AN ANALYSIS OF THE EFFECT OF AIRLINE Deregulation
UPON THE DEMAND FOR INTERCITY BUS SERVICE

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Table of Contents

I Introduction................................................................. 2

II History of Intercity Bus Industry
A. Introduction............................................................... 5
B. Regulation................................................................. 5
C. Deregulation............................................................. 9
   1. Immediate Effects............................................... 12

III Structure of the Intercity Bus Industry
A. Regulation and Post Deregulation..............................14
C. Market Concentration...............................................16
D. Demand facing Intercity Bus Service..........................21
E. Profitability............................................................23
   1. Factors Attributable to Financial Decline.................23

IV Evidence for Market Link between Air and Bus Travel
A. Lack of Intramodal Competition...............................27
B. The Oil Price Shock of 1979-80.................................28

V Brief Historical Sketch of Airline Industry
A. Industry structure under Regulation..........................31
B. Deregulation and its Effects.....................................35

VI Comparison of the Demand Demographics Between Bus and
Air Travel.................................................................38

VII Analysis: Airline Deregulation and the Bus Industry
A. Impact of Airline Deregulation upon Airfares...............44
   B. Cross Substitutability of Air and Bus travel..............49
      1. Econometric Models- Supply and Demand.............51

VIII Conclusion............................................................53

Appendix A. Regression Results of Intercity Bus Costs........57

Appendix B. Supply and Demand Equation for the Airline
   Industry..................................................................58

Appendix C. Inclusion of Dummy Variable for Price of Air
   in Bus Demand Equation...........................................59

Appendix D. Data Used for Regression Analysis..................60
INTRODUCTION
Hanna Schulte was all set to see America the Greyhound way...But when [the German college student] arrived at Dulles International Airport last week, she asked about air fares anyway. "I had no idea how cheap the flying is here," she said..."I don't think I'll need to take a bus anywhere."1

This brief excerpt, although not particularly fascinating in its revelation, is exemplificative of a far more complex aspect of modern American economic policy. During the 1930's, American regulatory fervor was at its peak. Fear of a repeated economic upheaval, like that of 1929, compounded with the exorbitant profits earned by the robber barons spawned government intervention. Consequently, regulation was imposed upon numerous industries, including air and bus transport.

Four decades later restrictions have been lifted not only in the airline industry but in the intercity bus industry as well. These changes are part of the new laissez faire government of the late 1970's and, thus far, the 1980's. By allowing the owners of industry and business to essentially go 'head to head', the government has introduced very powerful market forces which threaten to shake the stability of some of this nation's more steadfast corporations. Those companies that first come to mind within the transportation sector are Greyhound and Trailways, clearly the market leaders for the bus industry.

This paper is founded on the contention that the government, in deregulating the airline industry, failed to take into account the 'spillover' effects for other industries. The industry of particular interest within this context is the intercity bus industry. The intercity bus industry has received very little
notoriety with respect to airline deregulation. In fact, it has received very little attention altogether from both media and academia. There are, for instance, no definitive texts on the industry, nor has there been a proliferation of studies conducted with regard to industrial analysis. This is only partially explained by the bus companies themselves, which inhibit the degree of industrial analysis through protective proprietary policies.

It is, therefore, the purpose of this paper to analyze the effect that airline deregulation has had on the intercity bus industry. The paper begins with a brief historical sketch for the intercity bus industry, including a description of the conditions under regulation. This is followed by a discussion of the Bus Regulatory Reform Act and its effects upon the industry. In section III, I analyze the structure of the bus industry, placing particular emphasis on market concentration, demand, and profitability. This is followed by an analysis of the factors responsible for the industry's financial decline. In section IV, I introduce evidence that suggests that the air and bus industries are linked, which is followed by a brief historical sketch of the airline industry. Section VI offers a comparison of the demand demographics between bus and air travel. Finally, I conclude the paper with an empirical analysis of the effect of airline deregulation on the demand for bus service. This end is achieved in two parts. First, I demonstrate that airline deregulation has led to a drop in the level of fares. Secondly, I estimate the supply and demand equations for the bus industry and demonstrate that the quantity demanded of bus travel is, in part,
dependent upon the price of air travel.

Before we turn to the body of the paper it is first necessary to clarify certain aspects of the transportation industry. In transportation markets, demand is spatially- or time-located. Furthermore, demand is assumed to be random, and depends on availability of service. According to Pablo Spiller in his paper on *Quality, Capacity and Regulation*, transportation "firms supply capacity and determine location and price before demand is realized."² All public transportation markets are similar in that their product cannot be stored. Empty seats in a train, bus, or airplane, signify lost revenue. The marginal cost of an additional traveler in any mode is almost negligible, save the cost of the meals offered in some airlines. Therefore, unoccupied seats in any transport mode are considered a "deadweight loss that can never be recovered."³ Therefore, all transport strives for high load factors. A load factor is defined to be the percent of seats in a transport vehicle that are occupied by passengers. Finally, it is important to distinguish between intramodal and intermodal competition. Intramodal competition is that which arises between carriers of the same industry. Intermodal competition includes all transport modes which are viable substitutes with one another. These points are important to keep in mind, throughout the analysis of this paper.
II History of the Intercity Bus Industry

Introduction

"...the origin of the Greyhound Lines [c.1911] is said to be a four-mile run between Hibbing and Alice, Minnesota, in an open-air, seven passenger Hupmobile, at a fare of fifteen cents one-way or twenty-five cents round-trip."\(^1\)

The first two decades of the twentieth century in America marked a time when there was very little choice between alternative modes of transportation. Transportation was regarded by many as a luxury good, explained, not by price, but by its relative scarcity. The dominant mode was rail travel, supplemented predominantly by bus. Bus transport was not perceived by either consumer or producer, as a substitute good for rail. Instead, bus transport was utilized only as a means of getting to the closest railway station.

By the 1920's many railroads found themselves in financial disarray. In an attempt to reduce losses, unprofitable routes were abandoned. In order to compensate for the lost revenue along these routes, many railroad owners adopted bus transport as a low cost alternative means of transport. It was soon realized that bus service need not be confined to intrastate travel, and consequently, it became regarded as a viable means for regional and cross country transportation.

Regulation

As the intercity bus industry grew, both financially and geographically, government began to take interest in its development. The first sign of regulation began at the state
level in Pennsylvania in 1914. By 1930, all but two states had imposed some form of restriction upon bus service.

The impetus behind regulation in the bus industry changed over the years. Initially, government was concerned about insuring passenger safety and highway protection. Early ordinances stressed this aim. However, as the industry began to grow at an enormous rate in the 1920's, the state governments began to focus upon the economic implications that surfaced. There arose concern for what the government called 'economic stability' in the bus industry. In real terms this meant that the government believed it was necessary to place controls on fares and market entry. A report published by the Interstate Commerce Commission sums up the position of the state governments:

"...most... adopted the viewpoint that a free market environment would result in lower load factors, higher costs, and less reliable and less comfortable service at fluctuating fares." Furthermore, they believed that by not restricting entry, new firms would be unnecessarily duplicating capital which would increase costs for the whole industry. They feared that these costs would eventually be transferred to the consumer.

If we take into account our current knowledge of industrial organization, the government's fears do not appear to have been justified. First, if we accept the basic economic notion that markets left to themselves will realize an equilibrium condition that maximizes the combined surpluses of consumers and producers alike, then the intercity bus market, one could posit, would have been forced to price transport at the optimal rate. Assuming competitive market conditions (which did in fact exist at this time both in actual and potential competition) fares would have
been maintained at equilibrium levels. By restricting entry into the market, the government in effect, disrupted free market conditions by lessening competitive forces. In order to insure consumer protection, the only alternative they left themselves was the imposition of price controls.

Intercity bus service was essentially reduced to the status of public utility and treated as if it were a regulated monopoly. It can be argued that such policy is justifiable if large economies of scale are inherent to the industry. We shall see in the following chapter, however, that this is not the case in the intercity bus industry.

The government also failed to recognize that 'duplication of capital' by new entrants would shift the supply curve for bus transport out to the right. This would have lowered fares and increased the quantity of service available. The government's stance against an increase in capital in the bus industry, was in direct reaction to what happened in the railroad industry, years before. The railroads had purchased and employed an excess amount of fixed capital, resulting in a surplus of supply over demand. The government's mistake was in equating the cost structures of the two industries. The rail industry is very capital intensive, requiring enormous sums to cover its fixed costs. The bus industry, on the other hand, is dominated by its variable costs. Elizabeth Pinkston supports this by showing that average costs do not decrease over distance traveled (see appendix). It is unlikely that the increased costs (for the industry as a whole) associated with new entrants would have been
passed on to the consumer. A more probable result would have been a fare structure that more closely resembled costs.

Government did not take these points into consideration and hence, regulations were imposed. Many states utilized regulation in order to insure that towns were sufficiently serviced. When states attempted to place controls on markets that extended outside of state borders, however, the federal government stepped in. In 1925, the Supreme Court ordered that states could not exercise control over interstate bus routes. Federal regulation, however, was not officially imposed until a decade later with the Motor Carrier Act of 1935.

The Motor Carrier Act led to over forty years of intercity bus regulation. It was established in the wake of the Great Depression, in order to instill economic stability and prevent further financial disaster. The Interstate Commerce Commissions' interpretation of the act imposed restrictions on entry, exit and pricing policies. The Commission determined licensing of carriers, mergers or transferrals of operating rights, and the setting of fares and safety precautions.

According to established policy, regulatory matters involving interstate and intrastate routes were delegated to the federal and state governments, respectively. On the federal level, the government practiced a very strict policy with regard to entry into the intercity market. In fact, they exercised a form of protectionism, where applications by prospective entrants were carefully scrutinized to determine if they posed a threat to
the established firms:

The question, in substance, is whether the new operation or service will serve a useful public purpose, responsive to a public demand or need; whether this purpose can and will be served as well by existing lines or carriers; and whether it can be served by applicant with the new operation or service proposed without endangering or impairing the operations of existing carriers contrary to the public interest. (emphasis inserted)³

The terms of firm exit, on the other hand, were quite flexible. The same held true for established terms of schedule frequency. On the state level, however, strict ordinances often barred exit from intrastate routes. This hardline policy, characteristic of most states, is best explained by political motives. If service was lost in any region, the governor would eventually be held responsible by those individuals affected. Thus, the evidence suggests that on the federal level, regulation favored the protection of the industry, while at the state level, consumer interests were the primary aim.

Deregulation

It was only until the late 1970's that the Interstate Commerce Commission (I.C.C.) began to relax its entry standards. Studies leading up to deregulation pointed out that regulation was unnecessary and promoted inefficiency. In 1975, Elizabeth Pinkston completed her Ph.D. thesis on the intercity bus industry. She shared these same sentiments when she criticized the current regulation:

unrestricted entry and expansion would not have a major detrimental effect on the quality or price of bus service and ... on the contrary, some improvements might be forthcoming.... Governmental
regulation of the intercity bus transportation industry is found to be unnecessary to ensure efficient resource allocation. Furthermore, in 1981 congress declared that:

the existing Federal and State regulatory structure has tended in certain circumstances to inhibit market entry, carrier growth, maximum utilization of equipment and energy resources, and opportunities for minorities and others to enter the motor bus industry.6

A direct result of the growing skepticism was an increase in the flexibility of regulatory conduct as administered by the I.C.C. This led to a significant abandonment of less profitable routes by the majority of major carriers. Those routes dropped were characteristically ones that "did not fit in with major highway networks connecting large urban centers."5 This abandonment was to continue into the early 1980's and reach its peak the year following deregulation in 1982.

There were a number of factors which eventually led to the deregulation of the intercity bus industry. As demonstrated above, economists in the 1970's began reappraising the efficacy of regulation in terms of its economic efficiency. In 1975, the Brookings Institution published a report entitled Promoting Competition in Regulated Markets which questioned the economic justification of regulatory constraints in numerous industries. In addition, the of Ford, Carter, and Reagan administrations have all been in support of deregulatory measures. Under Carter's term in office a number of industries were unshackled from governmental constraints and left to face free market conditions; among these were the trucking and airline industries. It was the
deregulation in the airline industry, however, which eventually led the managers in the intercity bus industry to push for their own deregulation. Greyhound and Trailways, the industry's two dominant firms, were both very active toward this end. In fact, three months after airline deregulation, Greyhound submitted to Congress, *A Proposal for Federal Legislative Deregulation of the Intercity Bus Industry* (February, 1979). The industry leaders hoped to obtain the freedom to restructure routes in order to achieve profit maximization.

The U.S. Department of Transportation suggests an additional catalyst for deregulation. In their report on *The Impacts of Regulatory Reform on Intercity Bus Service* references are made to the competitive handicap that regulation has levied upon buses in relation to other modes of passenger transport. Particular emphasis is made with regard to the airline industry:

Clearly, the major impetus behind enactment of the Act was a desire to make the motor bus industry more competitive at a time the industry was facing increased competitive pressure from other transportation modes. Regulatory reform in the passenger airline industry had dramatically altered airline fare structures on many city-pairs that motor buses also served. Without similar reform for the bus industry, it was thought that it would be unable to respond to these increased pressures and thus be faced with reduced passenger loads and, presumably, less favorable income and profit statements.

Deregulation was finally achieved in 1982 with the Bus Regulatory Reform Act (BRRA). This act essentially liberalized the restrictions on exit and route abandonment and eased the restrictions on entry requirements. The burden of proof for exit shifted from the firm to the regulatory commission. The Act also removed a provision which had prevented carriers from servicing
intermediate points. By loosening its constraints, the functions of the Interstate Commerce Commission were greatly reduced. The I.C.C., "...was cast in the role of referee and final arbitrator in any controversies and disputes that arise over motor bus service."^8

**Immediate Effects of Bus Deregulation**

Clearly, an entire paper could be dedicated to examining the effects of bus deregulation; indeed, others have already achieved this end. It is, therefore, the purpose of this section to offer a brief synopsis of the after-effects of the BRRA in order to place this industry in proper perspective. This will, in turn, aid future analysis.

Passage of the Bus Regulatory Reform Act has had two major effects upon the intercity bus industry. First, it has led to a dramatic increase in new charter firms (class III carriers). The effect has not been as great in the Class I category, a market which is dominated by market leaders, Greyhound and Trailways. Charter firms typically require very low start-up or capital costs, perhaps best explaining the great increase of new firms in this section of the bus market. Greyhound and trailways have, nevertheless experienced a decline in their respective market shares (Figure 1).

The BRRA has also led to a move on the part of Greyhound and Trailways to "rationalize route structures."^9 In other words, these firms have taken advantage of the exit allowances and have effectively restructured routes as consistent with profit
Figure 1

Market Concentration over Time

Intercity Bus Industry (Class I)

2-firm Concentration Ratio (%)

Year
maximization. This has led to elimination of many unprofitable routes. Between passage of the Act in September 1982 and September 1983, a total of 1294 service points had been, or were proposed to be, dropped. Sixty percent of these service points did not have convenient access to a large urban area. This lack of service would leave a little over one million people, in a sense, stranded (although taxi service is a viable yet very expensive alternative form of transportation).

This route abandonment was not unique to deregulation, in fact it began in the late 1970's when the I.C.C. began to relax certain market restrictions. Between 1975 and 1984, total bus service declined steadily with an average annual rate of abandonment of 4.8 percent (Figure 2). Declines in departures, nevertheless, reached their peak in the year following deregulation with a rate of 16 percent, 330 percent higher than the average. In the following year, the drop in departures fell to 4 percent. Furthermore, the Department of Transportation concluded that:

In seven years prior to passage of the Act, not only did the number of terminations outnumber service initiations (by about 3.8 to 1), but the number of communities losing part of their service was greater than the number gaining service (by a factor of 3.1 to 1).

After passage of the act this rate of termination more than doubled with a ratio of 8.6 to 1. If nothing else, this evidence indicates that regulation was preventing some carriers from withdrawing from certain routes, and thus preventing profit maximization. The Department of Transportation believes that deregulation has had a relatively minimal effect overall, while
Figure 2

All States in the Sample Communities Receiving Bus Service 1975 – 1984

<table>
<thead>
<tr>
<th>Year</th>
<th>Any Service</th>
<th>Regular</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>3500</td>
<td></td>
</tr>
<tr>
<td>1979</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>1500</td>
<td></td>
</tr>
</tbody>
</table>
it has facilitated a tendency toward greater market efficiency:

In sum, while there have certainly been service losses following passage of the Bus Act, the change in regulatory environment is not necessarily to blame. The trend of declining service was well underway prior to 1982. At most the Bus Act may have permitted a rapid adjustment to the level of service the market could support.\(^{12}\)

With an understanding of the development of the intercity bus industry we turn to a more quantitative appraisal. In the next section we see how regulatory policy has helped shape the current structure of the industry.

### III Structure of the Intercity Bus Industry

It is the purpose of this section to describe the structure of the intercity bus industry. We will examine the particular trends in market density and determine whether the degree of high concentration that exists in the industry is justified by scale economies. We begin this section with a general overview of the industry.

The intercity bus industry is dominated by two vertically integrated firms, Greyhound and Trailways. Michael Redisch of the ICC describes this relationship as a "lopsided duopoly."\(^{13}\) Both of these firms are responsible for the manufacture of their own buses, which aids in the reduction of value added costs. Greyhound alone is responsible for approximately 50 percent of total operating revenues for all carriers, while Trailways and a competitive fringe composed of commuter, charter and special operation services account for the remaining 50 percent. In order to understand the current industrial structure, one must first look at its origins.

The late 1920's marked a time in the bus industry when
mergers ran rampant. Although, restrictions were placed on firm entry, the government allowed and even supported consolidation throughout the industry. The government justified this position by equating firm size with financial stability. It was during this period that the Greyhound Company emerged the dominant firm in the industry.

In an attempt to become competitive with Greyhound, a group of small companies united to form the National Trailways Bus System (NTBS). Most of the members of the NTBS were also tied into rail travel, which by law restricted any sort of transportation merger, thus, membership was voluntary. The members of the NTBS nevertheless enjoyed many of the benefits that are typically attained through horizontal merger. They shared economies of scale through joint marketing and advertising ventures. They also shared terminals, which greatly increased route networks. Most importantly the NTBS facilitated the exchange of buses for long haul trips which allowed the passenger to remain on the same vehicle even when passing from one company's route to another. This enabled the NTBS to be a viable competitor with Greyhound for cross country travel.

After passage of the Motor Carrier Act in 1935, the structure of the bus industry effectively remained frozen, with internal consolidations increasing the market concentration. Entry was severely limited until the late 1970's:

Between 1960 and 1970, the Commission [ICC] received only 121 contested applications for new authority, and denied 36 percent of the (55) regular route, 44 percent of the (27) charter requests, 39 percent of the (33) special operations requests, and 67 percent of the (6) contract requests.14
The Interstate Commerce Commission began to relax its entry restrictions in 1975, however there still existed a policy of protectionism for the two market leaders, Greyhound and Trailways. Between 1975 and 1977 the commission approved 87.5 percent of their applications for expansion while only approving 33 percent of those submitted by smaller carriers. This trend toward increased leniency on the part of the ICC can be seen by glancing over the growth patterns in the number of bus companies prior to deregulation (Figure 3). From 1975 up through 1982 there was a steady increase in the number of operating bus companies in the industry. As we will see shortly, this has led to a decline in the concentration ratio for the industry.

With the institution of deregulation in late 1982, Congress in essence lowered federal entry barriers. The ICC writes,

... actual and potential competition, rather than regulatory decree, are now to be the primary determinants of fare and service levels in the industry.15

The effect this had on the bus industry is quite apparent in the sharp increase of firms between 1982 and 1984. Between passage of the Bus Regulatory Reform Act in October 1982 and October of the following year, 54 percent of the applications for operation along select routes were from new carriers.

Concentration

Although deregulation has had a significant downward effect upon market concentration, the industry continues to demonstrate a high density level. Prior to deregulation, the industry demonstrated very high and very consistent concentration ratios,
Figure 3

The Number of Operating Bus Companies

O V E R T I M E

Years

fluctuating around 98 percent. This highly concentrated state is primarily the result of the state and federal regulatory practices that placed constraints on entry by new firms. Furthermore, under regulation the existing firms were limited to expansion via merger and acquisition. This has led to a condition of duopoly in most long haul markets, and even monopoly in many light density and short haul markets.

The Bus Regulatory Reform Act of 1982 ended over fifty years of regulation which effectively froze the industry in the midst of its evolution. If nothing else, this act has had a very noticeable effect upon the concentration of the industry. I have compiled a graph of the two-firm concentration ratios for the last six years, reproduced here from figure 1:

![Market Concentration over Time](image)
Concentration remained at a relatively constant level, between 97 and 98 percent, for the years leading up to 1982. In the year following deregulation, however, concentration dropped over 7 percent to 90.4 percent. Although this figure continues to gradually decline, it is quite clear that a very high degree of concentration still exists.

In an attempt to better ascertain the nature of this industry we must examine whether factors other than regulatory decree have attributed to the high level of market concentration. Since there are very low technological barriers to entry in the intercity bus industry, we can assume that this is not a factor substantiating the level of concentration. Similarly, no one carrier exhibits a superior level of innovation or efficiency. It is for these reasons that we must look at the cost structure of these firms to determine whether the level of concentration can be explained by economies of scale.

If scale economies were inherent in the intercity bus industry a firm might increase its capacity in order to move lower along its average cost curve. Therefore, up to a certain point, the largest firm could dominate the market by charging a lower price and selling more output than its competitors. If significant scale economies do exist in this industry the best way for the government to maximize consumer benefit is to establish a monopoly where price would be federally regulated.

A monopoly can be justified if there is a significant decline in average and marginal costs as the quantity of service increases. In most regulated monopolies, fixed costs have a
greater effect on average total costs than do variable costs. The intercity bus industry, however, demonstrates a very high variable to fixed cost ratio. According to a study done by the Interstate Commerce Commission back in 1978, 80-90 percent of a carrier's expenses are variable.\textsuperscript{16} Costs per mile actually increase with respect to firm size. This is explained by the higher labor costs that are associated with larger firm size (typically, there is a positive relationship between the size of the firm and the length of its routes. Since longer routes demand higher wages by drivers, larger firms incur higher labor costs). Labor costs alone, dominate over 50 percent of the total operating costs of Class I carriers.\textsuperscript{17}

Furthermore, the existence of hundreds of very small companies indicates that fixed costs do not pose a very high barrier to entry. There is a very low capacity needed to start a firm (in a very naive sense, one only needs to buy/lease a bus). Michael Redisch of the ICC confirms this notion and asserts that there is not necessarily an inherent advantage in a larger firm:

\begin{quote}
...Greyhound, with its extensive route and terminal network and frequent schedules, has a higher load factor per bus but also has higher costs per bus mile, with no clear cut size advantage in terms of either costs or profits.\textsuperscript{18}
\end{quote}

The existence of scale economies in the intercity bus industry may be justified to some degree if one takes into account consumer service. Increased firm size typically lends itself to increased route networking. Larger firms have interconnecting stations and are able to offer cross country service. The more extensive a route network is, the greater is the ease in getting from one destination to another. Implicit in
these advantages are shorter layovers, simplified ticket purchasing and ease in baggage checkthrough. Furthermore, there is the added advantage of advertising economies which invariably favor the larger firm. Although these are all advantages experienced through greater firm size, they nevertheless do not allow a firm to move down along its long-run average cost curve (an argument could be made for scale economies in advertising, however, this accounts for a very insignificant proportion of costs. In 1985 advertising expenses explained 4.5% of total operating expenses.)

High concentration in an industry is often the result of economies of scale. In the intercity bus industry, however, this does not appear to be the case. A number of studies have examined this question, however:

The utilization of sophisticated econometric techniques has not revealed statistically significant scale economies in the bus industry. This finding is supported by Elizabeth Pinkston in The Intercity Bus Transportation Industry (1975), Fred Fravel in "Returns to Scale in the U.S. Intercity bus Industry" (1978), Fravel, Helen Tauchen and Gorman Gilbert in Economies of Scale in the U.S. Intercity Bus Industry (1980), and Tauchen, Fravel and Gilbert in "Cost Structure of the Intercity Bus Industry" (1983). Furthermore, the actual passage of the BRRA, which granted firms greater pricing freedom and more lenient entry and exit policies did not attempt to help or hinder a size class of firms.

Therefore:

... Congress has implicitly concluded that significant scale economies and other non-regulatory entry barriers do not exist for buses.
The Demand facing Intercity Bus Service

With sufficient background as to the supply side of the industry, we now turn to a brief examination of demand. There are a number of factors which demonstrate an effect upon the demand for bus service. Clearly, fare levels are one of the most significant determinants. A fare increase, (as one would expect in most cases) leads to a decrease in the level of quantity demanded. Furthermore, prices of substitute modes, in theory, demonstrate a noticeable effect upon demand (a qualification is made here because this theory is tested in a later part of this paper). Consumer preferences are also an important determinant of demand, however, do to its subjective nature, it is more difficult to quantify. numerous factors which are relevant. The flexibility of service in some instances can be more important than price, as is the case with most business travelers,

In choosing a mode of travel, the passenger considers not only the fares, but also other factors such as the time spent in transit, [and] the opportunity cost of that time...

Another important factor determining demand is the geographic proximity of terminals to population hubs. If a firm can offer an extensive route network, servicing numerous intermediary destinations, then the particular carrier will be all the more attractive to the consumer. Other factors determining a consumer's preference are the level of comfort and safety offered by a particular carrier, and the seating and luggage capacity, which help in determining a carrier's load factor.

The intercity bus industry has a very distinct composition of travelers. Congress stated that a bus system "... is vital to
the transportation needs of the elderly, handicapped, and the poor." Bus travelers typically have lower than national average incomes and a large percentage of them are residents of small communities and rural areas. Young people, senior citizens, students, members of the armed services, women and minorities have a disproportionately high representation in this market than as compared with national percentages.

In my research on the bus industry I was unable to locate any formal assessments of the price-elasticity of the demand for bus service. In theory, however, travelers from small communities and rural areas would tend to be price-inelastic. This is explained because there does not exist a feasible transportation alternative to bus service apart from the automobile. Students and senior citizens, on the other hand, will generally be more sensitive to price due to their characteristically low income levels. When one takes into account that discounts and special scheduling are frequently offered to the more price-sensitive demanders- senior citizens, military personnel and students (discounts are usually offered to students at peak transport periods like vacation breaks from school) then one would expect the remaining demanders to be relatively price-inelastic. The ICC implies a degree of inelasticity in their report on the intercity bus industry.

Unlike motor carriers of property,... bus passengers were too fragmented to mount serious opposition to bus industry proposals for general fare increases. Furthermore, in an attempt to recover lost revenues during the recession, many carriers raised fares. Speaking before Congress,
the chairman of the ICC confirms this notion,

fare increases have also occurred on certain routes as the industry struggles to overcome its generally weakened financial condition resulting from the recent recession.25

Assuming the management of these firms understood the nature of the demand function facing bus service, this quote suggests that a price rise would lead to an increase in revenues. This is further evidence that the demand for intercity bus service is relatively inelastic. We examine this hypothesis empirically in Section V.

Profitability

So far, we have discussed market structure in terms of concentration and the nature of the demand function facing the intercity bus market. Next, we examine market performance as revealed by the industry's profitability. Profitability in the transportation sector is commonly measured by a ratio of operating expenses to operating revenues. This is aptly called the operating ratio. As this ratio approaches one, the level of profit in the industry nears zero, the industrial 'breakeven point'. When the ratio is less than one the industry is said to be earning positive profits. With this in mind, the operating ratio for the intercity bus industry in 1970 was 90.1 percent. By 1984 this figure had risen to 98.3 percent, demonstrating that the industry has become less profitable (Figure 4).

Factors Attributable to Industrial Decline

I have compiled a number of explanations for this declining profitability. One factor is the decrease in a subsidiary
Figure 4
Profitability over Time
Intercity Bus Industry

1/Operating Ratio = (Revenues/Expenses)
operation, outside that of passenger service—package express. Prior to the introduction of such companies as Federal Express, Flying Tigers and the U.S. Post Office's Overnight Express, the intercity bus industry enjoyed considerable profits in this market. Experts suggest that with the introduction of these new competitors, there has been a drop in the profitability of this sector, since the early 1970's. This, however, only explains fourteen percent of the industry's total operating revenues.

Another factor which has contributed to the decline in the profitability of the class I carriers (especially Greyhound and Trailways) is the rise of charter bus service. The Bus Regulatory Reform Act had a tremendous impact on the growth of charter buses, "...which require very low start-up or capital costs." Resse Taylor, chairman of the Interstate Commerce Commission, stated on September 25, 1984, before the Subcommittee on Surface Transportation,

More than 2,400 charter applications have been received, and it appears that more than half have been from first-time applicants. The growth in this particular market has resulted in increased intramodal competition throughout the industry. Charter bus companies can be considered parasitic competitors, because they have the flexibility of entering routes during peak demand and exiting those same routes as soon as demand begins to wane. Charter buses also have the ability to insure close to full capacity, because their frequency of service is contingent upon peaks in demand. With the rise in competition within this sector of the market, fares have dropped considerably, to the point
where most firms are operating with borderline profitability. The net result of the influx of charter services is an increase in competitive forces both intercharterly and extracharterly which has had a negative effect upon regular route fares.

Some officials at the ICC have attributed part of the decline in carrier profitability to increasing insurance costs, which have effectively raised costs across the whole bus industry. It is unclear whether the increase in operating costs was passed directly to the consumer in terms of higher fares, or was absorbed in toto by the carrier. If the costs were levied on the consumer, one would expect a drop in the quantity of service demanded. If the carrier were to assume all of the costs, this would reduce net revenues and consequently profits. Most likely, firms implemented a combination of the two alternatives, which would have nevertheless resulted in a reduction in carriers' profits. Evidence suggests, however, that the rise in insurance costs have not had a very significant effect upon industry profits. I have compiled data on insurance expenditures for the years 1970-85, obtained from the American Bus Association (see Figure 5). After converting the figures to real terms, there does not appear to have been a significant increase, nor a consistent increase in insurance expenditures. Furthermore, a comparison of insurance and safety expenditures to total expenditures accounts for only 3-5 percent of total costs.

The strike at Greyhound in late 1983 and early 1984 also had a negative effect on industry profitability. During this three month period Greyhound was unable to offer intercity service. The effects on profits are somewhat skewed, however. Although
Figure 5
Insurance and Safety Expenditures
IN REAL TERMS (index=1985)
Greyhound suffered financial losses during this period, other carriers such as Trailways and Carolina Coach benefited by a dramatic increase in their demand. Although this did not entirely off-set Greyhound's losses, the industry was only marginally affected. An additional factor contributing to the decline in the profitability of the bus industry was the recession in the early 1980's. Reese Taylor confirms the effects of the recession:

The bus industry did not fare well during the recent recession. However, even though the improving economy and passage of the Bus Act have not yet reversed declining ridership and earnings, the effects of the recession would have been more severe without the reforms included in the act.... [The bus industry is] the only transportation industry that has not shown marked improvement as the economy improves. 28

This last statement is supported by the sharp decline in the industry's operating ratio after 1981 (refer to Figure 4). As previously mentioned, many carriers attempted to regain losses, incurred during the recession, by raising fares. Nevertheless, the industry's profitability continued to slip.

Finally, the last and, I argue, most significant factor leading to the decline in the intercity bus industry's profitability can be attributable to increasing intermodal competition with airlines. Intermodal competition among public carriers first started becoming significant around 1950, however:

...intercity bus firms have not participated at all in the significant growth in total intercity travel since 1950." 29

From 1950 to 1982, the bus industry experienced a 2.8 percent decline in market share when compared with all intercity transport modes. The automobile, although private, has decreased approximately 3.5 percent, rail travel has shown a considerable
decrease of 5.8 percent, and air travel has made up the
difference with an 11.2 percent increase in market share. These results alone indicate that the intercity bus industry has lost some of its market to the airline industry. In the following section we develop this relationship further.

IV Evidence for Market Link between Air and Bus Travel

Lack of Intramodal Competition

The absence of intramodal competition in the intercity bus industry, offers evidence that this market is linked to the airline industry. In 1975, Elizabeth Pinkston concluded that in the bus industry, the number of carriers in any particular market has no significant effect upon bus fares. Thus, competitive factors do not appear to exist intramodally. Furthermore, the antitrust immunity which existed under regulation continues to exist today as one of the tenets in the Bus Regulatory Reform Act. This, in essence, permits collective discussion of fares between firms. In the year following deregulation in late 1983, the major carriers assembled and formed an Ad Hoc Committee responsible for, among other things, establishing general fares. One major result of this committee was to

...replace the $99 maximum one way fare that had been in effect for over one year with a series of new zones peaking at $149. In addition, the committee agreed upon a ten percent hike in interstate fares. It has always been Congress's objective to insure consumer protection. Therefore, such antitrust immunity could only be justified by the existence of competitive forces
outside of the bus industry.

As stated earlier, this external competition from airlines began to arise around 1950. It was not until the 1970's, however, that bus firms began to drop their fares along routes with which competition with airlines formally existed. One example of firms' reaction to this intermodal competition was a travel package offered by the major carriers in 1976, which included unlimited travel for a specified number of days. This marked an attempt at meeting the increased competition with airlines on long hauls. In addition,

bus firms also introduced round trip excursion fares in markets with significant air competition. These were priced at less than one-half the round-trip air night coach fare.33

Furthermore, although the structure of the bus industry is quite conducive to monopolization, based on its high concentration and antitrust immunity, firms still find it necessary to offer discounts and incentives to its most frequent patrons. This suggests that competitive forces which fail to exist intramodally are most likely to be present intermodally.

The Oil Price Shock of 1979-80

If we hypothesized about the effect that the oil shock of 1979 and 1980 had upon the intercity bus industry's profitability, one would have expected a decrease in profit attributable to the dramatic increase in the price of one of the industry's factor inputs, gasoline. Examination of the actual data, however, does not reveal an adverse effect upon the financial status of the industry. In fact, evidence supports just the opposite conclusion. Between the years 1979 and 1980,
when the oil price shock reached its peak, the industry's profitability actually rose significantly from its declining rate the period before. If the operating ratio for the airline industry is examined during this same period, one notes quite the opposite result; namely, domestic airline profitability declined. This evidence suggests a possible shift in demand away from air travel towards bus travel. At this point, we have only compared relative profitabilities of the two industries. In order to pursue this proposed transference of demand further, we must compare changes in the quantity of service between these two industries.

I have compiled two graphs depicting the change in quantity of travel for the air and bus industries between the years 1975 and 1984 (Figures 6 and 7 respectively). The units of measurement for air travel are revenue passenger miles and the units for bus travel are passenger miles. The difference in units is due to inaccessibility of data, however, both passenger miles and revenue passenger miles give accurate indications of fluctuations in quantity of service. Our interest here is not in comparing actual quantity of service but changes in service. The bars depicted are not quantity totals for each year, but rather differences between years. Therefore, a negative value indicates a decline in service from period A to period B. In short, the sign and magnitude of the values indicate the slope for the change in quantity.

With this in mind, we now turn to the evidence cited in the graphs. The period of interest in this discussion is the 1979-80 oil embargo, in which the price of oil and its by-products sky-
rocketed. As we shall see later in section VII, there existed an extreme escalation of air fares during this period, most likely explained by the increase in the price of jet fuel. Based on simple price theory one would expect the quantity of air service to decline. The evidence in Figure 6 confirms this, marking the most significant decrease in revenue passenger miles for the 1970-85 period. If we examine the bus industry (Figure 7), however, just the opposite effect is observed. The quantity of bus service not only increased during this period but actually reached its peak for the years 1970-85. The author would suggest that it is not coincidental that the airlines experienced their worst loss in travelers while buses experienced their greatest gain.

The increase in bus passenger miles would seem to imply that bus fares did not increase as drastically as air fares. Indeed, bus fares did not appear to be strongly effected by the price shock, whatsoever. The differences in the effects can be explained by the relative fuel efficiencies of the two industries. This is demonstrated in the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Intercity Buses</th>
<th>Airlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>133</td>
<td>15</td>
</tr>
<tr>
<td>1975</td>
<td>140</td>
<td>18</td>
</tr>
<tr>
<td>1977</td>
<td>141</td>
<td>20</td>
</tr>
<tr>
<td>1979</td>
<td>146</td>
<td>23</td>
</tr>
<tr>
<td>1981</td>
<td>141</td>
<td>24</td>
</tr>
</tbody>
</table>

Given a single gallon of motor fuel, buses are able to provide on average, seven times more passenger miles than airplanes. Furthermore, buses do not use nearly as much fuel per trip as do
airplanes. Consequently, fuel costs have a much greater effect upon price in the air industry than in the bus industry.

The oil price shock of 1979-80 provides an ideal opportunity to witness a temporary shift in the demand curves facing air and bus travel. The movement of these curves suggests a strong link between these two markets. This notion will be more rigorously tested later in section VII. With sufficient evidence linking the intercity bus industry to the air travel market, we turn to a brief discussion of the Airline Industry.

V The Airline Industry

It is the purpose of this section to briefly examine the nature of the airline industry with particular emphasis upon the internal effects of the Airline Deregulation Act. It is important to acknowledge that those policy changes that have effectively changed the internal structure of the airline industry have also created spillover effects, which have effected other industries. There is, therefore, an underlying assumption that deregulation, although exogenous to the bus travel, has levied an effect upon the intercity bus industry. This assumption will be more thoroughly tested in section VII. This section begins with a brief historical sketch of the airline industry and follows with a description of those governmental restraints that kept the industry regulated. We conclude with an analysis of the effects that deregulation has had in the airline industry.

A. Air Transport: The Regulatory years
The airline industry entered the commercial arena a little over fifty years ago as an efficient means of mail transport. In those days most people traveled by train or automobile. The postmaster general was particularly inspired by the potential of air travel and went so far as to meet with the airline owners to agree upon designated air routes for each airline. Although this system was to benefit the consumer eventually by facilitating convenient travel, the postmaster's methods of setting contracts were seen as anti-competitive. This resulted in the first form of airline regulation, the Airmail Act of 1934. This act was intended to maintain a competitive structure within this industry by mandating that sealed bids be given for airmail contracts for any given route. Inspired in part by the growth of the industry and the bidding procedures, price wars began to emerge:

The bidding for mail contracts became so intense that in 1938 Eastern offered to deliver the mail between Houston and San Antonio for free.\(^4\)

In that same year, congress approved the Civil Aeronautics Act of 1938 which set up the Civil Aeronautics Authority. This agency, which in two years was to be renamed the Civil Aeronautics Board, was responsible for the implementation of all of the regulatory constraints imposed upon the airline industry. Regulation was perceived as a means of avoiding "wasteful duplication of capital" by many competitors, when only a few were thought to be necessary to meet the demand. At the same time, it would be the responsibility of the Civil Aeronautics Authority to regulate prices so that monopoly profits would not ensue.

Federal regulation of the airline industry, not unlike that of the bus industry, arose in the wake of financial instability
as the government attempted to prevent a second 'Great Depression'. Even though passenger travel was rapidly increasing, the fare wars that emerged from the growing competition resulted in declining revenues for many carriers. As competition intensified, the prospect of widespread bankruptcy inspired Congress to act. Furthermore, there were a number of fatal plane crashes in the early 1930's, which prompted Congress to set up an authority that would both execute safety precautions and monitor the industry's economic status.

The Civil Aeronautics Board (CAB) sought to protect existing carriers by restricting entry. In all the years the industry was regulated, there were 79 attempts to establish new major airlines— all were refused. Meanwhile, "mergers and acquisitions reduced the number of major carriers from 16 to 10."³⁵ Regulation, essentially, diverted competition from price to service. Congress hoped such competition would promote increased safety throughout the industry. Although this end was achieved, most of the competition was directed at advertising and flight amenities, such as in-flight meals or seating.

In the early postwar years, the CAB set air fares according to the dominant mode of transport, rail (for first class rates). This rate setting was flawed in that air costs, unlike that for rail, drop considerably over distance. Thus, long haul air trips were far more profitable than short haul. Years later, the board began setting fares based on distance. It was not until 1969, however, that the board was able to settle on a definitive system by which to set fares for all markets. The system, entitled Domestic Passenger Fare Investigation (DPFI), was based on
industry average costs and varied according to distance. Opponents of the DPFI, however, argued that the system established fares that were substantially different from the cost of service in most markets. Furthermore, factors such as market density, (which tended to reduce average cost as density increased) were not factored into the rate scale. As inefficient as the DPFI was, firms were allowed some pricing freedom. They were permitted to set fares as high as 30 percent over the DPFI and were allowed to offer discounts not exceeding 25 percent of the set fare.36

Beginning in the early 1970's, a wave of deregulatory fervor began to sweep the nation. Industries such as banking, trucking, and telephone were under careful observation. A number of economists began to reexamine the benefits and losses associated with airline regulation. Many argued that regulation kept prices artificially high. In 1974, at the start of President Ford's administration, rampant inflation inspired Congress to initiate a study of inflationary forces within the federal government. It was generally believed that the artificial price levels in the airline industry contributed to this effect. Therefore, in October of that same year, the National Commission on Regulatory Reform was established to eliminate "federal regulations that increased costs to the consumer."37 Abolishment of airline regulation, was not certain, however, until President Carter appointed Alfred Kahn, staunch opponent of regulation, to act as chair of the CAB.
Deregulation and its Effects

The Airline Deregulation Act (ADA) was passed in late October, 1978. This act essentially removed the controls that the CAB had on entry and fares. The most immediate effect that resulted was an increase in the intensity of competition arising from new entrants:

Between May 1978 and May 1981 the Herfindahl index of concentration did not increase in any category of market and fell in most categories. Specifically, 69 percent of the 100 most heavily traveled markets were entered by one or more airlines.

Furthermore, the number of operating certified airlines almost tripled between 1978 and 1984 increasing from 44 to 114. This consequently resulted in a decline in the market shares of the pre-existing carriers.

The influx of new competitors led to a re-structuring of airline costs. New firms like People Express were not constrained to union contracts as were the established carriers. In fact, in 1982 forty percent of the formerly regulated carriers' expenses were labor, while labor for People Express was only twenty percent of total expenses. Many of the new carriers reduced labor costs by replacing the three man cockpit with only two men. In addition, the established carriers, like United and Eastern, were tied to labor contracts which stipulated that pilots work a maximum of 50 hours a month. Pilots employed by new entrants, having no labor constraints, averaged seventy-five hours per month, (fifty percent more than incumbent firms). In an attempt to become competitive with the new entrants, the pre-deregulation carriers were forced to reduce labor costs. Between 1978 and 1984, employee compensations such as pension and
insurance benefits, declined 6 percent. Cross utilization of employees further reduced costs. For instance, employees that were once solely responsible for baggage handling, became responsible for loading in-flight meals or even checking passengers through at gates.

Costs in many instances were further reduced at the sacrifice of service quality. Fewer in-flight amenities were offered to passengers. Furthermore, in order to increase load factors (i.e. the number of passengers per plane), more seats were installed in planes, thereby raising seating density. New entrants also demanded more flying hours per day from each plane.

With these cost reductions, new entrants were enabled to set fares lower than the pre-existing carriers. In an attempt to become more competitive with these low-cost airlines, all carriers were forced to become more efficient. This whole process forced fares to become more aligned with costs.

This has lead to one of the most visible effects of deregulation, the reduction of fares. The General Accounting Office conducted a study in which fares were compared before and after deregulation. The GAO concluded that after inflation was taken into account, fares fell by 6 percent between 1978 and 1984. This study, however, did not take into account the wide range of discounted fares that are available. James Ott, in an article in Aviation Week and Space Technology, claimed that price differentials have reached the magnitude of 70 percent for the same flight. Business fares are often used to subsidize lower discretionary (i.e. more price-elastic) flyers, which explains some of this variance. According to Harrison Donnelly in the
October 24, 1986 edition of Editorial Research Reports, 91 percent of current travelers pay fares below the standard coach rate. Donnelly concluded that, "On average, discounts have reduced fares by 63 percent." The Brookings Institution conducted another study that demonstrated that deregulation has led to fare savings of up to 35 percent for flights between 2500 and 3000 miles.

As a result of the lower air fares, the quantity of air travel demanded has increased. Melvin Brenner, airline industry analyst, confirms this notion (1983):

Significantly, in the last four years the North Atlantic industry load factor averaged 68 percent— an extraordinarily high level for a four-year average for an entire geographic region. Nevertheless, the industry was plagued in that region by price wars and discounting.

Airline deregulation has also led to an increase in convenience for the consumer with regard to stopovers. Before deregulation, the CAB's authority over routes allowed it full control over entry into industry and its submarkets. The board kept the industry unnaturally (in retrospect) concentrated, allowing only two or three firms in a given market. Certain airlines were restricted to servicing regional markets while only larger airlines, the trunks, were allowed to service major long-haul markets. Consequently, regional and market specialization developed. One effect this had was to decrease consumer welfare for those travelers that were forced to change airlines enroute, because there was no on-line connection. The facilitation of on-line connections was one result of deregulation. This had the effect of: 1. reducing chance of lost baggage and 2. increasing
consumer convenience (the consumer no longer has to leave the plane to locate a connecting flight). A study by Graham, Kaplan and Sibley concluded that deregulation has increased passenger convenience:

An analysis of travel patterns in a sample of more than 4000 markets shows that the fraction of trips that require passengers to change planes has remained about the same since 1978, but the proportion of passengers that must change airlines in route has decreased by 38 percent.46

There are a number of conclusions one can derive from the events following airline deregulation. Free market mechanisms seem to have forced fares to fall more closely in line with costs. The variations in pricing across submarkets appear to be the result of the distance and time sensitivity of passengers, "in ways which are broadly consistent with market efficiency criteria." 47 Furthermore, the increase in load factors since deregulation suggests that more efficient utilization of capital has ensued. Finally, the trimming of excess costs, necessitated in order to compete with new "no-frills" competitors, has forced the airline industry to become far more efficient than it had been under regulation.

VI Comparison of the Demand Demographics between Bus and Air Travel

In this section we compare the differences and similarities between the demand demographics facing the airline and intercity bus industries. This section is important in determining to what extent these two markets are viable substitutes. Buses
characteristically dominate the intercity transportation industry with respect to the number of passenger trips per mode. In 1982, for instance, buses were responsible for 390 million trips while airlines accrued a total of 275.8 million. Furthermore, buses are also responsible for carrying the greatest number of passengers a year. In 1981, buses carried 375 million passengers, whereas airlines were responsible for 276.8 million and Amtrak, only 20.6 million. When comparing distance traveled, airlines clearly dominate intercity travel. Airlines accumulated 202.1 billion passenger miles in 1981, followed by buses at 26.9 billion and Amtrak at 4.8 billion.

The Data used in this section was compiled from the National Travel Survey, 1977 Census of Transportation. I investigated extensively in search of a more recent study, however, officials at the Bureau of the Census claimed that due to financial constraints, future statistical compilations of this variety have been discontinued. Although these statistics are already nine years old, a report published in 1984 which utilized some of the data claimed,

...most of the bus companies we contacted confirmed that the characteristics of their bus passengers have not changed significantly since 1977.

Based on this finding I make the same assumption for air passengers. Lastly, the Census of Transportation study surveys "non-local trips" which is defined as trips in excess of 100 miles in length. This would tend to exclude commuters from the study, thus the data offers a viable assessment of intercity travel.

When comparing the family income levels of travelers, there
Figure 8
Choice of Mode According to Income
FAMILY INCOME UNDER $10,000

Roll (28.9%)
Air (18.2%)
Bus (52.9%)

Figure 9
Choice of Mode According to Income
FAMILY INCOME OVER $19,999

Roll (37.8%)
Air (44.0%)
Bus (18.5%)
appears to be a large differential between those that choose between air and bus transport. This evidence is supported by the following table:

<table>
<thead>
<tr>
<th>Family Income</th>
<th>Bus</th>
<th>Air</th>
<th>Auto*</th>
<th>Auto**</th>
<th>Rail</th>
<th>Total</th>
<th>Bus-Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under $5000</td>
<td>19.3</td>
<td>4.8</td>
<td>6.4</td>
<td>4.6</td>
<td>9.9</td>
<td>6.5</td>
<td>14.5</td>
</tr>
<tr>
<td>$5000 to $7499</td>
<td>12.2</td>
<td>3.9</td>
<td>6.2</td>
<td>4.9</td>
<td>6.5</td>
<td>6.1</td>
<td>8.3</td>
</tr>
<tr>
<td>$7500 to $9999</td>
<td>8.4</td>
<td>5.0</td>
<td>6.1</td>
<td>7.2</td>
<td>5.4</td>
<td>6.2</td>
<td>3.4</td>
</tr>
<tr>
<td>$10000 to $14999</td>
<td>20.4</td>
<td>14.7</td>
<td>21.6</td>
<td>23.7</td>
<td>15.3</td>
<td>20.6</td>
<td>5.7</td>
</tr>
<tr>
<td>$15000 to $19999</td>
<td>15.3</td>
<td>13.8</td>
<td>19.7</td>
<td>19.5</td>
<td>13.5</td>
<td>18.8</td>
<td>1.5</td>
</tr>
<tr>
<td>$20000 to $24999</td>
<td>10.9</td>
<td>16.2</td>
<td>15.9</td>
<td>17.9</td>
<td>13.5</td>
<td>15.8</td>
<td>-5.3</td>
</tr>
<tr>
<td>$25000 to $49999</td>
<td>12.0</td>
<td>33.9</td>
<td>21.1</td>
<td>19.9</td>
<td>30.5</td>
<td>22.4</td>
<td>-21.9</td>
</tr>
<tr>
<td>$50000 and over</td>
<td>1.4</td>
<td>7.7</td>
<td>3.0</td>
<td>2.3</td>
<td>5.4</td>
<td>3.5</td>
<td>-6.3</td>
</tr>
</tbody>
</table>

Note: Columns in table may not sum to 100 percent due to rounding.
* Auto/truck trips without camping equipment.
** Auto/truck trips with camping equipment.


In order to illucidate this point further, I have compiled two graphs representing the choice of mode according to family income. Figure 8 demonstrates that travelers with a family income below $10,000 have a greater propensity to choose bus travel over the other two means of public transportation. In Figure 9 we note just the opposite effect as income exceeds $19,999. In this income range air travel clearly dominates consumer choice over bus service by 25.5 percent. Within the bus industry, more than 60 percent of the travels have below median income of $16,009, whereas in the airline industry, more than 60 percent of the travelers have income above the median level. This evidence suggests that as travelers' income level grows,
there is a greater tendency to substitute air service for bus service.

It is important to note that since airline deregulation, changes in the fare structure in the airline industry have made air travel more affordable to low income groups. Since this data was compiled in 1977, the year before deregulation, it is likely that certain airline demographics have noticeably changed in favor of an increased number of low income travelers.

When comparing the age distribution of travelers with respect to transport mode, one notices a divergence between bus and air passengers (Figures 10 and 11). Passengers under the age of twenty-five compose 47.1 percent of the total bus travelers. In the airline industry, this age group only comprises 16.6 percent of total travelers. The middle age group, between 25 and 64, explain approximately 76 percent of airline passengers while representing only 36 percent of the bus travelers. Finally, 16.4 percent of bus passengers are sixty-five years or older, as compared with 6.8 percent for airlines. These results are demonstrated graphically on the following page.  

One may notice that these pie charts (Figures 10 and 11) are conspicuously similar to those on the previous page (Figures 8 and 9). This is attributable to the fact that income and age are not mutually exclusive. The majority of airline passengers lie between the ages 25 and 64, which include a large portion of business travelers and professionals who undoubtedly have higher than median incomes. Conversely, the majority of bus passengers are either below the age 25 or above the age 64. These patrons comprise the lower income sector of the population.
Figure 10
Age Distribution of Passengers by Mode
PASSENGERS UNDER 25 AND OVER 64

Figure 11
Age Distribution of Passengers by Mode
PASSENGERS BETWEEN THE AGES 25 AND 64
Furthermore, there appears to be a significant difference in the sex of air and bus passengers. Sixty-one percent of bus passengers are female, as compared with 36.9 percent for airlines. One can argue that sex, too, is correlated with income. For example, in 1977 the median income for male workers per week was $253 while that for females was only $156.\textsuperscript{52} Based on these results the greatest substitution between air and bus travel would occur between the income and age margins. This would mean that competition between the two industries is strongest for passengers within the annual income range of $10,000 and $20,000 (I calculated estimates for 1985 to be between $11,200 and $22,400), and passengers within the age ranges of 18 to 24 years and 55 to 64 years.

We conclude this section with an examination of the distance substitution between air and bus travelers. For the intercity bus industry, the median trip is a little over 400 miles while the median for domestic air flights is well over 1,000 miles in length. In 1981, the average bus trip length was 72 miles while that for airlines was 730 miles. From these simple statistics alone, one is able to witness yet another clear divergence in demand demographics between these two industries. Bailey, Graham, and Kaplan identify the distance substitution between bus and air travel:

As market distance increases, surface travel becomes a poor substitute for air travel. Since air travel is almost always faster, the total cost of air transportation will be less for individuals who place a high value on their time. In short-haul markets, where the time savings of air travel are relatively small, airlines tend to specialize in serving travelers who place a high value on time. At longer market distances air travel demand becomes less sensitive to air service convenience.\textsuperscript{53}
These conclusions are supported by data from the National Travel Survey. I have compiled two graphs demonstrating the distribution of travelers with respect to distance for air and bus travel (Figures 12 and 13). It is clear that buses dominate short hauls whereas airlines pre-dominate over long hauls. According to the study, 71 percent of round-trip bus travel is less than 600 miles in length. This same distance for airplanes explains only 13 percent of all trips. If we compare longer hauls, only 17 percent of bus travel is 800 miles or greater, as compared with 67 percent for airplanes. The Civil Aeronautics Board recognized airlines' competitive disadvantage in short hauls and consequently:

...the Board deliberately set fares below costs in markets of less than 400 miles so that air transportation would be more competitive with surface modes.\(^{54}\)

According to our results, the greatest substitution between modes would tend to occur at the margins, that is, somewhere between 400 and 1000 miles (see Figure 13b).

In this section we have examined and compared some of the demand demographics facing the air and bus industries. The results demonstrate a clear divergence between the characteristics of the demand for bus travel and the demand for air travel. These differences are not absolute, however. In each category there exists a considerable degree of overlap. For instance, while it is clear that buses cater to lower income travelers and airlines service those of a higher income category, it is not clear which mode dominates those consumers that lie in between these categories. It is these consumers that are of keen
Figure 12
Distribution of Ridership by Distance
Domestic Airline Industry

- 2000+ miles (43.0%)
- 200-599 miles (8.3%)
- 400-599 miles (9.1%)
- 600-799 miles (9.5%)
- 800-999 miles (8.0%)
- 1000-1999 miles (25.2%)

Figure 13
Distribution of Ridership by Distance
InterCity Bus Industry (1977)

- 2000+ miles (4.5%)
- 1000-1999 miles (8.8%)
- 800-999 miles (4.8%)
- 600-799 miles (8.2%)
- 400-599 miles (23.3%)
- 300-399 miles (16.5%)
- 200-299 miles (33.5%)
interest when comparing the substitutability between markets. In the following section we continue this analysis using a more empirical approach to determine if airline deregulation has had an effect upon the intercity bus industry.

VII  Analysis: Airline Deregulation - the spillover effects

This section of my paper is dedicated to an empirical analysis of the competitive relationship between the air and bus industries. We will examine the effect that the Airline Deregulation Act has had upon the airline industry and then examine to what degree this has effected its next closest competitor, the intercity bus industry.

It is my aim to test two hypotheses:

1. Airline Deregulation has led to a fall in the price of air service

2. A change in the price of air service will alter the demand for bus travel.

A. Airline Deregulation and its effect upon Price

We begin our analysis with the airline industry. Before Deregulation, the airline industry annually demonstrated a low operating ratio (operating costs/operating revenues). This is a very good indication that there existed a high profit level throughout the market. Based on economic theory, one would have expected these profits to have been bid away by new competitors as they entered the market. This did not occur, however, because there existed very high and, in fact, insurmountable barriers to entry in the form of federal regulation. Thus, theory suggests that removal of these barriers would lead to an influx of competitors up to the point at which economic rent can no longer
be earned. This would in effect shift the supply curve out to the right, increasing the quantity of air service and lowering its price (see figure 14).

In order to test whether the empirical evidence supports this theory, I examine the trends in price, quantity and concentration beginning with 1970. In order to facilitate this discussion, I have compiled three graphs. The first graph, Figure 15, depicts the change in quantity of domestic air travel over time. The units for quantity are measured in revenue passenger miles, which is simply defined as the distance traveled multiplied by the number of revenue paying passengers on each flight. This data represents annual compilations from Air Carrier Traffic Statistics under the category of domestic trunk carriers. As one can clearly see, there was a considerable increase in the quantity of air service between December 1977 and December 1979. This observation supports our hypothesis.

Next we look at the change in airline prices over time. I have arbitrarily chosen the fares for two major markets over the period 1976-1984. These markets link Chicago-Miami, and New York-Miami, respectively. These prices were extracted from the Official Airline Guide for the months July and December during the 1976-1984 period. These months were chosen in conjunction with their common destination, Miami, in order to define a market that is predominantly composed of vacation travelers. This market specification was made in order to insure routes which would be most competitive with the demand demographics for intercity bus travelers.

Brief inspection of both of Figures 16 and 17 yield a
Figure 14
THE AIRLINE INDUSTRY AFTER DEREGULATION

PRICE OF AIR TRAVEL

ORIGINAL FARE

NEW FARE

SUPPLY

DEMAND

SUPPLY OLD

SUPPLY NEW

QUANTITY OF SERVICE

ORIGINAL

NEW
Figure 15

Airline Revenue Passenger Miles over Time

Revenue Passenger Miles (Thousands)

Years

Figure 16
Airline Fares over Time
Chicago to Miami

Figure 17
Airline Fares over Time
New York to Miami
similar trend in the movement of air fares over time. In both the Chicago/Miami and New York/Miami markets, prices increased at a relatively constant and modest rate until July 1979 (Note: it should be mentioned that the data collection has been limited to the months December and July, therefore any references made toward a trend from one period to the next does not mean to imply that the month mentioned marked the most significant change in price). The sudden increase in fares in July 1979 can be attributable to the increase in costs resulting from the 1979-1980 oil price shock. I have included a graph charting the path of the price of jetfuel over time (Figure 18). The price of jetfuel effectively sky-rocketed, increasing 230 percent, between 1978 and 1981. Based on this knowledge, and the fact that airline cost structure is largely determined by the cost of fuel, one would have expected airline fares to follow in the same increasing trend. This expectation is refuted by the reality of events. In the Chicago/Miami market, air fares plummeted between July and December of 1980, when fuel prices were nearing their peak. Similarly, in the New York/Miami market, prices fell remarkably between December 1979 and December 1980. Based on the assumption that there would be a lag between the imposition of deregulation in 1978 and its consequential effects, the data appears to suggest a cause and effect relationship. The extreme decline in airline fares, contrary to the rise in the price of fuel, supports our initial hypothesis that airline deregulation has led to a decline in the price level.

Finally, we conclude this analysis with an examination of the trends in airline market concentration. I derived
Figure 18

Price of Jetfuel over Time

Jetfuel Prices

Years
concentration ratios by dividing the Revenue Passenger Miles for the top four domestic trunk carriers by the industry total (domestic). These statistics were obtained from annual publications of Air Carrier Traffic Statistics, compiled by the Civil Aeronautics Board for the years 1970 to 1984 (when the CAB was retired). Data for the year 1985 was obtained from the Air Transport Authority annual industry report.

From Figure 19, we can see that there has been a consistent trend toward a less concentrated industry ever since 1970. There does appear, however, to be a significant drop in concentration after 1978, the year in which deregulation was instituted. To test whether this change is statistically significant, I ran a simple regression with 'revenue passenger miles' as the dependent variable, and 'concentration' as the independent variable. In addition, I included a dummy variable for the years following deregulation in order to evaluate the significance of this period,

where,

\[ \begin{align*} 
D &= 0, \text{ for years 1970-1977} \\
D &= 1, \text{ for years 1978-1985} 
\end{align*} \]

\[ \begin{align*} 
\text{RPM} &= \text{Revenue Passenger Miles} \\
\text{CONC} &= \text{Four firm concentration ratio} \\
D*\text{CONC} &= \text{Dummy variable} \times \text{CONC} 
\end{align*} \]

The following results were obtained,

\[ \text{RPM} = 14.249 - 4.399 \ \text{CONC} + 0.544 \ D*\text{CONC} \]

\( (.331) \quad (.576) \quad (.084) \)

\[ \text{Standard Error} \]

\[ R^2 = 97.2\% \quad \text{SER} = .054 \quad DW = 1.15 \]

Given the following model,

\[ \text{RPM} = B_0 + B_1\text{CONC} + B_2\text{CONC*D} \]

we now test the hypothesis that market concentration decreased at a significantly faster rate than prior to airline deregulation. In short, we are testing whether \( B_2 \) is significantly greater than zero. The null hypothesis is constructed as follows,
Figure 19
Airline Market Concentration over Time

Years

4-firm Concentration Ratio

This implies that there is either no change in slope or that the slope decreases. Conversely, the alternative hypothesis states that the slope increases,

\[ H_0 : B_2 \leq 0 \]

\[ H_1 : B_2 > 0 \]

From the derived t-statistic for the dummy variable (6.45), we reject the null hypothesis and conclude with 99% confidence that there has been a statistically significant drop in the level of concentration in the domestic airline market. It is interesting to note that if we switch the years of our analysis to the period prior to deregulation, the dummy variable assumes a t-statistic of -6.45.

Given our conclusions about market concentration, we now focus upon its impact on airline fares. For the purpose of this discussion we refer to an article by Graham, Kaplan and Sibley on the "Efficiency and Competition in the Airline Industry". This article, published in 1983, concluded that concentration has a significant and positive effect on air fares (Figure 20).

**Figure 20**

FARES AND MARKET CONCENTRATION IN THE AIRLINE INDUSTRY

Placed in the context of our current analysis this indicates that a significant fall in market concentration will place downward pressure on the price of air travel. Therefore, based on the evidence given above I conclude that Airline Deregulation has led to decline in the price level of air travel.

Cross Substitutability of Markets

Having completed our analysis of the airline industry, we now turn our attention to the intercity bus industry. It is the purpose of this section to examine whether the air and bus markets are linked by price. In short, we are testing the following hypothesis: an increase (decrease) in the price of air service will increase (decrease) the demand for bus travel.

We begin our analysis by estimating the supply and demand functions for the intercity bus industry. The dependent variable for both equations is passenger-miles which acts as a proxy for quantity. This data was obtained from the Interstate Commerce Commissions' Office of Transportation Analysis. The demand equation is composed of three independent variables, the price of bus service, the price of air service, and the personal disposable income per capita,

\[ Q^D = f(P_{bus}, P_{air}, Y) \]

The consumer price index for intercity bus travel is used as a proxy for the price of bus service. The consumer price index for transportation modes is based on the average price per mile. The same source is responsible for the proxy for the price of air travel. Data for personal disposable income per capita is in nominal terms and was obtained from the 1986 edition of the Economic Report of the President.
The supply equation is composed of two independent variables, the price of bus service, and the price of gasoline,

\[ Q^S = f(P_{bus}, P_{gas}) \]

The Producer Price Index for gasoline was used as a proxy for the price of gasoline. When estimating these simultaneous equations we assume that the market is always in equilibrium. That is,

\[ Q_t^* = Q_t^D = Q_t^S \]

Two-stage least-squares estimation was utilized in order to eliminate the correlation of the price of bus service with the error term. In determining the exogenous variables used for this analysis, I estimated both the supply and demand equations for the airline industry. The results of these estimations can be found in the appendix. The following exogenous variables are assumed to be uncorrelated with the error terms in both regressions and thus, were used as instrumental variables for this estimation process: personal disposable income per capita, the consumer price index, the producer price index for gasoline, and the concentration ratio for the airline industry. Personal disposable income is considered exogenous because economic changes in the bus market have a negligible effect on the economy as a whole. Similarly, the consumer price index accounts for so many factors that changes in the price level of bus service have a negligible effect upon this index. The intercity bus industry accounts for less than 1% of the gasoline consumption for motor vehicles in the United States, therefore changes in its demand for gas will have an almost imperceptible effect upon the price of gas.57
Finally, the concentration ratio for the airline industry was used as an instrument because, in theory, changes in the market structure of the airline industry will be both external to the bus market and will indirectly effect the price of bus service through the price of air. Inclusion of these exogenous variables allows the two equations to be identified.

The natural logarithm was computed for all the variables in order to achieve two ends: 1. to remove the growth over time of the variance of the data and 2. to estimate elasticities of the independent variables by converting the data into homogeneous units.

Results

The following are the variables used to define the model,

\[ Q = \text{Total intercity bus passenger-miles, annual} \]
\[ P_{bus} = \text{Consumer Price Index for intercity bus travel} \]
\[ P_{air} = \text{Consumer Price Index for air travel} \]
\[ Y = \text{Personal Disposable Income per capita, nominal} \]
\[ G = \text{Producer Price Index for gasoline} \]

**Bus Demand**

\[ \log Q = -6.664 - 0.663 \log P_{bus} + 0.473 \log P_{air} + 1.2 \log Y \]

\[ (7.036) \quad (.472) \quad (.317) \quad (.869) \quad SE \]

\[ \text{SER} = 0.045 \quad \text{DW} = 1.61 \quad Q = 3.26 \]


**Bus Supply**

\[ \log Q = 3.110 - 0.041 \log P_{bus} + 0.065 \log G \]

\[ (.128) \quad (.035) \quad (.053) \quad SE \]

\[ \text{SER} = 0.035 \quad \text{DW} = 2.04 \quad Q = 3.26 \]


Between these two regressions, the one of particular interest in our discussion is the demand equation. The price
elasticity for bus demand is determined to be -.663, which is consistent with the theory of the downward sloping demand curve. It is interesting to note that this number represents a relatively price-inelastic curve. This may be explained by the constant proliferation of student and elderly discount vouchers by Greyhound and Trailways in an attempt at discriminating the more price-sensitive travelers. The t-statistic for this variable is -1.40, which is statistically significant at the .20 level.

According to the results, the demand for bus service is income-elastic (1.2). In other words, a small rise in personal disposable income yields a larger increase in the quantity of bus service demanded. Assuming that bus service is a normal good, this finding is also consistent with economic theory. This result is statistically significant at the .20 level.

We now turn to the variable of salient interest in this paper, the price of air service. The elasticity estimate for this variable is .473, which indicates that the demand for bus service is relatively inelastic with respect to air fares. The t-statistic for the price of air service is 1.49, which is statistically significant at the .20 level. The coefficient of this term is positive, confirming the expectation that a price rise in air service leads to a rise in the quantity demanded of bus service. This is also consistent with the theory of cross-substitutability of goods. What is most important in this discussion, however, is not the effect of a price rise, but rather the effect of a price drop. This model appears to confirm the hypothesis that a drop in the price of air service will lead to a drop in the quantity of bus service demanded.
Before we conclude this section, we synthesize our findings to determine the effect that deregulation has had on the intercity bus industry. The Airline Deregulation Act essentially opened up the industry to new entrants. Increased competition forced the price level to decline, which increased the quantity of air service demanded. This led to a decrease in the demand curve facing the bus industry. This is graphically represented in Figure 21, as the shift from Demand\textsubscript{old} to Demand\textsubscript{new}. In an attempt to eliminate unprofitable routes, thereby trimming losses, the supply of bus service shifted up and to the left. This is graphically represented as the shift from Supply\textsubscript{old} to Supply\textsubscript{new}. An additional supply curve is included, Supply\textsubscript{alternate}, because some firms, as reported by the ICC, attempted to raise fares in an attempt to recover lost revenues from the recession. The overall effect has been a relatively insignificant change in the price level of bus service, but a considerable loss in the quantity of bus service demanded.

VIII Conclusion

The intercity bus industry has seen increased competition both intramodally and intermodally. The former was a result of deregulation within the industry itself, and had little impact upon the financial status of individual carriers. The increase in intermodal competition, which arose as a consequence of the new low-fare airlines, has had a profound effect on the bus industry. Through our analysis we have determined that the
Figure 21

Cross Substitution Effect of Airline Deregulation upon the Intercity Bus Industry
Airline Deregulation Act of 1978 did, in fact, create 'spillover' effects with regard to the bus industry. Although there are a number of factors which have contributed to the bus industry's decline, I would suggest that none have been as injurious to the industry as airline deregulation.

Based on statistical evidence of the demand demographics of these two industries, airlines and buses appear to service very different divisions of the population. Buses dominate short distance routes while airplanes predominate over longer hauls. Furthermore, there is a considerable divergence between the income categories of these modes, where buses and airlines, respectively service the lower and higher income groups. This same sort of relationship exists for age classification. Closer examination of these differences, however, reveals that there exists a large area of substitution between these demand categories.

Survival of the bus industry along major intercity routes is to a large degree dependent upon the performance of the airline industry. Strong evidence suggests that the industry is tending toward a more concentrated state. There appears to be a high mortality rate among new entrants. For evidence toward this end, one need only cite the recent acquisition of People Express or the financial collapse in late August, 1986 of Frontier Airlines Inc., for evidence toward this end. Daniel F. May, president and chief executive officer of Republic Airlines, believes that the major reason for this high failure rate is that the current fares do not reflect carrier's cost structures:

If they were pricing their product correctly, they would be making money; Instead, a lot of them are
Furthermore, Melvin Brenner, airline economist, believes that the airline fare wars will not persist much longer. He cites such examples as the $99 New York-California fare as "absurdities" which are "...grossly inadequate to cover cost, even at a 100 percent load factor." It is for these reasons that ex-CAB chairman Alfred E. Kahn believes that the industry will become more concentrated in the future:

All these things make it impossible to say with confidence that the industry is not already evolving into an uncomfortably tight oligopoly.

A more concentrated airline industry would limit the degree of competition within markets. One consequence this might have would be to raise the price level of current air fares. Depending on the extent of the increase, this could allow the intercity bus industry to regain a portion of its lost market share. Furthermore, a decrease in competition in the airline industry might lend itself to a decrease in consumer convenience. This would make bus travel a more attractive option to consumers. It is unlikely, at least in the near future, that any major upheaval in the airline's current status will ensue. After the period of experimentation that followed the passage of the ADA, and the turbulence caused by the oil price shock of 1979-80, the industry is in need of stability.

There is a glimpse of hope for renovation within the bus industry, however. In January of this year, Fred G. Curry, former head of Trailways, acquired Greyhound Lines. This transfer of management may facilitate the renegotiation of labor contracts in the future. If this end is pursued it is probable
that the reductions in cost will allow Greyhound, and force other carriers, to price fares at levels that are more competitive with airlines. Not too surprisingly, Greyhound employees are dreading such cuts,

Lately Greyhound drivers had taken to wearing their corporate-emblem pins upside down. Perhaps a fresh start will get the hound back on its feet.
APPENDIX A

Regression Results of Intercity Bus Costs*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>T-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per bus-mile</td>
<td>-.83 x 10^-8</td>
<td>-.068</td>
</tr>
<tr>
<td></td>
<td>(dependent variable)</td>
<td></td>
</tr>
<tr>
<td>Bus-miles</td>
<td>83.9</td>
<td>12.46</td>
</tr>
<tr>
<td>Constant</td>
<td>83.9</td>
<td>12.46</td>
</tr>
<tr>
<td>$R^2 = .0001$</td>
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**APPENDIX B**

**Supply and Demand Equations for the Airline Industry**

Variables used:

- **RPM** = Revenue Passenger Miles for domestic air flights.
- **JET** = Producer Price Index for Jetfuel.
- **CONC** = Concentration Ratio for domestic air industry, derived by dividing the revenue passenger miles for the top four firms by the total for the whole domestic industry.
- **Pair** = Consumer Price Index for domestic air travel.
- **Y** = Personal Disposable Income per capita, nominal.
- **Pbus** = Consumer Price Index for intercity bus travel.

Instrumental variables:

- **CONC**
- **Y**
- **JET**
- **CPI** = Consumer Price Index

**Supply Equation**

\[
RPM = 10.593 + 0.102 \text{ JET} - 0.954 \text{ CONC} + 0.336 \text{ Pair} \\
(2.57) \quad (0.080) \quad (2.786) \quad (0.220) \text{ S.E.}
\]

\[
RPM = 11.99 \quad DW = 1.22 \quad SER = 0.094
\]


**Demand Equation without bus price**

\[
RPM = -9.647 + 2.206 \text{ Y} + 0.270 \text{ Pair} \\
(3.741) \quad (0.443) \quad (0.065) \text{ S.E.}
\]

\[
RPM = 11.99 \quad DW = 1.57 \quad SER = 0.059
\]


**Demand Equation with bus price**

\[
RPM = -6.416 + 1.805 \text{ Y} + 0.125 \text{ Pair} + 0.225 \text{ Pbus} \\
(7.66) \quad (0.943) \quad (0.305) \quad (0.482) \text{ S.E.}
\]

\[
DW = 1.46 \quad SER = 0.058
\]
APPENDIX C

Inclusion of Dummy Variable for Price of Air in Bus Demand Equation

The following are the variables used to define the model,

\[ Q = \text{Total intercity bus passenger-miles, annual} \]
\[ P_{bus} = \text{Consumer Price Index for intercity bus travel} \]
\[ P_{air} = \text{Consumer Price Index for air travel} \]
\[ Y = \text{Personal Disposable Income per capita, nominal} \]
\[ G = \text{Producer Price Index for gasoline} \]
\[ D = \text{Dummy variable for Deregulation} \]

where,
\[ D = 0 \quad \text{for years 1970-1977} \]
\[ D = 1 \quad \text{for years 1978-1985} \]

\[ D_{air} = \text{Dummy variable multiplied by the price of air travel} \]

Bus Demand

\[
\log Q = -2.68 - 0.663 \log P_{bus} + 0.473 \log P_{air} + 0.469 \log Y + 2.467 D - 0.488 D_{air}
\]

\[ (6.28) \quad (0.525) \quad (0.539) \quad (0.761) \quad (1.36) \quad (0.263) \quad \text{SE} \]

\[ \text{SER} = 0.046 \quad \text{DW} = 2.15 \quad \bar{Q} = 3.26 \]

Frequency: Annual \quad Period: 1970-1985

In order to test whether these results are significantly different from our original equation, the following F-test was performed:

\[
\frac{(SSR_U - SSR_U')}{SSR_{U/N-6}} > F_{2,n-6}
\]

Where,
- The null hypothesis is that the dummy variables are equal to zero,
  \[ H_0 : D = 0 \]
- The alternative hypothesis is that the dummy variables are not equal to zero,
  \[ H_a : D = 0 \]

Computation shows that the derived F-statistic is not greater than F-critical,

\[ 0.7158 < 4.10 \]

Therefore, we cannot reject the null hypothesis that there was no change in the slope and intercept of the demand curve after deregulation.
### APPENDIX D

#### DATA USED FOR REGRESSION ANALYSIS

<table>
<thead>
<tr>
<th>Year</th>
<th>BusPasMil</th>
<th>CPIBus</th>
<th>DPerCap</th>
<th>CPIAir</th>
<th>PPIGas</th>
<th>Concent</th>
<th>AirRPM</th>
<th>Jetfuel</th>
<th>CPI</th>
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<td>23.3</td>
<td>131.0</td>
<td>8134.0</td>
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<td>136.1</td>
<td>8322.0</td>
<td>129.6</td>
<td>100.9</td>
<td>.589</td>
<td>106.3</td>
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<td>8562.0</td>
<td>130.3</td>
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<td>.585</td>
<td>118.1</td>
<td>.82</td>
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<td>1973</td>
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<td>145.7</td>
<td>9042.0</td>
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<td>.572</td>
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<td>141.3</td>
<td>2.75</td>
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<td>9735.0</td>
<td>188.8</td>
<td>310.3</td>
<td>.560</td>
<td>181.0</td>
<td>3.05</td>
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<td>1979</td>
<td>25.6</td>
<td>279.8</td>
<td>9829.0</td>
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<td>499.4</td>
<td>.540</td>
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<td>9723.0</td>
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<td>.527</td>
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<td>1981</td>
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<td>.499</td>
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<td>1982</td>
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<td>.480</td>
<td>257.7</td>
<td>5.82</td>
<td>327</td>
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</table>
FOOTNOTES

Introduction


Paper


5 The Intercity Bus Industry. page.vi.


8 Ibid.,p.2.


10 Ibid.,p.ix

*Convenience in this context is defined by the I.C.C. as a distance less than 16 miles between the service point and the urban center.


12 Ibid.,p.35.


17 Office of Transportation Analysis, 1984., p.v.

18 Ibid., p.55.

19 Calculated from unpublished data on the Operating Expenses of Class I carriers from the American Bus Association.


21 Ibid., p.43.


24 Office of Transportation Analysis, 1984., p.68.


26 Ibid., p.5.

27 Ibid., p.6.

28 Ibid., p.4-5.

29 Office of Transportation Analysis, 1984., p.iv.


31 Data taken from ICC compilations of statistics from carriers annual (MP.1) reports.

32 Office of Transportation Analysis, 1984., p.88.

33 Ibid., p.70.

37 Ibid., p.30.
38 Ibid., p.120.
41 Peach, 1985. p. 47.
57 In 1982, buses consumed 1.1 billion gallons of gasoline as compared with the total for all motor vehicles, 113.4. Source:
DATA SOURCES FOR GRAPHS

- Figure 1  Bus Market Concentration. Concentration Ratios were derived by dividing the operating expenses for the top 2 firms (Greyhound and Trailways) by the total for all Class I carriers. Source: ICC Bureau of Accounts, income statement for large class I motor carriers of passengers, unpublished.

- Figure 2  Communities Receiving Bus Service. Reproduced from a report by the U.S. Department of Transportation. The Impacts of Regulatory Reform on Intercity Bus Service. Sept. 1984, p.3.


- Figure 4  Bus Profitability over time. Computed from data derived from American Bus Association Annual Report 1984, p.17.

- Figure 5  Insurance and Safety Expenditures (bus industry). Derived from ABA compilations of Operating Expenses: Class I Carriers, 1970-85.

- Figure 6  Change in Quantity of Air Travel. Revenue Passenger Miles derived from Air Carrier Traffic Statistics Civil Aeronautics Board, for years given.


- Figure 8 and 9  Choice of Mode According to Income. Figure 10 and 11 Age Distribution of Passengers by Mode. Figure 12, 13, 13b Distribution of Passengers According to Distance. Data obtained from U.S. Department of Commerce, Bureau of the Census, 1977 Census of Transportation. National Travel Survey, Report TC77-N-2, Tables 3G, 3E, 3I.

- Figure 15  Airline Revenue Passenger Miles. Revenue Passenger Miles derived from Air Carrier Traffic Statistics Civil Aeronautics Board, for years given.

- Figure 16 and 17  Airline Prices: selected markets. Fares selected are the lowest coach fares offered for that route. Source: Official Airline Guide- North American Edition. Dun & Bradstreet Corp.

- Figure 18  Price of Jetfuel over Time. State Energy Price and Expenditure Report 1970-82. Published April 1985, Energy Information Administration: Wash D.C. (Values for 1983-85 were estimated via a regression equation fitting jetfuel to producer price index for gasoline.)

- Figure 19  Airline Market Concentration over Time. Computed by dividing the revenue passenger miles of the top four domestic carriers by the total for that industry. Data derived from Air Carrier Traffic Statistics Civil Aeronautics Board, for years
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