to recovery of at least a portion of any up-front payments made to the agent as inducements to subscribe, particularly if the vendor expected to recoup those payments over the five-year life of the subscriber contract.

The third element is more controversial. The booking fee element tends to account for the largest portion of liquidated damages claims. In addition, as a conceptual matter, some argue that it is unfair to charge a travel agent for fees that would have been paid to the vendor by a different group of CRS customers -- participating airlines. Vendors counter that they have a reasonable expectation that the subscriber's use of their CRSs will generate booking fees, and that they depend on booking fees to earn a fair return on their investment. The subscriber's breach cuts the vendor off from these fees as well as from those the subscriber pays directly.

Lost booking fee profits would likely be recoverable as consequential damages if the subscriber had reason to foresee, at the time it signed its subscription contract, that the vendor would incur booking fee losses as a result of its breach.<sup>25</sup> The minimum use clauses in both the SABRE and APOLLO contracts provide fairly clear contractual notice. In addition, the vendors would argue that the liquidated damage clause itself provides some notice to the subscriber that a breach will result in lost profits from booking fees. Thus, it appears that the vendors have a fairly strong argument for their proposition that each of the three types of damages set forth in their standard subscriber contracts represents a compensable injury.

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<sup>24</sup> As the following discussion demonstrates, actual losses would arguably be difficult to ascertain with certainty. Such a conclusion might be undercut, however, by vendor statements in support of the reasonableness of their liquidated damages clauses that, if necessary, they could prove contractual damages in excess of those called for in the clauses.

<sup>25</sup> See Restatement of Contracts (Second), §3515 (1979); Corbin, Corbin on Contracts, §1007 (1964).



The question of whether the specific measures contained in the contracts are reasonable approximations of the vendors' actual damages is less clear. In addition, the answers to the question may vary depending on the specific contract. As a general matter, a plaintiff should only be entitled to recover the lost profits and reliance damages caused by a breach. Any costs saved because the plaintiff would not have to perform under the contract would not be charged to the breaching party.

As discussed above, the first element of liquidated damages requires payment of 100 percent or 80 percent of future subscription fees. While a vendor will lose revenues from subscription fees if the agent breaches, it will also save some expenses, such as communications and processing costs.<sup>26</sup> It is not clear what proportion of subscription revenues would be offset by those savings. As to the second element, repayment of inducements, some vendors' liquidation clauses require repayment of all inducements. However it is possible that a court might determine that a vendor was entitled to recover only that portion of the incentives reflecting the time remaining on the contract at the time of the breach.

Recovery of damages for lost booking fees in a liquidated damages clause poses similar questions. Although by some measurements vendor booking fees greatly exceed their costs of making the bookings, the loss of bookings resulting from a subscriber's breach would nonetheless reduce expenses. A court may or may not find that particular clauses adequately accounted for such savings.

Although the large vendors have plausible arguments supporting their assertions that their liquidated damages clauses are valid and enforceable under contract law, there is no certainty that the clauses will ultimately be upheld. It is possible, for example, that some courts might refuse to enforce a liquidated damages clause based on concepts of overreaching or unconscionability. In some cases, a subscriber's liability for lost booking fees could substantially exceed direct payments for which the subscriber is responsible under the contract. In addition, some travel agency groups contend that subscribers have no bargaining power in their dealings with vendors and that the terms of subscription contracts are imposed upon them. Those two factors might persuade some courts to refuse to enforce the clauses. Finally, some defendants in the contract litigation have asserted competitive defenses.<sup>27</sup>

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<sup>26</sup> As discussed in Chapter V, vendors' direct subscriber costs exceed average subscriber fees by some measures.

<sup>27</sup> It should be noted, though, that all of these defenses were rejected in the Austin Travel case cited above.

### E. Effects on CRS Competition

The intensity and nature of vendor competition for subscribers have evolved since the CRS rules were implemented. The SABRE, APOLLO, and PARS renewal programs discussed above were a response to an increase in conversion activity that coincided with the implementation of the CRS rule. The new booking fees and elimination of carrier-specific display bias that came as a result of the rule made participant booking fees, rather than anticipated incremental airline revenues, the primary CRS revenue source. This increased the vendors' incentives to automate agencies in areas where their air transportation presence (and the corresponding potential to earn incremental revenues) was small. The expectation of large booking fees also made vendors more willing to reimburse converted agents for their liquidated damages payments to the original vendor.<sup>28</sup>

For the first year after the CRS rule went into effect, SABRE and APOLLO appear to have been more active than the other vendors in converting agents from other systems, as well as persuading their existing subscribers to sign renewal contracts containing revised liquidated damages and other clauses.<sup>29</sup> The smaller vendors, particularly SYSTEMONE and PARS, have become much more aggressive in seeking to convert other vendors' subscribers in 1986 and 1987.<sup>30</sup>

Although incremental revenues may be less important than before, the battles being waged by vendors for the loyalty of subscribers appear to be particularly intense in areas of strategic importance to the vendors' airline operations. Thus, for example, internal documents show that SYSTEMONE has focused attention on signing subscribers in Florida, an area of strategic importance to Eastern. Similarly, PARS' co-owner, Northwest Airlines, has promoted that system in the areas around its major traffic

<sup>28</sup> For example, the primary element of damages under the liquidated damages clauses in place in late 1984 and early 1985 was remaining subscription payments. As set forth in Table 5.5, SABRE and APOLLO received respective averages of \$2,144 and \$2,725 per CRT in subscriber payments in 1986, and presumably received a similar amount in the early post-rule period. By comparison, at a rate of \$1.75 per booking, SABRE expected to earn annual booking fee revenues of at least \$4,200 per CRT (SABRE's current liquidated damages clause estimates an average of 200 bookings per CRT per month). Thus, the potential booking fee benefits from converting an agent more than justified some reimbursement to the agent for its liability for remaining subscription payments to its original vendor.

<sup>29</sup> SABRE converted 328 agencies in 1985 and 259 agencies in 1986. United reports 402 conversions to APOLLO in 1985 and 290 conversions in 1986. Responses to Information Directive, Item 33(a).

<sup>30</sup> TWA reports 121 conversions to PARS in 1986, up from 55 in 1985. SYSTEMONE's reported conversions increased from 115 agencies in 1985 to 340 agencies in 1986. DATAS II's conversions decreased from approximately 105 agencies in 1985 to 87 agencies in 1986.

hubs. SABRE and APOLLO have aggressively sought to expand their presence in California at the same time their parent airlines have sought to increase their presence there.

The competition for subscribers has resulted in a substantial amount of litigation. For example, the Texas Air Corporation recently reported that United and American were parties to 72 pending lawsuits in which they sought to enforce liquidated damages provisions against former subscribers. Liquidated damages payments from present or former APOLLO subscribers increased from \$244,680 in 1984, to \$422,101 in 1985, to \$904,765 in 1986.<sup>31</sup> SYSTEMONE and other affiliates of the Texas Air Corporation have adopted a policy of indemnifying some agents who switch from other systems against liability under liquidated damages clauses. They have also assisted those agents in challenging the legality of such clauses in court. American has responded by suing SYSTEMONE and its affiliates in Texas state court on a claim of tortious interference with contract.<sup>32</sup> Texas Air has countered with an antitrust complaint filed against American in U.S. District Court in Houston. It also recently filed a similar complaint against United and Covia.<sup>33</sup>

By the time SYSTEMONE and PARS began seeking subscribers with more vigor, most of the SABRE and APOLLO subscribers had signed new contracts with revised liquidated damages clauses. As a matter of logic, these contract renewal programs should have had the effect of making it more difficult for other vendors to convert subscribers.<sup>34</sup> The liability of subscribers for coverage of the original vendor's booking fee profits necessarily reduces the universe of automated agencies that would be logical targets for conversion efforts. Those agencies with relatively brief terms remaining on their contracts or those that are strategically important for the vendor's airline business would be the most logical conversion candidates. The contract renewal programs reduced the pool of likely conversion targets by starting new, five-year contract terms for a large number of agents.

<sup>31</sup> Response to Information Directive, Item 30.

<sup>32</sup> American Airlines, Inc. v. Continental Airlines, Inc. et al., No. 153-108286-87, Tarrant County, Texas District Court, 153rd Judicial District.

<sup>33</sup> SYSTEMONE Direct Access, Inc. v. American Airlines, Inc. C.A. No. H-87-3730 (S.D. TX); SYSTEMONE Direct Access Inc. v. United Air Lines, Inc. C.A. No. H-88-550 (S.D. TX).

<sup>34</sup> Any question about whether the current contracts restrict conversion efforts would be disposed of if American succeeded in its lawsuit against the Texas Air Corporation for tortious interference with contract. A victory by American would presumably mean that vendors could not even attempt to convert SABRE agents prior to the expiration of their full contract terms, regardless of costs.

The booking fee element in these clauses increases the disincentives for agents and smaller vendors to convert.<sup>35</sup> A vendor who sought to convert an agent whose current contract had a substantial term remaining would likely have to reimburse or indemnify the agent for a significant portion of the agent's damage liability to the original vendor. If the liability includes coverage of the original vendor's future booking fee and subscription fee profits, the second vendor's reimbursement to the subscriber would nullify much of the subscriber and participant revenue that could be expected from the converted agent. This would be true unless the converted agent could be expected to engage in substantially more booking activity or otherwise generate more CRS revenue after conversion, or the new vendor could sign the agent to a term longer than that remaining on its current contract. However, the cost of converting the agent might be justified if the new vendor includes in its calculation any increase in air transportation revenues that could be expected to follow the conversion.<sup>36</sup> The greatest potential for such revenue increases is, naturally, in areas and with agencies where the vendor already has a large air transportation presence. As a result, vendors may again have greater tendencies to target agencies in areas where they have a dominant air transportation presence and, more generally, to view CRS as one element of airline distribution strategy rather than as a separate line of business.

Consistent with such a development, vendors have accused each other of tying the payment of airline commissions to subscribers' use of their system. All vendors sometimes offer airline-related inducements, such as free tickets or frequent flyer benefits, to agents they wish to convert. Each also occasionally offers its CRS in conjunction with broader offers to create a "closer working relationship" with a given travel agency. For example, the vendor might offer to enroll the agency in a special incentive program, to provide the agency with access to special "help desks," and/or to allow the agency special authority to book capacity-controlled seats and fares. Such offers might accompany an offer to convert the agency from another vendor's system. If the vendor does not make commission offers conditional on CRS conversion, the prohibition against tying contained in the CRS rule may not be violated. Differentiating permissible inducements from prohibited ties is difficult at best. In some circumstances, vendors may engage in conversion tactics that violate, or come close to violating, the prohibition, although available data on override arrangements do not indicate a wide-spread pattern of abuse.

Table 6.1 presents information for 1986 on the number of subscribers who receive override commissions from each of the five vendor airlines. Also shown are the average airline domestic ticket revenues from each system's subscribers and from those subscribers that receive override commissions.

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<sup>35</sup> Or, even in the absence of a contract clause, the potential liability of an agent who switches systems for damages based on booking fees.

<sup>36</sup> In fact, the three smaller vendors do include such revenues in their calculations when deciding whether the anticipated benefits from converting a particular agent is worth the cost.

TABLE 6.1

ASSOCIATION BETWEEN OVERRIDE COMMISSIONS AND CRS SUBSCRIPTIONS

Vendor	NUMBER OF AGENCY LOCATIONS IN 1986 BY OVERRIDE PAYER						AVERAGE SALES (\$000)		
	<u>American</u>	<u>United</u>	<u>Eastern</u>	<u>Delta</u>	<u>TWA</u>	<u>Override Recipients</u>	<u>All Subscribers</u>	<u>Subscribers Receiving Overrides</u>	<u>All Subscribers</u>
American									
Primary:	2,277	2,522	1,987	1,975	1,497	4,438	8,677	\$1,581	\$1,063
Secondary:	143	214	170	169	151	289	350		
United									
Primary:	739	4,190	1,666	1,556	1,302	4,561	6,511	1,331	1,072
Secondary:	124	196	128	140	136	232	264		
Eastern									
Primary:	84	650	1,221	254	140	1,728	4,271	674	487
Secondary:	170	214	271	229	142	342	400		
Delta									
Primary:	28	360	182	318	69	685	2,045	782	513
Secondary:	163	131	178	230	111	263	292		
TWA									
Primary:	216	796	547	380	678	1,322	3,189	1,060	677
Secondary:	209	309	230	221	217	404	548		
All Systems:	3,344	8,518	5,603	4,483	3,686	12,734	24,693	\$1,272	\$870

Source: Information Directive, Item 27. Sales: Airlines Reporting Corporation, Agency/Airline year Sales Tape - 445.

Larger agencies are the preferred targets of all vendor airlines' override programs. The airline passenger ticket sales generated by each system's primary subscribers that receive override commissions are greater than the average for that vendor's subscribers. Moreover, the airline ticket sales generated by SABRE and APOLLO subscribers are greater than what is generated from other systems' subscribers.

Not only are primary subscribers to SABRE and APOLLO the predominant recipients of override commissions from American and United (together accounting for roughly 90 percent of American's override recipients and 79 percent of United's), but they also include 65 percent of Eastern's override recipients, 79 percent of Delta's, and 76 percent of TWA's, which may be due to the fact that SABRE and APOLLO subscribers tend to be larger agencies. Moreover, none of the three smaller vendors pays override commissions to as many of its own subscribers as it does to SABRE or APOLLO subscribers.

Beside the courtship of large travel agencies by the vendor airlines, American and United favor their own primary subscribers: American pays overrides to 2,277 primary subscribers to SABRE but only 739 APOLLO subscribers; United pays override commissions to 4,190 APOLLO subscribers, but 2,522 SABRE subscribers. However, United paid override commissions to 4,328 primary subscribers of other CRSs. Among subscribers to the three smaller systems, the pattern is less clear-cut.

Competition for subscribers has not, by any means, been foreclosed. The number of subscribers and the amount of air transport revenues processed through CRSs has increased markedly since 1983.<sup>37</sup> Along with that development, there has been some movement in the vendors' national market shares. SABRE's share of domestic air transport revenues processed by automated travel agencies decreased from 49 percent to 42.9 percent between 1983 and 1986; APOLLO's share increased from 31 percent to 32.4 percent; PARS' share decreased from 12 percent to 10.2 percent; SYSTEMONE's share increased from five percent to 9.6 percent; and DATAS II's share increased from two percent to 4.9 percent. Also, in some metropolitan areas, market shares have changed markedly as shown in Appendix IV and Tables 5.11 and 5.12. Vendors' conversion efforts have been quite visible. Table 3.11 shows that 1,107 subscribers, out of a total of 24,693, are reported as having switched systems in 1986. By comparison, over 2,900 subscribers were brought in as newly automated agencies and more than 8,000 existing subscribers renewed their contracts with their then-current vendors. A four percent conversion rate might appear somewhat low given the apparent vigor of vendors' recruitment efforts and in comparison to a renewal rate of 30 percent. However, this seemingly low level of conversion activity could be caused by a number of factors, such as subscribers' satisfaction with their current systems, or reluctance to incur the cost and disruption of switching

<sup>37</sup> Compare Table 3.1 with NPRM, Tables 1 and 2.

## VII. EMERGING TECHNOLOGICAL DEVELOPMENTS IN THE CRS INDUSTRY

### A. Introduction

The development of CRSs during the late 1960s and early 1970s required not only technological expertise but also substantial financial resources. By the early 1980s, there was a pronounced gap in technological sophistication and performance between the two largest CRSs -- SABRE and APOLLO -- and the smaller systems. More recently, however, the smaller vendors have narrowed this "technology gap" and all five vendors are now offering subscribers comparable reservation features and enhancements.

The CRS vendors compete with each other in terms of the service features they offer subscribers. This competition produces benefits for subscribers and air travelers. SYSTEMONE, for instance, recently acquired a company that specializes in providing travel agents with computer software for accounting and other back-office functions. And both United and American are redesigning their CRSs around personal computers that have the capability to handle accounting, managerial, and other back-office functions.<sup>1</sup>

Computer technology is enhancing the capability of existing CRSs and creating the potential to rearrange the economic relationships that now prevail among vendors, agents, and air carriers. Technology now exists that will permit customers to research airline schedules, seat availability and fares, make reservations, and pay for tickets, all without a travel agent's (or other human) involvement. Nevertheless, formidable institutional barriers, resistance to unfamiliar systems, and other constraints have prevented the diffusion of this technology.

This chapter examines those technological developments that will affect the structure of the CRS industry over the next five to ten years. Three major technological developments are discussed -- interactive automated ticket machines, personal computers, and commercial information networks. The final section presents conclusions.

### B. Interactive Automated Ticket Machines

An interactive automated ticket machine (ATM) consists of a computer with attached printer that permits passengers to research schedules and fares, make reservations, and purchase and receive tickets and boarding passes without the intercession of a human agent. The early ATMs were essentially

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<sup>1</sup> "A Shoving Match in the Travel Agency," Business Week, June 22, 1987, 116.

ticket printers (not attached to the airlines' host computers) and were designed to issue one-way tickets on routes with simple fare structures. In 1983 a second generation of ATMs became available. These machines offer a CRT screen, keyboard selection of options, credit-card reader for payment, and an attached printer for issuing tickets and boarding passes. These newer machines are usually linked directly to the host's airline computer. The only transactions that these machines cannot process are complex itineraries or journeys of more than eight flight segments. A common criticism of ATMs is the length of time required to conduct a transaction. However, the time it takes to use an ATM is approximately the same as that required when a traveler uses the services of a travel agent.<sup>2</sup> Although earlier models were unpopular with travelers, newer installations, such as American's "Travel Teller," allow a "quick path" to bypass the menu and obtain a boarding pass. Travelers may also use such terminals to enter data for frequent flyer programs.<sup>3</sup>

The ATM is still evolving. The addition of a high-resolution color monitor and video-disk player, combined with menu-driven software and touch-screen control, offers the capability to display films or pictures to potential clients as well as to provide the standard information, booking, and sales features available on earlier machines.

American Airlines, for example, is testing a new system, SABREVISION, that will interface eventually with SABRE. American foresees these machines being located in travel agencies and at neutral locations, such as shopping malls. Eight of these units were being tested as of March 1987. Delta Air Lines' DELTASTAR will be offered as an enhancement to DATAS II. At least initially, DELTASTAR appears to be directed at self-service use by clients within travel agency offices. DELTASTAR will provide DATAS II users with a video sales component; it is not clear whether a stand-alone capability is intended for this machine.<sup>4</sup>

Liberty Travel (New Jersey) has announced its intention to install touch-screen video systems equipped with magnetic strip (credit card) reader and printer in stand-alone travel kiosks in Liberty offices and at neutral locations.<sup>5</sup> These interactive machines will permit the customer to book and purchase tickets by credit card without the intervention of a travel counselor. The touch-screen-activated system will provide video presentations describing destination options and selected locations. Initially, the agent will deliver the travel documents to the customer.

<sup>2</sup> "Self-Service Machines," OAG Frequent Flyer, September 1987, 40-41. Airlines compete vigorously for the patronage of the "walk on" business traveler. Some airlines are actively encouraging business travelers to use ATMs.

<sup>3</sup> "Executive Travel File," OAG Frequent Flyer, December 1987, 84.

<sup>4</sup> "Video Sales Come of Age," Travel Weekly, March 23, 1987, 55.

<sup>5</sup> Ibid.



More advanced versions of these video systems will have the capability to print the travel documents immediately.

A remote printer is a device that can be used to produce documents such as tickets or boarding passes at remote locations upon command from a central computer. When combined with an ATM, a remote printer is able to display, reserve, sell, and deliver travel documents. Remote printers are now being used to print tickets and boarding passes at locations such as corporate travel offices, where the installation of a complete CRS terminal would be uneconomical.

The primary application of the ATMs to date has been in the sale of tickets by airlines at airports or city ticket offices. Initially introduced to sell one-way tickets in high-volume, shuttle-type markets, the capability of these machines has outstripped their use by airlines. In a recent article, a representative of NCR Inc. indicated that no airline promotes the use of ATMs. Presumably, the airlines fail to market this technology because it would compete with travel agents, upon whom they depend to book the overwhelming majority of their tickets, and because certain travel agency organizations have threatened to boycott any airline that relies on self-ticketing machines. At present only a few hundred self-ticketing machines are being operated in the United States.<sup>6</sup>

### C. Personal Computers

Personal computers (PCs) are having the greatest impact upon existing CRSs, as they offer many advantages over the standard "dumb terminal," which the industry currently uses. (The dumb terminal provides a keyboard and a CRT for communicating with a vendors' main computer.) The CRS vendors are now offering PCs to travel agents as an upgrade for dumb terminals.

American recently unveiled a new CRS work station built on IBM's Personal System/2, while Delta has developed a PC LAN-based DELTASTAR reservation and agent automation system.<sup>7</sup> Both of these PC-based systems provide agents with the capability to store information about customer preferences (e.g., seating, meals, aircraft type) and corporate travel policies (e.g., class of travel or preferred airline) and to use this information to modify schedule displays. These preferences and guidelines can be automatically integrated into any booking request by programming the computer either to reject requests that fall outside these guidelines or to identify non-complying requests.<sup>8</sup> A similar capability is available to a travel agency manager

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<sup>6</sup> "Self-Service Machines," OAG Frequent Flyer, September 1987, 40.

<sup>7</sup> "American Debuts New SABRE Hardware," Business Travel News, September 21, 1987, 1.

<sup>8</sup> "Delta Takes Off with Revamped LAN-Based Reservation System," PC Week, August 4, 1987, C-1.

who can monitor and control the flight information agents are able to view on their terminals. Just as a client's preferences can be automatically superimposed upon the information and booking process, so can the travel agency manager's. Personal computers may also be used as stand-alone computers to provide back-office support functions for subscribers and management information services for clients.<sup>9</sup>

The CRS vendors are also introducing user-friendly, simplified, menu-driven PC versions of their CRSs. The simplified computer languages used by these systems allow non-professional users to make transactions without requiring an agent to interpret the data (e.g., translate airline codes). Although such systems could be used by air travelers to bypass travel agents, the vendors plan to link these systems to agents by sending clients' requests into a queue in the agent's reservation terminal. Travel agents are, of course, less than enthusiastic about the prospect of an emerging technology that could replicate many of the services they now provide to travelers. To allay these fears, the CRS vendors have indicated they do not intend to use this capability to bypass agents.<sup>10</sup>

An important, if currently untapped, opportunity for PC application to the CRS environment is presented by the feasibility of connecting multiple CRSs to one PC. The computing capability of the PC could then be used to search among CRS systems for the service and fares that most closely meet the passengers' travel requirements. This practice is now prevented by licensing requirements that preclude multiple hookups.<sup>11</sup>

#### D. Commercial Information Networks

A commercial information network (CIN) allows subscribers to connect their PCs to both mainframe computers and other PCs. Thus, the user has access to multiple data bases and more computer software. Although the greatest growth of CINs has come with the spread of PCs, CINs have existed since modems provided the dial-up capability to link computers to terminals.

<sup>9</sup> "CRS Vendors Target Travel Agents," Air Transport World, August 1986, 40.

<sup>10</sup> "Res Vendors to Unveil Systems for Commercial Use," Travel Weekly, September 22, 1986, 106.

<sup>11</sup> The ability to access last seat availability and to book that seat is not uniform for each airline across CRSs. Also, the number of "special fares" a participating airline can display is more limited than the vendor airline's display. The ability to attach multiple hookups to single personal computers with the resulting capability to search across systems automatically would make the different CRSs truly substitutable. Of course, competition among simultaneously connected CRSs would require more than the licensing of connections: minimum-use requirements and five-year terms of contract may impede competition among vendors for agencies. Also, in view of the rapid expansion of direct access, there may be little reason to expect higher quality service from multiple CRS access.

In May 1983 the electronic OAG was instituted as an on-line version of the printed OAG.<sup>12</sup> This service provides schedule and fare information and, as of mid-1986, a capability to book reservations and issue tickets. The electronic OAG is available through approximately 20 CINs, as well as through direct subscription. A unique feature of the electronic OAG is its provision for direct mailing or airport pickup of tickets, thereby bypassing a travel agent (although American and TWA tickets must be obtained through a Thomas Cook office).<sup>13</sup> The electronic OAG uses APOLLO for the actual automated link between its own computers and the internal reservation computers operated by participating airlines.

The American EASYSABRE and TWA TRAVELSHOPPER systems are similar to the electronic OAG. During the transaction, a list of agents is displayed on the system and the client may choose one. By making the agents an integral part of the process (and paying them commissions), the CRS vendors have attempted to overcome agents' opposition to automated systems. Representatives of each system claim that the use of its system is satisfactory and growing gradually.<sup>14</sup> Nevertheless, incentives for growth would undoubtedly be greater if commissions were rebated to home users.

These three principal vendors -- EASYSABRE, TRAVELSHOPPER, and the electronic OAG -- use CINs to provide widespread access to their "do-it-yourself" travel reservation systems. The three systems are all available as a service on most CINs.<sup>15</sup> Because of the only occasional access requirements of the individual user, the expense of a "hardwired" communications link connecting the user's terminal (usually a PC located in the user's home or office) to the central CRS computer would generally be impractical. (One of the three systems, the electronic OAG, provides direct subscriber access for a monthly fee and a charge per activity.)

#### E. Outlook and Conclusions

The technology now exists for major changes in the way travelers review airline schedules and fares, make reservations, and obtain travel documents. But, as with all innovation, more is required than the availability of new technology. The marketing innovation with the greatest potential for

<sup>12</sup> "Passengers Take Command with On-Line OAG," PC World, December 1986, 307.

<sup>13</sup> Telephone conversation with Richard Nelson, General Manager, OAG, August 4, 1987.

<sup>14</sup> "Home Computer Res Systems Get Mixed Agent, Client Reception," Travel Weekly, August 25, 1986, 17.

<sup>15</sup> Telephone conversation with Richard Nelson, General Manager, OAG, August 4, 1987.

changing the way travelers obtain flight information and make travel arrangements -- automated ticket machines -- is not being promoted by either the CRS vendors or the airlines. With its potential for bypassing the travel agent's involvement in the reservations and ticketing process, automatic ticketing has been opposed by travel agents. Air carriers have been unwilling to promote this technology and risk alienating agents; consequently, the number of ATMs in operation has remained small. Thus, until airlines decide that it is a good business decision to bypass travel agents and offer discounts to customers for air travel purchased through an ATM, these systems will not become a major force in the sale of air travel.

The sharing of commission revenues between corporations and agencies has become an accepted practice. It is unclear, however, whether the sharing of commissions is because of shared costs (e.g., the corporate travel office issues the ticket), leaving the agent with undiminished average profits, or an essential part of the overall "package" of incentives necessary to obtain the corporate account, which could reduce agency profits.<sup>16</sup>

The use of PC-based reservation systems is revolutionizing the amount of information travel agents can store and utilize. Personal computers also provide agents with enhanced back-office automation and expedite the production of billings and other financial documents. The PC allows the agent to provide a higher level of service. In the vast majority of transactions, though, the agent still provides the traveler with important flight-related information, as well as selling the ticket and issuing travel documents. Personal computers, therefore, may enhance the attractiveness of existing CRSs.

Simultaneous PC interface with several CRSs, which would allow automatic switching across the various systems from one terminal, is technologically feasible. If switching among systems were permitted (including the use of hardware and software designed to implement such applications), a strong incentive would exist for the vendors to compete on the basis of the service features they offer and the cost of their services to the agent, including payments to agencies to promote the use of a system for booking. At the same time, airlines might provide agents with a financial incentive to book reservations on their airlines using the CRS that charged the lowest booking fee.

To attach "foreign" equipment to a vendor's equipment, subscribers must receive that vendor's permission. In fact, SYSTEMONE and DATAS II do not allow a subscriber to attach any equipment that they have not provided. SABRE, APOLLO, and PARS allow some equipment to be attached to their

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<sup>16</sup> "Managers, Agents: Commission Sharing Not Bad," Travel Weekly, November 9, 1987, 85.

systems. In a sample price list, American Airlines indicated that it would charge \$750 to "certify" a printer, \$1,000 to certify an "intelligent" terminal, and \$1,500 to certify a mainframe computer. Additional fees are also charged for installing this equipment. These fees appear to be quite high, and very few agencies have obtained permission for such attachments.<sup>17</sup>

Representatives of the CINs claim that the level of usage is satisfactory and growing gradually. But until modem-equipped PCs become more widely distributed and utilized by households and businesses, the potential of these systems is unlikely to be exploited. Technology exists to permit automation of reservation and ticketing services to the general public and commercial clients. Nevertheless, it does not seem likely that any of the technological developments and applications discussed in this chapter will have a dramatic effect on the structure of the CRS industry over the next two to five years. Any CRS vendor willing and able to overcome the opposition of travel agents could readily implement such automation while offering passengers a partial rebate of the resulting cost savings. With appropriate economic conditions it appears likely -- although far from certain -- that at least some of these technologies will change the roles played by airline-owned CRSs or travel agents themselves in the sale and distribution of airline services over the next five to ten years.

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<sup>17</sup> Res Systems Roundup Tells Tale of Numbers," Travel Weekly, May 25, 1987, 125.

## APPENDIX I

## RULES GOVERNING AIRLINE-OWNED COMPUTER RESERVATION SYSTEMS

Display of Information

All systems shall provide a primary display or primary displays that include the schedules, fares, rules, and availability of all carriers in accordance with the provisions of this section. Primary displays shall be at least as useful for subscribers, in terms of functions or enhancements offered, and the ease with which such functions or enhancements can be performed or implemented, as any other displays maintained by the system vendor.

In ordering the information contained in a primary display, system vendors shall not use any factors directly or indirectly relating to carrier identity.

System vendors may order the display of information on the basis of any service criteria that do not reflect carrier identity and that are consistently applied to all carriers, including the system vendor, and to all markets.

System vendors shall provide upon request to all subscribers and participating carriers the current criteria used in ordering flights for the primary displays and the weight given to each criterion.

System vendors shall not use any factors directly or indirectly relating to carrier identity in constructing the primary displays of connecting flights.

System vendors may select the connecting points to be used in the construction of connecting flights for each city pair on the basis of any service criteria that do not reflect carrier identity and that are applied consistently to all carriers, including the system vendor, and to all markets.

System vendors may select connecting flights for inclusion ("edit") on the basis of service criteria that do not reflect carrier identity and that are applied consistently to all carriers, including the system vendor.

System vendors shall provide upon request to all subscribers and participating carriers current information on:

- o all connecting points used for each market;
- o all criteria used to select connecting points;
- o all criteria used to "edit" connecting flights; and
- o the weight given to each criterion in 1 and 2 above.

If system vendors select connecting points for use in constructing connecting flights, they shall use at least nine points for each city-pair, except that vendors may select fewer than nine such correcting points for a city-pair where:

- o fewer than nine connecting points meet the service criteria;
- o the vendor has used all the points that meet those criteria, along with all additional connecting points requested by participating carriers.

Upon receipt of information from any carrier, system vendors shall apply the same standards of care and timeliness to loading information concerning participating carriers as it applies to the loading of its own information.

If a system vendor provides special loading capability to any other carrier, it shall offer the same capability to all participating carriers in a non-discriminatory fashion as soon as technically feasible.

Each system vendor shall provide upon request to all participating carriers all current data base update procedures and data formats.

#### Display of Information

A system vendor shall not deny access to its system to two or more carriers whose flights share a single designator code, absent a determination by the Department of Transportation that the use of the code constitutes a violation of 49 U.S.C. 1381.

A system vendor shall not discriminate against any carrier on the basis of that carrier's using the same designator code as another carrier, either by display bias, or any other means relating to providing the system.

#### Contracts with Participating Carriers

No system vendor shall discriminate among participating carriers in the fees for participation in its system, or for system-related services. Differing fees to participating carriers for the same or similar levels of service shall be presumed to be discriminatory.

No system vendor shall condition participation in its system on the purchase or sale of any other goods or services.

System vendors shall provide upon request to carriers current information on their fee levels and fee arrangements with other participating carriers.

#### Contracts With Subscribers

No subscriber contract shall have a term in excess of five years.

No system vendor shall directly or indirectly prohibit a subscriber from obtaining or using any other system.

No system vendor shall require use of its system by the subscriber in any sale of its air transportation services.

No system vendor shall require that a travel agent use its system as a condition for the receipt of any commission for the sale of its air transportation services.

No system vendor shall charge prices to subscribers conditioned in whole or in part on the identity of carriers whose flights are sold by the subscriber.

Service Enhancements

In the event that a system vendor offers a service enhancement to any participating carrier, it shall offer it to all participating carriers on non-discriminatory terms.

Marketing Information

Each system vendor shall make available to participating carriers on non-discriminatory terms all marketing, booking, and sales data that it elects to generate from its system. However, domestic data must only be provided to domestic participating carriers. International data can only be released with the permission of the participating carrier.



## APPENDIX II

## ALGORITHMS FOR CONSTRUCTING CRS SCHEDULE DISPLAYS

While there are subtle differences among the ranking criteria used by the vendors, the process of creating a schedule display can be divided into three stages: (1) the establishment of procedures by which flights are classified as eligible for display; (2) a method of selecting flights in response to a subscriber's entry of city pair, date, and time; and (3) a ranking algorithm, by which selected flights are ordered for display.

Under DOT's rules the ordering of displays must be done according to objective criteria. In addition, if requested by participants, the rules require vendors to construct connections over at least nine hubs. These provisions help ensure that CRS displays provide travelers with accurate information on competitive service offerings.

Each system maintains a list of city pairs available for display and of hubs over which connections may be constructed. Generally, origin-destination (O-D) city pairs include all city-pair markets having non-stop or direct service, plus many city pairs with only connecting service. These city pairs are identified by historic traffic patterns, frequency of subscriber inquiry, or specific requests from participating airlines; the number of city pairs vary among systems and over time, but are well in excess of 200,000. Subscribers can also create itineraries not stored in advance by specifying likely connect points.

Similar criteria are applied to identify potential connection points, with the addition of constraints on feasibility of connections and maximum flight time, circuitry, number of segments, or number of carriers on a multi-segment flight. Although the availability of nine connection points is mandatory, SABRE, APOLLO, and SYSTEMONE will construct 30 single connection itineraries, PARS 25, and DATAS II 12.

All vendors consider a smaller number of double connections -- i.e., itineraries requiring two successive changes of plane. SABRE will include on request a maximum of two connect points for each O-D pair served by a participant; APOLLO allows each participant to request up to 1,500 O-D pairs on its routes, with one additional single and one double connect point for each; SYSTEMONE admits requests for up to two connect points for each city pair, one of which may be a double connection; PARS accepts requests for additional city pairs with a maximum of one single and one double connecting point on routes served by the participant; DATAS II accepts up to two (single or double) connecting routes per O-D pair for each carrier.

In response to a subscriber's request for flight availability between given cities at a certain date and time, each CRS assembles a number of eligible flights. APOLLO selects groups of 16 flights in chronological order of departure, starting two hours before the requested time; SABRE selects groups of 20 flights in order of displacement from the requested time, direct service being included before connecting; DATAS II selects all flights within a three-hours-earlier to three-hours-later band (six hours for international flights); PARS starts two hours before the requested time

and proceeds forward at least three hours, filling a 140 item record of flight options; and SYSTEMONE backs up two hours and proceeds forward to the end of the day.

Once the set of candidate flights is assembled, it is ranked for display on the basis of several criteria. APOLLO picks the first eight flights (of the previous 16 selected) using the sum of elapsed flight time and displacement from the requested departure as a ranking factor; the first and second groups of eight flights are then each presented in order of the following service categories:

1. Non-stop and direct flights;
2. Single on-line (and code sharing) connections;
3. Single interline connections between related carriers that do not share codes;
4. Single unrelated interline connections;
5. Double on-line (and code sharing) connections;
6. Double related, non-code-sharing interline connections; and
7. Double unrelated interline connections.

Within each category, the ranking of the flight is by minutes of elapsed time plus displacement, except that no elapsed time is assigned to nonstop flights. When 16 flights have been displayed, another group of 16 is selected and ranked.

Instead of using a hierarchy of categories like APOLLO's, SABRE uses a weighting system, with flights ranked by penalty points. These points are assigned as follows:

1. Displacement: one point per minute
2. Stops (up to five): 60 points each
3. On-line connections: 60 points each
4. Interline connections: 90 points each
5. Inter-airport connections: 150 points each

The sorting method employed by DATAS II is like APOLLO's: different criteria are used for assigning flights to a display and for ordering the display. Ten flights are assigned to a screen on the basis of elapsed time, although flights are considered to have the same elapsed time if time differs by 40 minutes or less. Ties for elapsed time are broken by ranking according to displacement from requested time, with the earlier chosen if displacement is equal. Next, flights are arranged for display on the screen in a Official Airline Guide format, i.e., first all nonstop and direct flights, then all connections, with each category arranged in chronological order of departure.

PARS uses a method intermediate between sorting by categories and ranking by point scores. Points are assigned as follows:

1. Elapsed time: minutes\*
2. Displacement: minutes
3. On-line connection: 30
4. Interline connection: 120
5. Inter-airport connection: 90
6. Not desired origin or destination airport: 180
7. Not requested service class: 120

These points are used to rank flights for display within each of three primary categories: direct service, single connection, and double connection. However, at the subscriber's option, this hierarchy of categories may be overridden to provide a single, combined ranking by points alone.

SYSTEMONE is unique in giving no consideration at all to elapsed time or displacement from requested time. Instead, it lists flights in the following categorical order:

1. Nonstop services;
2. Direct services with one or more stops;
3. Two-nonstop-segment on-line connections;
4. Two-nonstop-segment interline connections;
5. Two-multistop-segment on-line connections;
6. Two-multistop-segment interline connections; and
7. Three-segment connections.

Within each category, flights are displayed in chronological order of departure, starting two hours before the requested time.

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\*For nonstop flights, predicted minutes based on mileage are used in place of scheduled minutes.

All vendors were asked to submit comparable information on the value of passenger bookings originally made directly with sales representatives of their airlines. However, there does not appear to be any reason to use these figures to revise our incremental revenue estimates for the vendor airlines (other than the adjustment of estimated American incremental revenues discussed below). Accordingly, we have made no other adjustments to their estimates of incremental revenue or to the measures we derive from their reported estimates. Nor is it evident that other partial corrections intended to refine the measure of passenger revenue that is subject to the influence of display bias or a halo effect, and thus to classification as incremental revenue, would improve the accuracy of the estimates previously reported in Tables 4.2 and 4.7.

Because we have consistently measured and expressed incremental revenues as a fraction of total vendor airline revenues sold by travel agents equipped with its CRS, our resulting estimates of the dollar value of incremental revenue in each year are consistent with those implied by vendors' internal studies. The dollar estimates of incremental revenues reported in Tables 4.2 and 4.7 are each derived by multiplying the fraction of total vendor airline revenues sold through its CRS that represents incremental revenues by the dollar value of total airline revenues sold through its CRS in each year.

#### APOLLO Incremental Revenue

United Airlines commissioned two major studies of the incremental revenues contributed by APOLLO, as well as a separate analysis of the contribution of its incentive commission program to airline revenues when the participant was an APOLLO-equipped travel agent. In 1983, Dr. William E. Wecker estimated that converting a SABRE-equipped travel agent to the use of United's APOLLO system resulted in a 13 percent average increase on the dollar volume of travel on United flights booked by that agent.<sup>1</sup> This study was based on an analysis of changes in actual booking patterns of 130 travel agents who had converted from American's SABRE system to APOLLO during 1982, adjusted to remove the effect of changes in their booking patterns that would have occurred if they had continued to evolve according to past trends. A subsequent internal analysis conducted by United concluded that placing an APOLLO-equipped travel agent on United's override program raised its dollar share of passenger bookings on United flights by an additional 11 percent.<sup>2</sup>

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<sup>1</sup> Dr. William E. Wecker, "The Amount of Additional Air Transportation Revenue United Receives Because of APOLLO," November 1983.

<sup>2</sup> "Special Sales Incentive Proposal," Study summarized in "Automation Impact on Agency Shares," December 1984, document supplied by United Airlines in response to USDOT Information Directive, Item 20, 005169.

In response to the CAB's CRS rules in late 1984, United conducted an extensive analysis of the comparative booking patterns of SABRE-equipped, non-automated, and APOLLO-equipped travel agents in 14 cities served heavily by United flights. (The study does not report the total number of agents included in the analysis.)<sup>3</sup> This study is by far the most comprehensive -- and, in our judgment, reliable -- of the studies conducted by United (and perhaps by any vendor), and we have relied on its findings to estimate the contribution of APOLLO to the passenger revenues and profitability of United Airlines. This study concluded that prior to the imposition of the CAB anti-bias rules, APOLLO-equipped travel agents who did not participate in any airline's override commission program booked 18 percent more United passenger revenues on average than comparable, non-automated travel agents.

Because this finding applied to the pre-rule period, we interpret the 18 percent figure as the sum of APOLLO display bias and halo effects prior to November 1984. The proper interpretation of this figure for use in estimating the fraction of total APOLLO revenue attributable to the combined bias and halo effects appears to be that APOLLO-equipped travel agents booked 118 percent of the United passenger revenue booked by non-automated travel agents, of which 18 percent was due to their use of APOLLO. Thus, 18 percent divided by 118 percent, or 15.3 percent, of total United-generated revenue apparently stemmed from combined bias and halo effects, according to United's analysis. This figure is used in Table 4.2 to estimate the incremental revenues generated by the APOLLO system for the years 1976 to 1983.

The same study concluded that after the CAB rules took effect, the additional United revenue booked by APOLLO-equipped agents using the unbiased primary APOLLO display and not receiving override commissions from any airline declined to 16 percent compared with their non-automated peers.<sup>4</sup> Because this difference did not reflect any effect of screen display bias, we conclude that the halo effect, by itself, must have been responsible for the full 16 percent, with screen display bias having accounted for the remaining two percentage points (18 percent minus 16 percent) during the pre-rule period. Applying the same "normalization" discussed above, United's analysis estimates that of its domestic passenger revenue sold through APOLLO during 1985 and 1986, 16 percent divided by 116 percent, or 13.8 percent, results from the halo effect. This figure appears in Table 4.2 for the years 1985 and 1986 and is also used in Table 4.7 to

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<sup>3</sup> "Automation - Impact on Agency Shares," December 1984, Document supplied by United Airlines in response to USDOT Information Directive, Item 20, 005171-005199.

<sup>4</sup> The CAB rules governing CRSs originally allowed vendors to supply travel agents with a "secondary" display that could continue to be biased, but required that the "primary" display present unbiased flight rankings. This practice was ended during 1985.

estimate APOLLO incremental revenue from the halo effect for the years 1987 to 1992. The 14.9 percent figure shown for 1984 in Table 4.2 represents the 13.8 percent halo effect contribution plus the bias effect (equal to 15.3 percent minus 13.8 percent, or 1.5 percent), with the latter prevailing only during the ten months of the year before the CAB's 1984 rules took effect.<sup>5</sup>

### SABRE Incremental Revenue

According to the documents submitted by American Airlines, that carrier conducted only one major analysis of the incremental revenues contributed by SABRE during 1983.<sup>6</sup> This analysis consisted of two parts: (1) an evaluation of incremental airline passenger revenue contributed to American by SABRE and (2) an estimate of the effect of preferential display of American flights on passenger bookings by SABRE-equipped agents. The SABRE incremental revenue analysis compared the booking patterns of SABRE-equipped agents, non-automated travel agencies, and users of various other CRSS. It concluded that during 1982, \$268 million (or 23.7 percent) of the \$1,129 million in American Airlines passenger revenue sold through SABRE resulted from the combined effect of screen display bias and the halo effect (i.e., 23.7 percent represented total incremental revenues). The 23.7 percent figure is used in Table 4.2 to estimate the incremental airline passenger revenue accruing to American during the period 1976 to 1988.

American employed an elaborate statistical analysis to estimate the fraction of bookings made by SABRE agents for travel on its flights that was attributable to their preferential display on SABRE screens. While only limited documentation of the procedure employed was provided by American, it appears to have entailed estimating the parameters of a statistical model of travelers' choices among the flight alternatives presented to them by SABRE-equipped agents, using a sample of several thousand such choices. In addition to the elapsed times, closeness with which their arrival or departure times matched travelers' requests, and other characteristics of the flight alternatives presented, the position of flights on the SABRE display was found to influence travelers' selection of flights. Using the resulting statistical estimate of the strength of this influence, the analysis concluded that the preferential display of American flights in SABRE accounted for 19.6 percent of the total value of passenger tickets booked for travel on American flights by SABRE subscribers.

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<sup>5</sup> The results for APOLLO appear to show that bias was a relatively minor source of incremental revenue compared to halo. This may be true; however, it does not necessarily mean that our estimate of APOLLO halo is too high. Our estimate is in line with those we derived for the other vendors, and well below that produced by our own regression analysis.

<sup>6</sup> "Marketing Automation Economics," August 1983, document supplied by American Airlines in response to USDOT Information Directive, Item 20, 20-0002 to 20-0023.

However, the same analysis also reported that only 57 percent of sales by SABRE-equipped agents resulted from passengers' selection of an American flight from the flight availability display presented to a SABRE agent (the only sales for which screen position could have affected choice of carrier); the remainder was presumably requested by travelers or otherwise selected without comparison to flight alternatives operated by competing carriers. Thus, the analysis concluded that only 19.6 percent of 57 percent, or 11.2 percent, of American bookings and made through SABRE was attributable to its preferential display of American flights.

As indicated above, however, the value of host airline passenger revenue booked through its CRS is smaller than that sold through the CRS, since some passenger tickets included in the latter figure were originally booked directly through the airline's sales representatives. Thus, the 11.2 percent figure overstates the amount of revenue sold by SABRE subscribers that was attributable to the screen display bias that existed prior to November 1984. Supplemental information recently provided by American Airlines indicates that during 1983, 32.0 percent of American Airlines' passenger revenue was initially booked through its CRSs, while 41.0 percent of that revenue was actually sold by SABRE-equipped agents.

Since American's domestic passenger revenue amounted to \$3,603 million in 1983, the 32.0 percent figure implies that \$1,153 million was initially booked through SABRE. Of this amount, American's analysis suggests that 11.2 percent, or \$129 million, represented the product of bias in SABRE screen displays. Applying the 41.0 percent figure to this same total revenue suggests that \$1,477 in American domestic passenger revenue was actually sold through SABRE during 1983. Thus, the \$129 million of American Airlines' 1983 domestic passenger revenue that was apparently attributable to SABRE display bias represented 8.7 percent of the \$1,477 in total American Airlines domestic passenger revenue actually sold through SABRE during 1983.

Thus, we conclude that the difference between American's estimate of the 23.7 percent of SABRE revenue that represented incremental airline revenue and the 8.7 percent that apparently stemmed from bias, or 15.0 percent, represented the halo effect created by American's favorable relations with its SABRE subscribers. Because the 1984 rules are assumed to have eliminated bias, the 15.0 percent figure appears in Table 4.2 as the percent of SABRE incremental revenue during 1985 and 1986, as well as in Table 4.7 for the period 1987 to 1992. The 1984 figure in Table 4.2 (21.0 percent) represents ten months of incremental revenue at the higher bias plus halo figure (23.7 percent), with the remaining two months of the year at the lower halo-only figure (15.0 percent).

### PARS Incremental Revenue

TWA conducted various internal analyses of the incremental airline passenger revenues generated by PARS.<sup>7</sup> Several of these studies compared the growth in passenger revenue booked on TWA by PARS-equipped agents with that booked by agents equipped with other airlines' CRSs, both before and after those agents were automated. Separate comparisons were performed for travel agencies of different size, as well as for agencies that the airline judged to be "predisposed" to book passengers on TWA, because of their booking patterns before they were equipped with PARS. For example, one analysis concluded that during the 1979 to 1981 period, TWA revenue booked by PARS-equipped travel agents grew 16 percent relative to TWA revenue booked by SABRE agents and 10 percent relative to APOLLO agents. Previous analyses showed considerably larger differentials for earlier periods.

Unfortunately, it appears impossible to infer any measure of TWA incremental revenues owing to the PARS system from these differential growth rates. Even if it were possible to do so, any such estimates would represent the net effect of pro-TWA bias and halo effects on PARS agents' booking patterns and pro-host bias and halo effects on the booking behavior of agents equipped with competing CRSs. Further, other TWA internal studies arrived at widely differing estimates of the magnitude of incremental airline revenue resulting from PARS display bias (from 12 percent to as high as 53 percent). Thus, there appears to be no reliable way to construct an estimate of the magnitude of pre-rule incremental revenue generated by PARS from the various analyses conducted by TWA.

However, other data provided by TWA do allow a comparison of the fraction of airline ticket and revenue sales that represented travel on TWA flights between PARS agents and those equipped with other CRSs during the post-rule period. An analysis of these data indicates that, on average, the fraction of total airline revenue booked by PARS agents on flights operated by TWA is 4.9 percentage points higher than that booked on TWA flights by agents equipped with other CRSs. However, this difference probably represents the combined effect of the presumably favorable relationships maintained by each CRS-owning airline with its subscribers. If these relationships are equally influential for all CRS vendors, then approximately half of this 4.9 percentage point difference may owe to the halo effect created by relations between TWA and PARS-equipped travel agents. Since TWA bookings by these PARS subscribers on average represented 20.8 percent of their total air travel sales during the same period, this effect apparently accounts for 11.8 percent (one-half of 4.9 percent divided by 20.8 percent) of total TWA revenue booked by PARS agents. Because we have not been able to construct an estimate of the contribution of PARS bias to incremental revenue, the 11.8 percent figure has been used in Tables 4.2 and 4.7 to estimate the magnitude of PARS incremental revenues for periods before and after the CAB

<sup>7</sup> "Statistical Analysis of Agency Automation Efforts," February 1, 1979, May 1981, and May 1982, documents supplied by Trans World Airlines in response to USDOT Information Directive, Item 20, documents 20-21, 20-19, and 20-17.



rule. This assumption may cause the estimates of PARS profitability reported in Table 4.10 to be too low, although for other reasons these figures may overstate its profitability.<sup>8</sup>

### DATAS II Incremental Revenue

Delta reported very limited information on the magnitude of incremental revenues generated by its DATAS II system. The only reported analysis of DATAS II incremental revenues compared changes between the third quarters of 1984 and 1985 on the fraction of total air transportation revenue booked on Delta flights by various groups of travel agents: 80 agencies that converted to DATAS II from other CRSs, 11 agencies that subscribed to DATAS II throughout the period, and nine agencies whose DATAS II contracts were canceled.<sup>9</sup> Probably because the study period coincided when the CAB issued its CRS rules, the study revealed several anomalies that made it unsuitable for use in estimating the incremental revenues generated from DATAS II.<sup>10</sup>

Neither this study nor any other documentation submitted by Delta suggests that systematic display bias existed in DATAS II even prior to the CAB rules, so any incremental revenue it generated must have stemmed from whatever halo effect was created by Delta's relations with DATAS II subscribers. The only estimate of its magnitude reported on Delta documents is that Delta passenger revenue increases approximately 10 percent as a

<sup>8</sup> TWA submitted revenue, expense, and operating data for its PARS system only for the years 1980 to 1986, although other internal documents submitted suggest that commercial operation of PARS began during 1978. The effect of the presumably negative cash flows for PARS during 1978 and 1979, together with the resulting deferral of the earliest positive cash flows, would be to reduce its calculated economic rates of return under the assumptions used in to calculate Table 4.10. Because the comparative magnitudes of this possible omission and the exclusion of bias-generated incremental revenues from total PARS cash flows are impossible to evaluate a priori, it is difficult to judge whether the rates of return indicated for PARS in Table 4.10 are likely to overstate or understate its true profitability.

<sup>9</sup> "Halo Effect," internal memorandum dated January 8, 1986, document supplied by Delta Airlines in response to USDOT Information Directive, Item 20, document 20001.

<sup>10</sup> Most important, the 11 agencies subscribing to DATAS II throughout the study period showed a larger increase in the share of revenue booked on Delta than did those converted to DATAS II from other systems. In addition, even agencies whose DATAS II contracts were canceled showed a substantial increase in the percentage of revenue booked on Delta, no doubt partly because of the elimination of bias from other systems which they presumably began to use subsequently. Finally, an additional group of agencies converted to DATAS II in the quarter following the end of the study period showed a substantial decline in the percent of airline passengers booked on Delta flights.

result of the improved "rapport" established with DATAS II subscribers.<sup>11</sup> This estimate appears to be based on the finding that during the first half of 1985, the fraction of all passenger segments booked by DATAS II subscribers exceeded Delta's nationwide market share of passengers carried by approximately 10 percent. Because we lack a more reliable estimate to substitute for this figure, Tables 4.2 and 4.7 use the ten percent figure to estimate the contribution of DATAS II to Delta's airline passenger revenues (no bias revenue is included, as discussed above).

### SYSTEMONE Incremental Revenue

In response to the Department's Information Directive, Eastern Air Lines provided a single study of changes in travel agent bookings on Eastern flights in six of its major air travel markets during the period 1983 to 1985.<sup>12</sup> This study contained two analyses, dated December 1984 and August 1985, which calculated year-to-year changes over the period 1983 to 1985 in revenue booked for travel on Eastern flights by existing SODA subscribers -- subscribers converted from another CRS to SODA during each of those years, new SODA subscribers that had not previously utilized a CRS, and subscribers to other systems. The study also reported the percent by which the increase in Eastern revenue for each of these three types of SODA subscribers exceeded that for subscribers to other CRSs for the United States in total, as well as for the six markets studied.

Analysis of the nationwide data reported in this study indicates that the proportion of passenger revenue booked on Eastern flights by experienced SODA subscribers exceeded that for new SODA subscribers over this period by 10.0 to 12.4 percent, with the lower figure representing the result for the most recent year studied. Expressed as a percent of the (higher) growth in bookings by experienced SODA agents, this difference ranged from 9.1 to 11.0 percent. Because this difference presumably reflects the effect of the development over time of a business relationship between Eastern and its new subscribers, we interpret it as a measure of the halo effect stemming from this relationship. (Table 4.2 employs the more recent 9.1 percent figure.)

We cannot, however, infer from the revenue growth figures reported in the study a reliable measure of whether SYSTEMONE display bias contributed to incremental revenues for Eastern. Although the difference in Eastern booking growth rates between long-term or newly converted SODA subscribers and travel agents equipped with other CRSs should provide some indication of its effect, this difference also reflects other influences. We are thus unable to develop a satisfactory measure of the independent effect of possible pro-Eastern bias on booking patterns of the system's subscribers.

<sup>11</sup> "DATAS II - Three Year Review," internal memorandum dated July 30, 1985, document supplied by Delta Airlines in response to USDOT Information Directive, Item 20, document 20004.

<sup>12</sup> "Exhibit II: S.O.D.A. Revenues," document provided by Eastern Airlines in response to DOT Information Directive, Item 20, document 20-1, 00025-00063.

## APPENDIX IV

MARKET SHARES OF CRS VENDORS  
ANNUAL REVENUES -- (PRIMARY SYSTEMS)\*  
LARGE & MEDIUM HUB CITIES  
1983 - 1986

CITY/ MSA	ST	CRS	JULY 1982 - JUNE 1983		1986		PCT CHANGE	PT MKT SHR
			ANNUAL REVENUE AMOUNT	PERCENT	ANNUAL REVENUE AMOUNT	PERCENT		
<b>LARGE HUBS:</b>								
Atlanta 0520	GA	Apollo (UA)	45,930,825	25.78%		135,234,642	27.20%	1.42
		DatasII (DL)	6,402,140	3.59%		107,571,321	21.64%	18.04
		Pars (TW)	5,827,758	3.27%	2-FIRM	56,949	0.01%	-3.26
		Sabre (AA)	36,481,134	20.47%	69.59%	119,773,685	24.09%	3.62
		Soda/SysI(EA)	78,060,102	43.81%		134,557,866	27.06%	-16.75
		MarsPlus(TY)	5,476,547	3.07%		0	0.00%	
		Totals	178,178,506	100.00%		497,194,463	100.00%	
Boston 07C	MA	Apollo (UA)	46,921,070	11.54%		101,428,861	13.89%	2.35
		DatasII (DL)	3,728,859	0.92%		28,912,128	3.96%	3.04
		Pars (TW)	39,293,006	9.66%	2-FIRM	79,953,739	10.95%	1.28
		Sabre (AA)	305,998,405	75.24%	86.78%	447,870,709	61.32%	-13.92
		Soda/SysI(EA)	10,760,443	2.65%		72,275,474	9.89%	7.25
		MarsPlus(TY)	0	0.00%		0	0.00%	
		Totals	406,701,783	100.00%		730,440,911	100.00%	
Charlotte 1520	NC	Apollo (UA)	10,212,046	32.50%		23,571,950	26.26%	-6.24
		DatasII (DL)	1,199,542	3.82%		3,685,900	4.11%	0.29
		Pars (TW)	0	0.00%	2-FIRM	0	0.00%	0.00
		Sabre (AA)	3,863,298	12.30%	74.66%	23,666,453	26.36%	14.07
		Soda/SysI(EA)	13,245,473	42.16%		38,840,755	43.27%	1.11
		MarsPlus(TY)	2,899,073	9.23%		0	0.00%	
		Totals	31,419,432	100.00%		89,765,058	100.00%	
Chicago 14C	IL	Apollo (UA)	375,692,304	47.17%		627,115,717	50.52%	3.35
		DatasII (DL)	17,403,396	2.19%		39,317,874	3.17%	0.98
		Pars (TW)	27,099,425	3.40%	2-FIRM	34,113,833	2.75%	-0.65
		Sabre (AA)	365,637,828	45.91%	93.08%	519,127,741	41.82%	-4.09
		Soda/SysI(EA)	5,162,069	0.65%		21,700,561	1.75%	1.10
		MarsPlus(TY)	5,430,707	0.68%		0	0.00%	
		Totals	796,425,729	100.00%		1,241,375,726	100.00%	
Dallas 31C	TX	Apollo (UA)	2,770,024	0.73%		19,212,635	3.12%	2.40
		DatasII (DL)	7,580,453	1.99%		26,913,721	4.38%	2.38
		Pars (TW)	5,486,050	1.44%	2-FIRM	4,821,500	0.78%	-0.66
		Sabre (AA)	360,952,638	94.93%	96.92%	562,460,616	91.46%	-3.47
		Soda/SysI(EA)	0	0.00%		1,569,046	0.26%	0.26
		MarsPlus(TY)	3,456,044	0.91%		0	0.00%	
		Totals	380,245,209	100.00%		614,977,518	100.00%	

CITY/ MSA	ST	CRS	JULY 1982 - JUNE 1983		1986		PCT PT CHANGE MKT SHR
			ANNUAL REVENUE AMOUNT	PERCENT	ANNUAL REVENUE AMOUNT	PERCENT	
Denver 34C	CO	Apollo (UA)	233,964,453	76.12%	272,914,372	76.02%	-0.10
		DatasII (DL)	4,679,011	1.52%	8,528,963	2.38%	0.85
		Pars (TW)	9,097,378	2.96%	9,454,844	2.63%	-0.33
		Sabre (AA)	58,441,852	19.01%	57,057,035	15.89%	-3.12
		Soda/SysI(EA)	197,940	0.06%	11,048,847	3.08%	3.01
		MarsPlus(TY)	993,828	0.32%	0	0.00%	
		Totals	307,374,462	100.00%	359,004,061	100.00%	
Detroit 35C	MI	Apollo (UA)	110,233,797	37.06%	165,131,631	35.14%	-1.92
		DatasII (DL)	6,113,266	2.06%	27,327,595	5.82%	3.76
		Pars (TW)	4,135,646	1.39%	10,942,640	2.33%	0.94
		Sabre (AA)	172,279,837	57.93%	254,391,866	54.14%	-3.79
		Soda/SysI(EA)	1,329,576	0.45%	12,066,411	2.57%	2.12
		MarsPlus(TY)	3,316,166	1.12%	0	0.00%	
		Totals	297,408,288	100.00%	469,860,143	100.00%	
Honolulu 3320	HI	Apollo (UA)	58,371,776	56.41%	107,853,409	74.41%	18.00
		DatasII (DL)	0	0.00%	0	0.00%	0.00
		Pars (TW)	0	0.00%	0	0.00%	0.00
		Sabre (AA)	45,056,430	43.54%	37,088,370	25.59%	-17.95
		Soda/SysI(EA)	0	0.00%	0	0.00%	0.00
		MarsPlus(TY)	52,454	0.05%	0	0.00%	
		Totals	103,480,660	100.00%	144,941,779	100.00%	
Houston 42C	TX	Apollo (UA)	10,051,053	3.36%	71,735,373	18.39%	15.04
		DatasII (DL)	8,500,661	2.84%	14,714,011	3.77%	0.93
		Pars (TW)	3,563,635	1.19%	9,331,331	2.39%	1.20
		Sabre (AA)	260,130,559	86.86%	224,125,817	57.46%	-29.40
		Soda/SysI(EA)	13,386,585	4.47%	70,135,791	17.98%	13.51
		MarsPlus(TY)	3,855,596	1.29%	0	0.00%	
		Totals	299,488,089	100.00%	390,042,323	100.00%	
Las Vegas 4120	NV	Apollo (UA)	6,854,086	16.81%	11,231,874	18.53%	1.72
		DatasII (DL)	104,766	0.26%	1,484,430	2.45%	2.19
		Pars (TW)	20,604,754	50.55%	24,956,808	41.17%	-9.38
		Sabre (AA)	11,870,784	29.12%	13,637,681	22.50%	-6.62
		Soda/SysI(EA)	709,713	1.74%	9,304,048	15.35%	13.61
		MarsPlus(TY)	618,322	1.52%	0	0.00%	
		Totals	40,762,425	100.00%	60,614,841	100.00%	
Los Angeles 49C	CA	Apollo (UA)	424,007,192	33.42%	652,146,086	39.41%	5.98
		DatasII (DL)	24,050,020	1.90%	56,714,979	3.43%	1.53
		Pars (TW)	191,422,905	15.09%	237,186,632	14.33%	-0.76
		Sabre (AA)	607,080,303	47.86%	680,936,388	41.15%	-6.71
		Soda/SysI(EA)	4,857,378	0.38%	27,811,483	1.68%	1.30
		MarsPlus(TY)	17,120,974	1.35%	0	0.00%	
		Totals	1,268,538,772	100.00%	1,654,795,568	100.00%	

CITY/ MSA	ST	CRS	JULY 1982 - JUNE 1983		1986		PCT PT CHANGE MKT SHR	
			ANNUAL REVENUE AMOUNT	PERCENT	ANNUAL REVENUE AMOUNT	PERCENT		
Memphis 4920	TN	Apollo (UA)	2,419,023	5.73%			10.87	
		DatasII (DL)	900,244	2.13%			8.95	
		Pars (TW)	0	0.00%	2-FIRM	0	0.00%	0.00
		Sabre (AA)	38,892,140	92.14%	97.87%	70,603,046	72.26%	-19.88
		Soda/SysI(EA)	0	0.00%		65,174	0.07%	0.07
		MarsPlus(TY)	0	0.00%		0	0.00%	
		Totals	42,211,407	100.00%		97,712,329	100.00%	
Miami 56C	FL	Apollo (UA)	17,281,859	5.62%			-0.37	
		DatasII (DL)	17,960,919	5.84%			0.37	
		Pars (TW)	17,914,125	5.82%	2-FIRM	9,060,717	1.97%	-3.85
		Sabre (AA)	188,947,160	61.39%	77.88%	192,069,758	41.76%	-19.63
		Soda/SysI(EA)	50,753,367	16.49%		206,162,654	44.82%	28.33
		MarsPlus(TY)	14,915,136	4.85%		0	0.00%	
		Totals	307,772,566	100.00%		459,969,372	100.00%	
Minneapolis 5120	MN	Apollo (UA)	57,886,424	21.71%			-2.62	
		DatasII (DL)	508,660	0.19%			1.34	
		Pars (TW)	19,789,047	7.42%	2-FIRM	8,327,456	1.82%	-5.61
		Sabre (AA)	138,889,317	52.09%	73.80%	307,568,535	67.10%	15.01
		Soda/SysI(EA)	12,533,133	4.70%		47,956,145	10.46%	5.76
		MarsPlus(TY)	37,022,853	13.89%		0	0.00%	
		Totals	266,629,434	100.00%		458,347,989	100.00%	
New York 70C	NY	Apollo (UA)	241,251,534	16.12%			-4.17	
		DatasII (DL)	20,912,457	1.40%			0.29	
		Pars (TW)	232,942,693	15.56%	2-FIRM	313,528,150	13.50%	-2.06
		Sabre (AA)	929,335,559	62.09%	78.20%	1,423,223,147	61.30%	-0.78
		Soda/SysI(EA)	63,370,022	4.23%		268,215,965	11.55%	7.32
		MarsPlus(TY)	9,033,688	0.60%		0	0.00%	
		Totals	1,496,845,953	100.00%		2,321,632,520	100.00%	
Orlando 5960	FL	Apollo (UA)	5,077,731	9.69%			25.53	
		DatasII (DL)	7,426,994	14.17%			8.76	
		Pars (TW)	971,180	1.85%	2-FIRM	543,363	0.48%	-1.37
		Sabre (AA)	16,065,528	30.64%	65.18%	22,864,149	20.14%	-10.51
		Soda/SysI(EA)	18,108,520	34.54%		24,122,156	21.24%	-13.30
		MarsPlus(TY)	4,776,732	9.11%		0	0.00%	
		Totals	52,426,685	100.00%		113,543,284	100.00%	
Philadelphia 77C	PA	Apollo (UA)	143,246,152	43.23%			6.50	
		DatasII (DL)	6,540,470	1.97%			-0.42	
		Pars (TW)	85,732,070	25.87%	2-FIRM	115,702,593	21.21%	-4.66
		Sabre (AA)	54,762,980	16.53%	69.10%	83,948,793	15.39%	-1.14
		Soda/SysI(EA)	36,384,946	10.98%		66,105,786	12.12%	1.14
		MarsPlus(TY)	4,692,752	1.42%		0	0.00%	
		Totals	331,359,370	100.00%		545,545,258	100.00%	

CITY/ MSA	ST	CRS	JULY 1982 - JUNE 1983		1986		PCT PT CHANGE MKT SHR		
			ANNUAL REVENUE AMOUNT	PERCENT	ANNUAL REVENUE AMOUNT	PERCENT			
Syracuse 8160	NY	Apollo (UA)	0	0.00%	10,363,515	21.82%	21.82		
		DatasII (DL)	0	0.00%	0	0.00%	0.00		
		Pars (TW)	635,029	2.29%	2-FIRM	624,368	1.31%	-0.98	2-FIRM
		Sabre (AA)	27,002,452	97.41%	99.70%	35,680,951	75.12%	-22.29	96.94%
		Soda/SysI(EA)	82,628	0.30%		828,246	1.74%	1.45	
		MarsPlus(TY)	0	0.00%		0	0.00%		
		Totals	27,720,109	100.00%		47,497,080	100.00%		
Tucson 8520	AZ	Apollo (UA)	3,542,993	6.33%		8,033,777	10.93%	4.60	
		DatasII (DL)	0	0.00%		123,386	0.17%	0.17	
		Pars (TW)	13,192,642	23.57%	2-FIRM	17,532,191	23.86%	0.29	2-FIRM
		Sabre (AA)	37,988,397	67.87%	91.44%	44,851,829	61.03%	-6.84	84.89%
		Soda/SysI(EA)	470,471	0.84%		2,950,010	4.01%	3.17	
		MarsPlus(TY)	778,077	1.39%		0	0.00%		
		Totals	55,972,580	100.00%		73,491,193	100.00%		
Tulsa 8560	OK	Apollo (UA)	1,185,975	2.25%		1,481,680	2.25%	-0.00	
		DatasII (DL)	1,268,942	2.41%		743,966	1.13%	-1.28	
		Pars (TW)	20,315,492	38.58%	2-FIRM	13,899,538	21.10%	-17.48	2-FIRM
		Sabre (AA)	29,892,862	56.76%	95.34%	49,436,989	75.04%	18.28	96.14%
		Soda/SysI(EA)	0	0.00%		320,361	0.49%	0.49	
		MarsPlus(TY)	0	0.00%		0	0.00%		
		Totals	52,663,271	100.00%		65,882,534	100.00%		
West Palm Beach 8960	FL	Apollo (UA)	6,405,148	12.85%		24,880,544	23.98%	11.13	
		DatasII (DL)	3,400,699	6.82%		19,776,838	19.06%	12.24	
		Pars (TW)	3,972,202	7.97%	2-FIRM	5,368,430	5.18%	-2.79	2-FIRM
		Sabre (AA)	17,267,519	34.64%	62.58%	19,943,602	19.23%	-15.42	56.53%
		Soda/SysI(EA)	13,924,529	27.94%		33,764,674	32.55%	4.61	
		MarsPlus(TY)	4,872,951	9.78%		0	0.00%		
		Totals	49,843,048	100.00%		103,734,088	100.00%		

CITY/ MSA	ST	CRS	JULY 1982 - JUNE 1983		1986		PCT CHANGE MKT SHR
			ANNUAL REVENUE AMOUNT	PERCENT	ANNUAL REVENUE AMOUNT	PERCENT	
<b>SUMMARY TOTALS</b>							
LARGE HUBS		Apollo (UA)	2,581,246,802	28.78%	4,141,965,686	30.25%	1.47
		DatasII (DL)	163,175,911	1.82%	534,158,964	3.90%	2.08
		Pars (TW)	1,089,990,542	12.15%	1,444,800,736	10.55%	-1.60
		Sabre (AA)	4,633,704,228	51.66%	6,373,709,429	46.54%	-5.12
		Soda/SysI(EA)	357,883,785	3.99%	1,199,387,980	8.76%	4.77
		MarsPlus(TY)	143,293,967	1.60%	0	0.00%	
		TOTAL	8,969,295,235	100.00%	13,694,022,795	100.00%	
MEDIUM HUBS		Apollo (UA)	654,585,050	32.50%	1,088,255,428	34.74%	2.23
		DatasII (DL)	40,363,551	2.00%	147,526,908	4.71%	2.70
		Pars (TW)	279,758,155	13.89%	335,368,630	10.70%	-3.19
		Sabre (AA)	929,087,223	46.13%	1,293,944,849	41.30%	-4.83
		Soda/SysI(EA)	67,493,147	3.35%	267,891,714	8.55%	5.20
		MarsPlus(TY)	42,603,021	2.12%	0	0.00%	
		TOTAL	2,013,890,147	100.00%	3,132,987,529	100.00%	
TOTAL LARGE AND MEDIUM HUBS		Apollo (UA)	3,235,831,852	29.46%	5,230,221,114	31.08%	1.62
		DatasII (DL)	203,539,462	1.85%	681,685,872	4.05%	2.20
		Pars (TW)	1,369,748,697	12.47%	1,780,169,366	10.58%	-1.89
		Sabre (AA)	5,562,791,451	50.65%	7,667,654,278	45.57%	-5.08
		Soda/SysI(EA)	425,376,932	3.87%	1,467,279,694	8.72%	4.85
		MarsPlus(TY)	185,896,988	1.69%	0	0.00%	
		TOTAL	10,983,185,382	100.00%	16,827,010,324	100.00%	

SOURCE: 1983 Revenue Data - Department of Justice, Appendix A to the Comments and Proposed Rules, Advance Notice of Proposed Rulemaking - - Airline Computer Reservations Systems, November 1983.  
1986 Revenue Data - Airlines Reporting Corporation, Agency Location Sales On Behalf of Individual Airlines (Agency/Airline year sales tape - 445).

\* The "Primary System" in those agencies that employ multiple CRSs is defined as the CRS that books the largest amount of total agency bookings.

NOTE: MSA codes ending in "C" represent a 1983 CMSA to 1986 MSA/NECMA conversion.

## 1983 CMSA TO 1986 MSA/NECMA CONVERSION

<u>CMSA</u>	<u>MSA</u>	<u>NECMA</u>
07		1123, 4763, 5403, 6453, 9243
10	1280, 5700	
14	0620, 1600, 2960, 3690, 3800, 3965	--
21	1640, 3200	
28	0080, 1680, 4440	
31	1920, 2800	
34	1125, 2080	
35	0440, 2160	
41		3283
42	1145, 2920, 3360	
47	3760	
49	0360, 4480, 6000, 6780	
56	2680, 5000	
63	5080	
70	0875, 3640, 5015, 5190, 5380, 5600, 5640, 5950	1163, 5483
77	6160, 8480, 8760, 9160	
78	0845, 6280	
79	6440, 8725	
80		5403, 6483
82	7040	
84	5775, 7360, 7400, 7485, 7500, 8720	
91	7600, 8200	