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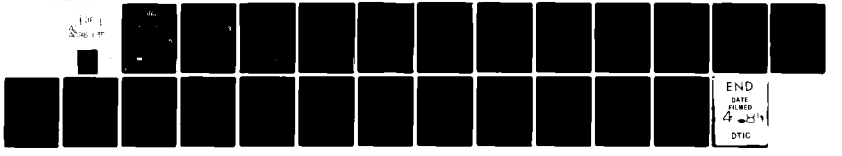

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DO FINANCES INFLUENCE AIRLINE SAFETY, MAINTENANCE, AND SERVICES?

By David R. Graham, Marianne Bowes

CNA

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TABLE OF CONTENTS

LIST OF TABLES

PREFACE

The study summarized in this report was conducted under contract 78-C-60 for the Civil Aeronautics Board. We are grateful for the cooperation of staff members of the CAB, the FAA, the Public Utilities Commission of California, and the Insurance Council of America. We gratefully acknowledge Bob Frank's and Ben Sobin's valuable comments on an earlier draft of this report. The responsibility for this report is ours; the views expressed here need not reflect the views of the CAB or its staff.

SUMMARY

This study addresses the question of whether financially stressed airlines are likely to cut back activities contributing to airline safety, to reduce maintenance expenditures, or degrade service levels. Theoretical analysis shows that financially unsuccessful airlines have some incentives to cut back in these areas. The forces influencing such decisions are so numerous and complex, however, that we cannot predict whether such cutbacks would or would not occur in any particular case. We do show, however, that variations in the profitability, liquidity, and debt-equity leverage of the eleven trunk airlines over the period 1965 to 1977 did not affect their accidents, maintenance expenditures, and passenger complaints. A summary of this study and our findings are presented in this report.

DO FINANCES INFLUENCE AIRLINE SAFETY, MAINTENANCE, AND SERVICES?

In setting airline merger policy and financial fitness standards, the Civil Aeronautics Board soon will shape the framework of competition in the airline industry. Connected with this is the question of whether the losers in competition -- the financially unsuccessful airlines -- might degrade the safety or reliability of their operations, or provide unacceptably low levels of passenger service. If so, it might be better to promote mergers or force shutdowns of unsuccessful airlines than to permit competition to run its full course.

To shed some light on this question, we have studied the relationships between the financial well-being of airlines and their operational performance. We find that although there are some circumstances in which it is plausible to expect financially unsuccessful airlines to be less safe, to choose lower levels of passenger services, or to spend less on aircraft maintenance, we have not found this to be true for the major airlines.

This report summarizes our study and findings. First we discuss the airlines' incentives relating to safety, service, and maintenance decisions. This discussion suggests the the financial circumstances most likely to lead to degradation of safety, services, and maintenance. In the second section we describe the sample of airlines considered in the study and the method of analysis. In the third section we summarize the findings. A brief conclusion follows. The reader interested in the complete details of the study and findings can find them in the study memorandum submitted to the CAB staff.

AIRLINE INCENTIVES

Maintenance, safety, and service expenditures can be considered investments, because they yield returns over time. As is the case with any investment, financial considerations such as profitability, liquidity, and debt-equity leverage figure into decision making. We find it plausible, in theory, that an unprofitable or insolvent airline would cut back on investments in maintenance, safety and services. The forces influencing such a decision are so numerous and complex, however, that a cutback is by no means a certainty, even for an airline in severe financial trouble.

We focus on safety, maintenance, and service decisions, because they are measurable aspects of the quality of airline operations that affect passengers directly. Safety, of course, is the primary concern of policy-makers. Maintenance expenditures are also considered, because of their bearing on safety, and because the expenditures clearly are directly influenced by airline policy. Passenger service quality and operational reliability are also of concern to the CAB, and are considered along with safety and maintenance.

Expenditures on Safety, Maintenance, and Services are Investments

Expenditures on safety, on maintenance, and on services are in effect investments. While part of their payoff is realized fairly quickly, the rest is spread over time. Increasing passenger services might lead to immediate increases in passenger demand, but the effect should also grow as passengers learn to expect better service. Maintenance expenditures prolong an aircraft's useful life, and increase its reliability. Increased reliability decreases costs and increases demand. Maintenance expenditures also increase the present and future resale value of an aircraft. The benefits from safety expenditures for pilot training and improvements in operating procedures will be spread over time as well.

Financial Investment Incentives

Airline safety, maintenance, and service spending decisions are determined by trading off the current costs of this spending against the long-run benefits. Airline profitability, borrowing opportunities, and interest rates influence decisions through their effect on this tradeoff. Financial leverage is also important, because borrowing is more costly when leverage is high. Also, because their liability is limited, stockholders in highly leveraged airlines sometimes find it to their advantage to choose risks that jeopardize the solvency of these airlines.

The tradeoff between expenditures and profitability has two facets: (1) the incentive for investment increases with anticipated future returns, and of course, (2) the incentive for investment is low if an airline's current profits fall to the point that it cannot stay in business. In short, current investment is attractive when an airline has good prospects for the future, while poor prospects give little incentive to invest.

Long-run profitability is perhaps the single most important factor determining how airlines respond to financial difficulties. An airline in such difficulties may or may not continue investing at high levels depending on the prospects for the future. Hence, there is no reason to expect a close relationship between current or past profitability and an airline's investment policies. Knowing how the airline perceives the future is the key to understanding its investment incentives.

Besides depending on profitability, an airline's safety, maintenance, and service expenditures will be affected by the interest rate and the availability of loans. When the interest rate paid on borrowed money is high, or the airline is cash constrained and unable to borrow, expenditures with payoffs in the future will be limited only to those that are very profitable. An airline will tend to desire cutbacks in all investment areas when the borrowing rate rises or the airline's lines of credit dry up.

Stockholders' attitudes toward risk also play a role in safety, maintenance, and service decisions, but their importance is uncertain. Because their liability is limited, stockholders do not bear all the costs of decisions involving potential losses exceeding the value of equity. If such losses result, and the firm goes into bankruptcy, the stockholders will lose only their equity. Remaining losses will be borne by the creditors. Thus if equity is low relative to potential losses, airline owners might prefer to spend less on reducing accident risks than they would choose were their equity position more substantial.

Other Investment Incentives

There are several considerations opposing these financial incentives to reduce spending on safety, maintenance, and services. First, maintaining levels of expenditures on maintenance, safety, and services is productive if it increases the liquidation (or merger) value of an airline. Second, pilots, mechanics, and managers stake their personal and professional reputations on the safety and quality of the airline they are associated with. Pilots, of course, have especially strong incentives to promote safety. Third, airlines must meet FAA minimum safety and service standards.

In addition, liability insurance, by eliminating those catastrophic losses that exceed stockholder equity, reduces stockholders' incentives to increase risk. Insurers are known

to consider accident experience in establishing premiums and can refuse to insure excessively risky airlines. Lenders, too, have an interest in assuring that owners' decisions do not impose excessive risks on them. Since airline long- and short-term debt is often heavily concentrated with a few institutions, lenders also have considerable influence in restricting excessive risks.

We conclude that incentives for safety, maintenance, and service spending are weakened when (1) current and expected future earnings are low -- or negative, (2) the firm cannot borrow or can borrow only at relatively high interest rates or (3) the firm's stockholders have little stake in the long-run viability of the airline. A firm is most likely to cut back on safety, maintenance, and service spending when one or more of those conditions exist. But other incentives for investment do not disappear, and the outcome may be that airlines do not react substantially to their financial problems. Consequently, although there is a tendency for airlines to cut back when they are in tough financial circumstances, such cutbacks are by no means a certainty.

DESCRIPTION OF THE ANALYSIS

The empirical study is an attempt to infer whether major airlines have altered their safety, maintenance, or service policies in response to changes in their financial condition. The premises of our analysis are that (1) differences across airlines in safety, maintenance, and services are largely due to differences in their scales of operation; and (2) if financial considerations such as profitability, liquidity, or debt-equity leverage influence airline policies, these variables will account for differences in airline safety, maintenance, and services above those accounted for by scale differences. Specifically, we examine the performance of the eleven trunk airlines over the period 1965 to 1977, and use statistical tests to determine (after controlling for scale differences) whether airline profitability, liquidity, or leverage helps explain differences in airline safety, maintenance, and services

The Airlines and Time Period Analyzed

Data were gathered for the eleven trunk airlines -- American, Braniff, Continental, Delta, Eastern, National, Northwest, Pan Am, TWA, United, and Western -- for the period 1965-77. The statistical analysis was structured to allow

comparison of airlines with each other at a given point in time as well as to allow comparison of a given airline with itself over time.

The profitability of the airline industry varied substantially over the period. The late 1960s was a period of high profits and rapid traffic growth. The 1970s were characterized by low profits due partly to two recessions (one in 1970 and one in 1974-5) and the fuel crisis beginning in late 1973.

There was also considerable variation in profitability among the trunks. Between 1965 and 1976, Braniff, Delta, National, Northwest, and Western had average after-tax rates of return on equity of 12% or more. In contrast, Eastern, Pan Am, and TWA averaged 5% or less. Pan Am lost money in eight consecutive years (1969-76), and at one point considered bankruptcy. Eastern lost money in four years and TWA in three years of the thirteen year sample period.

The Variables[1]

The total number of accidents and the amount spent on maintenance were used to represent the levels of safety and maintenance, respectively. Total accidents include all reported cases of serious injury or property damage in addition to serious fatal accidents. The numbers of passenger complaints in several categories were used as proxies for the level of service.

Five alternative measures of financial health were used:

(1) Liquidity measure: The ratio of current assets to current liabilities.

(2) Debt-Equity Leverage measure: The ratio of equity to the sum of debt plus equity (book value).

(3) Current Profitability measure: The ratio of net income after taxes to the book value of equity.

(4) Long-Term Profitability measure: The ratio of the stock market value of the airlines' equity to the book value of the airlines' equity.

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[1]Precise variable definitions and data sources can be found in the Glossary.

(5) Loss measure: A variable indicating whether an airline reported losses in a given year.

(1) and (2) are balance sheet ratios, traditionally used in finance to measure liquidity and leverage. Under normal operating conditions, these ratios are managed by the airlines to suit their individual operating circumstances, and variations across airlines have little significance. Airlines in financial stress, however, will tend to have lower liquidity and higher leverage than they would otherwise. All else the same, we expect safety, maintenance, and services to decline as liquidity declines and as leverage increases for a given firm. (3) is a straightforward measure of current profitability. (4) represents current and expected future profitability; it shows how investors value an airline's use of its assets relative to their historical cost. In theory, safety, maintenance, and services will fall as these profitability measures fall. Finally, (5) is intended to show whether losses imply a different type of airline behavior.

We use different measures of output to explain each of the safety, maintenance, and service variables. We've made the following assumptions:

(1) Total accidents for each airline depend on the airline's number of flights and total air-miles flown.

(2) Airline maintenance expenditures for each kind of aircraft depend on the number of planes and total flight hours using that kind of aircraft.

(3) The number of complaints filed against an airline depends on the number of airline passengers, the average length of the airline's flights, and the passenger load factor.

In addition to these output variables, we also included qualitative variables designed to account for differences across airlines that are not explicitly reflected in size differences. Such differences might, for example, be due to differences in r=ute structure, or in management efficiency. These variables identify systematic differences among the airlines, but they do not show the reasons for such differences. These variables will henceforth be referred to as "airline-specific variables."

The Alternative Relationships Considered

In an attempt to cover the wide range of possible forms that the relationship between finances and safety, maintenance, and services could take, we tried several alternatives.[1]

(1) A concurrent relationship: the current financial variable is assumed to explain the same year's safety, maintenance, and services.

(2) A lagged relationship: the current financial variable is assumed to explain the following year's safety, maintenance, and services.

(3) A two-year moving average relationship: each variable is averaged over two years to smooth out random fluctuations.

In total, five specifications were tried. For each specification we tried a linear relationship and a proportional relationship between the variables.

We feel that the range of alternative relationships we tried is sufficiently wide that our findings are representative of the true relationships in the sample. In interpreting the findings, however, it must be emphasized that the empirical results are based on particular variables and limited data. We cannot rule out the possibility of finding some other relationship using different variables, model specifications, or data.

III. FINDINGS

Although several relationships between the financial variables and safety, maintenance, and services were tried, they all yielded essentially the same results. It is important evidence that our results do not change when different relationships are tried. It would be repetitious and possibly misleading, however, to report all of these results so we report only the results in which the financial condition of each firm was

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[1]The first two were considered both with and without airline-specific variables. The moving average specification was estimated without the shift variables.

measured using the current financial variables. These results are entirely representative; none of the conclusions would change were we to report any of the other relationships tried.

Findings Relating to Output and Firm-Specific Variables

Overall, the statistical models worked very well. We were able to explain 20 to 30 percent of the variation in accidents, and over 90 percent of the variation in complaints and maintenance expenditures.[1] The output and airline- specific variables generally contribute significantly to our ability to explain safety, maintenance expenditures, and services.

The coefficients in table 1 show how safety, maintenance, and service variables change with the scale of airline operations. We find that accidents increase roughly in proportion to increased flight activity. Maintenance expenditures increase somewhat less than in proportion with aircraft and utilization.

Two sets of results using complaints are reported in order to emphasize the differences between the effects of increased activity accompanied by increased capacity (and constant load factors) and increased activity accompanied by constant capacity and (increased load factors).

We find that complaints rise quickly as load factor rises. The increase in complaints ranges from 1/2 of 1 percent to nearly 4 percent when passengers and load factors increase 1 percent. But, when airline capacity is also increased, we find that passenger complaints typically decline slightly as total passengers go up. We believe this reflects a case of statistical reverse causality; those airlines that have kept complaint rates down have grown the most rapidly, yielding a negative correlation between complaints and total passengers. These results support the common-sense notions that service quality falls off as airlines approach full capacity utilization, and that airlines offering better service grow faster.

The airline-specific variables show how factors other than output influence safety, maintenance, or services. This analysis requires that one airline be singled out as the base against which the other airlines are compared. (The findings do not depend on which airline is used for this purpose.) We have used

[1]Because of the large element of chance involved in airline accidents, we would not expect to be able to explain much of the variation in accidents using output variables.

TABLE 1

RELATIONSHIP OF SAFETY, MAINTENANCE,
AND SERVICES TO THE SCALE OF AIRLINE OPERATIONS

Safety

	Percentage Increase When Departures and Air Miles Increase by 1 percent
Total Accidents	1.11

Maintenance

	Percentage Increase When Aircraft and Aircraft Hours Increase by 1 percent
B-707 Maintenance Expenditures	.951
B-727 Maintenance Expenditures	.866
B-747 Maintenance Expenditures	.791
DC-10 Maintenance Expenditures	.856

Complaints

	Percentage Increase When Passengers and Aircraft Capacity Increase by 1 percent	Percentage Increase When Passengers Increase by 1 percent Holding Capacity Constant
Total Complaints	-.425	1.832
Flight Cancellations and Delay Complaints	-.875	.561
Overbookings		
(a) Complaints	-.038	2.463
(b) Passengers Denied Confirmed Space	1.191	3.546
Baggage Loss and Damage Complaints	-.364	3.888
Baggage Delay Complaints	.177	3.951

Pan American because it has been the least profitable airline and because its route structure sets it apart from the other carriers.

Taken as a group, the airline- specific variables were always statistically significant in our results. The significant findings for individual airlines are summarized in Table 2. At the top of the table are the results for total airline accidents. Total accidents refer to both foreign and domestic operations. A comparison of some limited data on international operations showed that accident rates on international routes were about equal among the trunks, and that these rates were higher than those for domestic operations. This is reflected in our findings in table 2, which show that because of their heavy concentrations in international operations, Pan Am and TWA have higher accident rates overall than the other carriers.

The maintenance findings show that several airlines manage to spend less on aircraft maintenance than Pan Am. Our data did not allow us to discriminate between domestic and international maintenance expenditures so we don't know whether the extent of Pan Am's international operations accounts for this difference. It is worth noting, however, that many of the airlines cited earlier as the most profitable also appear in this list. Since these airlines do not have demonstrably worse safety or complaint records, these maintenance cost differences must reflect cost differences associated with either route structure or management efficiency.

Our findings show that Pan Am generally has more complaints than the other airlines taken as a group, but the individual differences are typically not significant. When flight overbooking complaints are considered, however, five airlines are found to have significantly fewer complaints than Pan Am. Pan Am's high complaint rate is widely acknowledged throughout the industry, and so these findings are not surprising.

Firm-specific differences are apparent in our sample, reflecting the fact that the airlines operate in a wide range of circumstances. In the following section we address the issue of whether adding financial variables to the statistical analysis further increases our ability to explain safety, maintenance, and services.

TABLE 2

DIFFERENCES AMONG AIRLINES THAT ARE NOT ACCOUNTED FOR BY THE SCALE OF OPERATIONS

		Total Accidents	
Safety		Less than Pan American	More than Pan American
		American Braniff Continental Delta Eastern Northwest Western	none
		Maintenance Expenditures	
Maintenance		Less than Pan American	More than Pan American
	B-727-----	Braniff Northwest Western	none
	B-707-----	American Braniff Northwest TWA Western	none
	B-747-----	Northwest	TWA
		Complaints	
Service		Less than Pan American	More than Pan American
Flight Overbookings	-----	Braniff Continental National Northwest Western	none

--The Other Complaint categories show no significant differences for individual airlines, but they are significant as a group.

Findings Relating to Financial Variables

Table 3 summarizes the findings about the hypothesis that current finances influence safety, maintenance, and services. Estimates that support the hypothesis are denoted with asterisks. Estimates that contradict the hypothesis are indicated with zeros. All of the blank spaces in the table are associated with estimates that are not statistically distinguishable from zero.

The following example illustrates how the table is read. Overbooking complaints are found to correlate as expected with the liquidity ratio. (The footnote to the table shows there is only a 10 percent chance that the estimated coefficients reflect a purely random relationship.) At the same time, overbooking complaints are found to correlate with the ratio of the market value of equity to the book value of equity, and the loss dummy, but in the opposite direction to that hypothesized. Finally, no significant relationship is found between total complaints and either the income ratio or the leverage ratio.

We cannot perform rigorous statistical analysis of these overall results, because the estimated effects are unlikely to be independent of each other. These results strongly suggest, however, that there is no overall relationship between the financial variables and safety, maintenance, and services. Because of the random elements involved, a large number of independent estimates generally would yield several significant positive and negative coefficients even when the two variables are in fact unrelated.

One way to summarize the results is to count up significant coefficients. We find, overall, that while 22 percent of the estimated coefficients are significant with 90 percent confidence (two-tailed test), only about 7 percent are both significant and have the sign supporting the hypothesis that finances influence safety, maintenance, and services. Estimates of the "wrong" sign outnumber estimates that support the hypothesis by a ratio of more than 2 to 1.

We also find no systematic patterns when subgroups of the results are considered. For example, consider the six sets of results set off by the dashed lines in Table 3. First, in the upper left hand corner we find that of the twelve possible estimates of relationships between complaints and the two balance-sheet ratios, only one is significant. When complaints are related to income variables, the significant results are always

TABLE 3

RELATIONSHIP OF SAFETY, MAINTENANCE, AND SERVICES TO CURRENT AIRLINE PROFITABILITY, LIQUIDITY, AND DEBT-EQUITY LEVERAGE[1]

	Liquidity Ratio	Leverage Ratio	Income Variables: Income ÷ Equity	Income Variables: Market Equity ÷ Book Equity	Income Variables: Loss Dummy
Service (Complaints					
Total				0	
Flight Cancellation				0	
Overbooking	*			0	0
Confirmed Space Denials					
Baggage Loss				0	
Baggage Delay				0	
Maintenance Expense					
B-707	0				
B-727	*				
B-747					
DC-10		0		*	
Safety (Total Accidents)			*		N/A

[1]Estimates with effect in direction supporting hypothesis that financial stress reduces safety maintenance and services are denoted * if 90 percent probability that true value is not zero (i.e. estimate differs from zero by more than 1.65 standard deviations).

Estimates with opposite effect denoted

0 if 90 percent probability that the value is not zero.

Blanks indicate less than 90 percent chance that true value is not zero.

of opposite sign to that supporting the hypothesis. Thus complaints are not systematically related to either the balance-sheet or income variables.

The maintenance results, shown in the middle two boxes, also show no systematic relationship. When maintenance is related to balance sheet ratios, three significant coefficients are obtained. Two are of the "wrong" sign; one is consistent with the hypothesis. When the income variables are considered, only one of twelve estimates is significant.

In the bottom row we find that only the income ratio relates significantly to total accidents. This, of course, is a finding that should not be dismissed lightly, because it does suggest a relationship between the rate of return on equity and safety. The magnitude of the expected effect is quite small, however. The estimate indicates that increasing an airline's rate of return on equity by 20 percentage points would decrease the airline's accident rate by less than 1/4 of one percent. At the same time, there is not much to corroborate this finding. None of the other three income and balance-sheet variables were significantly related to accidents, and we did not find income to be significant in any of the ten maintenance and complaints relationships. As mentioned earlier, an occasional significant finding such as this can result even though there is no underlying relationship between the variables.

We find that airline output and the airline-specific variables explain variations in accidents, maintenance expenditures, and complaints quite well. This shows that the models used are reasonable approximations of reality. At the same time, the results show no systematic effect of the financial variables. We conclude that accidents, maintenance, and complaints were essentially unrelated to variations in the financial positions of the trunk carriers in the sample period.

CONCLUSION

Findings such as those reported here bear directly on pending CAB policy decisions. However, these results leave substantial gaps in our knowledge of relationships between finances and safety, maintenance, and services. We have observed only the major airlines in a broad, but nevertheless limited, range of financial circumstances. Much can and will be learned as the industry continues to grow.

The primary area of economic regulation in the coming years will be the fitness standards soon to be defined by the

CAB. In this study, we have not substantiated empirically the effectiveness of fitness standards, because we found no relationship between financial variables and safety, maintenance, and services. At the same time, our findings provide little empirical guidance as to how standards should be set. Nevertheless, we did find that fit airlines perform "better" in theory, so fitness standards should not be dismissed solely on the limited evidence presented here.

We feel it is best to approach the problem of setting fitness standards by considering specific, practicable definitions, and weighing their benefits against their costs. It is important to keep in mind that deregulation is intended to increasecompetition. High levels of safety and services must, of course, be ensured. On the other hand, it is important not to stifle the newly gained competition outright with excessive fitness standards.

The merger questions currently facing the CAB also hinge importantly on the issues of competition and the reaction of an airline to changes in its financial condition. Our findings show, over a wide range of circumstances, that it wouldn't make much difference in terms of passenger safety and services if an unprofitable airline were allowed to continue in operation.

It is worth noting that FAA operational standards will remain in place following deregulation. These standards cover pilot training, maintenance, and operational procedures. In part operational standards and fitness standards substitute for each other in assuring high levels of safety and service. Operational standards can dictate desired airline behavior, but operational standards can be costly to enforce effectively. Fitness standards can serve as a screening device, allowing entry only to those airlines with financial incentives to provide high levels of safety and services. Concern over financial fitness, put another way, is concern that operational standards are too low, too costly to enforce, or not always met. These standards and their enforcement should be considered in conjunction with the fitness and merger issues.

This study was intended to show the CAB whether major airlines have responded to their financial troubles by cutting back on safety, maintenance, or services. It appears they have not. Of course, we can't be sure what would happen in financial circumstances beyond the range observed, or how the behavor of smaller airlines would compare with the behavior we've observed for the major trunks. Still, our findings suggest that the Board need not be greatly concerned with the financial condition of airlines over a wide range of financial circumstances.

GLOSSARY OF TERMS

The following definitions are taken primarily from the CAB's Glossary of Air Transportation Terms (GATT).

Accident: An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which any person suffers death or serious injury as a result of being in or upon the aircraft or by direct contact with the aircraft or anything attached thereto, or in which the aircraft receives substantial damage. (NTSB, Annual Review of Aircraft Accidents.) The numbers of total and fatal accidents came from this publication.

Assets: Total assets was taken from line 31 in "Part V. Balance Sheet Data of the Certificated Route Air Carriers" of the Handbook of Airline Statistics. Current assets: consisting of assets which can be converted into cash within one year, was taken from line 10 of the same publication.

Average stage length: "the average distance covered per aircraft hop in revenue service, from take-off to landing." (GATT, p. 100) Derived by dividing the number of revenue plane-miles in scheduled passenger service by the number of departures, both numbers being taken from the Annual Review of Aircraft Accidents.

Block hours: "the hours computed from the moment an aircraft first moves under its own power for purposes of flight until it comes to rest at the next point of landing." (GATT, p.9) Derived by aircraft type by multiplying together lines 23, 25, and 26 in "Part III. Equipment Type by Individual Carrier" of Aircraft Operating Cost and Performance Report.

Consumer complaint: a complaint about some aspect of air carrier service; expressed in a letter received by the CAB's Office of the Consumer Advocate. Total complaints include complaints in all 25 of the categories defined by the CAB, Flight cancellation and delay complaints are those in the categories "flight cancellation" and "flight delay"; overbooked flight complaints are those in the category "reservation oversale"; baggage loss and damage complaints are those in the categories "baggage loss" and "baggage damage"; and baggage delay complaints are those in the category "baggage delay." The numbers of such complaints were taken from Table 8 in Summary of Consumer Complaints (available back to 1972).

Debt: taken from line 41, "long-term debt," in Part V of the Handbook of Airline Statistics.

Departure: technically, an "aircraft departure" is "an aircraft takeoff made at an airport." (GATT, p. 6) The terms "departures" and "flights" are used interchangeably in this report. The number of departures in total scheduled passenger service was taken from the Annual Review of Aircraft Accidents. The number of departures by aircraft type was derived by multiplying together line 23, line 31, and 1/line 28 in Part III of Aircraft Operating Cost and Performance Report.

Equity: The book value of equity was taken from line 55, "total stockholder equity," in Part V of the Handbook of Airline Statistics. The market value of equity was computed by multiplying the average number of shares of common stock outstanding during a given year (from Moody's or carriers' annual reports) by the price per share on the last business day of that year. It should be noted that in general the trunks have issued little preferred stock.

Income: the net income or profit of the airlines. Taken from line 37, "net income before special items" (equivalent to net income after tax), in "Part IV. Income Statement Data of the Certificated Route Air Carriers" of the Handbook of Airline Statistics.

Leverage: A measure of the relative share of equity and debt in the airline's capital structure. In this study we use the ratio of equity to the sum of debt plus equity.

Liabilities: Current liabilities, consisting of liabilities which are due within one year, was taken from line 40, "total current liabilities", in Part V of the Handbook of Airline Statistics.

Liquidity: A measure of the relative maturity structures of assets and liabilities. In this study we use the current ratio: the ratio of current assets to current liabilities.

Maintenance: taken by aircraft type from line 9, "total maintenance-flight equipment" in Part III of Aircraft Operating Cost and Performance Report.

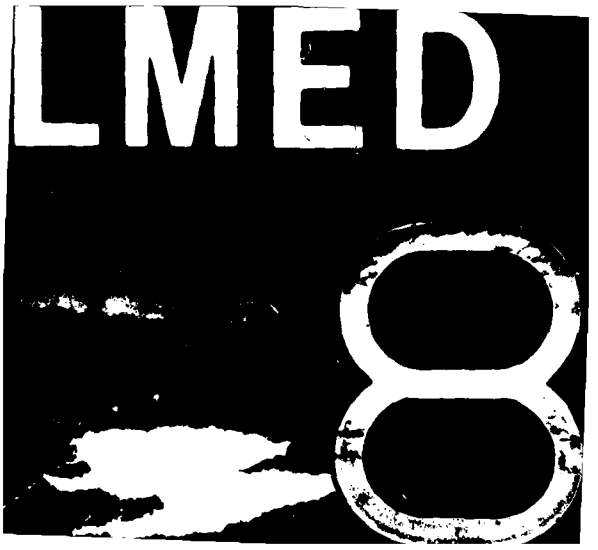
Miles: the number of revenue plane-miles (or simply "miles") is the total number of miles flown in revenue service: for scheduled passenger service, this was taken from the Annual Review of Aircraft Accidents. A passenger-mile is: "one passenger transported one mile. Passenger-miles are computed by multiplying the aircraft miles flown on each flight stage by the number of passengers transported on that stage." (GATT, p. 79) The number of passenger-miles was also taken from the Annual Review of Aircraft Accidents.

Passengers: "Total enplanements" from Passengers Denied Confirmed Space was used to represent the number of passengers. "Passenger enplanements" are defined as "the total number of passengers boarding aircraft, including originating and stopover or on-line transfer passengers." (GATT, p. 43)

Passenger Load Factor: Total passenger enplanements divided by total available seats. This figure was obtained from airline annual reports and Moody's Manual.

Planes: "Average aircraft assigned to service," line 22 in Part III of Aircraft Operating Cost and Performance, was used to represent the number of planes for the different aircraft types.

Trunk air carrier: "a class of certificated route air carriers receiving original certification under the 'grandfather clause' of the Civil Aeronautics Act (Aug. 22, 1938) and whose primary operations are in domestic scheduled passenger service between relatively medium and large air traffic hubs." (GATT, p. 30)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8