PREDICTING THE OPERATING PROFIT OF MAJOR GLOBAL AIRLINES USING FLIGHT CREW, MAINTENANCE, AND AIRCRAFT OWNERSHIP COSTS

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January 2007

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ABSTRACT

The problem the study focuses on is the lack of understanding of the relationships between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit) of major global airlines. A predictive, correlational, quantitative method and design combination was used because it is the statistical technique used to describe, measure, and predict variable relationships. The key results are that there is no significant linear relationship between the predictor variables and the criterion variable. The key conclusion is that major global airline executives should use the mean of the operating profit to predict the operating profit of major global airlines. The key recommendation is that major global airlines and stakeholders need to adopt a model that provides flexibility to adjust the supply to the demand efficiently.

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CHAPTER 1: INTRODUCTION

The airline industry's profitability has fluctuated throughout the period of 1960 to 2000 (Gritta, Chow, & Freed, 2003). Major global airlines, as members of the airline industry, have had problems sustaining profitability since 1960 (Doganis, 2002). Major global airlines are airlines with annual gross revenues over $1 billion (Wells & Wensveen, 2004). Although multiple research studies have contributed to the knowledge of airline industry profitability as a whole (Doganis, 2002), this research study focuses on major global airlines and examines whether a correlation exists between flight crew costs, maintenance costs, aircraft ownership costs, and operating profit.

The study starts with an emphasis on the social importance and the theoretical interest associated with the profitability of major global airlines. The purpose of the quantitative study was to determine the strength to which the three predictor variables, flight crew costs, maintenance costs, and aircraft ownership costs, influence the criterion variable, operating profit, of major global airlines. The knowledge gained from the study may be significant to major global airline finance departments and investors in the effort to understand major global airline profitability within the context of fixed costs and operating profit. Airline management scholars may use the study as a foundation toward resolving the cyclical problem of major global airlines (Tarry, 2004). The intent of the study was to determine the correlation between multiple variables and generate a regression model to predict the operating profit of major global airlines. The broad theoretical area under which the research study applies is the fundamental theory approach of cost-volume-profit (CVP) relationship theory.

Background of the Problem

Airline profitability represents both a social concern and a business interest to airline managers attempting to manage profitability margins (Doganis, 2005). From a social perspective, major global airlines' profit losses have contributed to large unpaid debt and the loss of employee pensions as well as inconvenienced customers (Miller, 2003). From an airline business interest perspective, airline profitability has been cyclical and with operating margins below 10% since 1960 (Doganis, 1991). The airline industry approaches profitability differently than other industries (Doganis, 2002). Most industries use the rate of return on assets to measure profitability (Anthony & Reece, 1989). However, the airline industry is unable to apply the return on assets rate to measure profitability accurately because of varying depreciation policies, a combination of leasing and purchasing policies, and government subsidies (Doganis, 2005). Consequently, airline profitability measures are either the annual operating profit as a percentage of the total annual operating revenue or the total operating revenue as a percentage of the total operating expenditure (Wells, 1993). The operating profit does not include interest charges or nonoperating items whereas net profit does include interest charges and nonoperation items (Wells). When using the annual operating profit as a percentage of operating revenue, the airline industry's profitability has fluctuated in the period from 1960 to 2000 (Gritta, Chow, & Freed, 2003), and profitability for global airlines has been a problem during that period (Doganis, 2005).

The airline industry has been through several distinctive business cycles in which it experienced profits and losses (Wells, 1993). In 1961, 1970, 1982, 1990, and 1991, the airline industry lost the sum of $7.1 billion (Wells). In 2002, the second largest air carrier in the world, United Airlines, filed for bankruptcy (Marshall, 2005). With financial losses in the billions, many creditors and investors incurred the debt and endured the economic loss (Doganis, 1991). Employees experienced job losses and were left wondering whether their pension plans were secure (Marshall, 2005). Customers were also impacted by the disruption of air carrier service (Borenstein & Rose, 1995).

In addition to the social concerns, the large profit losses in the airline industry have raised business profitability concerns for airline managers, investors, and scholars (Doganis, 1991). The industry operates under varying financial conditions including varying depreciation policies, equipment leases, purchase terms, and government subsidies, which present a problem to determine asset values (Doganis). To improve airline profitability, air carriers have consolidated, formed alliances, resegmented consumer markets, and reengineered operational models (Costa, Harned, & Lundquist, 2002). In addition, from a theoretical perspective, airline executives have studied the basic profit characteristics of the business through the focus of the total fixed costs and contribution margin (Anthony & Reece, 1989).

Statement of the Problem

During the period from 1960 to 2000, the airline industry's profitability has been cyclical (Gritta, Chow, & Freed, 2003). There has been a lack of sustained profitability for global airlines since 1960 (Doganis, 2005). Major global airlines' net profit margins during profitable years, 1978, 1988, 1997, and 1998, were between 2% to 3% (Tarry, 2004). In contrast, the pretax profit margin for corporate industries is forecasted to average 9.5% between 2005 and 2008 (McGee & Peters, 2005).

Other studies have contributed to the knowledge of major global airline profitability; however, these studies have not specifically explained the relationship between flight crew costs, maintenance costs, aircraft ownership costs, and major global airline profitability (Doganis, 2005). The problem is the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. More specifically, major global airline profitability margins have been affected by flight crew costs, maintenance costs, and aircraft ownership costs (Wells, 1993), but, to date, studies have not explained the relationships between these costs and operating profit (Doganis, 2005).

This predictive, correlational, quantitative study used flight crew costs, maintenance costs, and aircraft ownership costs as the predictor variables to examine whether these variables are correlated with the operating profit of major global airlines. Previous research has suggested that the 2% to 3% profit margins obtained by global airlines, lower in comparison to those in other industries, are due to the large fixed costs (Doganis, 2005). Specifically, crew costs are the second largest operating expense facing airlines today (Cohn & Barnhart, 2003), maintenance expenses have increased by 90% between 1970 and 1982 (Doganis, 1985), and aircraft ownership costs have had a negative impact on airline economics (Lyth, 1993). Scholars, airline executives, and investors may use the results from the study as a foundation toward better understanding and modifying the current profitability model for major global airlines and addressing the 2% to 3% profit margins issue (Tarry, 2004).

The population for the research study was major global airlines based on their shared revenue and operations characteristics (Cohen, Manion, & Morrison, 2000). The actual number of registered major global airlines varies over time as companies enter and exit the market (Taneja, 1987, 1989). In May 2004, the International Air Transport Association (IATA) reported in its 2004 annual report that membership grew to 275 airlines, which included both global airlines and nonglobal airlines (International Air Transport Association, 2004). The 275 airlines in the report also included major airlines, national airlines, and regional airlines. In June 2006, there were 65 global airlines, and 51 of those airlines were major global airlines providing service to passengers (Air Transport Intelligence, n.d.).

Purpose of the Study

The purpose of the predictive, correlational, quantitative study was to address the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit for major global airlines. More specifically, the purpose was to determine the strength to which the three predictor variables, flight crew costs, maintenance costs, and aircraft ownership costs, influence the criterion variable, operating profit, of major global airlines from 1980 to 2004, that is, over a 25-year period. The predictive, correlational, quantitative method and design combination was appropriate because it is the statistical technique used to describe and measure variable relationships. The specific relationships being evaluated in the study are those between flight crew costs, maintenance costs, aircraft ownership costs, and operating profit of major global airlines. Computation of the correlation coefficients and regression equations was used to answer the research questions (Cohen, Manion, & Morrison, 2000).

The predictive design could identify flight crew costs, maintenance costs, and aircraft ownership costs as significant predictors of operating profit for major global airlines. Of the two types of correlational designs, explanatory and predictive, the predictive design allows for the measurement of the predictor variables and the criterion variable to forecast (Nardi, 2005). The type of data and the required method of analysis support the choice for the predictive, correlational, quantitative method and design.

The predictive, correlational, quantitative research study was to identify variables that may significantly predict the criterion variable (Cohen, Manion, & Morrison, 2000). The predictive design study examined flight crew costs, maintenance costs, and aircraft ownership costs as the predictor variables. The criterion variable was operating profit of major global airlines.

The population for the study was all major global airlines as reported by the International Civil Aviation Organization (ICAO). The specific number of global airlines over a 25-year period varies due to new market entrants and companies exiting the airline industry (Doganis, 2001). For example, in 1980, 21 major global airlines reported financial data to ICAO whereas in 2004, 51 major global airlines reported financial data to ICAO (Air Transport Intelligence, n.d.).

The geographical location of the study was global. The study examined airline data with operations from multiple countries around the world. Investors and governments of multiple countries (Wells, 1993) own major global airlines.

Significance of the Study

Although studies on airline profitability are available (Doganis, 2005), these studies have not specifically examined the potential relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. A correlation and regression analysis between these costs and operating profit may help major global airline executives understand profitability as related to these costs that, in turn, may better explain the characteristics of profit margins. Airline management scholars may use the study as a foundation toward understanding and resolving the cyclical problem of major global airlines and the 2% to 3% profit margins (Tarry, 2004). The contribution of the research study may provide explanations required to help improve profitability for current and future major global airlines. The significance of the study was to understand the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines.

Significance of the Study to Leadership

The results of the study may add to existing empirical leadership knowledge within the context of fixed costs versus operating profit of major global airlines. Within this context, airline executives may enhance the decision-making processes in the area of risk. In addition, airline executives may stimulate innovation in the area of operational efficiency.

Airline executives are expected to make business decisions to optimize efficiency and productivity. The study may identify a link between financial variables, which may assist airline executives understand future financial risks and enhance risk management. Although risk management is not new to major global airlines, new perspectives on risk management within the global environment are a significant part of corporate strategies due to its usefulness for the corporate vision (Chowdhury, 2002). The increasing activity in global environments requires business leaders to incorporate innovative risk management (Chowdhury). Airline executives may be able to incorporate results from the study exploring the relationship between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines, in an effort to enhance existing risk management practices.

Findings from the research study may also stimulate innovation in the area of fixed costs in the operational models of major global airlines. Top executives of various industries, businesses, and multinational corporations address the many challenges of globalization with innovation (Steyrer, Hartz, & Schiffinger, 2006). The second significant contribution to leadership is the possible opportunity to use the study's findings to stimulate innovation in the area of fixed costs, which may introduce new operational efficiencies.

In summary, the significant contributions of the study to leadership could be in the form of empirical leadership knowledge. The first significant contribution to leadership may be the incorporation of results to enhance existing risk management practices. The second significant contribution to leadership is the possible opportunity to incorporate results to stimulate innovation in the area of fixed costs to introduce new operational efficiencies.

Nature of the Study

The nature of the study is a predictive, correlational analysis between multiple variables. The specific focus of the study was to identify whether a correlation exists between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. The problem was the lack of understanding of the relationships between the variables (Doganis, 2005). Researchers use predictive, correlational design studies to research associations between multiple variables (Triola, 2003). The intent of this predictive, correlational research study was to determine the strength of the linear relationship between the three-predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit) for major global airlines from 1980 to 2004 and produce a regression analysis.

The identified sample group was 10 major global airlines. The flight crew costs, maintenance costs, aircraft ownership costs, and operating profit of these 10 major global airlines were researched in U.S. dollars from 1980 to 2004. The source of the secondary data was ICAO's *Digest of Statistics: Financial Data*. The objective was to analyze whether a correlation exists between the predictor variables and the criterion variable. Following the correlation analysis, a regression analysis was considered in an effort to predict the operating profit for major global airlines.

Research Questions

Research questions further define the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines (Neuman, 2003). The intent of the predictive, correlational research study was to answer the following research questions. The following are the research questions for the study.

1. Is an increase in flight crew costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?

2. Is an increase in maintenance costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?
3. Is an increase in aircraft ownership costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?

Hypotheses

The study incorporates an evaluation of the statistical hypothesis for each of the predictor variables. A decision to reject the null hypothesis suggests that a significant linear correlation exists between the predictor variable and the criterion variable (Nardi, 2005). The following are the hypotheses for the study in relation to each of the research questions:

$H_0$1: Flight crew costs are not negatively related to the operating profit of major global airlines.

$H_1$1: Flight crew costs are negatively related to the operating profit of major global airlines.

$H_0$2: Maintenance costs are not negatively related to the operating profit of major global airlines.

$H_1$2: Maintenance costs are negatively related to the operating profit of major global airlines.

$H_0$3: Aircraft ownership costs are not negatively related to the operating profit of major global airlines.

$H_1$3: Aircraft ownership costs are negatively related to the operating profit of major global airlines.

Theoretical Framework

The broad theoretical area under which the research falls is the fundamental theory approach of cost-volume-profit (CVP) relationship theory. The CVP model suggests that a useful way of studying the basic profit characteristics of a business is to focus on the total fixed costs and contribution margin (Warren, Fess, & Reeve, 2004). Finance departments and strategic planning departments frequently use CVP modeling as a basis for choosing among various sales-volume strategies and the most profitable combination of product to produce (Jaekicke & Robichek, 1964). The model does not include adjustments for risk and uncertainty, which limits the use of the CVP model for analysis (Warren, Fess, & Reeve, 2004).

From a major global airline perspective, adjusting the traditional CVP model with major global airlines' cost risks makes the model more useful for profitability analysis (Jaekicke & Robichek, 1964). The results of the study may offer a better understanding of the risk adjustments to flight crew costs, maintenance costs, and aircraft ownership costs. The results of the study may be used to enhance the traditional CVP model in the analysis of operating profit for major global airlines.

There are four basic methods to increase profit for a given single product. The first is to increase the selling price per unit (Anthony & Reece, 1989). The second is to decrease the variable cost per unit (Warren, Fess, & Reeve, 2004). The third is to decrease the fixed costs (Anthony & Reece, 1989). The fourth is to increase the volume (Warren, Fess, & Reeve, 2004). A better understanding of the strength of the linear relationship between the fixed costs and the operating profit may help select the applicable method to increase profit for a given product or service (Warren, Fess, & Reeve). The study was associated with the CVP model because the purpose of the study was to address the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and operating profit of major global airlines.

From a leadership perspective, inspirational and intellectually stimulating leaders with idealized influence are transformational leaders (Steyrer, Hartz, & Schiffinger, 2006). According to the transformational leadership theory, leaders inspire their followers to go beyond their own self-interest in aspiring to achieve the organization's self-interest through innovation and other process efficiencies. Leaders recognize that innovation generates real growth that can be in the form of a product, a service, or a strategic operational efficiency (Steyrer, Hartz, & Schiffinger). The results of the study may generate innovative strategies that leaders of major global airlines can employ in the area of fixed costs and operating profit.

There is a link between the study and the field of corporate finance. Strategic planning, within corporate finance, includes the process of deciding how to commit the organization's resources (Tirole, 2005). Strategic planning allocates capital as a resource for the organization (Chew, 2001). The results of the study may help to explain operating profit as a function of efficient strategic capital planning and resource financing.

Another issue in the airline industry is the industry's definition of profitability. The airline industry does not use the profitability measures used by other industries due to the difficulty of estimating real asset values. Airlines have varying depreciation policies, combine equipment lease and purchase policies, and some receive government subsidies, which results in alternate methods to calculate asset values. The profitability measures selected by the airline industry include either the annual operating profit as a percentage of total annual operating revenue or the total operating revenue as a percentage of operating expenses (Doganis, 1991). The link between the study and the industry's definition of profitability is that the study findings might influence the desired decision for airline profitability measure.

Definition of Terms

The following definitions provide additional clarity for the predictor variables and the criterion variable. The definitions also provide a better understanding of the other concepts relevant to the context of the study. The definitions are in alphabetical order.

An *airline* is an organization transporting cargo and passengers in an aircraft (Wells, 1993).

Airline profitability is expressed as annual operating profit as percentage of annual operating revenue (Doganis, 1991).

Aircraft ownership costs include the sum of the aircraft rental expenses and flight equipment depreciation expenses (Wells & Wensveen, 2004).

A *cabin crew* refers to flight attendants providing both customer service and regulated safety compliance to passengers during in-flight operations (Doganis, 1991).

Cabin crew costs include the sum of pay and allowances, pensions, insurance, traveling, and other expenses generated by cabin crews while providing tasks related to in-flight operation for a period (Wells & Wensveen, 2004).

A *certificated airline* is a company in the air transportation business holding a certificate of public convenience and necessity issued by the former Civil Aeronautics Board (CAB) or the Department of Transportation (DOT).

Crew costs include the sum of pay and allowances, pensions, insurance, traveling, and other expenses, such as uniforms, generated by both flight crews and cabin crews while providing tasks related to in-flight operation for a period (Doganis, 1991).

A *flight crew* refers to the pilot, copilot and flight engineer who perform duties associated with the in-flight operation of the flight equipment (Wells & Wensveen, 2004).

Flight crew costs include the sum of pay and allowances, pensions, insurance, traveling, and other expenses generated by flight crews while providing tasks related to in-flight operation (Wells & Wensveen, 2004).

Flight equipment depreciation costs include the normal annual depreciation of flight equipment expenses (Doganis, 2005).

Flight equipment rental costs include expenses incurred from rental of flight equipment lease agreements (Doganis, 2005).

A *global airline* is an organization transporting cargo and passengers with an aircraft beyond host country borders (Wells, 1993).

The *load factor* is the portion of aircraft seating capacity sold or used (Wells, 1993).

Maintenance costs include the sum of expenses of the engineering staff expenses, maintenance administration expenses, and maintenance technician expenses toward the effort of reliable flight equipment operations (Doganis, 1991).

A *major global airline* is an organization transporting cargo and passengers in an aircraft beyond host country borders with annual gross revenues over $1 billion (Wells, 1993).

The *net profit* is the operating profit minus interest and all other expenses (Wells & Wensveen, 2004).

The *operating profit* is the total revenue minus total expenses before the subtraction of nonoperating items and interest (Wells & Wensveen, 2004).

The *profit* equals the total revenues minus the total fixed costs, minus the total semivariable costs, and minus the total variable costs (Warren, Fess, & Reeve, 2004).

Profitability describes the financial state of an entity where total revenues exceed total costs (Ross, Westerfield, & Jaffe, 2004).

A *regional airline* is an organization transporting cargo and passengers in an aircraft within host country borders (Wells, 1993).

Assumptions

To manage the study's requirements and for the purpose of financial analysis, one variable and fixed cost categorization will be selected. Airline fixed and variable cost categorization varies between airlines (Doganis, 1991). Airline cost categorizations are influenced by the airline's host country accounting practices (Wells, 1993). Because the study's secondary data are from ICAO's database, each cost category is based on the parameters set by ICAO's annual *Digest of Statistics: Financial Data*. Similarly, airline profitability is the operating profit calculated annually for global airlines by ICAO (Doganis, 1991).

The data extracted from the *Digest of Statistics: Financial Data* were assumed accurate and reflective of a true representation of each airline's operating costs and operating profits. The individual extracting the data was assumed to understand the purpose of the data. The database was assumed not to have changed or not to have been modified during the period of the study.

Limitations

Limitations of the study included the application of the predictive model to major global airlines. The model may not be applicable in its entirety to national airlines or regional airlines. The predictive model may not completely explain the increase or decrease in the operating profit of major global airlines.

A limitation of the study was also the number of major global airlines that were not in operation for the entire period of analysis (1980 to 2004). Airline entries and exits are a historical measurement of changes in the industry. The predictive, correlational study findings may present a general trend between the predictor variables and the criterion variable. The following is a list of limitations:

1. The study was limited to 10 major global airlines for the period of 1980 to 2004.
2. The study was limited to Air Transport Intelligence's database capture of flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines.
3. The validity of the study was limited to the reliability of the data presented in ICAO's *Digest of Statistics: Financial Data*.

Delimitations

The study was confined to 10 major global airlines. The study was confined to the corresponding secondary data provided in ICAO's *Digest of Statistics: Financial Data* for these 10 airlines. The focus of the study was on flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines as presented in Air Transport Intelligence's ICAO Financials Module.

Summary

Major global airline profitability presents a concern for travelers and a business concern to airline managers, investors, and other major global airline stakeholders such as the freight industry, aircraft manufacturers, and major global airline vendors. Significant airlines' profit losses have contributed to unpaid debts and the loss of employee pensions including inconvenienced customers. Although studies on airline profitability are available (Doganis, 2005), these studies have not specifically examined the potential relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. A correlation analysis between these costs and operating profit may help airline executives better understand how these variables influence major global airline profitability.

The problem is the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. More specifically, major global airline profitability margins have been affected by flight crew costs, maintenance costs, and aircraft ownership costs (Wells, 1993), but, to date, studies have not explained the relationships between these fixed costs and operating profit (Doganis, 2005). The results of this quantitative study may identify a correlation between these three fixed costs and operating profit, which may be used by airline executives to better understand and predict operating profit.

The significance of the study is to understand the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. The study's contribution to leadership is in the form of empirical knowledge. Airline executives may use the results of the study to enhance existing risk management practices and introduce new operational efficiencies.

The research study obtained secondary data published as ICAO's *Digest of Statistics: Financial Data* through Air Transport Intelligence's ICAO Financials Module. The objective of the study was to analyze and measure whether a correlation exists between the predictor variables and the criterion variable and to develop a predictive equation to predict the operating profit of major global airlines. Chapter 2 is a review of the literature, which conceptualizes, justifies, and interprets the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines.

CHAPTER 2: REVIEW OF THE LITERATURE

The study's literature review conceptualizes, justifies, and interprets the lack of sustained profitability in the global airline industry (Doganis, 2001). Included was the historical and philosophical development of global airline profit margins in the context of other literature. The theoretical framework, predictor variables, and the criterion variable of the study are presented in this chapter.

Documentation

The literature search was a scholarly research on the topic of global airline profitability, flight crew costs, maintenance costs, and aircraft ownership costs. The research was performed using several search tools offered by the University of Phoenix library. The first search included the article database sources of peer-reviewed articles using EBSCOhost, ProQuest®, and InfoTrac OneFile® using the following key words: airline, airline profitability, aircraft ownership costs, cabin crew costs, certified airline, flight crew costs, flight equipment depreciation costs, flight equipment rental costs, global airline, maintenance costs, major global airline, operating profit, profitability, and regional airline. The second search included books and dissertations. The second search also included the Oxford Scholarship Online source, the ProQuest® Digital Dissertations, and the University of Phoenix library book source using the same key words used in the first key word search. The third search included encyclopedias and dictionaries, specifically, the *Encyclopedia Britannica Online* and *Webster's Third New International Dictionary*.

Industry

The airline industry has decreasing unit costs, demand growth, and profit losses (Doganis, 1985). From 1964 to 1967 and in 1978, the airline industry earned over 4% in net profit (Doganis, 1991). Between 1960 and 1990, the airline industry produced four periods of net profit (Doganis, 2002). From 1990 to 1998, the airline industry produced a net profit of 2% or better in 1996, 1997, and 1998 (Doganis, 2001). Corporate profits grew and beat Wall Street's expectations in 1999 and 2000 (Hope & Kang, 2005). In 2002 and 2003, the impact of the terrorist attack on September 11, 2001, in the United States, the economic recession, severe acute respiratory syndrome (SARS), and the war in Iraq were sources for the losses of the airline industry (Gritta, Chow, & Freed, 2003). In 2004, the industry lost $5 billion, and airlines continued to file for bankruptcy (Higgins, 2005).

The airline industry does not use profitability measures widely used by other industries due to the difficulty of estimating real asset values. Airlines have varying depreciation policies and varying equipment leases and purchase policies and receive government subsidies. The profitability measures selected by the airline industry include either the annual operating profit as a percentage of the total annual operating revenue or the total operating revenue as a percentage of operating expenses. ICAO calculates the annual operating profit method. Within the annual operating profit measure method, the operating profit does not include interest charges, and the net profit includes payment of interest and other nonoperating items (Doganis, 1991). Using ICAO's profitability measure, the world airlines have experienced six distinctive financial phases between 1960 and 2004 (Doganis, 2001).

During the 1960s, the unit costs declined, profit margins increased, and load factors decreased (Humphreys, 1976). Revenue yields decreased in the 1960s at a lesser rate than costs. In the 1960s, the fares also decreased at a lower rate than costs (International Civil Aviation Organization (ICAO), 1988).

In 1968, the load factors decreased below 50%, and unit costs began to rise, reducing the profit margin through 1970 (McDougall, 1988). The period of 1968 to 1975 was representative of cyclical net profits (Doganis, 1991). The airlines reacted with an adjustment to load factors (Doganis). Fuel prices affected the load factor adjustment during the Arab-Israeli war of October 1973 (Maclaury, 1978). The increase in fuel prices continued through 1975 (Maclaury). The world airlines were also affected by inflation, and the economic recession in Europe and the United States affected passenger transport. These events combined and pushed many airlines into financial hardship (Doganis, 1991).

From 1975 to 1978, the world airlines improved financially because of decreased fuel prices and other operating costs. The load factors remained above 55% (Miller, 1976). However, the economic prosperity lasted only three years (Peterson, 1990).

From 1979 to 1983, airlines were affected by the increasing fuel prices and decreasing ticket prices (Erfle & McMillan, 1990). The higher load factors were not enough to compensate for the increasing fuel prices and decreasing ticket prices (Erfle & McMillan). From 1980 to 1982, airlines recorded profit losses (Fraser & Kannan, 1990). Braniff and Laker Airways went bankrupt while other airlines increased debt or took cash infusions from their respective governments or investors (Lengnick-Hall, Organ, & McFillen, 1985). In 1980, IATA member airlines lost $1,850 million and $1,900 million in 1981 (Doganis, 1991). In 1982, IATA member airlines lost $1,800 million (Doganis). Some IATA member airlines, such as Singapore Airlines, benefited from lower labor costs, and these airlines were profitable in 1982 (Doganis). The airline industry also experienced a period of liberalization, internationally, and deregulation in the United States (Hindley, 2004).

From 1984 through 1989, the airlines experienced favorable financial performance (Chow, Gritta, & Hockstein, 1988). The airline industry was positively affected by lower fuel prices and an increase in demand from improving world economies (Chow, Gritta, & Hockstein). The financial performance peaked in 1987 and 1988 (Doganis, 1991). Although financial performance improved, airlines were managing debt accumulated during the poor performance of the early 1980s (Doganis, 2005). The interest payments on capital loans for airlines totaled approximately $4 to $4.5 billion (Doganis, 2001). Despite the improved financial performance in the 1980s, several factors affected profit losses for multiple airlines with service to the United States and Europe. These factors included the bombing of Libya in 1986 and the terrorism activity in Europe and the Middle East (Andrews, 1989).

From 1990 to 1993, the airline industry experienced another financial downturn (Doganis, 2001). Fuel prices rose, and the economic condition in the United States and Britain worsened (Meyer & Menzies, 2000). The economic conditions were also negatively impacted by the invasion of Kuwait in 1990 and the war that followed in 1991 (Doganis, 2001). Eastern Airlines, Air Europe, Pan American, Midway, and TEA Airways had gone bankrupt by the end of 1991 (Doganis). The conditions worsened in 1992 with overcapacity and falling yields resulting in market share battles (Gilson, 2000).

Among the top 20 largest airlines in the world, only British Airways, Cathay, Singapore Airlines, and Swissair produced a net profit between 1991 and 1993 (Gilson). Asian airlines also continued to operate profitably between 1991 and 1993 (Doganis, 2001).

Airlines required capital to survive in the early 1990s (Doganis, 2001). Airlines from the European Union received $10.4 billion in state aid through 1995. In 1997, Alitalia received $1.7 billion in aid from the Italian government. Other privatized airlines received capital injections from shareholders (Doganis, 2005).

From 1994 onward, the airlines began to reduce costs while demand rose (Doganis, 2001). The improvement trend continued through 1997 (Costa, Harned, & Lundquist, 2002). In 1998, the airline industry, as a whole, was again profitable (Costa, Harned, & Lundquist). Although the airlines were profitable, annual capital loan interest payments for IATA's members doubled from $1.8 billion in 1988 to $3.6 billion in 1992. The large debt set the economic environment for profit losses into the future (Doganis, 2001).

As the U.S. airlines reached net profits of $6 billion in 1997, the Asian airlines were operating with profit losses. The Asian airlines were affected by an economic crisis in the second half of 1997 (Natalisa & Subroto, 2003). The Asian airlines were affected by increasing fuel costs, interest charges, and debt repayments. In 1997, Japan Airlines posted a net loss of $513 million, Korean Airlines lost $424 million, Philippine Airlines lost $253 million, and Asiana lost $425 million (Doganis, 2001).

In 1998, the East Asian airlines posted profit losses. Cathay Pacific was unprofitable, and Philippine Airlines almost went bankrupt after a pilot strike. In

Indonesia, two large domestic airlines stopped operations, and Garuda almost ceased to operate (Sadi & Henderson, 2000).

Although unprofitable East Asian airlines affected the European and North American airline routes to East Asia, 1998 was better than 1997 for the East Asian airlines in terms of airline profitability (Lederer & Nambimadom, 1998). Profitability was affected by lower fuel prices. Despite the financial success, the airlines were still trying to recover from the poor economic conditions of the early 1990s (Doganis, 2001).

In 1999, despite airline executives' concern for overcapacity and lower yields (Doganis, 2001), airlines were profitable (Reece & Sobel, 2000). Domestic airlines operating with low cost margins in Europe and the United States also affected the situation. Fuel costs also started to rise because member countries of the Organization of the Petroleum Exporting Countries (OPEC) were imposing production quotas on oil production. For example, the price of crude oil rose from $10.28 per barrel in February 1999 to $28.14 in February 2000. Because the airline fuel prices followed the increased trend, those airlines that did not hedge fuel prices were negatively affected (Doganis, 2001).

In the period from 2000 to 2003, the airlines experienced another cyclical downturn (Gritta, Chow, & Freed, 2003). The downturn resulted from higher fuel prices and a higher supply of airline capacity (Doganis, 2001). Airlines also had to address large debt with banks in order to survive (Miller, 2003). Several airlines filed for bankruptcy including United Airlines and US Airways (Doganis, 2001). The terrorist attack on New York City on September 11, 2001, resulted in higher costs associated with new airline security directives and the ability to raise capital (Wang, 2004).

In 2004, the airline industry reflected some signs of recovery. Passenger traffic started to increase, and there was a better balance between demand and supply. Although the economic conditions in the airline industry started to improve, airlines were challenged in attracting capital investment (Tarry, 2004).

Global Airlines

To conceptualize, justify, and interpret global airline profitability, the literature review describes the development of the global airline. An airline is an organization transporting cargo and passengers in an aircraft (Wells, 1993). Aircraft transporting passengers and cargo are government certified to do so for profit (Taneja, 1987, 1989). Global airlines are operators within the commercial system of air transportation, including domestic and international certificated companies (Wells, 1993). The term airline also includes charter air services (Wells).

A certificated airline is a company in the air transportation business holding a certificate of public convenience and necessity issued by the former Civil Aeronautics Board (CAB) or the Department of Transportation (DOT). The certificate authorizes the performance of scheduled and unscheduled air transportation operations. The grouping includes passenger and cargo operators and all cargo operators (Wells, 1993).

Global airlines or international airlines are U.S. or foreign certified air transportation operators engaged in operations between multiple international destinations. Global airlines may be classified as major airlines, as national airlines, or as regional airlines. Major airlines have annual gross revenues over $1 billion. National airlines have annual gross revenues between $100 million and $1 billion. Regional airlines have annual revenues up to $99.9 million (Wells, 1993).

Airlines are a commercial system of international and domestic air transportation entities including certificated route airlines, air taxis, regional airlines, commercial operators of large aircraft, and air travel clubs. These airlines perform air transportation services under the bilateral agreements in the form of treaties between two nations to establish international air services. Host country governments designate services for each country through the bilateral agreements (Taneja, 1989). Prior to 1985, the U.S. airlines and the Russian airline Aeroflot accounted for three-quarters of the world's domestic operations. Most airlines of other countries are international airlines. Smaller countries cannot economically sustain airline operations solely within their borders (Doganis, 1985).

Criterion

To conceptualize, justify, and interpret the criterion variable, the literature review describes the development of the operating profit of major global airlines. Profit is the total revenues minus the total fixed costs and minus the total variable costs, which include the total semivariable costs and the total variable costs (Anthony & Reece, 1989). For example, the profit formula may be expressed as:

1. Profit = Total Revenue – Total Fixed Costs –Total Variable Costs ; where,
2. Total Variable Costs = Total Semivariable Costs + Total Variable Costs.

Total revenue is the total dollar amount earned from sales of goods and services (Anthony & Reece). A total fixed cost is the sum of the cost items that do not vary with volume sales (Warren, Fess, & Reeve, 2004). A total semivariable cost is the sum of those costs that include a combination of variable cost items and fixed costs items

(Anthony & Reece, 1989). A total variable cost is the sum of those cost items that vary with volume (Warren, Fess, & Reeve, 2004).

From a corporate financial state perspective, profitability describes an entity's state of yielding profits over a period. An entity producing a positive net income over a period is referred to as profitable. An entity in this financial state is said to be operating in a state of profitability (Ross, Westerfield, & Jaffe, 2004).

The above method is the traditional measure for profitability, but it cannot be applied to the airline industry because it is difficult to estimate real asset values for airlines with varied depreciation policies, varying equipment leases and purchases, and government subsidies. Instead of using the traditional measure, airline profitability is measured as the annual operating profit as a percentage of the annual operating revenue. Another measure used by ICAO calculates the operating profit as a percentage of the operating revenue annually (Doganis, 1991). The operating profit for major global airlines is total revenue minus total expenses before the subtraction of interest charges and all other nonoperating items (Doganis, 2002). The operating profit of major global airlines is the criterion variable of the study. The findings of the study may predict the operating profit of major global airlines. The operating profit may be predicted with a multiple regression equation (Jackson, 2005).

To provide a historical perspective on the operating profit of major global airlines, some trends date back to 1960. Between 1960 and 1985, the airline industry experienced a 23% growth rate with a net profit over 4% from 1964 to 1967 and in 1978. A large part of the industry's current revenue is encumbered as debt on accumulated aircraft debts. To finance aircraft orders, the airline industry would need to achieve an operating profit excluding interest of 6% each year. Achieving a 6% profit margin is not very likely because those margins have not been achieved since 1969. The airline industry's 2% to 3% profit margin was the major problem facing the airlines during the 1990s (Doganis, 2002). In addition, the fuel prices exceeding $28.14 per barrel in February 2000, increasing competition, increasing aircraft financing charges, increasing maintenance costs, and increasing labor costs have kept the profit margin below 6% (Tarry, 2004).

In comparison with other industries, the less than 6% airline industry profit margin is not reflective of the industry's risk characteristics. In comparison, between 1980 and 1998, the airline industry did not achieve a profit margin similar to other industries (Taneja, 1989). For example, the pharmaceutical industry is the most profitable industry returning a median return on equity of 35% (Brown, 2001). The pretax profit margin for corporate industries is forecasted to average 9.5% between 2005 and 2008 (McGee & Peters, 2005).

Unlike other industries, the airline industry is disproportionately affected by labor costs, capital costs, and fuel costs (Taneja, 1989). Labor represents 27% to 40% of total operating expenses. In addition, the airline industry is highly competitive and characterized by high technology turnover. All of these factors combined in keeping the profit margin below 4% between 1980 and 1998 (Doganis, 2001).

A historical perspective on the cyclical nature of the industry reveals that the airline industry went through three distinct business cycles during the 1960s, 1970s, and 1980s. The industry recorded a profit loss of about $38 million in 1961 and profit gain of $427 million by 1966. In 1970, the industry lost $200 million and profited $1.2 billion in 1978. The industry recorded losses of $916 million in 1982 and recorded gains in 1988 of

$1.7 billion. Between 1990 and 1991, the industry lost $6.0 billion. Most of these profit losses are attributed to the effect of the general economic conditions such as fuel costs and economic downturns (Wells, 1993).

The scope of the literature review on the profitability of global airlines is from 1960 to 2004. There are no gaps in the literature review when researching global airline profitability in terms of documented airline profitability. The literature review reflects the business cycles experienced by the airline industry since 1960.

Predictor Variables

To conceptualize, justify, and interpret the predictor variables, the literature review describes the cost areas of the flight crew costs, maintenance costs, and aircraft ownership costs. Both ICAO and the CAB have split the operating costs into direct operating costs and indirect operating costs (Doganis, 1985). The direct operating costs include flight operations, maintenance with overhead, and depreciation with amortization (Doganis). Flight operations costs include flight crew salaries with other expenses such as fuel, oil, airport with en-route charges, insurance, rental of flight equipment, and cabin crew salaries (Doganis). The review below examines each of the individual predictor variables: (a) flight crew costs, (b) maintenance costs, and (c) aircraft ownership costs.

Flight Crew Costs

Flight crew costs cover the direct salaries, traveling, stopover expenses, allowances, pensions, insurance, and other social welfare payments for pilots, copilots, and flight engineers. Flight crew costs, also called cockpit crew costs, are calculated either on a route-by-route basis or expressed as an hourly cost per aircraft type. The route-by-route method is calculated by multiplying the hourly flight crew costs of the aircraft type by the block hours for the particular route (Doganis, 1985). The flight crew expenses constitute a large proportion of the total labor expenses when analyzed as a ratio of flight crewmembers to total company employees (Wells, 1993).

Flight crew costs contribute to the largest part of airline operating costs: the cost of flight operations. These costs have a direct impact on the airline's operating profit (Glatthorn & Joyner, 2005). The present study examines whether a correlation exists between flight crew costs and the operating profit of major global airlines. If a correlation exists, the strength of the correlation will be analyzed.

On a route basis, labor expenses can become a major cost differentiator. Because flight crew expenses represent a large percentage of total labor costs, flight crew expenses have an impact on airline profitability. The impact is noticeable in the international markets (Doganis, 2001). Historically, crew salaries and airport costs have increased between 1972 and 1982. Crew costs have increasingly contributed to airline flight operating expenses. In comparison to other operating expenses, fuel expenses drive the operating costs with the highest degree of all other operating costs (Doganis, 1985).

In addition, between 1978 and 1993, crew labor relations experienced cost and productivity problems. The labor costs and productivity ratio has not changed in relation to the statistics provided by the Air Line Pilots Association (ALPA). Flight crew costs account for 60% of the cost differences between low-cost airlines and all other airlines. For example, major global airlines such as American, Delta, United, Northwest, and USAir would need labor cost concessions or productivity increases of $1.6 billion to match the flight crew costs of low-cost airlines (Dooley, 1994).

A review of the 1998 flight crew costs showed that flight crew costs represent a disproportionate amount of an airline's labor expenses. Within the North American air carriers, the flight crews make up 10% to 12% of the total workforce, and within the European airlines, the flight crews make up 6% to 9% of the total workforce. In comparison to total workforce labor expenses, flight crew expenses represent 20% to 30% of the total labor expenses for most global airlines (Doganis, 2001).

Airline executives recognize that lower route costs are a requirement for airline profitability and that the flight crew costs are not the only factor, which affects these costs; other factors include fuel costs, level of airport services, and size of aircraft (Doganis, 2001). The unit cost of flight crew labor and the efficiency of use are the factors that affect the overall cost of the airline operation, despite the other factors. Major global airline executives have been working hard to manage flight crew costs since the 1970s and will continue to work on the issue (Doganis).

Crew costs are the second largest operating expense for airlines. Changes affecting crew costs, such as a small improvement in crew scheduling, can have a critical financial impact on the airline's operation expenses. The idea of mixing other factors such as incorporating key maintenance routing decisions with crew scheduling can improve the flight crew cost impact on an airline's operating expenses (Cohn & Barnhart, 2003).

Maintenance Costs

ICAO has classified maintenance costs, the second predictor variable of the study, as maintenance and overhaul costs, which include many joint expenses related to maintaining reliable flight equipment operations. Major global airlines monitor and publish maintenance and overhaul costs that include both routine and nonroutine maintenance, maintenance checks, and all labor costs related to all pay grades of engineering and support staff involved directly and indirectly in the maintenance of flight equipment. If airlines subcontract maintenance work to third party vendors, those expenses are categorized under the maintenance cost and overhead line item of published expense reports (Doganis, 1985).

From another perspective, total maintenance costs cover a wide range of costs related to the entire maintenance and overhaul activity (Kinnison, 2004). Maintenance expenses are separated into three categories: airframe maintenance, engine maintenance, and maintenance burden. The maintenance burden is the total maintenance administrative costs and the overhead related to performing maintenance activity on flight equipment (Wells, 1993). In terms of airline operating expenses, maintenance costs are also part of the costs of flight operations. Maintenance costs have a direct cost impact on the airline operation expenses (Doganis, 1985). The present study examines the correlation strength of maintenance costs on major global airline operating profit.

Historically, the unit costs of maintenance and overhaul rose by 90% between 1970 and 1982. Maintenance costs changed with the introduction of wide-bodied aircraft and technically advanced aircraft, which resulted in lower maintenance costs. The 90% increase in maintenance costs was not proportionate to the increase in flight operations expenses for the same period (Doganis, 1985).

In comparison, airline maintenance costs and the maintenance costs of other industries are utilized differently during manufacturing processes (Hora, 1987). Other industries' maintenance costs are disregarded as part of the value-added chain. Other industries consider maintenance costs as manufacturing overhead rather than a discrete step in the production process. In contrast, major global airlines consider maintenance costs as a discrete step in the production process. For example, Eastern Airlines found that better maintenance programs could provide $75 million in productivity improvements in the first year of joint contract with the machinists' union (Hora, 1987).

As stated above, maintenance costs rose between 1970 and 1982 (Doganis, 1985), and, in order to control rising costs, airlines focused on maintenance operations as a potential source of savings. Unlike what happens in other industries, the airline industry's maintenance is regulated by federal regulating agencies. Federal regulations and internal safety policies limit cost savings improvements. Despite the limitations, top airline executives believed that better maintenance planning of the cycle demand was one opportunity to save on maintenance expenses (Feo & Bard, 1989).

Other research suggested that one way to impact maintenance costs is to implement a standardized fleet. Financially, the standardization of the fleet was difficult to justify with strict operational requirements. If strategically and financially possible, one of the benefits from the standardization of the fleet is lower maintenance costs (De Borges Pan & Espirito Santos, 2004).

The airline maintenance costs remain a critical component of business efficiency strategy. For example, when Greg Brenneman became president of Continental Airlines in 1994, he addressed the challenge of high maintenance overall costs. One of the key challenges included helping the company lower its maintenance costs and improve its dispatch reliability. From a strategic plan perspective, lowering maintenance costs was one of the five principles used as a guide for returning the company to profitability (Brenneman, 1998).

In summary, maintenance costs are part of the costs of airline flight operations. Historically, maintenance costs have been rising and remain on the forefront of top airline executives as a cost-saving opportunity for airline operating expenses (Doganis, 1985). The present study examines whether a correlation exists between maintenance costs and major global airlines' operating profit and if it does, the strength of that correlation.

Aircraft Ownership Costs

Aircraft ownership costs, the third predictor variable, include the sum of annual aircraft depreciation charges using straight-line depreciation and a residual value. The costs also include the aircraft rental expenses from lease agreements. The aircraft ownership cost variable incorporates both the implementation of airline purchasing options and leasing options (Doganis, 1985).

In the airline industry, the depreciation cost is also analyzed and published as an hourly depreciation expense. The hourly depreciation cost of each aircraft is calculated by dividing annual depreciation by the block hours for the respective year. This perspective on aircraft ownership costs pertains to flight equipment purchases (Doganis, 1985).

Aircraft ownership costs can also be in the form of rental charges. Airlines may choose to lease the aircraft rather than to purchase the aircraft to realize financial advantages. The monthly rental charge includes the expenses of lease agreements, and it is classified as a direct operating expense for major global airlines (Doganis, 1991).

From another perspective, depreciation of flight equipment equates to the aircraft ownership costs when an airline purchases an aircraft. Airlines use straight-line depreciation over a number of years with a residual value up to 15%. Depreciation periods will vary by aircraft, ranging between 14 to 16 years or longer (Wells, 1993).

In terms of their contribution to operating expenses, aircraft ownership costs contribute to the direct flight operations costs in the form of depreciation when purchased or flight equipment rental when leased. The aircraft ownership costs directly affect major global airline operating expenses (Martin, Jones, & Keskinocak, 2003). This study examines whether a correlation exists between aircraft ownership costs and the operating profit of major global airlines and if it does, the strength of that correlation.

Historically, like the maintenance and overhaul costs, aircraft ownership costs also increased between 1970 and 1982. The aircraft ownership costs were 50% higher between 1970 and 1982 than they had been in previous years. To minimize the increasing expenses, airline executives negotiated longer depreciation periods and better residual value with both purchases and lease agreements (Doganis, 1985).

Fractional aircraft ownership programs have revolutionized aircraft ownership costs for corporate aviation. For a smaller portion of aircraft ownership costs, fractional management companies offer owners the convenience of a full-time flight department. Although the fractional management companies have similar business cost requirements as the airlines, the idea of fractional management has not been implemented in the airline industry (Martin, Jones, & Keskinocak, 2003).

In summary, the aircraft ownership costs have an impact on airline fortunes. Procurement policies and procurement decisions placed airlines, like Eastern Airlines, in bankruptcy. The management of aircraft ownership may be a factor in airline profitability (Lyth, 1993). The present study examines whether a correlation exists between aircraft ownership costs and the operating profit of major global airlines and if so, the strength of that correlation.

Study Context

The literature review of the predictor variables and the criterion variable clarifies the context of the study. It includes the identification, application, and relationship of the contextual factors associated with the problem statement presented in chapter 1. The literature review presentation includes the population and sample, the environment and setting, and the contextual factors.

Population and Sample

The population is all major global airlines including both U.S. airlines and international airlines. Major global airlines have similar characteristics in that each organization transports cargo and passengers in an aircraft beyond its host country borders with annual gross revenues over $1 billion (Wells, 1993). The annual gross revenue over $1 billion is the characteristic that separates major global airlines from national airlines ($100 million to $1 billion), large airlines ($10 million to $99.9 million), and medium and small airlines (under $10 million) (Wells & Wensveen, 2004).

In 2000, the industry structure included 15 major airlines, 38 national airlines, and 91 certified and noncertified regional airlines (Wells & Wensveen, 2004). In May 2004, IATA reported in its 2004 annual report that its airline membership had grown to 275 airlines, again including other airlines and major global airlines. In June 2006, there were 65 global airlines providing service to passengers, including major airlines, national airlines, large airlines, medium airlines, and small airlines. For the 2004 period, 51 major global airlines reported financial data to ICAO. For the 1980 period, 21 major global airlines reported financial data to ICAO (Air Transport Intelligence, n.d.).

The sample size is 10 major global airlines for the period of 1980 to 2004. Of the 51 major global airlines that published financial data in the 2004, 10 published financial data every year between 1980 and 2004 and held the status of major global airlines for the same period. For this reason, the convenience sampling method was used to derive at the sample (Nardi, 2005).

Environment and Setting

The airline industry has a history of low profit margins, in comparison to other industries, and cyclical profitability. Between 1980 and 1998, the airline industry has remained below 4% in net profits as a percentage of revenue, when profitable. The industry is unstable due to the constant impact of environmental developments and constraints (Doganis, 2001).

After the terrorist attack on New York City on September 11, 2001, the problems challenging the airline industry were higher costs associated with new airline security directives (Swartz, 2004), the ability to raise capital, the cost of capital, and the price of jet fuel. Airlines reacted by cutting capacity, grounding aircraft, deferring aircraft deliveries, cutting capital spending, trimming food services, and laying off employees (Wang, 2004). The Gulf War and the SARS crisis also affected the economic situation of the airline industry. Airlines continually decreased airfares in an attempt to increase passenger volume. The price wars decreased yields and generated losses for airlines (Jarach, 2004).

The history of the airline industry shows that war, financial crises, economic recessions, business competition, terrorist attacks, and even SARS have an impact on airline profitability. Airlines continue to recover from the decrease in passenger numbers and flight frequency. These economic conditions have led to the strategic airline alliances (Feng, 2003). In addition to the economic conditions, terrorist attacks, and financial crises are the commercial aspects of international air transport. Governed bilateral air treaties between countries also affect major global airlines. Legal restrictions on foreign equity ownership in national carriers and restrictions on foreign airline operations on domestic routes have decreased the development of multinational businesses (Richards, 2001).

Despite the economic challenges, the U.S. airlines are decreasing the expansion of domestic routes and increasing international routes. The strategy of airline executives is to seek increased yields on passenger and cargo traffic. Domestic airlines with reduced cost structures have contributed to the decrease in yields for domestic airlines (Putzger, 2004).

Contextual Factors

The airline industry's contextual factors are defined using eight categories: the founding year, the economic growth factor, the inflation factor, the fleet capacity, the replacement of aircraft, the airline profitability, the cyclical nature of the industry, and the future trend of the industry (Wells & Wensveen, 2004). With regard to the founding year, in 1914, a passenger was able to purchase an airfare to fly on an open-cockpit between Tampa and St. Petersburg. In 1916, the U.S. Post Office was able to obtain the required federal funding to transport mail by air. In 1918, the first regular air mail route was established between New York City and Washington, DC. The airmail routes provided the basis for today's airlines. For example, Colonial Airlines, operating the airmail route between New York and Boston, was the predecessor of American Airlines (Wells & Wensveen, 2004).

With regard to economic growth, there is a direct correlation between economic growth and air travel. Economic prosperity leads to increased business activity, and new outlets generate increase business travel (Wells, 1993). Economic growth increases family income resulting in increased spending on leisure travel (Loomis, 2006). The opposite effect occurs during an economic recession: business travel and leisure travel decrease (Wells & Wensveen, 2004).

As far as inflation is concerned, interest rates increase resulting in aircraft-funding problems for airlines. During increased inflation periods, labor costs and fuel costs increase resulting in airlines' absorbing the costs or passing the costs on to the consumer (Malakoff, 2003). During the periods of 1990 to 1994 and 2000 to 2002, airlines sustained profitability losses (Wells & Wensveen, 2004).

Regarding fleet capacity, airlines use the passenger load factor as an indicator for capacity. The passenger load factor is a ratio of passengers flown to available seats (Davila & Venkatachalam, 2004). During economic prosperity periods, airlines increase available seats, which drive aircraft purchases or leases for additional aircraft. During economic recessions, airlines are in an overcapacity condition: available seats exceed the demand (Yang, Raeside, & Smyth, 2005).

With regard to replacement aircraft, airlines have the challenge to replace aging aircraft between 2005 and 2010 (De Bruijn & Steenhuis, 2004). Legislation required airlines in the United States to meet low noise level regulations by December 31, 1999 and in Europe by April 1, 2002 (Pierce, 2005). Airlines modified aircraft to meet the regulations, but the replacement demand remains (Wells & Wensveen, 2004).

With regard to airline profitability, airline assets are expensive as smaller model aircraft cost approximately $25 million and larger jets cost over $140 million (Holcomb & Remer, 2004). To fund the capital requirements, airlines need to demonstrate to investors the ability to sustain the funding requirements (Pavcnik, 2002). The net profit losses in the billions have put airlines in the position of no retained earnings and record low stock prices (Wells & Wensveen, 2004). The net profit losses increase the challenge of airlines supporting current debt loads and meeting future capital needs (Pavcnik, 2002).

In terms of the cyclical nature of the industry, orders for aircraft have peaked six different times since 1960. The aircraft-ordering cycles are driven by the economic prosperity and recession patterns of the world economy. Unlike what happens in the retail business, the aircraft price does not justify retaining an inventory of aircraft. Without aircraft in inventory, airlines cannot adjust the balance between the available seats and the demand for seats (Wells & Wensveen, 2004).

With regard to the future trend of the industry, history has demonstrated that airlines could recover from economic recessions (Ratliff & Vinod, 2005). Aircraft manufacturers predict that aircraft deliveries will double between 2005 and 2025. The assumption is that the international economy will continue its aggressive prosperity ("Good Year for Airbus," 2004).

In conclusion, the airline industry's contextual factors are defined by eight categories. The factors are the founding year, the economic growth factor, the inflation factor, the fleet capacity, the replacement of aircraft, the airline profitability, the cyclical nature of the industry, and the future trend of the industry. These contextual factors influence the economic cycles in the airline industry (Wells & Wensveen, 2004).

Summary

The airline industry has experienced falling unit costs, demand growth, and profit losses since 1960 (Doganis, 1985). The net profit of the airline industry worldwide between 1960 and 1990 did not exceed 7%. From 1964 to 1967 and in 1978, the airline industry earned over 4% in net profit as a percentage of revenue. Between 1960 and 1990, the industry produced four periods of net profit (Doganis, 1991). From 1990 to 1998, the industry produced less than 4% net profit in 1996, 1997, and 1998 (Doganis, 2001). Corporate profits increased and exceeded Wall Street's expectations in 1999 and 2000 (Hope & Kang, 2005). In 2002 and 2003, the impact of the terrorist attack on September 11, 2001, in the United States, the economic recession, SARS, and the war in Iraq affected the resulting net profit losses of the airline industry (Gritta, Chow, & Freed, 2003). In 2004, the industry lost $5 billion, and airlines filed for bankruptcy (Higgins, 2005).

To conceptualize, justify, and interpret the predictor variables, the development of the flight crew costs, maintenance costs, and aircraft ownership costs have been described. Both ICAO and the CAB have split the operating costs into direct operating costs and indirect operating costs. The direct operating costs include flight operations, maintenance/overhead, and depreciation/amortization. Flight operations costs include flight crew salaries/expenses, fuel/oil, airport/en-route charges, insurance/rental of flight equipment, and cabin crew salaries (Doganis, 1985). From this expense structure, the predictor variables are categorized as follows: (a) flight crew costs, (b) maintenance costs, and (c) aircraft ownership costs.

The study's population is all major global airlines including both U.S. airlines and international airlines. Major global airlines have similar characteristics in that each organization transports cargo and passengers in an aircraft beyond its host country borders with annual gross revenues over $1 billion (Wells, 1993). For example, for the 2004 period, 51 major global airlines reported financial data to ICAO. For the 1980 period, 21 major global airlines reported financial data to ICAO (Air Transport Intelligence, n.d.).

The sample size is 10 major global airlines for the period of 1980 to 2004. Of the 51 major global airlines that published financial data in the 2004, 10 airlines maintained the status of major global airlines and published financial data every year between 1980 and 2004. For this reason, the convenience sampling method was used to derive the sample size (Nardi, 2005).

The airline industry's contextual factors are defined by eight categories. The factors are the founding year, the economic growth factor, the inflation factor, the fleet capacity, the replacement of aircraft, the airline profitability, the cyclical nature of the industry, and the future trend of the industry. These factors influence economic cycles in the airline industry (Wells & Wensveen, 2004).

Conclusion

The literature review findings for the study characterized the airline industry from 1960 through 2004 with cyclical net profits and profit margins less than 7%. The airline industry has a history of lower profit margins in comparison to other industries. Between

1980 and 1998, the airline industry has sustained net profits for 10 years and net profit losses for 9 years (Doganis, 2001). The industry is unstable due to the constant impact of developments and constraints (Wells & Wensveen, 2004). The literature review results reflect that the terrorist attack on September 11, 2001, in the United States, the economic recession, SARS, and the war in Iraq were sources for the profit losses of the airline industry (Gritta, Chow, & Freed, 2003). In 2004, the industry lost $5 billion, and airlines continued to file for bankruptcy (Higgins, 2005). The literature review findings reflect that flight crew costs, maintenance costs, and aircraft ownership costs influence the operating profit of major global airlines. The literature review findings, however, do not reflect the strength of the linear relationship between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines.

CHAPTER 3: METHOD

The purpose of this predictive, correlational, quantitative research study was to identify variables that may be significant predictors of the criterion variable, operating profit for major global airlines (Cohen, Manion, & Morrison, 2000). Specifically, the variables of flight crew costs, maintenance costs, and aircraft ownership costs on the operating profit were examined. The operating profit is defined as the total revenue minus total expenses before the subtraction of nonoperating items and interest (Wells & Wensveen, 2004). Chapter 3 presents the research method, design appropriateness, population, sampling method, data collection procedures, validity, and data analysis.

Research Design

This quantitative research study examines the variables of flight crew costs, maintenance costs, and aircraft ownership costs as they relate to operating profit. Correlation coefficients and multiple regression procedures were calculated to answer the specific questions in the study (Cohen, Manion, & Morrison, 2000). The intention is to use the study's findings to predict relationships between flight crew costs, maintenance costs, aircraft ownership costs and operating profit of major global airlines. This predictive, correlational design is appropriate because it may anticipate outcomes using the predictor variables and the criterion variable (Cohen, Manion, & Morrison). Of the two types of correlational designs, explanatory and predictive, the predictive design allows for the measurement of the predictor variables, and it allows for the prediction of the criterion variable (Nardi, 2005). The type of data and required method of analysis support the choice for the predictive, correlational design.

The choice of the predictive, correlational design allowed for the exploration of the relationship between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. With reliable relationships, these predictor variables may be used to make predictions regarding major global airline operating profits. The predictive, correlational research design choice permits the measurement of the strength of association between multiple variables (Jackson, 2005). The study attempted to explore the relationship and measure the strength of correlation between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines.

Appropriateness of Design

Predictive, correlational designs identify variables that may significantly predict an outcome (Cohen, Manion, & Morrison, 2000). The predictive, correlational design allows researchers to investigate the correlation of multiple variables by analyzing the sample with statistical tests, draw conclusions about the relationships between variables, and predict the criterion variable (Jackson, 2005). The predictive, correlational design is appropriate because the study intends to identify correlations between flight crew costs, maintenance costs, aircraft ownership, and the operating profit of major global airlines; these correlations, in turn, may be used to predict the major global airlines' operating profit.

The design fulfills this study's goals, and it was the optimum choice for the study for the following reason. The study explores the association between flight crew costs, maintenance costs, and aircraft ownership costs to predict the operating profit of major global airlines. A predictive, correlational design is a relational research design that explores the relationship between variables and predicting an outcome (Cohen, Manion, & Morrison, 2000). The optimum research design for analyzing a sample using statistical data to draw correlational conclusions and make predictions is the predictive, correlational design (Nardi, 2005).

Research Questions

The research questions further narrowed the scope of the study (Nardi, 2005) in relation to the correlation between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. The following are the research questions for the research study.

1. Is an increase in flight crew costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?
2. Is an increase in maintenance costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?
3. Is an increase in aircraft ownership costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?

Population

The population of the study is all major global airlines. Major global airlines are airlines with annual gross revenues over $1 billion (Wells & Wensveen, 2004). Global or international airlines are those airlines with operations in both domestic and international markets (Taneja, 1987). In the context of the study, major global airlines exclusively transporting cargo are excluded. Also excluded are airlines with only passenger charter operations or only domestic passenger operations. The rationale for excluding these airlines is that these airlines have multiple business operation models and different lines of business from the major global airlines of interest in the study (Wells & Wensveen, 2004).

The study examined major global airline financial data between 1980 and 2004, included in ICAO's *Digest of Statistics: Financial Data*, published through Air Transport Intelligence's online database portal, ICAO Financials Module. To put into perspective the number of major global airlines with all other airlines, note that 188 total airlines published financial data for the 2004 period. Of these, 51 airlines were major global airlines. In comparison to the 1980 period, 21 major global airlines reported financial data to ICAO. Between 1980 and 2004, 10 major global airlines reported complete financial data sets for each year (Air Transport Intelligence, n.d.).

In summary, the total number of major global airlines is the population for the study. The population of major global airlines may vary as airlines enter and exit the market (Wells & Wensveen, 2004). Table 1 lists the 51 major global airlines that reported financial data to ICAO for the 2004 period (Air Transport Intelligence, n.d.).

Table 1

2004 Population of Major Global Airlines

Airline	2004 Operating profit (loss)
Air Canada	(46,253)
Air China	552,681
Air France	64,716
Air India	(38,453)

Alaska	(38,288)
Alitalia	(470,992)
All Nippon	598,249
America West	(3,612)
American	(421,012)
American Eagle	219,186
American Transair	(557,182)
Asiana	124,224
Austrian Airlines Group	91,888
Britannia Airways and Thomsonfly	280,331
British Airways	1,024,165
British Midland	(20,781)
Cathay Pacific	456,818
China Eastern Airlines	164,057
China Southern Airlines	47,402
Comair	67,496
Continental	(280,730)
Delta	(1,612,738)
EasyJet Airline	90,522
El Al	57,326
Finnair	(13,168)
Iberia	232,011
Indian Airlines	13,819
Jal	288,421
JetBlue Airways	113,128
KLM	259,302
Korean Airlines	335,310
LAN Chile	172,100
Lufthansa	164,195
Malaysian Airlines	62,242
Mexicana	15,187
MyTravel Airlines	51,476

Northwest	(433,997)
Philippine Airlines	126,660
Ryanair	361,833
South African Airways	173,731
Scandinavian Airlines	(150,561)
Singapore Airlines	431,316
Swiss Air	1,213
TAM Linhas Aéreas	91,460
TAP Air Portugal	(37,527)
Thai Airways	502,717
Turkish Airlines	49,898
United	(1,166,382)
US Airways	(347,933)
Varig	155,154
Virgin Atlantic	22,234

Note. The 2004 total revenue is in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved May 18, 2006, from http://www.icaodata.com/default.aspx

Informed Consent

The study gathered and analyzed secondary data. The secondary data is from Air Transport Intelligence's ICAO Financials Module. The use of Air Transport Intelligence's ICAO Financials Module did not enlist individual participants, and informed consent is not required.

Sampling Frame

Convenience sampling, a nonprobability sampling method, was used for the study. Researchers commonly use the convenience sampling method when only a certain amount of data is available for analysis (Triola, 2003). The convenience sampling procedure was used to select the available major global airlines with published financial data in Air Transport Intelligence's ICAO Financials Module database between 1980 and 2004 (Air Transport Intelligence, n.d.). Table 2 lists the 10 airlines that maintained the status of a major global airline and reported financials to ICAO every year from 1980 to 2004.

Table 2

Sample of Major Global Airlines

Airline	1980 Operating profit (loss)	2004 Operating profit (loss)
Air Canada	76,845	(46,253)
Air France	(47,938)	64,716
American	(112,679)	(421,012)
British Airways	(249,455)	1,024,165
Delta	164,179	(1,612,738)
Iberia	(89,042)	232,011
Jal	43,955	288,421
Lufthansa	(1,521)	164,195
Scandinavian Airlines	(3,564)	(150,561)
United	(67,929)	(1,166,382)

Note. The total revenue for 1980 and 2004 is in U.S. dollars and in thousands of dollars. Source of the data was "ICAO Financials Module" by Air Transport Intelligence, n.d. Retrieved May 18, 2006, from http://www.icaodata.com/default.aspx

Confidentiality

The required data was publicly available and published by multiple sources, including IATA, ICAO, and Air Transport Intelligence. Moreover, the major global airlines studied are publicly traded companies that publish flight crew costs, maintenance costs, aircraft ownership costs, and operating profit in their respective annual financial reports. No process was required to ensure confidentiality due to the nature of the data analyzed.

Geographic Location

In all cases, major global airlines conduct business throughout the world. Location did not limit the study. In 2004, major global airlines represented 33 different countries serving every continent (Air Transport Intelligence, n.d.)

Instrumentation

The study utilized secondary data published in Air Transport Intelligence's ICAO Financials Module database (Air Transport Intelligence, n.d.). Collection of other primary data was not required for the study. Collection of the financial data for the study followed a systematic process to ensure accuracy of the data. Permission to collect the data was not necessary since the information is publicly available.

Data Collection

The data included flight crew costs, maintenance costs, aircraft ownership costs, and operating profit between 1980 and 2004 for each of the 10 major global airlines. The first step was to acquire a logon for Air Transport Intelligence's ICAO Financials Module database. Air Transport Intelligence's search engine, within ICAO Financials Module database, allows for the retrieval of airline financial data between 1973 and 2004. Global airlines not in operation between the entire period of 1980 and 2004 were removed from the search. Any major global airline in operation between 1980 and 2004 and failing to report financial data to ICAO was identified and removed from the database search in order to analyze only those global airlines reporting financials between 1980 and 2004. The extracted data for the variables of flight crew costs, maintenance costs, aircraft ownership costs, and operating profit of global airlines was downloaded into Excel®. The next step was identifying global airlines with annual gross revenue over $1 billion, which identifies those global airlines as major global airlines (Wells & Wensveen, 2004).

Data Analysis Steps

The objective of this predictive, correlational design was to describe the strength of the linear relationship between multiple variables and predict an outcome (Triola, 2003). The Pearson product-moment correlation coefficient was used to determine the relationship between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. After interpreting the linear correlation coefficient, selecting the significance level, and calculating the test statistic, either the null hypothesis was rejected or it was failed to be rejected for each of the predictor variables (Glatthorn & Joyner, 2005). When a linear correlation existed between the variables, the paired sample data was used to generate a multiple regression equation to predict the operating profit of major global airlines. Detailed below is the sequence of steps followed for the data analysis.

Step 1: Graphical Analysis

The first step of the analysis was to explore the data by constructing a series of scatterplots to reflect any potential relationships between variables (Triola, 2003). Individual scatterplots were created for each of the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit). In the first scatterplot analysis, all 250 bivariate data points were plotted. The second and third scatterplot analysis required splitting the sample data into two groups labeled as Group 1 and Group 2 with 125 bivariate data points plotted per group. The last scatterplot analysis was performed with the data collapsed across each major global airline for each year, and 25 bivariate data points were plotted.

Step 2: Calculation of the Linear Correlation Coefficient

The Pearson product-moment correlation coefficient measures the presence and strength of the linear relationship between two continuous variables (Triola, 2003). Pearson *r*-values were calculated to measure the strength of the linear relationship between each of the predictor variables and the criterion variable. Individual calculations were conducted for each of the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit). Four Pearson r-values calculations were performed, one for all of the data, one for Group 1, one for Group 2, and one for the data collapsed across each major global airline for each year.

Step 3: Interpretation of the Linear Correlation Coefficient

Interpretation of the correlation coefficients followed the Pearson product-moment correlation coefficient calculations. The absolute value of the individually computed Pearson *r*-values was compared to the critical value in the Critical Value Table for Pearson's at a 95% confidence level. The step determined whether a significant linear correlation existed for each of the predictor variables prior to performing formal hypothesis testing.

Step 4: Formal Hypothesis Testing

The fourth step evaluated the statistical hypothesis for each of the predictor variables. Findings of the test statistic evaluation may result in the failure to reject the null hypothesis or the rejection of the null hypothesis (Nardi, 2005). The decision to reject the null hypothesis suggests that a significant linear correlation exists between the predictor variable and criterion variable. The null hypotheses for each of the predictor variables were evaluated separately. A decision to reject or fail to reject the null hypothesis was made for each of the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit). Failing to reject the null hypothesis would mean that there is no significant evidence to conclude that there is a linear relationship between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines (Sprinthall, 2002).

Step 5: Regression Analysis

If significant evidence existed to conclude that there is a linear correlation between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines, the process to create a multiple regression model would follow the hypothesis testing of the correlation coefficients. A multiple regression model would examine the relative contributions of each predictor variable to the criterion variable (Nardi, 2005). A regression coefficient for each predictor variable would have been calculated and an assessment of the influence would have been performed for each predictor variable. A multiple regression equation would have been built to express the linear relationship between the predictor variables and the criterion variable. The multiple regression equation may have been used for the prediction of the operating profit of major global airlines (Triola, 2003).

Because significant evidence did not exist that there is a linear correlation between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines, the process to create a multiple regression model did not follow the hypothesis testing of the correlation coefficients. A multiple regression model was not used to examine the relative contributions of each predictor variable to the criterion variable (Nardi, 2005). Instead, the adjusted R^2 and p-value were calculated for each predictor variable to support the formal hypothesis testing results and confirm whether a regression equation was suitable to predict the operating profit for major global airlines.

Validity and Reliability

To support the validity and reliability of the study, the sample was divided into two equal groups, and the data analysis steps documented above were performed for each individual group. The study is valid if meaningful and justifiable correlations are made between the sample data collected and the population (Neuman, 2003). The analysis of meaningful and justifiable correlations between crew costs, maintenance costs, aircraft ownership costs, and the operating profit to answer the research questions determines the validity of the study (Cohen, Manion, & Morrison, 2000). The validity of the study may also be dependent on its reliability (Nardi, 2005). Therefore, the reliability of the study was also examined, addressed, and explored (Triola, 2003).

The process of repeated administration of a study supports the reliability of the study (Cooper & Schindler, 2002). As the sample data was divided into two equal groups and the same data analysis steps were administered, the study's reliability was supported. By collapsing the data across years, the study could minimize the influence of the multiple cycles of industry performance as previously described in chapter 2. The linear correlation coefficient r of both samples were examined to determine whether similar correlations between crew costs, maintenance costs, aircraft ownership costs, and the operating profit could be produced. Reliability of the data is suggested by a similar pattern of correlations that obtained between the two groups.

Summary

The purpose of this predictive, correlational, quantitative research study was to determine and predict the strength to which the three predictor variables flight crew costs, maintenance labor costs, and aircraft ownership costs affect major global airlines' operating profit. These variables were collected for 10 major global airlines between 1980 and 2004. The purpose of the study was to determine whether correlations exist between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit) of major global air carriers. The total number of major global airlines represents the population for the study. Several statistical procedures determined the strength of the relationship between each of the predictor variables and the criterion variable. Both the validity and reliability of the study were supported by dividing the sample population into two equal groups and performing the same data analysis steps mentioned above for each group. The next chapter reports the results of the statistical procedures.

CHAPTER 4: RESULTS

Chapter 4 details the results of the statistical procedures presented in chapter 3. The purpose of this predictive, correlational, quantitative research study was to identify whether flight crew costs, maintenance costs, and aircraft ownership costs have a linear correlation relationship with the operating profit for major global airlines, and if so, to produce a multiple regression model to predict the operating profit of major global airlines. Chapter 4 contains the findings and the summary of the study's results. First, the research questions, a summary of the data, and the main analysis steps used in this study are presented. Second, the results of the graphical analysis, the linear coefficient calculation, the interpretation of the linear correlation coefficient, the formal hypothesis testing, the regression analysis, and the secondary analysis are presented. Lastly, the summary contains the complete results of the data analysis.

Research Questions

The research questions narrowed the scope of the study (Nardi, 2005) in relation to the correlation of flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. The following were the research questions for the study:

1. Is an increase in flight crew costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?
2. Is an increase in maintenance costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?

3. Is an increase in aircraft ownership costs associated with a decrease in the operating profit of major global airlines, and if so, what is the strength of the linear relationship?

Data and Analysis Steps

The data used to answer these questions included flight crew costs, maintenance costs, aircraft ownership costs, and operating profit between 1980 and 2004 for each of the 10 major global airlines: Air Canada, Air France, American, British Airways, Delta, Iberia, Jal, Lufthansa, Scandinavian Airlines, and United. The data was retrieved from Air Transport Intelligence’s ICAO Financials Module database. The extracted data for the variables of flight crew costs, maintenance costs, aircraft ownership costs, and operating profit of the 10 global airlines was downloaded into Excel® with the MegaStat add-in functional feature activated. Appendix A reflects the secondary data retrieved from Air Transport Intelligence’s ICAO Financials Module database.

The predictor variables (i.e., flight crew costs, maintenance costs, and aircraft ownership costs) and the criterion variable (i.e., operating profit) of the 10 major global airlines were manipulated into four data sets. The first data set, labeled Group All, included the predictor variables and the criterion variable for each of the 10 major global airlines with 250 bivariate data points. To test the reliability and the validity of the data, the predictor variables and the criterion variable of the 10 major global airlines were split into two groups, labeled Group 1 and Group 2. Group 1 was the second data set with 125 bivariate data points and it included Air Canada, Air France, American, British Airways, and Delta. Group 2 was the third data set with 125 bivariate data points and it included Iberia, Jal, Lufthansa, Scandinavian Airlines, and United. To minimize the influence of the multiple cycles of industry performance as described in chapter 2, the predictor variables and the criterion variable were collapsed for each of the major global airlines across years to generate a final data set labeled Group Collapsed with 25 bivariate data points.

As described in chapter 3, the first step of the analysis process was the graphical analysis with the construction of scatterplots between each of the predictor variables (i.e., flight crew costs, maintenance costs, and aircraft ownership costs) and the criterion variable (i.e., operating profit). The second step was the calculation of the Pearson product-moment correlation coefficient to measure the presence and strength of the linear relationship between the predictor variables and the criterion variable (Triola, 2003). The third step was the interpretation of the Pearson product-moment correlation coefficient. After interpreting the linear correlation coefficient, the fourth step was the formal hypothesis testing. The fifth step was the regression analysis.

Graphical Analysis Results

The graphical analysis was performed in a sequence of scatterplots for the flight crew costs, the maintenance costs, and the aircraft ownership costs.

Flight Crew Costs

The graphs do not depict a significant linear relationship between flight crew costs and the operating profit for the four data sets (i.e., Group All, Group 1, Group 2, and Group Collapsed). Scatterplots graphically reflect any potential relationships between flight crew costs and the operating profit of major global airlines (Triola, 2003). The graphs are illustrated for each data set in Figure 1, Figure 2, Figure 3, and Figure 4.

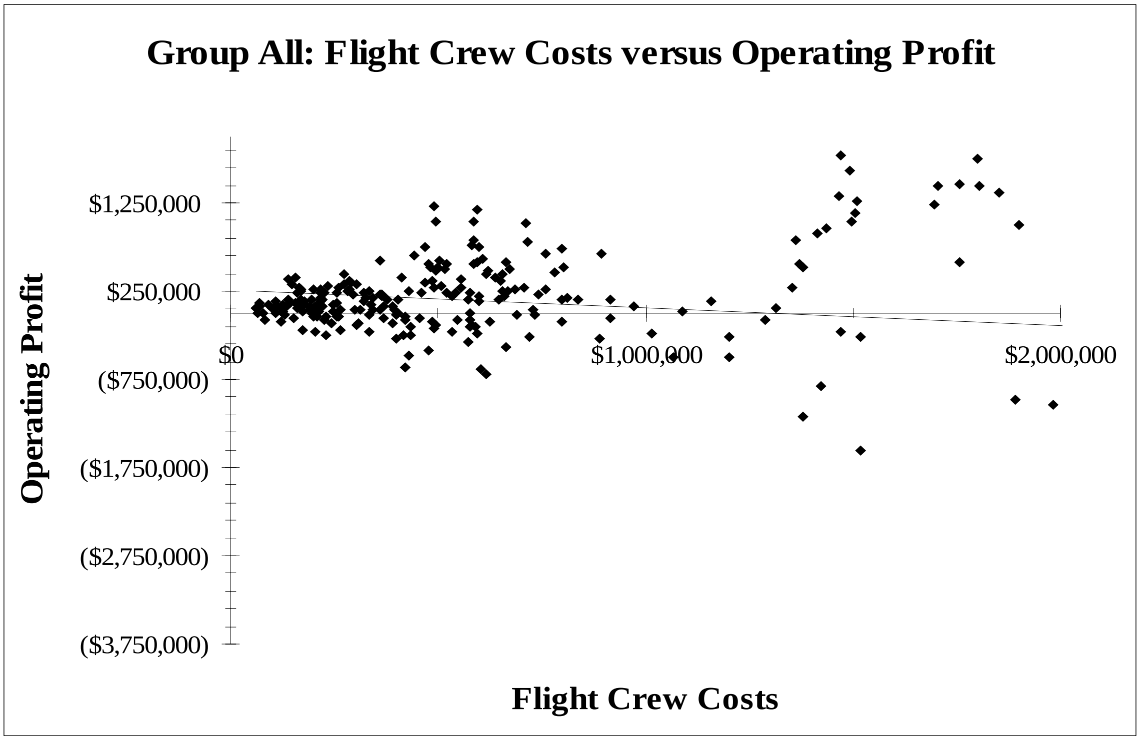

Figure 1. Flight crew costs versus operating profit for Group All.

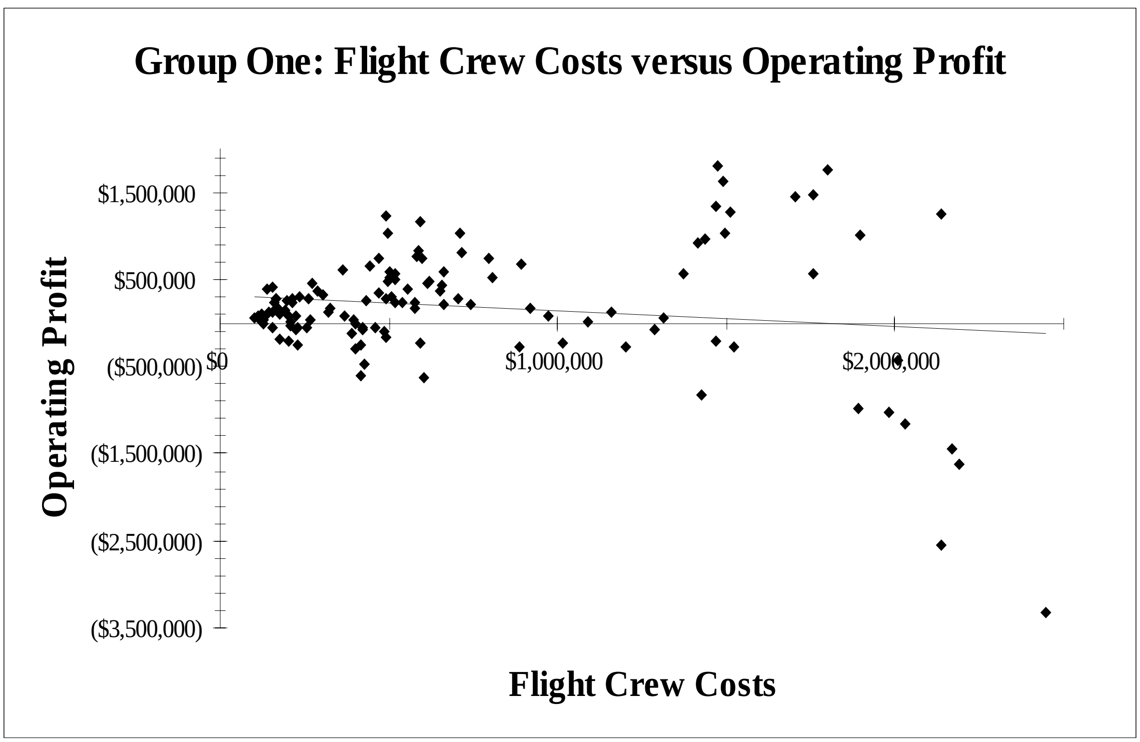

Figure 2. Flight crew costs versus operating profit for Group 1.

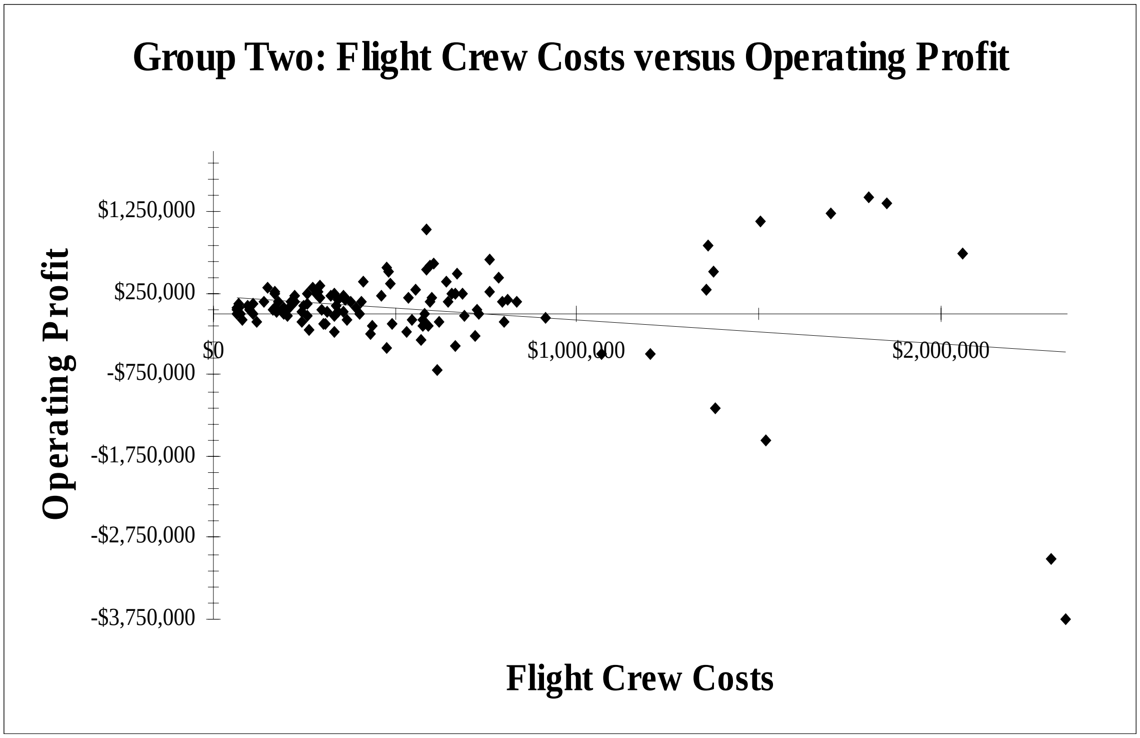

Figure 3. Flight crew costs versus operating profit for Group 2.

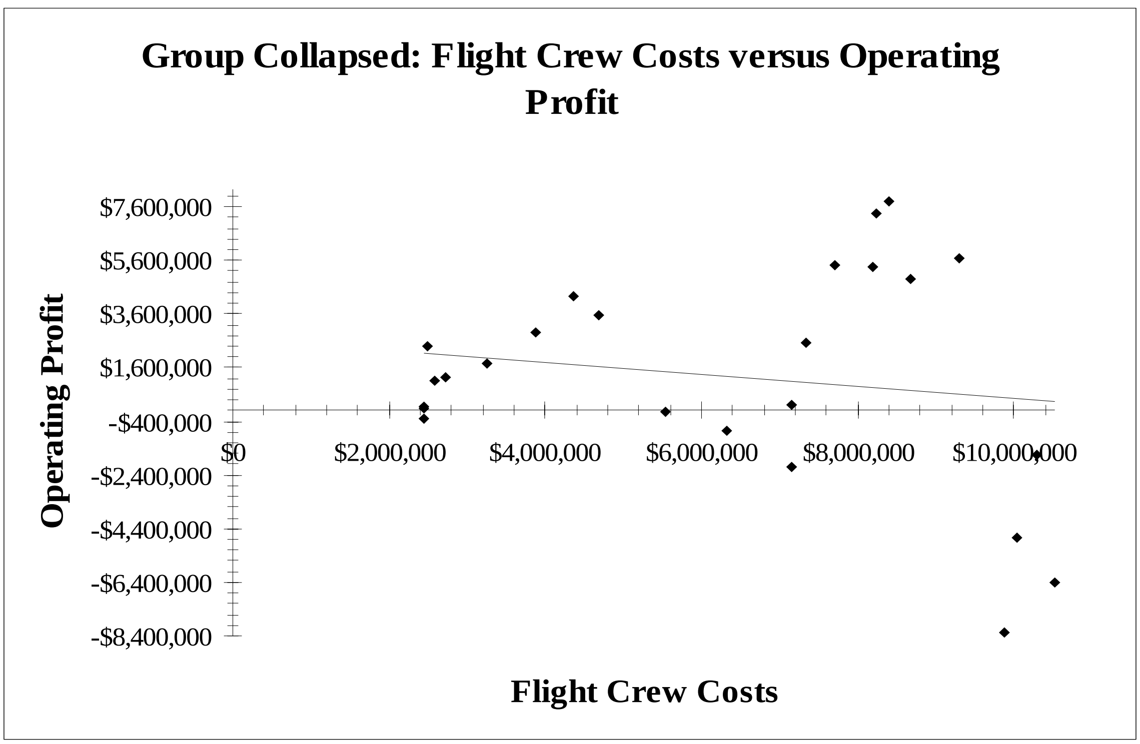

Figure 4. Flight crew costs versus operating profit for Group Collapsed.

Maintenance Costs

The graphs do not depict a significant linear relationship between maintenance costs and the operating profit for the four data sets (i.e., Group All, Group 1, Group 2, and Group Collapsed). Scatterplots graphically reflect any potential relationships between maintenance costs and the operating profit of major global airlines (Triola, 2003). The graphs are illustrated for each data set in Figure 5, Figure 6, Figure 7, and Figure 8.

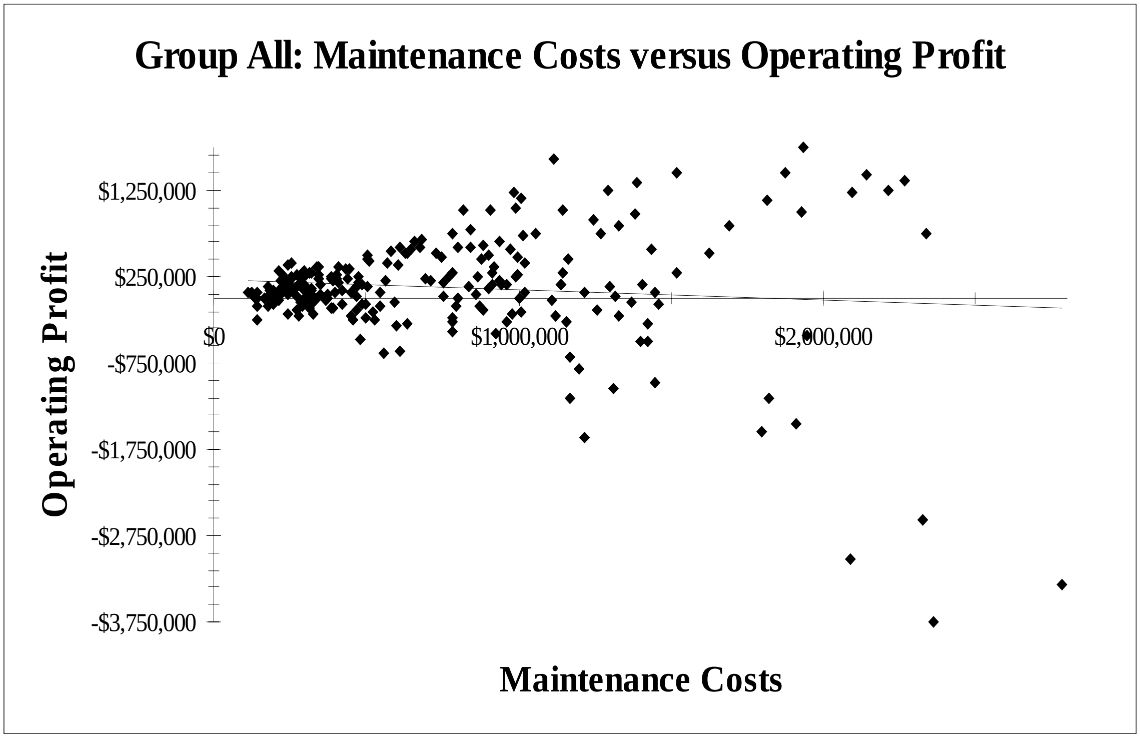

Figure 5. Maintenance costs versus operating profit for Group All.

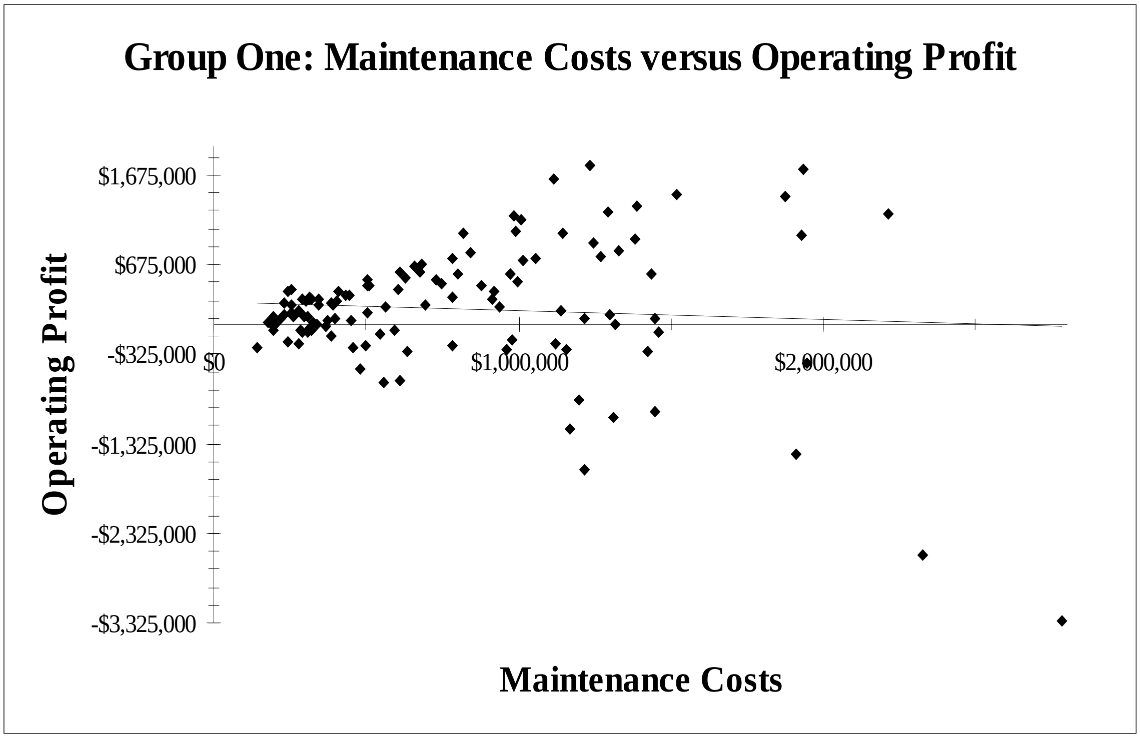

Figure 6. Maintenance costs versus operating profit for Group 1.

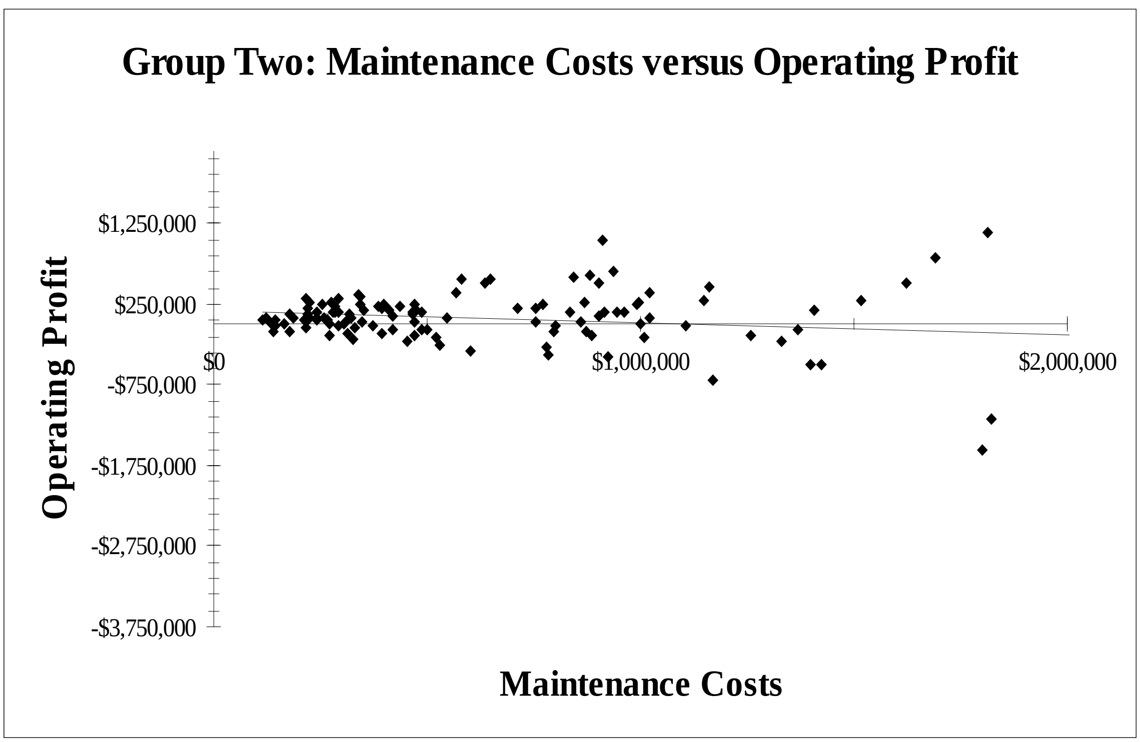

Figure 7. Maintenance costs versus operating profit for Group 2.

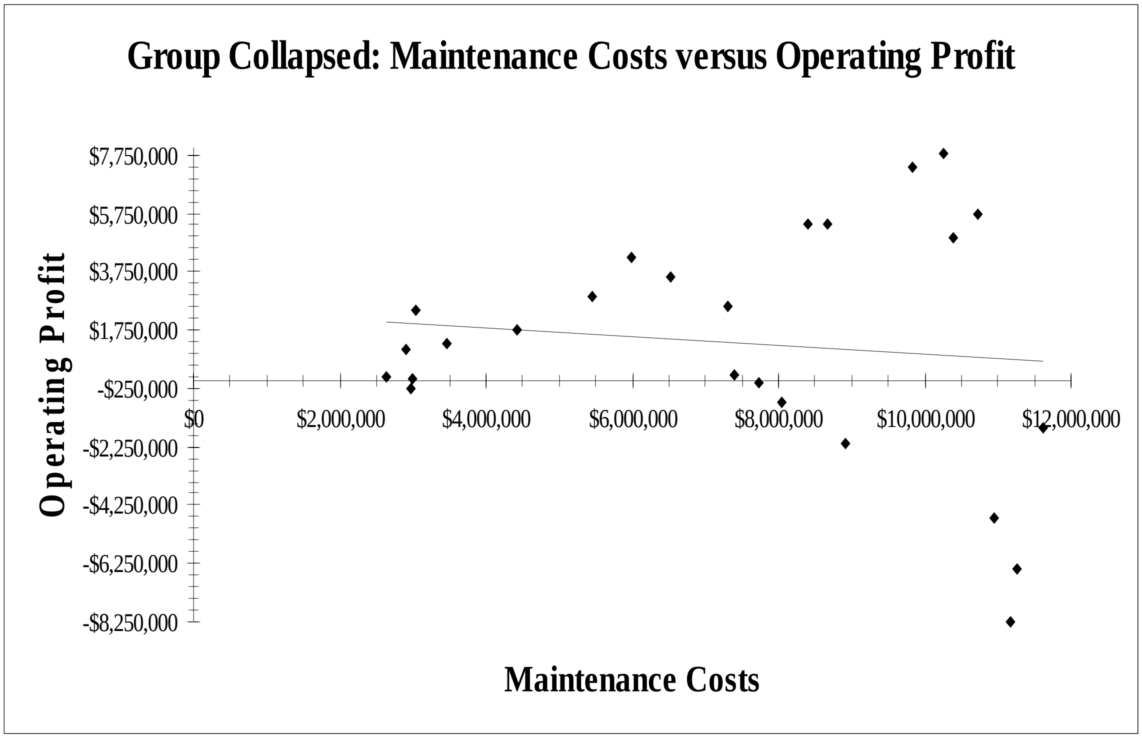

Figure 8. Maintenance costs versus operating profit for Group Collapsed.

Aircraft Ownership Costs

The graphs do not depict a significant linear relationship between aircraft ownership costs and the operating profit for the four data sets (i.e., Group All, Group One, Group Two, and Group Collapsed). Scatterplots graphically reflect any potential relationships between aircraft ownership costs and the operating profit of major global airlines (Triola, 2003). The graphs are illustrated for each data set in Figure 9, Figure 10, Figure 11, and Figure 12.

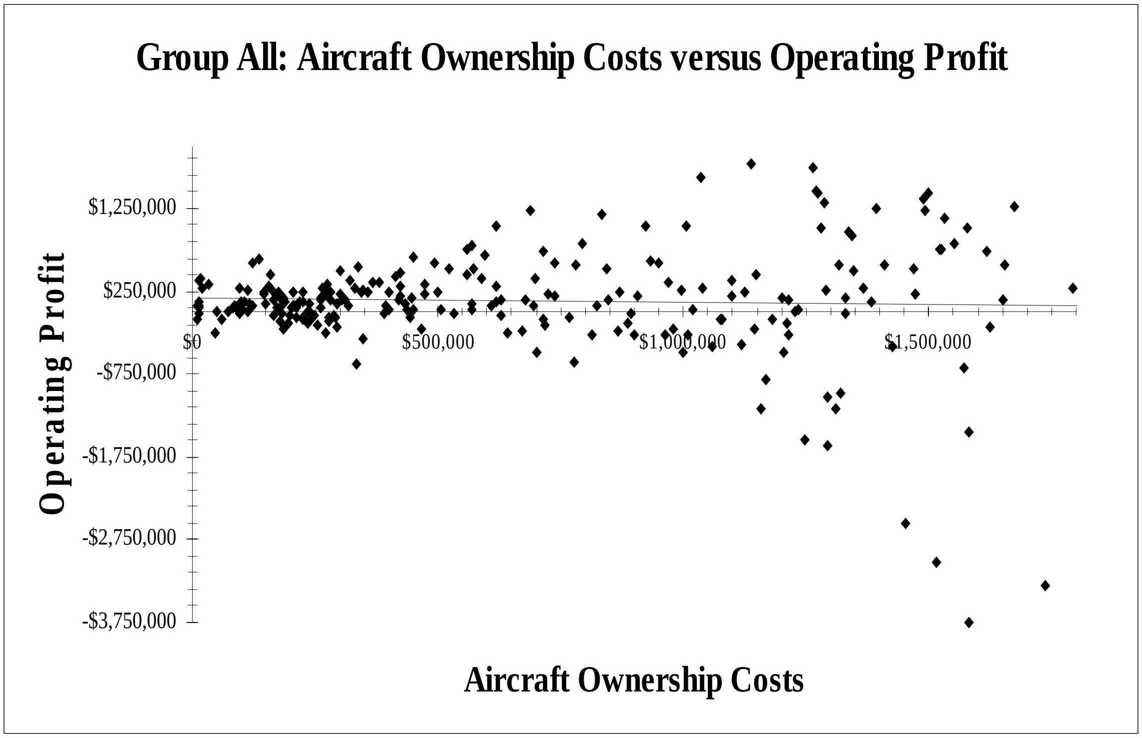

Figure 9. Aircraft ownership costs versus operating profit for Group All.

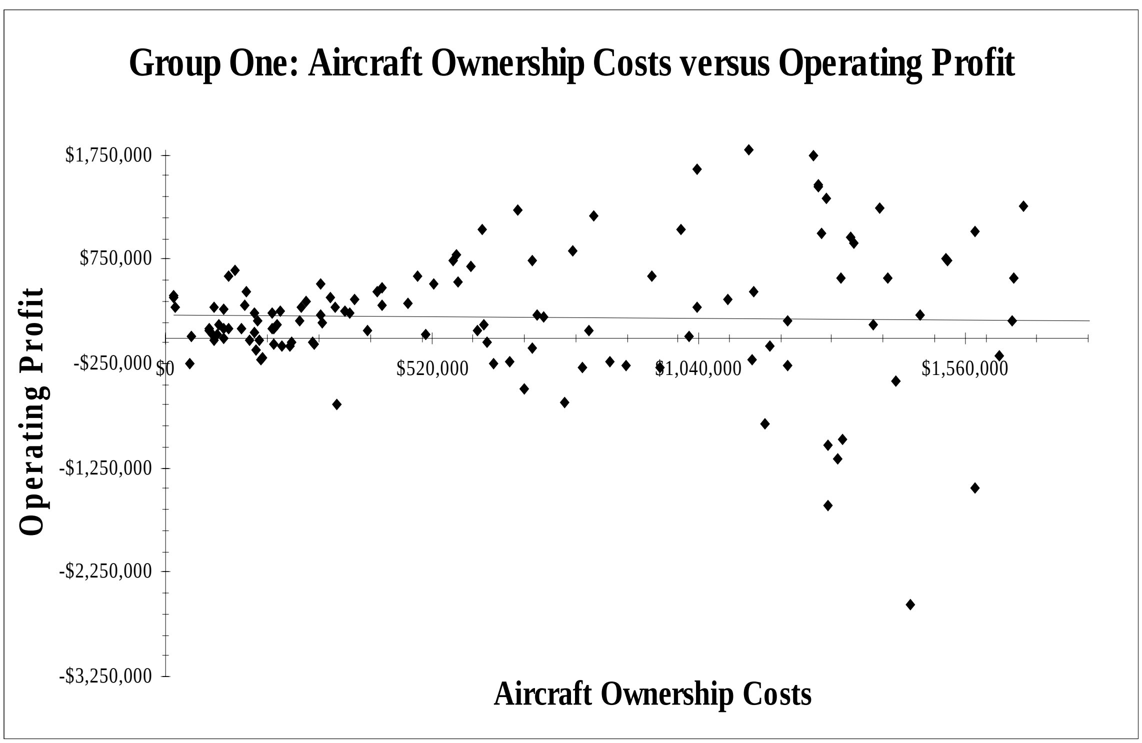

Figure 10. Aircraft ownership costs versus operating profit for Group 1.

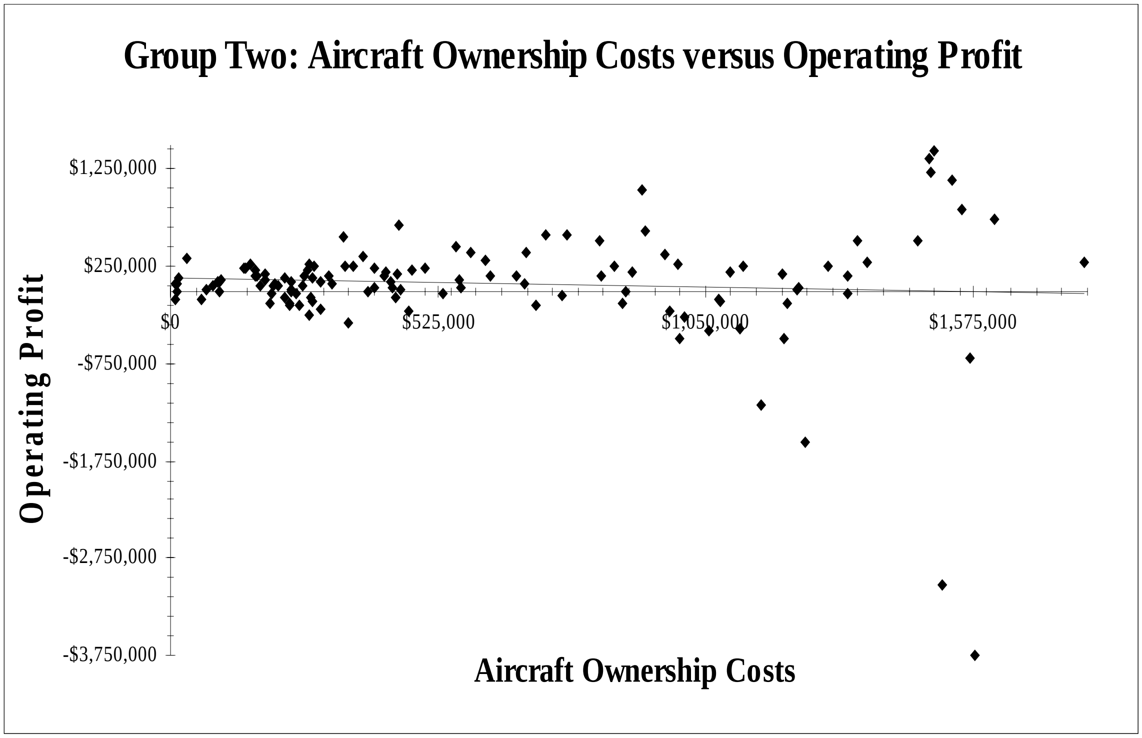

Figure 11. Aircraft ownership costs versus operating profit for Group 2.

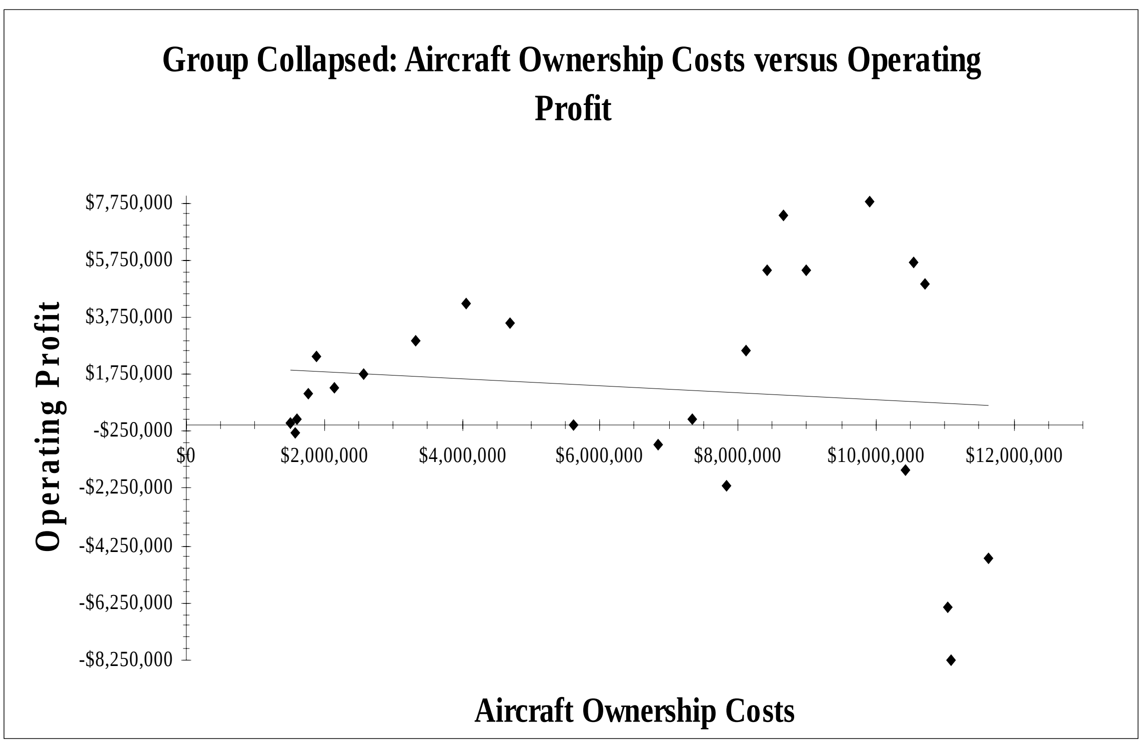

Figure 12. Aircraft ownership costs versus operating profit for Group Collapsed.

Linear Correlation Coefficient Calculation

The Pearson product-moment correlation coefficient measures the presence and strength of the linear relationship between two continuous variables (Triola, 2003). In the second step of the data analysis, the Pearson *r*-values were calculated to measure the strength of the linear relationship between each of the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit). Individual calculations were conducted for each of the predictor variables and the criterion variable.

Flight Crew Costs

The calculation findings reflect a Pearson *r*-value of -.17, -.16, -.23, and -.16 between flight crew costs and the operating profit for Group All, Group 1, Group 2, and Group Collapsed, respectively. The Pearson product-moment correlation coefficient measures the presence and strength of the linear relationship between flight crew costs and operating profit (Triola, 2003). Table 3 shows a summary of the calculation results.

Maintenance Costs

The calculation findings reflect a Pearson *r*-value of -.10, -.07, -.15, and -.12 between maintenance costs and the operating profit for Group All, Group 1, Group 2, and Group Collapsed, respectively. The Pearson product-moment correlation coefficient measures the presence and strength of the linear relationship between maintenance costs and the operating profit (Triola, 2003). Table 3 shows a summary of the calculation results.

Aircraft Ownership Costs

The calculation findings reflect a Pearson *r*-value of -.04, -.02, -.07, and -.11 between aircraft ownership costs and the operating profit for Group All, Group 1, Group 2, and Group Collapsed, respectively. The Pearson product-moment correlation coefficient measures the presence and strength of the linear relationship between aircraft ownership costs and operating profit (Triola, 2003). Table 3 shows a summary of the calculation results.

Table 3

Pearson r-value Results

Data structure	Flight crew	Maintenance	Aircraft ownership
Group All[a]	-.17	-.10	-.04
Group 1[b]	-.16	-.07	-.02
Group 2[b]	-.23	-.15	-.07
Group Collapsed[c]	-0.16	-.12	-.11

Note. The PEARSON function in Excel® was used to calculate the Pearson *r*-value for data points.

[a]n = 250. [b]n = 125. [c]n = 25.

Interpretation of Linear Correlation Coefficient

The Pearson *r*-value may be interpreted through two methods. Using the first method, if *r* is close to zero, one may conclude that there is no significant linear correlation between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit). If *r* is close to negative one or positive one, one may conclude that there is a significant linear correlation between the predictor variables and the criterion variable (Triola, 2003). Using the second method, one may compare the absolute value of the computed Pearson *r*-values to the critical value in the Pearson's Critical Value Table at a particular confidence level to determine the linear relationship. If the absolute value of the computed Pearson *r*-values exceeds the critical value in the Pearson's Critical Value Table, at a designated confidence level, there is a significant linear correlation (Triola, 2003).

For this study's interpretation of the linear correlation coefficient, the absolute value of the computed Pearson *r*-values was compared to the critical value in the Pearson's Critical Value Table at a 95% confidence level. The critical value was retrieved from the MegaStat add-in feature using Excel® rather than from a published copy of Pearson's Critical Value Table. The interpretation of the linear correlation coefficient was performed for the flight crew costs, the maintenance costs, and the aircraft ownership costs.

Flight Crew Costs

The Group All and the Group 2 comparison findings reflect there is a linear relationship between flight crew costs and the operating profit of major global airlines. The absolute value of the computed Pearson *r*-values exceeds the critical value retrieved from the MegaStat add-in feature using Excel®. The Group 1 and the Group Collapsed comparison analysis findings reflect there is no significant linear relationship between flight crew costs and the operating profit of major global airlines. The absolute value of the computed Pearson *r*-values does not exceed the critical value. A summary of the calculation findings is presented in Table 4.

Maintenance Costs

The Group All, Group 1, Group 2, and Group Collapsed comparison findings reflect there is no significant linear relationship between maintenance costs and operating profit of major global airlines. The absolute value of the computed Pearson *r*-values does not exceed the critical value retrieved from the MegaStat add-in feature using Excel®. A summary of the calculation findings is presented in Table 4.

Aircraft Ownership Costs

The Group All, Group 1, the Group 2, and Group Collapsed comparison findings reflect that there is no significant linear relationship between aircraft ownership costs and operating profit of major global airlines. The absolute value of the computed Pearson *r*-values does not exceed the critical value retrieved from the MegaStat add-in feature using Excel®. A summary of the calculation findings is presented in Table 4.

Table 4

Critical Value Comparison

Data structure	Calculated *r*-value	Critical value	Significant linear correlation
		Flight crew	
Group All[a]	-.17	±.12[*]	Yes
Group 1[b]	-.16	±.18[*]	No
Group 2[b]	-.23	±.18[*]	Yes
Group Collapsed[c]	-.16	±.40[*]	No
		Maintenance	
Group All[a]	-.10	±.12[*]	No
Group 1[b]	-.07	±.18[*]	No
Group 2[b]	-.15	±.18[*]	No
Group Collapsed[c]	-.12	±.40[*]	No
		Aircraft ownership	
Group All[a]	-.04	±.12[*]	No
Group 1[b]	-.02	±.18[*]	No
Group 2[b]	-.07	±.18[*]	No
Group Collapsed[c]	-.11	±.40[*]	No

Note. The critical value was retrieved from Excel® using MegaStat through the correlation matrix function.

[a]n = 250. [b]n = 125. [c]n = 25.

[*]$p < .05$.

Formal Hypothesis Testing Results

After the interpretation of the linear correlation coefficient, an evaluation of the statistical hypothesis for each of the predictor variables was performed. A decision to reject or fail to reject the null hypothesis was made for each of the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) at a 95% confidence level. Rejecting the null hypothesis for the predictor variables would mean that there is significant evidence to conclude that there is a linear correlation between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. Failing to reject the null hypothesis for the predictor variables would mean that there is no significant evidence to conclude that there is a linear correlation between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines (Sprinthall, 2002). The *t*-test statistic was calculated, and a formal hypothesis test was performed for the flight crew costs, the maintenance costs, and the aircraft ownership costs.

Flight Crew Costs

For the flight crew costs formal hypothesis testing, the claim was made that H_0: $p = 0$ (there is no linear correlation between flight crew costs and operating profit) and H_1: $p \neq 1$ (there is a linear correlation between flight crew costs and operating profit). The calculation finding reflects a *t*-value of -2.64 and a critical value of ±1.97 for Group All. The null hypothesis is rejected and a conclusion is made that there is a negative linear correlation between flight crew costs and operating profit. For Group 1, the calculation results reflect a *t*-value of -1.75 and a critical value of ±1.98. The formal hypothesis testing process results in failing to reject the null hypothesis and concluding that there is no linear correlation between flight crew costs and operating profit. For Group 2, the calculation results reflect a *t*-value of -2.63 and a critical value to be ±1.98. The formal hypothesis testing process results in rejecting the null hypothesis and concluding that there is a negative linear correlation between flight crew costs and operating profit. For Group Collapsed, the calculation results reflect a *t*-value of -.78 and a critical value to be ±2.06. The formal hypothesis testing process results in rejecting the null hypothesis and concluding that there is a linear correlation between flight crew costs and operating profit. A summary of the findings is presented in Table 5.

Table 5

Flight Crew Costs Formal Hypothesis Testing Results

Data structure	Calculated *t*-value	Critical value	Decision	Conclusion
Group All[a]	-2.64	±1.97*	Reject	Negative linear correlation
Group 1[b]	-1.75	±1.98*	Fail to reject	No significant linear correlation
Group 2[b]	-2.63	±1.98*	Reject	Negative linear correlation
Group Collapsed[c]	-0.78	±2.06*	Fail to reject	No significant linear correlation

Note. The critical value was retrieved from Excel® using MegaStat through the probability/*t*-distribution function.

[a]n = 250. [b]n = 125. [c]n = 25.

*p < .05.

Maintenance Costs

For the maintenance costs formal hypothesis testing, the claim was made that H_0: $p = 0$ (there is no linear correlation between maintenance costs and operating profit) and

H_1: $p \neq 1$ (there is a linear correlation between maintenance costs and operating profit). The Group All calculation results reflect a *t*-value of -1.56 and a critical value of ±1.97. The Group 1 calculation results reflect a *t*-value of -.82 and a critical value of ±1.98. The Group 2 calculation results reflect a *t*-value of -1.64 and a critical value of ±1.98. The Group Collapsed calculation results reflect a *t*-value of -.57 and a critical value of ±2.06. With all data sets, Group All, Group 1, Group 2, and Group Collapsed, the formal hypothesis testing process results in failing to reject the null hypothesis, and a conclusion is made that there is no linear correlation between maintenance costs and operating profit. A summary of the findings is presented in Table 6.

Table 6

Maintenance Costs Formal Hypothesis Testing Results

Data structure	Calculated *t*-value	Critical value	Decision	Conclusion
Group All[a]	-1.56	±1.97[*]	Fail to reject	No significant linear correlation
Group 1[b]	-.82	±1.98[*]	Fail to reject	No significant linear correlation
Group 2[b]	-1.64	±1.98[*]	Fail to reject	No significant linear correlation
Group Collapsed[c]	-.57	±2.06[*]	Fail to reject	No significant linear correlation

Note. The critical value was retrieved from Excel® using MegaStat through the probability/*t*-distribution function.

[a]n = 250. [b]n = 125. [c]n = 25.

[*]$p < .05$.

Aircraft Ownership Costs

For the aircraft ownership costs formal hypothesis testing, the claim was made that H_0: $p = 0$ (there is no linear correlation between aircraft ownership costs and operating profit) and H_1: $p \neq 1$ (there is a linear correlation between aircraft ownership costs and operating profit). The Group All calculation results reflect a *t*-value of -.55 and a critical value of ±1.97l. The Group 1 calculation results reflect a *t*-value of -.20 and a critical value of ±1.98. The Group 2 calculation results reflect a *t*-value of -.81 and a critical value of ±1.98. The Group Collapsed calculation results reflect a *t*-value of -.55 and a critical value of ±2.06. With all four data sets, the formal hypothesis testing process results in failing to reject the null hypothesis and concluding that there is no linear correlation between aircraft ownership costs and operating profit. A summary of the findings is presented in Table 7.

Table 7

Aircraft Ownership Costs Formal Hypothesis Testing Results

Data structure	Calculated *t*-value	Critical value	Decision	Conclusion
Group All[a]	-.55	±1.97*	Fail to reject	No significant linear correlation
Group 1[b]	-.20	±1.98*	Fail to reject	No significant linear correlation
Group 2[b]	-.81	±1.98*	Fail to reject	No significant linear correlation
Group Collapsed[c]	-.55	±2.06*	Fail to reject	No significant linear correlation

Note. The critical value was retrieved from Excel® using MegaStat through the probability/*t*-distribution function.

[a]n = 250. [b]n = 125. [c]n = 25.

*p < .05.

Regression Analysis Results

There is no evidence to conclude that there is a significant linear relationship between maintenance costs, aircraft ownership costs, and the operating profit of major global airlines with all data sets. The flight crew costs and operating profit for major global airlines analyses findings were mixed. The analysis step proposed in chapter 3, that is, to create a multiple regression model, did not follow the formal hypothesis testing of the correlation coefficients. A multiple regression equation was not built to express the linear relationship between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit).

Instead, the adjusted R^2 and *p*-value were calculated for the four data sets in further support that a regression equation was not suitable to predict the operating profit for major global airlines. The results of the regression analysis, presented in Table 8, reflect that the adjusted R^2 is not high enough to support the use of a regression equation to predict the operating profit of major global airlines. In addition, the *p*-value is not small enough to support the use of the regression equation to predict the operating profit of major global airlines.

Table 8

Regression Analysis

Data structure	Adjusted R^2	*p*-value
Group All[a]	.04	.005
Group 1[b]	.03	.08
Group 2[b]	.08	.004
Group Collapsed[c]	.06	.24

Note. The regression analysis results were calculated with Excel® using MegaStat through the regression analysis function.

[a]n = 250. [b]n = 125. [c]n = 25.

Secondary Analysis Results

The findings from the primary analysis steps raised two issues and prompted a two-part secondary analysis. First, the mixed findings of the linear relationship between flight crew costs and the operating profit of major global airlines raised a sampling issue. The sampling method used in the study, resulting in a sample of 10 major global airlines, may have caused the results not to be representative of the population. The second issue was whether a trend analysis better supports the hypothesized relationships.

In the first part of the secondary analysis, the sample was modified to include all 2004 major global airlines, as listed in Table 1. Then, the graphical analysis and the calculation of the linear correlation coefficient were repeated using the flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of all 2004 major global airlines. Excluded from the first part of the secondary analysis was Ryanair because of incomplete data.

Sampling Issue: Graphical Analysis

The scatterplots do not depict a significant linear relationship between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of all 2004 major global airlines as listed in Table 1. The scatterplots, illustrated in Figure 13, Figure 14, and Figure 15, plot 677 bivariate data points.

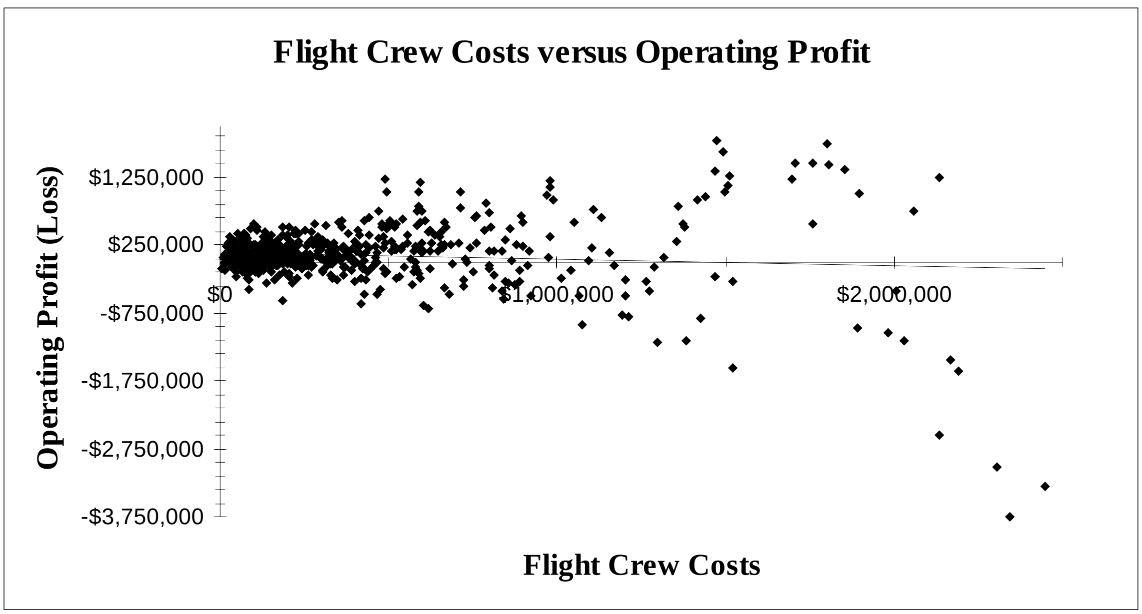

Figure 13. Flight crew costs versus operating profit for all 2004 major global airlines.

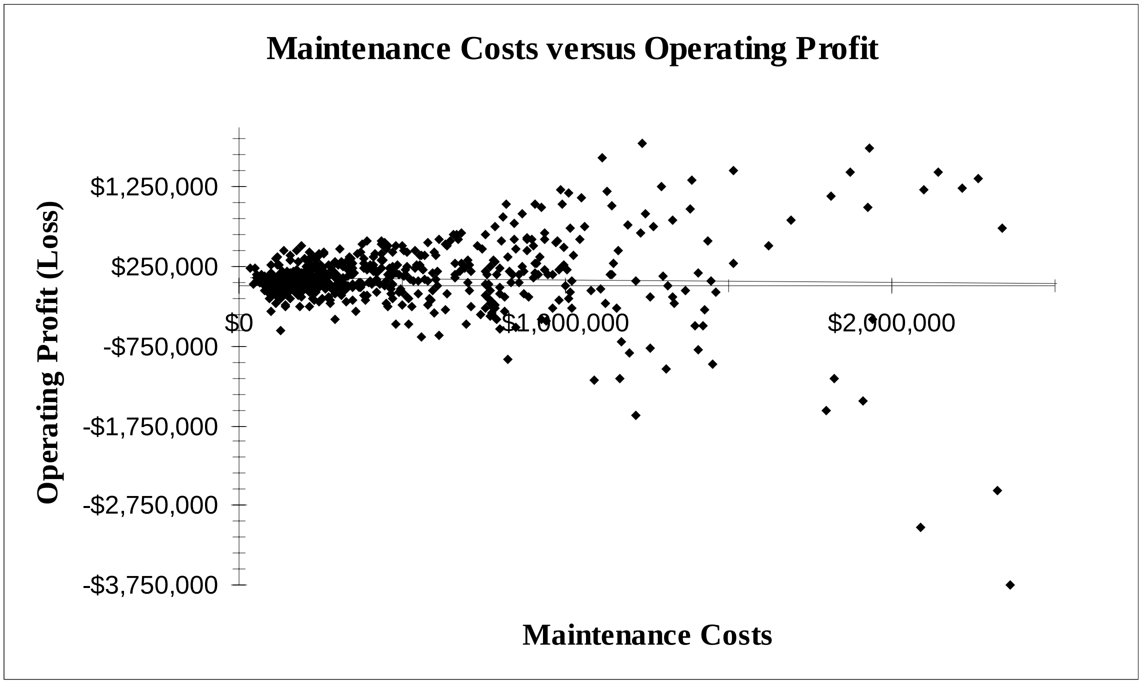

Figure 14. Maintenance costs versus operating profit for all 2004 major global airlines.

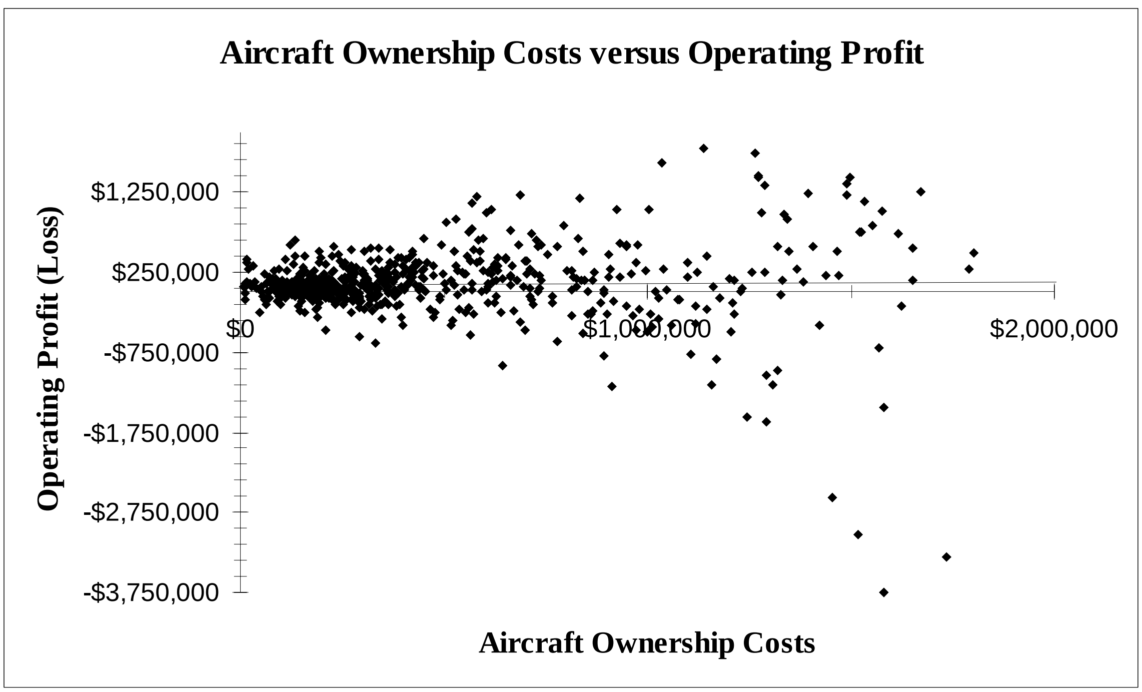

Figure 15. Aircraft ownership costs versus operating profit for all 2004 major global airlines.

Sampling Issue: Linear Correlation Calculation

The linear correlation calculation analyses do not support that a linear relationship exists between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit for all 2004 major global airlines as listed in Table 1. The linear correlation calculation finding reflects a Pearson *r*-value of -.10, -.03, and .01 between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines, respectively.

Trend Analysis: Costs versus Operating Profit

In the second part of the secondary analysis, a trend analysis was performed using flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of the initial 10 sample airlines, as listed in Table 2, to examine whether a trend analysis better supports the hypothesized relationships. To minimize the influence of the multiple cycles of industry performance as described in chapter 2, the predictor variables and the criterion variable were collapsed for each of the major global airlines across years to generate the fourth data set labeled as Group Collapsed with 25 bivariate data points. The trend analysis indicates a comparative relationship of the predictor variables and the criterion variable over time for the major global airlines (Triola, 2003).

The trend analysis indicates that the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) increase over time and that the criterion variable (i.e., operating profit) is cyclical over time. This trend analysis is shown in Figure 16.

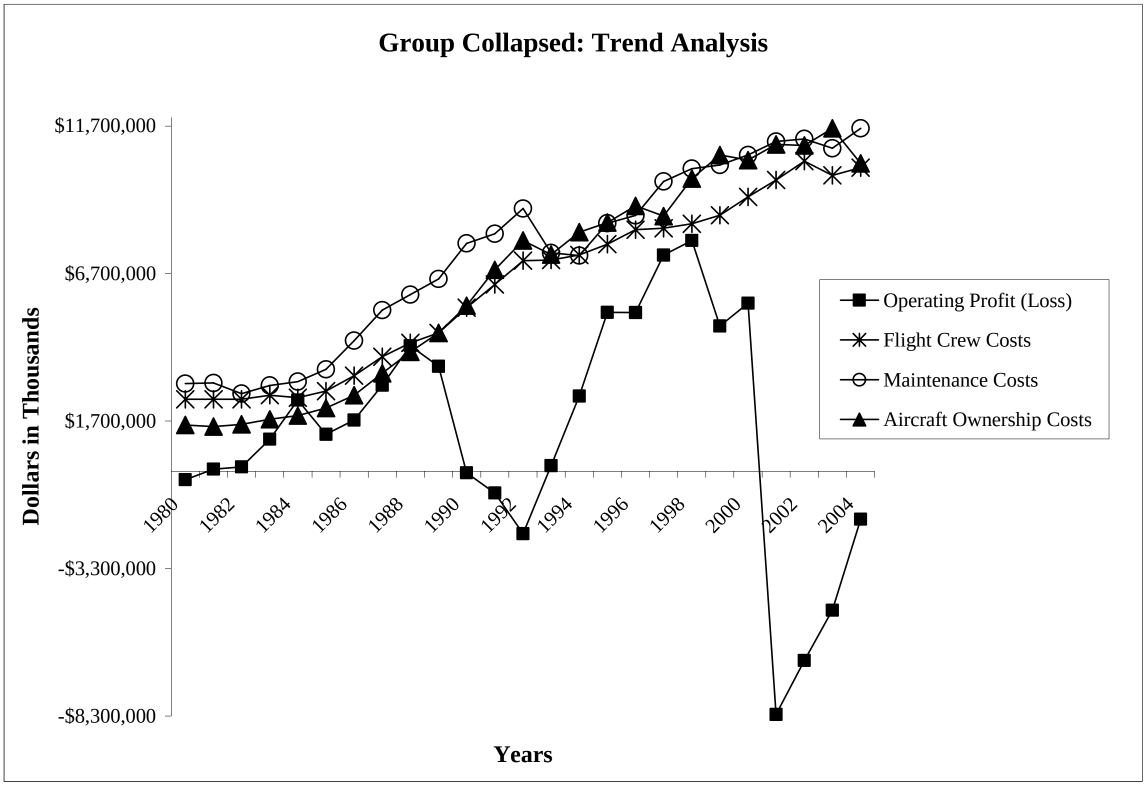

Figure 16. Trend analysis of the predictor variables and the criterion variable for the 10 sample airlines collapsed over time.

Summary

The objective of this predictive, correlational design was to examine and describe the strength of any linear relationship between flight crew costs, maintenance costs, aircraft ownership, and the operating profit of major global airlines. The results of the five-step analysis did not indicate that a significant linear relationship exists between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit). Because a significant linear relationship does not exist between the predictor variables and the criterion variable, a multiple egression equation is not suitable to predict the operating profit of major global airlines. From the regression analysis, the calculation results of the adjusted R^2 and *p*-value also indicate that a multiple regression equation is not suitable for predicting the operating profit of major global airlines (Triola, 2003).

With regard to the research questions and the hypotheses, an increase in the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) is not associated with a decrease in the criterion variable (i.e., operating profit) of major global airlines. In addition to the primary analysis, the trend analysis performed in the secondary analysis indicates that in 1980, 1990 to 1992, and 2001 to 2004, the predictor variables increased while the criterion variable decreased. Alternatively, the predictor variables increased and the criterion variable increased from 1981 to 1989 and from 1993 to 2000. The five-step analysis findings fail to reject that the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) are not negatively related to the criterion variable (i.e., operating profit) of major global airlines.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The research problem this study focused upon was the lack of understanding of the relationships between flight crew costs, maintenance costs, aircraft ownership costs, and the operating profit of major global airlines. The purpose was to determine that if a significant linear relationship existed between the three-predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit) of major global airlines from 1980 to 2004. If a significant linear relationship existed, the intent was to produce a multiple regression equation to predict the operating profit of major global airlines. The predictive, correlational, quantitative method and design combination was used because it is the statistical technique used to describe, measure, and predict variable relationships. The study was limited to 10 major global airlines for the period of 1980 to 2004, to Air Transport Intelligence's database capture of the predictor variables and criterion variable, and to the validity and reliability of the data presented in ICAO's *Digest of Statistics: Financial Data.* Chapter 5 is organized into the conclusion, the implications, and the recommendations of the study.

Conclusion

An increase in flight crew costs, maintenance costs, or aircraft ownership costs are not directly associated with a decrease in the operating profit of major global airlines. The study's findings fail to reject the null hypotheses, which state that flight crew costs, maintenance costs, or aircraft ownership costs are not negatively related to the operating profit of major global airlines. The findings indicated that there is not a significant linear relationship between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit) of major global airlines.

The trend analysis, from the secondary analysis, indicates that the operating profit of major global airlines is cyclical despite the increased trend of the predictor variables. A plausible explanation is that the operating profit of major global airlines is negatively related to multiple variables over time, including, but not exclusively, the three-predictor variables. According to financial theory, with all other variables constant, an increase in costs will cause a decrease in profit (Chew, 2001). The findings suggest that in the major global airline industry other variables are not constant and directly influence the operating profit, as discovered in chapter 2.

Present findings are important because they confirm that the relationships between the predictor variables (i.e., flight crew costs, maintenance costs, aircraft ownership costs) and the criterion variable (i.e., operating profit) are not linear. The trend analysis findings are consistent with the chapter 2 findings with regard to other economic and social factors negatively influencing the operating profit of major global airlines. For example, from 1984 through 1989, the industry was positively influenced by fuel prices and by improving world economies. The industry was negatively influenced by rising fuel prices and poor economic conditions from 1990 through 1993. From 1994 through 2000, the industry was influenced by rising demand. Finally, from 2000 through 2003, the industry was influenced by large debt, higher fuel prices, and a higher supply of capacity.

The study's findings do not directly reject the concept that the predictor variables may marginally influence the criterion variable, as highlighted in the chapter 2 findings.

The findings do suggest that another relationship must exist between the three-predictor variables and the criterion variable, other than a significant linear relationship. However, the study's findings do not suggest that any existing theory be modified.

In summary, a reasonable explanation for the results is that, along with a marginal influence of the three-predicator variables, other variables significantly influence the operating profit of major global airlines. The literature review suggested that flight crew costs, maintenance costs, and aircraft ownership negatively influence operating profit (Doganis, 1991). In addition, terrorist attacks, fuel prices, economic recessions, and even SARS have a negative impact on airline profitability (Feng, 2003). The trend analysis illustrated the cyclical nature of the operating profit of major global airlines despite the increase in flight crew costs, maintenance costs, and aircraft ownership costs over time. The trend analysis illustrates the negative and positive influence of the economic and social variables. The results are consistent with the chapter 2 discussion that other economic and social factors negatively influence the operating profit of major global airlines.

Implications

The findings suggest two inferences. The first inference pertains to executive leadership direction on predicting operating profits of major global airlines. The second inference pertains to the general contributions to existing executive leadership knowledge with regard to risk and the stimulation of innovation in the area of fixed costs.

The implication for major global airline executives is that predicting operating profits using a multiple regression model with flight crew costs, maintenance costs, and aircraft ownership costs is not a viable option. In fact, predicting the operating profit using the three-predictor variables for major global airlines would yield inaccurate forecasts. The findings suggest that other social and economic predictor variables should be analyzed to yield a suitable multiple regression equation for forecasting the operating profit of major global airlines. Until these other social and economic predictor variables are analyzed and confirmed as having a significant linear relationship with the operating profit, major global airline executives should simply use the mean of the operating profit to predict the operating profit of major global airlines. This inference is supported by exiting forecasting methods, which state that in the absence of a significant linear correlation, the best estimate for the operating profit is simply the calculated mean of the operating profit (Triola, 2003).

The second implication refers to the statement in chapter 1 that the proposed intent to explain the facts and observations could add to existing empirical leadership knowledge within the context of fixed costs versus operating profit of major global airlines. Although the explanation of the facts and observations did not add to existing empirical leadership knowledge within the context of fixed costs versus operating profit of major global airlines, findings suggest that increase knowledge of fixed costs and operating profit may enhance the decision-making processes in the area of risk and the stimulation of innovation in operational efficiency. This inference is supported by the proposed actions by stakeholders, under the recommendations section, which are intended to stimulate critical thinking and innovation within global airline industry leadership in the area of global airline profitability.

Recommendations

The following recommendations are organized into three categories. The first category is the recommendations for future theory and research. The second category is the recommendations for action by key stakeholders. The last category is the recommendations for the study itself to be replicated.

Future Theory and Research

With regard to future theory and research, a multiple regression model with flight crew costs, maintenance costs, and aircraft ownership costs may be used to predict the operating expenses of major global airlines versus the operating profit, as the findings suggest. The newly developed multiple regression model to predict the operating expenses combined with a marketing model to predict the operating revenue may enhance the process to forecast operating profit of major global airlines. In summary, the mathematical combination of both the operating expense model and the operating revenue model may be used by airline executives to predict the operating profit of major global airlines accurately.

Actions by Stakeholders

With regard to actions by key stakeholders such as aircraft manufacturers, aircraft vendors, labor unions, and major global airlines, the literature review suggested that major global airlines are restricted to adjusting the supply of available aircraft seats to the demand of aircraft seats sold by the long-term aircraft leases and by the long-term aircraft financing. Furthermore, the literature review findings indicated that major global airlines pay a flight crew premium because of the relationship of dedicated flight crew to aircraft type. Major global airlines also pay a premium for aircraft maintenance because of the unique maintenance programs by aircraft type as well as the dedicated maintenance personnel training required by aircraft type. Lastly, if strategically and financially possible, major global airlines would benefit with lower maintenance costs through the standardization of the fleet (De Borges Pan & Espirito Santos, 2004).

The action by key stakeholders is to have the aircraft manufacturers and the component manufacturers, such as engine manufacturers, avionics manufacturers, and gear manufacturers, form an alliance to produce a cloned aircraft by fleet type and a leasing company to deliver the cloned aircraft to the global airline market on monthly bases. The aircraft is cloned in the sense that each fleet type has identical gear components, engines, avionics, and maintenance programs. The cloned aircraft type would be delivered to the global airline market through a newly formed aircraft leasing company, fully funded by the aircraft manufacturers. The newly established leasing company would offer monthly leases versus the existing 20-year lease terms or 20-year finance terms. The results would generate multiple benefits to multiple stakeholders.

The first benefit of a monthly leasing structure is major global airlines would be able to adjust the available aircraft seat supply to the demand of passenger travel, reducing the aircraft ownership costs. The resulting impact of the cloned aircraft by fleet type would be an aircraft with one operation manual and one maintenance program with the ability to be piloted and maintained by a cross-utilized labor force over multiple global airlines, reducing flight crew costs and maintenance costs. With the ability to adjust the available aircraft seat supply to the demand of passenger travel, major global airlines could easily address the cyclical effect of operating profit on the industry and on the aircraft manufacturers, such as engine manufacturers, avionics manufacturers, and gear manufacturers. The aircraft manufacturers would benefit from an otherwise costly cyclical aircraft order market.

Study Replication

This study should be replicated using a time series analysis versus a correlational analysis to study the influence of all operating costs on the operating profit of major global airlines. The replication should cover multiple economic periods and it should include only major global airlines because these airlines currently address the greatest challenges with diverse aircraft fleet types serving existing diverse markets. Lastly, the replicated study should attempt to identify which cost variables directly negatively influence the operating profit of major global airlines.

In summary, for future theory and research is a combination model predicting operating expenses and predicting operating revenue to enhance the process to forecast operating profit. The action by key stakeholders is to form an alliance to produce a cloned aircraft by fleet type and a leasing company to deliver the cloned aircraft to the global airline market on monthly bases. The study itself should be replicated using a time series analysis versus a correlational analysis using all operating costs.

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APPENDIX: DATA REGARDING THE MAJOR GLOBAL AIRLINES

Air Canada Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	76,845	112,661	194,954	84,401
1981	61,249	103,350	448,719	83,699
1982	(20,759)	128,217	198,665	94,806
1983	23,127	125,923	180,250	91,707
1984	33,367	126,089	191,308	101,576
1985	1,518	124,319	200,581	112,918
1986	92,808	125,314	198,448	114,594
1987	81,840	133,468	220,326	123,730
1988	116,716	155,087	267,763	104,627
1990	90,873	176,539	299,058	149,047
1991	(35,356)	207,572	312,934	165,221
1992	(208,921)	203,327	279,470	186,025
1993	(190,093)	174,822	244,820	187,774
1994	(60,082)	152,487	195,209	212,309
1995	115,342	143,979	234,245	218,817
1996	163,328	171,240	281,203	262,447
1997	144,871	194,198	257,556	306,027
1998	261,533	199,974	302,198	348,940
1999	70,544	204,572	399,548	394,346
2000	306,014	234,668	316,055	423,290
2001	30,970	264,666	324,955	507,734
2002	(482,939)	428,682	479,467	700,785
2003	(246,475)	417,475	140,930	641,438
2004	(615,149)	418,870	611,552	779,032

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO

Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from

http://www.icaodata.com/default.aspx

Air France Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(47,938)	257,495	318,292	288,214
1981	(47,828)	230,732	286,895	247,458
1982	(83,457)	225,118	291,758	225,399
1983	85,146	221,928	259,562	209,990
1984	236,153	160,245	229,690	173,848
1985	232,451	215,264	256,913	206,776
1986	281,827	261,944	346,994	263,600
1987	366,741	288,188	410,242	367,386
1988	331,829	304,823	442,496	472,579
1990	127,996	322,041	506,344	620,024
1991	(286,976)	399,133	633,493	814,028
1992	(92,235)	484,016	548,202	715,721
1993	(285,151)	888,390	1,425,091	964,284
1994	(637,723)	604,097	556,603	333,461
1995	(232,072)	592,909	499,461	866,169
1996	201,887	659,942	563,307	737,080
1997	224,617	578,359	692,549	724,903
1998	581,795	663,183	803,715	950,428
1999	287,350	706,952	913,245	1,038,483
2000	369,735	651,793	921,371	1,098,438
2001	446,166	616,202	880,523	1,147,200
2002	213,059	741,267	938,347	1,470,994
2003	155,970	917,031	1,141,791	1,214,856
2004	126,745	1,157,290	1,300,157	1,382,182

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

American Airlines Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(112,679)	389,157	383,796	177,377
1981	43,356	396,196	371,445	173,636
1982	(18,247)	399,684	368,663	182,912
1983	249,517	430,471	386,442	223,353
1984	339,065	468,514	434,656	274,416
1985	506,484	518,370	501,826	302,716
1986	392,062	553,921	605,172	320,419
1987	473,184	621,725	746,136	423,910
1988	800,995	714,307	842,512	568,304
1990	730,796	796,478	1,013,598	715,900
1991	67,973	973,473	1,214,528	824,827
1992	17,506	1,090,855	1,315,113	1,020,467
1993	(77,204)	1,288,107	1,461,220	1,179,801
1994	563,662	1,372,653	1,437,895	1,318,351
1995	911,583	1,416,328	1,244,887	1,342,340
1996	967,820	1,437,933	1,380,580	1,335,380
1997	1,330,845	1,466,597	1,388,626	1,288,376
1998	1,447,013	1,705,122	1,873,491	1,273,605
1999	1,748,383	1,799,425	1,931,241	1,263,308
2000	1,002,895	1,898,135	1,928,703	1,279,711
2001	1,242,993	2,134,640	2,214,147	1,394,387
2002	(2,557,807)	2,136,185	2,323,525	1,453,299
2003	(3,312,914)	2,448,700	2,785,025	1,735,936
2004	(1,444,016)	2,166,943	1,912,757	1,580,903

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was “ICAO Financials Module,” by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

British Airways Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(249,455)	228,853	455,586	46,697
1981	11,197	210,425	335,227	49,635
1982	287,584	164,927	292,769	19,024
1983	408,665	154,420	257,579	16,877
1984	377,397	136,790	240,402	14,420
1985	284,987	166,286	319,606	95,483
1986	273,058	215,049	404,009	113,405
1987	444,821	272,012	503,147	158,811
1988	598,011	361,991	613,745	123,838
1990	649,896	443,906	657,030	134,816
1991	303,369	508,549	784,423	154,314
1992	596,315	503,496	673,688	492,177
1993	515,620	500,662	731,179	524,083
1994	745,229	469,517	784,879	559,990
1995	1,029,557	496,416	816,784	617,921
1996	1,220,650	489,411	986,477	686,648
1997	1,168,288	593,240	1,009,940	834,990
1998	831,259	587,641	1,326,665	795,037
1999	760,882	582,596	1,271,020	1,522,653
2000	155,968	574,769	1,138,208	1,650,503
2001	561,591	520,720	972,577	1,653,891
2002	(174,137)	491,398	980,779	1,625,829
2003	485,231	496,211	996,142	1,803,942
2004	745,173	598,486	1,057,827	1,526,632

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

Delta Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	164,179	324,929	278,526	179,498
1981	86,505	369,178	310,978	206,527
1982	(85,948)	421,008	311,415	242,883
1983	(57,207)	457,471	317,592	291,037
1984	287,344	489,761	314,762	331,620
1985	231,207	541,339	346,986	358,897
1986	225,003	520,047	391,856	301,790
1987	434,243	654,776	512,861	413,386
1988	524,637	804,610	630,364	571,899
1990	676,550	893,656	679,940	596,125
1991	(235,128)	1,014,056	785,979	672,374
1992	(266,353)	1,201,533	960,996	899,762
1993	(825,508)	1,424,999	1,196,472	1,169,008
1994	(274,908)	1,520,566	1,158,437	1,214,449
1995	(215,110)	1,468,832	1,120,844	1,145,715
1996	1,038,427	1,498,161	990,553	1,005,426
1997	571,113	1,758,628	974,682	1,408,617
1998	1,621,277	1,491,145	1,114,795	1,036,053
1999	1,793,140	1,471,719	1,235,862	1,138,334
2000	1,261,086	1,510,071	1,291,675	1,673,563
2001	1,459,357	1,756,585	1,515,885	1,272,048
2002	(971,982)	1,893,280	1,449,857	1,320,793
2003	(1,035,369)	1,981,477	1,309,915	1,293,094
2004	(1,157,165)	2,028,649	1,168,779	1,310,257

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

Iberia Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(89,042)	119,953	176,379	60,379
1981	(7,002)	109,568	142,257	13,102
1982	62,551	97,709	142,392	11,627
1983	(82,776)	81,487	141,498	11,016
1984	65,162	65,588	112,969	13,451
1985	76,870	68,808	124,217	8,507
1986	130,241	108,709	176,588	14,629
1987	326,483	147,052	215,909	31,969
1988	277,970	169,352	222,645	157,605
1990	80,650	192,349	259,476	205,133
1991	(107,578)	241,111	312,825	277,061
1992	(185,270)	263,377	326,884	294,277
1993	(120,874)	306,357	393,042	232,659
1994	(130,839)	303,838	272,952	193,792
1995	44,424	298,929	241,786	210,375
1996	202,795	294,911	221,962	269,018
1997	269,001	288,257	275,223	271,911
1998	244,454	283,186	256,190	358,415
1999	320,980	271,293	294,106	619,407
2000	34,790	312,677	348,706	570,511
2001	33,471	342,867	307,583	436,826
2002	(22,274)	333,882	292,159	533,832
2003	216,779	358,963	285,188	473,394
2004	157,429	405,461	294,178	628,105

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

Jal Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	43,955	190,290	210,837	177,063
1981	52,866	205,785	221,038	201,415
1982	(33,296)	201,529	214,098	197,955
1983	89,694	214,072	224,258	238,407
1984	156,001	221,206	243,066	261,362
1985	88,524	248,251	319,919	295,727
1986	181,043	340,755	475,037	445,730
1987	398,598	412,299	569,745	590,266
1988	564,717	479,279	647,648	779,232
1990	516,386	479,657	637,575	843,482
1991	193,461	535,459	712,604	905,361
1992	(97,302)	623,510	796,703	1,075,975
1993	(388,285)	663,286	785,228	1,118,078
1994	(273,036)	720,762	780,483	1,008,663
1995	(99,855)	798,633	871,902	1,078,665
1996	159,123	835,564	961,030	1,330,551
1997	40,203	726,847	859,259	1,233,566
1998	251,376	667,257	771,597	1,123,874
1999	192,876	599,352	756,291	1,098,591
2000	260,002	686,280	867,937	1,290,344
2001	505,010	671,968	901,697	1,346,989
2002	(131,107)	582,742	885,505	1,211,229
2003	7,934	578,906	1,001,859	1,228,870
2004	(685,931)	616,312	1,169,864	1,570,523

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was “ICAO Financials Module,” by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

Lufthansa Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(1,521)	194,137	303,363	237,079
1981	13,968	172,084	270,863	235,870
1982	56,099	161,899	266,454	260,453
1983	139,807	177,264	466,620	279,965
1984	249,061	167,614	471,664	280,599
1985	70,421	168,682	546,776	317,274
1986	19,702	245,876	753,817	450,842
1987	105,664	340,289	901,999	568,332
1988	150,338	378,648	944,336	678,150
1990	73,342	390,097	1,019,118	695,682
1991	(134,655)	492,756	1,257,460	886,464
1992	(215,330)	532,237	1,331,354	980,197
1993	(414,431)	475,726	925,034	1,057,536
1994	(6,979)	401,686	372,337	894,928
1995	367,773	485,666	340,532	970,693
1996	248,553	656,812	992,453	870,804
1997	270,191	758,905	994,372	997,131
1998	616,371	606,909	882,610	932,851
1999	1,031,059	587,551	909,143	924,411
2000	144,160	598,667	836,060	846,253
2001	583,357	594,787	844,422	737,482
2002	(158,249)	589,148	1,010,377	718,957
2003	400,336	639,168	1,022,838	698,747
2004	(28,571)	690,692	1,106,909	1,329,184

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was “ICAO Financials Module,” by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

Scandinavian Airlines Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(3,564)	76,526	164,176	95,377
1981	4,052	66,621	135,165	71,709
1982	54,323	62,296	126,873	82,316
1983	82,018	68,916	186,626	91,800
1984	117,736	70,205	218,978	100,107
1985	89,130	92,453	239,663	96,818
1986	149,426	138,188	279,512	165,753
1987	131,978	219,028	468,014	223,848
1988	222,843	225,453	437,538	145,737
1990	157,773	214,976	285,547	169,121
1991	237,658	257,941	342,964	145,029
1992	204,806	362,464	394,392	168,080
1993	168,322	217,968	351,605	184,984
1994	(30,632)	260,559	329,575	245,179
1995	118,796	256,719	319,305	187,107
1996	355,189	292,790	342,907	379,188
1997	229,058	321,157	402,825	400,590
1998	244,631	333,778	399,856	343,552
1999	184,894	364,384	409,382	423,334
2000	31,911	358,252	471,207	401,845
2001	93,274	337,708	421,262	432,511
2002	(213,690)	334,212	453,275	468,170
2003	(64,434)	369,539	499,234	441,729
2004	(257,560)	432,701	530,636	271,090

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx

United Data

Year	Operating profit (loss)	Flight crew costs	Maintenance costs	Aircraft ownership costs
1980	(67,929)	548,637	488,439	224,034
1981	(146,729)	576,747	471,355	233,932
1982	(68,549)	577,574	421,260	276,887
1983	152,362	646,611	488,363	310,929
1984	550,005	586,854	580,595	338,171
1985	(328,004)	572,389	600,174	348,565
1986	(10,007)	732,808	798,945	388,842
1987	151,217	797,068	915,141	419,635
1988	668,568	761,275	937,525	449,282
1990	456,856	782,878	1,163,132	559,083
1991	(54,252)	914,113	1,367,725	767,839
1992	(490,606)	1,066,326	1,422,996	998,668
1993	(496,470)	1,200,408	1,397,405	1,204,746
1994	295,191	1,355,729	1,516,009	1,366,596
1995	512,969	1,378,640	1,624,482	1,467,599
1996	831,937	1,361,295	1,689,990	1,552,738
1997	1,130,224	1,506,425	1,815,543	1,533,610
1998	1,225,507	1,698,275	2,096,940	1,491,855
1999	1,435,194	1,805,319	2,141,197	1,497,882
2000	1,357,927	1,854,145	2,265,418	1,488,347
2001	740,828	2,059,894	2,340,149	1,618,048
2002	(3,743,100)	2,344,509	2,363,590	1,580,308
2003	(3,021,810)	2,306,629	2,088,147	1,516,082
2004	(1,553,749)	1,519,485	1,799,872	1,246,265

Note. The operating profit (loss), flight crew costs, maintenance costs, and aircraft ownership costs for 1980 through 2004 are in U.S. dollars and in thousands of dollars. The source of the data was "ICAO Financials Module," by Air Transport Intelligence, n.d. Retrieved November 11, 2006, from http://www.icaodata.com/default.aspx