COMPARISONS IN MEASURING AIRLINE PERFORMANCE BETWEEN FINANCIAL FACTORS AND TRAFFIC FACTORS:

Focused on the Leading Air Carriers in Asia-pacific

By

Dong-hyun Lee

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
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ABSTRACT

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Abstract: Traditional ways of measuring factors in airline performance are examined. Unlike other industries, airlines apply two kinds of quantitative measures to see operation results: financial figures and traffic ones. Here, seven financial factors and seven traffic factors are chosen and tested. Those figures to investigate operation performances of fifteen leading Asia-pacific airlines from 2000 until 2004 are acquired from public notices as secondary data sources. By carrying out correlation, t-Test, regression, and time-series on SPSS v.10, the following outcomes are found. First, financial results and traffic results are not linearly related much: when $p < 0.01$, ten cases of forty-nine combinations match. Second, in all six traffic factors are correlated with three financial assets-factors, while only one traffic factor is correlated with a financial equity-factor. Third, overall there is no striking difference in financial/traffic performance between alliance airlines and non-alliance airlines. On the other hand, there is remarkable difference in financial/traffic performance between the Far-east Asia airlines and the Southeast Asia airline. Based on the above consequences, two models in Debt Ratio vs. Freight Ton-Km., and Return on Assets vs. Load Factor are created. Lastly, Return of Assets and Load Factor in 2005 are presumed, as indicating 4.6% and 73.6% respectively.

Key-words: airlines, financial, traffic, performance, measure

Dedicated to Soon-jeong Cho, and Soho Lee

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

1. Questions in Argument

Air transportation industry is one of the unique business areas. Managing international air carriers(hereinafter, airlines) is a series of challenges and threats. A huge sum of capital is required to establish an airline company. Global mind-sets are needed for the management to run airlines across nations under the strict international laws.

In addition, the industry becomes more and more sensitive to direct/indirect externalities like economic downturn, military disputes, natural disasters, terrorist threats, and air crashes. Under such an internal/external complexity, measuring airlines performance has to be more systematic. On this account the author understands that there may be two hi-lighted arguments over how to measure quantitative factors concerning airlines performance. One is related to selecting factors. The other is connected with estimating consequences.

First, as almost all airlines in the world are corporations, outsiders in general public mainly tend to rely on financial factors such as net profit, or stock value, and also refer to annual reports, or business news. On the other hand insiders or analysts working for the industry rather prefer air-traffic(hereinafter, traffic) factors such as average load factor, carried revenue passenger, or transported revenue ton. Selecting which of the factor is sometimes controversial accordingly. For instance, more passengers this year than that of last year must be a good signal for any airline. But probably the consequence does not always make a hit with higher net profit for the fiscal than for the past years. Thus if

one sticks to nothing but either financial factors or traffic factors, the output to gauge airlines performance can be biased. This issue is the first argument to be tested.

Second, the writer argues whether there may be a linearly mutual relationship between the two kinds of factors. In other words, for example, if passenger yield goes up, it may affect return on equity, or return on assets. This question is the second argument to be mainly examined.

2. Objectives, Scope and Method

■ *Objectives:* The study helps (a) outsiders from air industry select adequate ways of measuring airlines performance; (b) insiders/the management of airlines figure out linear relations between financial results and traffic results, or otherwise.

■ *Scope:* In total 15 leading Asia-pacific airlines are tested. The airlines among the Big-50 in the world are selected in accordance with the world's top 25 airlines 2004 announced by *Air Transport World* 2005. The basic data sources are its Top 25 & 200 lists of *Airline Business* 2005. From the source balance sheets, profit/loss sheets, and annual reports of each airline are also used to collect seven financial factors each year and seven traffic factors each year. The span of period is five years ranging from 2000 to 2004 on fiscal year basis.

■ *Method:* On the quantitative basis it is organized and deployed as follows[1)]: the author (a) reviews briefly other studies on the subjects of

1) A methodology which mainly relies on measuring numeric output corresponding to numeric input, and analyzing the key findings from the output.

airline performance and its measurement, which cause the argument of the study; (b) discusses comparisons of financial/traffic factors; (c) looks over 15 sample airlines about general profiles, recent operations, and business environments in the 21st century; (d) sets up three hypotheses, verifies them, makes a couple of models, and further presumes two kinds of factors as of 2005 through four analytical tests; (e) concludes key findings, noticeable implications/recommendations, and potential limitations of the study.

II. ISSUES IN MEASURING AIRLINE PERFORMANCE

1. Reviews of Prior Researches with Similar Subjects of the Study

It is well known to airline authorities that the field of air transportation relatively possess fewer researches than other business areas. Naturally prior researches on the airline performance, as a special topic, have been rarely at home and even abroad. In addition, almost all domestic researches into measuring factors of the airline performance are biased toward qualitative studies which mainly deal with effects of strategic alliance on airlines, or benefits of frequent flyer program to airlines under a descriptive method. As lacking a process of quantitative analyses and inspections, such an approach befitting to general reports are unnoticed much. It is found that among home studies, only less than five quantitative ones handle issues of the airline performance, while a lot more overseas studies adopt the quantitative/metrical methods. In the <Table 1> several prior researches are introduced which have been referred to the study.

In the case of domestic studies, Lee (2003) advances the argument that value-based estimation and performance measurement associated with EVA/MVA are required to Korea national carriers, as world's successful airlines focus on maximization of their firm value these days.

Suh (2002) tests performance measurement of eleven airlines joining four strategic alliances by using their three kinds of frequent flyer results. Kim and Cho (2000) also examine increasing rates and its significances to investigate code-sharing airlines performances by analyzing their nine kinds of sales operation results.

<Table 1> Prior overseas/domestic researches affecting the study

Region	Author(Year)	Main Idea	Testing	Variables
Abroad	FLOULRIS, Triant WALKER, Thomas (2005)	Financial performance: Low-cost carriers and full-service airlines	Regression Time-series	Current Ratio Debt-assets Ratio Total Assets Turnover Interest Coverage Ratio Net Profit Margin Return on Assets Return on Equity
	CLARKE, J. Paul LEE, Alex MILLER, Bruno (2004)	Airline managerial performance to measure financial health (Air-Score Model)	Discriminant Time-series	Profitability Ratio Leverage Ratio Activity Ratio Investment Ratio
	OUM, Tae-hun PARK, Jong-hun ZHANG, Anming (2000)	Systemic approaches to airlines globalization and alliances based on economic analyses	Correlation Regression	Operating Revenue Net Profit Output Price Route Kilometer Route Numbers Employee Numbers
	WANG, Zhi. H. EVANS, Michael (2002)	Economic impact on airline market and alliance	t-Test Variance	Market Category Airlines Numbers Alliance Type Passenger Numbers Passenger Revenues
Korea	LEE, Soo-jin (2003)	Value-based estimation of airlines management	Correlation Regression	EVA MVA
	SUH, Myong-sun (2002)	Loyalty-marketing performance on strategic alliance airlines	Correlation Duncan Regression	FFP Size FFP Validity
	KIM, Sung-hyuk CHO, In-hwan (2000)	Sales performance on strategic code-sharing airlines	Fundamental t-Test	Revenue Sales Expenses Net Income

In the case of overseas papers, Flouris and Walker (2005) suggest that low-cost carriers and legacy carriers show different operation performances on the short-term basis during post-9/11. They carry out empirical comparisons between financial ratio analyses and stock performance analyses, by applying time-series/cross-sectional approaches. Clarke, Lee, and Millers (2004) examine a way of measuring financial

health for ten American-based airlines. Their adjusted Z-score, called 'Air-score model' analyzes four financial ratios, diagnoses range of financial healthy. And they foresee feasibilities of their safety, viability, bankruptcy, and resuscitation by using MDA[2]. Previous to that, Wang and Evans (2002) conduct ANOVA testing and time-series analysis to check performances/differences of airlines operations and alliances activities, as newly defining systemic alliance variables[3]. And also Oum, Park, and Zhang (2000) handle broad alliance issues and airlines economic concerns; examine empirical testings performances of world's major airlines and alliances; demonstrate how to measure operational productivity, profitability, return, and economic market value.

2. Introductions of a Reference Research and its Model

As stated earlier, Flouris and Walker release a well-organized treatise on measuring airline performance. They practice time-series and cross-sectional methods to look over the performance differences between low-cost carriers and legacy carriers. They also examine the stock and financial performance of three major airlines in the U.S. in the aftermath of the 9/11, terrorist attacks in 2001[4].

Due to the following four aspects, its methodology is worth referring to. Firstly the topic of their paper is closely related to that of this treatise. Secondly their approaches are empirical/quantitative ways based on airline operation information. Thirdly sources of the two studies are

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2) The acronym of "Multiple Discriminant Analysis".
3) The acronym of "ANalysis Of VAriance".
4) The incident resulted in dramatic changes in the air industry and gave significant implications for the economic gains and future perception of the viability of airlines.

the secondary data. Lastly their study gives the writer several academic hints to achieve conceptualization of the variables: what kinds of financial factors are important to explore airlines performance.

Because most airline companies, especially international airlines relatively manage a huge size of assets and make a great outlay to parts of fixed and labor costs. In the sense Flouris and Walker offer a good exemplar, so that the author can group financial ratios into four standards: liquidity ratios, activity ratios, financing ratios, and profitability ratios. Consequently this study directly refers to selection of their financial variables.

III. COMPARISONS BETWEEN FINANCIAL & TRAFFIC FACTORS

1. Understanding of Selected Financial Factors

There are a couple of criteria to select financial factors. The first criteria is the industry foundation. IATA*(International Air Transport Association)* publishes in the end of each year its annual report titled AERP*(Airline Economic Results and Prospects)*[5]. The summary report examines overall financial results on the yearly basis, and breaks down the analysis into passenger aircraft operations and cargo operations. It also includes analyses of yield, of unit cost trends, of effects on currency exchange rates, and of productivity measures. One of the appendixes in the report defines ten financial ratios which are used for its summary within the book. The following financial ratios are composed by three categories: (a) profitability, (b) liquidity, and (c) leverage. The definition is very similar to Flouris' and Walker's. As the AERP states, the following [Figure 1] outlines the calculation of the ten ratios and describes each calculation[6].

The second criterion is the academic foundation. According to the former Flouris' and Walker's logical definitions, the author can also obtain decisive clues to choosing independent/dependent variables, as settling seven financial factors which are commonly used as accounting and financing ratios.

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5) There are two major airline-related world organizations. One is ICAO(International Civil Aviation Organization) which mainly handles aviation laws and issues across airlines and nations. The other is IATA, whereas, definitely deals with commercial practices and technical actions of air transport, travel agency and system criteria.
6) Appendix 2: Financial Ratios - Definitions. p.46, Part 1, AERP as of 2003 December.

[Figure 1] Financial ratios in AERP of IATA: Ways of calculation

PROFITABILITY	
Operating Ratio, %	Operating Revenue / Operating Expenses * 100
Gross Profit Margin, %	Operating Profit / Operating Revenue * 100
Net Profit Margin,%	Net Profit or Result / Operating Revenue * 100
Return in Equity, %	Net Profit or Result / Equity * 100
Total Assets Turnover	Operating Revenue / Total Assets
Fixed Assets Turnover	Operating Revenue / Net Fixed Assets
LIQUIDITY	
Current Ratio	Current Assets / Current Liabilities
Quick(Acid) Ratio	(Current Assets - Inventories) / Current Liabilities
LEVERAGE	
Net Debt/Equity Ratio	Liabilities(Long-term + Current - Bank Deposits) / Equity
Interest Charges Ratio, %	Net Interest / Operating Expenses * 100

Furthermore three categories and six ratios among ten ratios of AERP are the same to those of Flouris' and Walker's[7]. Thus the writer believes that selection of financial factors for this study has no problem with academic and air-industrial.

Seven financial factors of Flouris and Walker are derived from four categories by them: (a) liquidity ratios, (b) activity ratio, (c) financing ratio, and (d) profitability ratio. Liquidity ratios provide measures of a company's ability to satisfy short-term obligations. Activity ratios measures a company's efficiency in managing its assets. Financing ratios provide decisive implications of the risk of a company concerning pay back of its long-term debts. And profitability ratios assist in evaluating

7) Only 'Return on Assets(ROA)' is not specified for the ratio groups of AERP.

various aspects of a company's profit making activities. It is important to remember that when using any financial ratio to assess the overall stability of a company, more than one ratio should be considered when formulating an accurate opinion and analysis. For instance, a firm's solvency ratios may be ideal, but if the ratios that help analyze profitability and activity are bad and sales are stagnant, a much different opinion would be formulated (Flouris and Walker, 2005).

■ *Liquidity ratios: current ratio.* The current ratio measures the ability of the firm to pay its current bills while still allowing for a safety margin above the required amount needed to pay current obligations. The ratio obtained by dividing the total of the current assets by the total of the current liabilities, and we calculate the current ratio accordingly as follows:

Current Ratio = Current Assets / Current Liabilities

■ *Activity ratios: total asset turnover.* The total asset turnover is a measure of how efficiently and effectively a company uses its assets to generate sales. The higher the total asset turnover ratio is, the more efficiently a firm's assets are used. It is known that the ratio is crucial for airlines, especially ranging from mid-sized carriers to low-cost carriers which are normally free from hub airports. And it is rather independent on its industry average, for a high value of the ratio is nothing but caused excessive current assets of a firm. We calculate the total asset turnover ratio as follows:

Total Assets Turnover = Sales / Total Assets

■ *Financing ratios: debt-assets ratio and interest coverage ratio.* Debt-assets ratio is a simple but effective ratio that indicates the firm's

debt-paying ability in the long run. The ratio represents the percentage of assets financed by creditors, and helps to determine how well the creditors are protected in case of insolvency. The higher the ratio is, the greater the degree of outside financing is by creditors. A high debt-assets ratio indicates that the firm has more debt and is risky for creditors. We calculate the debt-assets ratio as follows:

Debt-assets Ratio = Total Liabilities / Total Assets

The interest coverage ratio (sometimes referred to as "time interest earned") measures the ability of the firm to service all debts. The figure measures how many times interest payments can be made with a firm's earning before interest expenses and taxes(hereinafter, EBIT) are paid. The higher the ratio, the more likely the firm can meet its obligations. The figure is determined by the following formula:

Interest Coverage Ratio = Earning Before Interest & Tax / Interest

■ *Profitability ratios: net profit margin, return on assets, and return on equity.* They enable us not to over-estimate/under-estimate any firm's performance, as simply having a look at its bottom line - as a kind of absolute number. The net profit margin measures the amount of profits available to shareholders after interest and taxes have been deducted on the income statement. It is calculated as follows:

Net Profit Margin = Net Income / Sales

The return on assets(ROA) measures the firm's ability to utilize its assets to create profits by comparing profits with the assets generating profits. The equation is as follows:

Return on Assets = Net Income / Total Assets

The return on equity(ROE) measures the return earned on the

owners' equity in the firm. The higher the rate, the better the firm has increased wealth to shareholders. The basic formula is as follows:

$$\underline{\textit{Return on Equity = Net Income / Stockholders' Equity}}$$

2. Understanding of Selected Traffic Factors

In comparison to financial factors, selecting and defining traffic factors are relatively transparent to be understood. That is because unless the purpose of a certain examination is exceptional, IATA, airlines, and air industry journals are using fixed traffic definitions to measure transportation performances, and to rank transport volumes. Occasionally, each airlines use flexibly uncommon factors, according to their managerial focus and operational size.

On the contrary, utilizing traffic factors and their definitions are still in common to the airline transportation industry. Trends of choosing factor have changed by the ways of business and the management interest, while we preferred load factor in 1980, yield factors in 1990, and nowadays we have further focused on revenue factors since 2000[8]. Consequently along with the author's empirical viewpoint, professional expertise working for IATA, and analysts' advice of the company where the author works at, seven objective factors are rather subjectively selected[9]. The factors are defined and used at AERP issued by IATA and the secondary data sources.

■ *Passenger traffic factors: available seat-kilometers, revenue*

8) The tendencies are referred from the internal interviews with Asiana Airlines' staff.
9) For more than 13 years since 1992 the author has worked at an airline with expansive carriers, as devoting himself to the areas of passenger reservation, loyalty marketing, strategic alliance, and travel agency e-business.

passenger-kilometers, passenger on board. Available seat-kilometers(ASK) is used in judging the size of airlines, in parallel with the revenue passenger-kilometers(RPK). Where RPK measures an airline's actual traffic, ASK measures an airline's potential traffic. The main drawback in ASK is that it doesn't give any indication of whether an airline's load factors are good. Since the advent of computerized reservation systems, RPK and ASK figures tend to be fairly close, since most airlines can fill their seat with little difficulty. Lastly, the passenger on board is an intuitive factor which can be simply earned to count every single passenger on the planes, regardless of revenue or non-revenue. We respectively calculate ASK and RPK accordingly as follows:

Available Seat-kilometers = Number of seats available for sale * Total distance

Revenue Passenger-kilometers = Number of revenue passengers * Total distance[10)]

■ *Freight(Cargo) traffic factors: Freight Tonne-Kilometers.* The Freight tonne-kilometers is used in gauging the size of air cargo carriers. If an aircraft carries 100 tonnes of cargo 1,000 kilometer, it earns 100,000 FTK's toward the airline's total. FTK is the fairest way to measure to cargo carrier's size, as it is a composite of raw tonnage and of the size of the carrier's route network. The passenger airline equivalent to FTK is RPK. We calculate FTK accordingly as follows:

Freight Tonne-kilometers = Number of revenue tonnes of freight * Total distance

■ *Passenger Revenue factors: Passenger Load-factor, Passenger Yield.* The passenger load-factor is expressed as the percentage of total passenger capacity utilized. In other words, it is the same to value of RPK divided by ASK. Whereas the passenger yield is written as the average

10) Those carried at 25% or more of the normal applicable fare.

revenue from transporting one passenger over one kilometer. Similarly, the value is the passenger traffic revenues divided by RPK. The passenger load-factor can be going high easily, in case each ticket price is extremely low. On the contrary, the passenger yield can be going up readily, in case each ticket price is very much high. They are used in the field because of their complementary natures accordingly.

Passenger Load-factor = Revenue Passenger-kilometers / Available seat-kilometers

Passenger Yield = Passenger traffic revenue / Revenue passenger-kilometers

■ *Aircraft factor: Number of fleets.* The number of fleets is used in simply judging airline's apparent scale and its transport capability. The definition includes any type of airplane for both passenger and freight irrespective of size, in case the aircraft is purchased and leased. But in general short-term based rental aircraft is not included.

For brevity <Table 2> describes all selected factors. The three-lettered variables referring over the following chapters onwards are used in the process data analysis for the sake of convenience.

<Table 2> Measurement variables: seven financial & seven traffic factors

Financial Factor	Variables Name	Traffic Factor	Variables Name
Current Ratio	CRR	Passenger load-factor	LDF
Debt-assets Ratio	DAR	Passenger Yield	YLD
Total Assets Turnover	TAT	Passengers on Board	PAX
Interest Coverage Ratio	ICR	Revenue Passenger-Km.	RPK
Net Profit Margin	NPM	Available Seat-Km.	ASK
Return on Assets	ROA	Freight Tonne-Km.	FTK
Return on Equity	ROE	Number of Fleets	FLT

IV. GENERAL OVERVIEWS OF 15 AIRLINES IN ASIA-PACIFIC

1. Facts on Data Source & Sampling Standard for Quantitative Analyses

The data sources of most results are *Air Transport World*(hereinafter, ATW) and *Airline Business*(hereinafter, ABZ) which are known as the distinguished airline journals. Nonetheless the information from the sources are not enough to refer to, the other results have been taken from annual reports, and investor relations submitted by the airlines over their web-sites. Other indirect/minor sources include returns to regulatory bodies such as IATA and ICAO, or other national civil aviation bodies and press statements. The scope of financial and traffic results includes cargo operation performance, and partially non-air business performance, according to each airlines accounting and managerial standard. <Table 3> shows 15 sample airlines and the criteria of selection from the ATW and ABZ.

■ *Definition of Regions: region entity, region definition.* For IATA purpose, the world has been split into the geographical regions as outlined below:

■ *Region Entities:* Ten nations are introduced. Hong Kong is the part of China, but it has another governing system, so it is the independent entity in the study. China Taipei, known as Taiwan is also the separate entity from China mainland. Korea stands for South Korea.

■ *Region definition:* In the ABZ and the AERP, Asia-pacific includes Australia and New Zealand. Both countries are within the scope of this paper. The region of the Asia-pacific in the study consists of the Southeast Asia, the Southwest Pacific, and the Far-east Asia. Korea,

Japan, and China mainland are in the Far-east Asia. Most countries including Hong Kong within geographic boundary of the Southeast Asia are in the definition of the Southeast Asia. Australia and New Zealand are in the definition of the Southwest pacific.

<Table 3> Basic definitions: 15 Asia-pacific airlines

Rank	Airline	Code	Nationality	Alliance	Region
1	Japan Airlines Group	JL/JAL	Japan	-	Far-east Asia
2	ANA Group	NH/ANA	Japan	Star	Far-east Asia
3	Qantas Airways	QF/QFA	Australia	Oneworld	Southwest Pacific
4	Singapore Airlines	SQ/SIA	Singapore	Star	Southeast Asia
5	Korean Air	KE/KAL	South Korea	Skyteam	Far-east Asia
6	Cathay Pacific	CX/CPA	Hong Kong	Oneworld	Southeast Asia
7	Air China Limited	CA/CCA	China	-	Far-east Asia
8	Thai Airways	TG/THA	Thailand	Star	Southeast Asia
9	Malaysia Airlines	MH/MAS	Malaysia	-	Southeast Asia
10	China Southern Airlines	CZ/CSN	China	-	Southeast Asia
11	China Airlines	CI/CAL	China Taipei	-	Far-east Asia
12	Asiana Airlines	OZ/AAR	South Korea	Star	Far-east Asia
13	China Eastern Airlines	MU/CES	China	-	Far-east Asia
14	EVA Air	BR/EVA	China Taipei	-	Southeast Asia
15	Air New Zealand	NZ/ANZ	New Zealand	Star	Southwest Pacific

Source: 'Top 25 Airlines', Air Transport World July, 2005.

2. Reviews of Operational Environments and Incidents around Asia-pacific

■ *Overall market situation:* Even the Asia-pacific market has been flourishing due to rapid economic growth rate, it has been a long hard down-turn since 2001. Unsurprisingly the year of 2003 was at the peak of slump for all Asia-pacific airlines because of SARS crisis, and war in Iraq. Asia-pacific had 13 million fewer passengers in 2003[11]. However

11) For the full year 2003, the downturn caused by the Iraq was and SARS caused RPKs to drop 9.7%, to 422 billion. The number of passengers declined by 12.1% to 95.8 million - equivalent to three years of lost growth. The seat load factor for the year was down by nearly 5 points, to an overall 69.7%.

with the increasing numbers of international passengers traveling to and from the Asia-pacific region, the airlines industry has suffered rather less in the region than it has worldwide as <Table 4>.

Several external hardships taking place for three years from 2001 around the region were not serious much. A resounding rebound in world passenger traffic finally put the numbers decisively ahead of the previous peak in 2000[12]. While most analysts predict that traffic will settle down to something like it former long-term growth rates, oil price and slowing economics could still spoil the outlook. Nevertheless there is little doubt that 2004 and 2005 must be rebound years.

<Table 4> Top 200 passenger airline statistics by region - 2004

Region	RPK			Load-factor		Passenger		Yield(RPK)		Airline
	billion	change	share	rate	change	million	change	cent	change	number
Africa	69.6	13.0%	1.9%	68.6%	2.4	30	11.1%	8.16	4.2%	10
Asia-pacific	949.7	19.6%	26.1%	71.4%	2.8	478	16.7%	7.89	5.4%	52
Latin America	1,036.7	10.1%	28.5%	75.9%	0.8	541	9.3%	10.83	4.7%	72
Middle East	137.4	13.7%	3.8%	68.9%	2.6	80	4.8%	8.36	2.0%	17
North America	146.9	24.1%	4.0%	70.9%	1.7	58	16.0%	6.70	3.3%	10
Total	1,300.2	11.8%	35.7%	75.3%	2.0	750	8.2%	7.83	-0.1%	39

Source: 'Airline Rankings - Passenger Analysis', Airline Business August, 2003.

That is mainly because with the economic boom in the region coupled with a greater tourist presence, the number of people visiting the region is likely to increase and hence push industry growth further. At the net level, Asian carriers have continued their strong performance, while European airlines achieve a net result of just over $1 billion.

12) The strongest growth was in 2000 when the industry grew by 3.6%. In the 1999-2003 period the compound annual growth rate(CAGR) of the industry was 0.7%.

Compared to either European or the U.S. airlines, Asia-pacific carriers have more competitive labor costs and high productivity levels, networks that are focused more on long-haul flying and a big cargo component.

■ *Competitive Landscape from 2001 to 2004:* Following the terrorist attacks in 2001, Cathay Pacific, China Airlines, and Eva Air reported a deferment of travel to the North America. Korean Air, Asiana Airlines, Japan Airlines, and All Nippon Airways were also severely affected due to the sensitivity of the Japanese and Korean industries to services to and from the North America. The effect of this tragedy seems to be subsiding however, with consumer faith returning to the industries.

Whilst Asiana Airlines faced the same rising costs as other carriers, domestic demand and intra-regional traffic has held up relatively well following September 2001. Carriers such as Malaysia Airlines and other Southeast Asia based airlines are still restructuring while Korean Air and Asiana Airlines, with high exposure to the U.S. routes, announced route cutbacks that have stayed to this day.

Many of the airlines in the Asia-pacific have incurred financial hardship due to increasing fuel and insurance costs, depreciating currencies and softening demand for travel to the Middle East and the North America. Carriers that were particularly vulnerable to the effects of a decrease in passenger demand included Malaysia Airlines, Japan Airlines, and All Nippon Airways. In addition, particularly for pilots and other qualified staff, there are one or two pressures emerging on labor costs in many airlines except for those of China. That's why the recent join in the high-growth league is mostly the share of the China

mainland's carriers.

Lastly, one remarkable fact is that eight companies among major Asia-pacific airlines are the members of the Big-3 global strategic alliances. Necessarily each members share strategic goals of the each alliance, as offering customer global access, and providing seamless service within the alliance by setting more code-share networks. However as long as many routes are overlapped between carriers, especially for the Star Alliance members, there might be a potential and internal competitiveness across cobweb-like routes of the alliance.

■ *Operational challenges in the 21st century:* A lot of big incidents have occurred around Asia-pacific and adjacent regions such as a battle in Iraq, SARS, 9/11, rise in crude oil prices, Tsunami, and sluggish market. Such indirect/direct impacts on the air transportation business have tremendously posed financial troubles on Asia-pacific airlines without any exception. The consequences are too wide and complex to cope with them on short-term basis. Thus some cases are still working on operational challenges, in terms of finance/operation. <Table 5> shows hi-lighted happenings from 2001 until 2004.

3. Profiles of 15 Airlines and Reports in Outlines in the 21st Century

■ *Japan Airlines(IATA Code, JL/JAL):* Japan Airlines Group is Japan's number one airline, transporting around 33 million passengers a year. For the fiscal year ended March, 2005, the company earned revenue of $19,841 million. JAL is currently owned by Japan Airlines Systems Corporation, a holding company founded in 2002 by the merger of JAL and Japan Air Systems(JD/JAS). The two companies are running

separately but are to be fully integrated in 2004. JAL is headquartered in Tokyo, Japan.

<Table 5> Hi-lighted incidents affecting Asia-pacific airlines business[13)]

Category	Actual Case	Time	Origin/ Impact Route	Degree	Duration
Warfare	Iraq Battle	2Q/2003	Iraq/Middle Asia, USA	High	Mid
Epidemic	SARS	4Q/2002	China, Southeast Asia	High	Mid
Terrorism	9.11	3Q/2001	USA/Worldwide	High	Short
Natural disaster	Sea-quake[14)]	4Q/2004	Indonesia/Southeast Asia	Medium	Short
Energy shock	Rise in oil prices	2Q/2004	Worldwide/Worldwide	Medium	Long
Recession	Underconsumption	3Q/2003	Korea, Japan/Far-east Asia	Low	Long

The company's activities include scheduled and non-scheduled air transport service and aircraft maintenance service. As the holding company, it is also responsible for the control and administration of business activities of affiliated companies relating to air transport and aircraft maintenance.

■ *All Nippon Airways(IATA Code, NH/ANA):* All Nippon Airways is Japan's second largest carrier as well as the biggest in-country player, as operating between 35 local destinations and 25 international destination in 12 countries. ANA posted sales of $12 billion for 2004, an increase 6.5% compared to 2003. The company also operates an international hotel chain and is involved in businesses such as maintenance and ground support. All Nippon Airways is headquartered in Tokyo, Japan.

■ *Qantas Airways(IATA Code, QF/QFA):* Qantas Airways, established in 1920 as Queensland and Northern Territory Aerial Services Limited,

13) Duration - Short: less than 6 months, Mid: 6 months to 1 year, Long: over 1 year.
14) So-called, Tsunami.

today operates a range of flying business and a diverse portfolio of airline-related businesses. In particular the airline owns four subsidiary airlines including a young low-cost carrier. Thus Qantas and its affiliates employ nearly 35,000 people, operate 188 airplanes, and offer customers nearly 6,000 flights each week covering in-country, New Zealand and worldwide networks. It has a reputation for excellence in safety, reliability and maintenance skill. But it now faces significant restructuring challenges, for Australia moves further to full open skies agreement with Singapore and the UAE, and the government lifts foreign ownership caps on Qantas to increase share values and ease pressure on capital access. The airline is a member of Oneworld Alliance at the leading position, and headquartered in Sydney, Australia.

■ *Singapore Airlines(IATA Code, SQ/SIA):* Singapore Airlines, one of the best airlines in the world, is the country's national commercial and freight air carrier. For year ended March 2004, the company generated revenues of $5.6 billion. The company's main activity is as a commercial airline along with a subsidiary airline, Silk Air. SIA's other activities are airport terminal services, catering and engineering services. It flies to over 120 cities worldwide without serving any domestic route, and has its headquarters in Singapore.

■ *Korean Air(IATA Code, KE/KAL):* As a leading member of Skyteam which is one of the mega alliances, Korean Air is the biggest carrier in Korea, the largest operator of cargo service among the region's airlines, ahead of SIA and JAL. And also it is the 3rd-largest airfreight operator as of 2002 in the world, and the largest gain on the trans-pacific routes. Recently the airline announced 1Q2004 financial results that were above

outsider projections for the period at the net profit line. But since the end of 1990, it has showed a significant leverage within capital structure, as rapidly changing aging jet-planes. A bad reputation concerning frequent crashes for more than 20 years causes such a strong drive of the aircraft renewal program which is regarded as a successful fleet restructuring. Route expansion is focused on China and the U.S., and the China traffic, a very profitable market, is 10% of the total. The company also operates a domestic hotel chain and three huge maintenance hangars. KAL is headquartered in Seoul, Korea.

■ *Cathay Pacific(IATA Code, CX/CPA):* Cathay Pacific, mainly owned by Swire Pacific Group, operates scheduled passenger and cargo services to around 80 worldwide destinations. For the year ending 31 December 2004, 5,016 million, a rise of 32.1% on the previous year. The company has a fleet of over 80 aircraft and its subsidiaries provide other flight related services in Hong Kong such as catering and maintenance. CPA is headquartered at Hong Kong's Cheklapkok International Airport.

■ *Air China(IATA Code, CA/CCA):* As a China's flag carrier, Air China listed in December in 2004 when Cathay Pacific took a 9.9% stake, signaling much closer equity and operational ties. It is expected that further significant aircraft orders will be placed to handle the capacity demands of the 2008 Beijing Olympics, for which Air China is the official carrier. It has a fleet of 151 aircraft that fly to 72 domestic and 36 international as well as regional destinations. CCA is headquartered in Beijing, China mainland.

■ *Thai Airways(IATA Code, TG/THA)*: Thai Airways, is operating a total of 83 aircraft in its fleet in 2004, shows 40th consecutive year of

profitability upon the fiscal year of 2004. Further to playing in a global airlines alliance, the Star, THA tries to establish tourism alliance to promote Thailand tourism and travel industry to help revive the Thai economy. Thus the airline increases cooperation at domestic and regional level to strengthen the airline's competitive edge and expand market share, as low-cost carriers continuously come up around the Southeast Asia. Especially a revamped and restructured THA responds well to the Tsunami tragedy that devastated some popular holiday destinations in southern Thailand. Traffic is now quickly getting back to normal after providing significant aid for relief work. For the year ended September 2004, it posted a net profit $243 million despite soaring fuel prices. The company is headquartered in Bangkok, Thailand.

■ *Malaysia Airlines(IATA Code, MH/MAS)*: As for Malaysia airlines, the financial year end March 2004 was one of significant achievement. Because MAS recorded the best performance since the airlines listed in 1985 despite of the onset of Iraq battle and the outbreak of SARS. Thanks to double digits increase rate annual, in a $184 million, two-year upgrade, its 34 fleets will be refitted with the cabin beds and a new IFE system which offer 350 entertainments on demand. It launched new services to some Europe, increased in frequency to existing India and China destinations. To meet capacity requirement, the airlines is looking at additional 60 leases/orders to replace old airplanes. On the cargo front, it will receive two more mega freighters. It runs 110 small and large planes that fly to 32 domestic and 78 international/regional destinations. MAS has its headquarter in Kuala Lumpur, Malaysia.

■ *China Southern Airlines(IATA Code, CZ/CSN):* China Southern Airlines is China's next largest airline. For the fiscal year ended in December 2004, the company generated sales of $2,897 million. It operates a fleet of more than 120 jets, and serves approximately 350 destinations worldwide, including 285 domestic airports. CSN has many code-sharing agreements with Delta Air Lines, Japan Air Systems, and Vietnam Airlines. Its headquarters is in Guangdong, China.

■ *China Airlines(IATA Code, CI/CAL):* China Airlines runs flights to around 50 cities in 25 countries. It has locations in many countries around the world, including the U.K., the U.S., Germany, Australia, and Japan. The company reported total revenue of $2.89 billion for fiscal 2004, a increase of 26.8% on fiscal 2002 results. Net profit was 125.7 in 2004. The company is headquartered in Taipei, Taiwan.

■ *Asiana Airlines(IATA Code, OZ/AAR):* Asiana, founded in 1998 as a second national international carrier of South Korea, is fast-growing airlines, as entering the Star Alliance in 2003. Asiana prospered over the past eight years from Korean Air's safety woes, which the government banning Korean from new routes and giving them to Asiana. Nevertheless until the end of 1990's its performance was not remarkable due to excessive cost of capital resulting from high leverage investment and weak finance structure. However by succeeding in many-sided restructures and severe assets disposals for financial re-engineering, its operation has started improving noticeably since 2002. And near future growth also looks promising. Because strength of the KRW against the USD has a positive effect; the radical demand for cargo and passenger service in the Asian-pacific affects its on-going profitability. The airline

with about 6,500 directors/employees carries more than 1 million home/foreign passengers on the monthly mean by utilizing 63 planes. AAR is headquartered at Seoul Gimpo Airport, Korea.

■ *China Eastern Airlines(IATA Code, MU/CES):* China Eastern Airlines is one of China's three major airlines. CES's annual traffic growth is extremely outstanding, as its traffic change, for instance from 2003 to 2004, shows 51.0% as ranking eight among Top-25 fastest traffic growth airlines. For the fiscal year ended in December 2004, the company generated sales of 2.54 billion. The company operates passenger and cargo aircraft between 210 destinations in China and abroad. Like other china carriers, CES has also a plenty of code-sharing agreements with Air France, All Nippon Airways, American Airlines, and Qantas. The company is headquartered in Shanghai, China.

■ *Eva Air(IATA Code. BR/EVA):* Eva was established in 1989 as a 100% privately owned Taiwan-based airline as an affiliate of Evergreen Marines Corporation, the world's leading container-shipping line. Under the managerial influence of its mother company, Eva air's cargo operation has much more competitive than its passenger business. From the maiden flight on 1991, EVA has grown steadily and today. It serves 43 major destinations with a fleet of 50 aircraft including 17 cargo airplanes. As a result of the cargo-focused business, its FTK ranks within ten in the world. The airline also has a joint-venture with General Electric for managing the second maintenance hangar at Taipei airport. EVA is headquartered in Taoyuan Hsien, Taiwan.

■ *Air New Zealand(IATA Code, NZ/ANZ):* Air New Zealand, the greatest national carrier of New Zealand, is at the turning point in its

history. Since acquiring a huge airline, Ansett Australia, at the end of 1990's - turned out to be failed -, the airline has experienced a severe financial and operational restructuring so far. All significant legal disputes involving probable loss have been provided for in the accounts. Even there remains the possibility that litigation could still be pursued against the company for losses arising out of the collapse of Ansett in September 2001. Various cost problems are the keys to overcoming the terrible after-shock of M&A with Ansett and non-airline businesses, despite of the recent better performance. Air New Zealand operates nearly 90 planes. In the meantime replacing is going on introducing new wide-body planes and up-to-date economical jets for regional routes. ANZ is headquartered in Auckland, New Zealand.

V. QUANTITATIVE ANALYSES AND TESTS

1. Conceptual Frameworks

This empirical analysis is conducted through ten stages, as [Figure 2] represents. It steps in brief (a) the routine pre-stage ranging from 'initial argument' to 'confirmed argument'; (b) the topic settlement regarding airlines performance measurement; (c) definition of 14 variables for seven financial factors and seven traffic factor; (d) review of ATW and ABZ; (e) selection of 15 airlines in Asia-pacific. <Table 6> shows the criteria how to select them from ATW and ABZ. All of the leading airlines rank within 25 based on different measures which result in different rankings at the highest on ATW, and hold Top 50 rank in the Asia-pacific, according to ABZ's Top 150.

<Table 6> Standards of selection: 15 Asia-pacific airlines[15)]

Rank	Airline	Top 25 on ATW	Category of Top 25	Number of Top 25	Top 150 on ABZ	Revenue as Top 150
1	Japan Airlines Group	3	Op. Revenue	7 of 7	3	19,794
2	ANA Group	7	Op. Profit	6 of 7	9	11,752
3	Qantas Airways	6	Op. Profit	5 of 7	12	7,837
4	Singapore Airlines	1	Net Profit	5 of 7	14	7,276
5	Korean Air	3	FTKs	6 of 7	18	7,031
6	Cathay Pacific	4	Net Profit	5 of 7	22	5,009
7	Air China Limited	11	Op. Profit	6 of 7	23	4,054
8	Thai Airways	13	Op. Profit	6 of 7	24	3,679
9	Malaysia Airlines	23	FTKs	2 of 7	28	3,061
10	China Southern Airlines	14	Passenger	2 of 7	31	2,897
11	China Airlines	8	FTKs	2 of 7	32	2,891
12	Asiana Airlines	14	Net Profit	2 of 7	36	2,628
13	China Eastern Airlines	23	Op. Profit	3 of 7	38	2,542
14	EVA Air	9	FTKs	1 of 7	39	2,485
15	Air New Zealand	24	Net Profit	1 of 7	41	2,196

Source: Air Transport World July, 2005., and Airline Business July, 2005.

15) Sorted by top 150 airlines ranking defined by Airline Business, 2005.

Through the couple of magazines, annual reports, financial sheets available on the airlines' web-sites, total five fiscal years' raw data are collected. In terms of the conceptualization and then operational definitions of samples and variables, we refer to the preceding chapters, III. and IV. respectively.

The ways of comparison employ both cross-sectional and time-series analysis. The cross-sectional analysis includes in total 14 financial and traffic factors over the 15 airlines. The time-series analysis covers their financial and traffic results over time from 2000 to 2004 for five fiscal years. The collected data are manually re-treated by MS-Excel to make workable variables. And afterwards correlation, t-Test, regression, and time-series are processed to check hypotheses, and produce models as well as presumptions. [Figure 2] depicts the test steps and processes mainly composed of four statistical procedures running on SPSS v.10.

■ *Correlation:* To see linear relations between financial factors and traffic factor, correlation analysis associated with Pearson's co-efficient is applied to the 14 factors which are all ratio scale. 정충영・최이규(2002) assert that Pearson's co-efficient(Y_p) ranging from +1 to -1[16]. If Y_p is more than +/- 0.8, the variables are in a very high relation. If Y_p is +/- 0.6~0.8, they are in a high relation. In case Y_p is +/- 0.4~0.6, and +/- 0.2~0.4, the relations are in medium and in weak respectively.

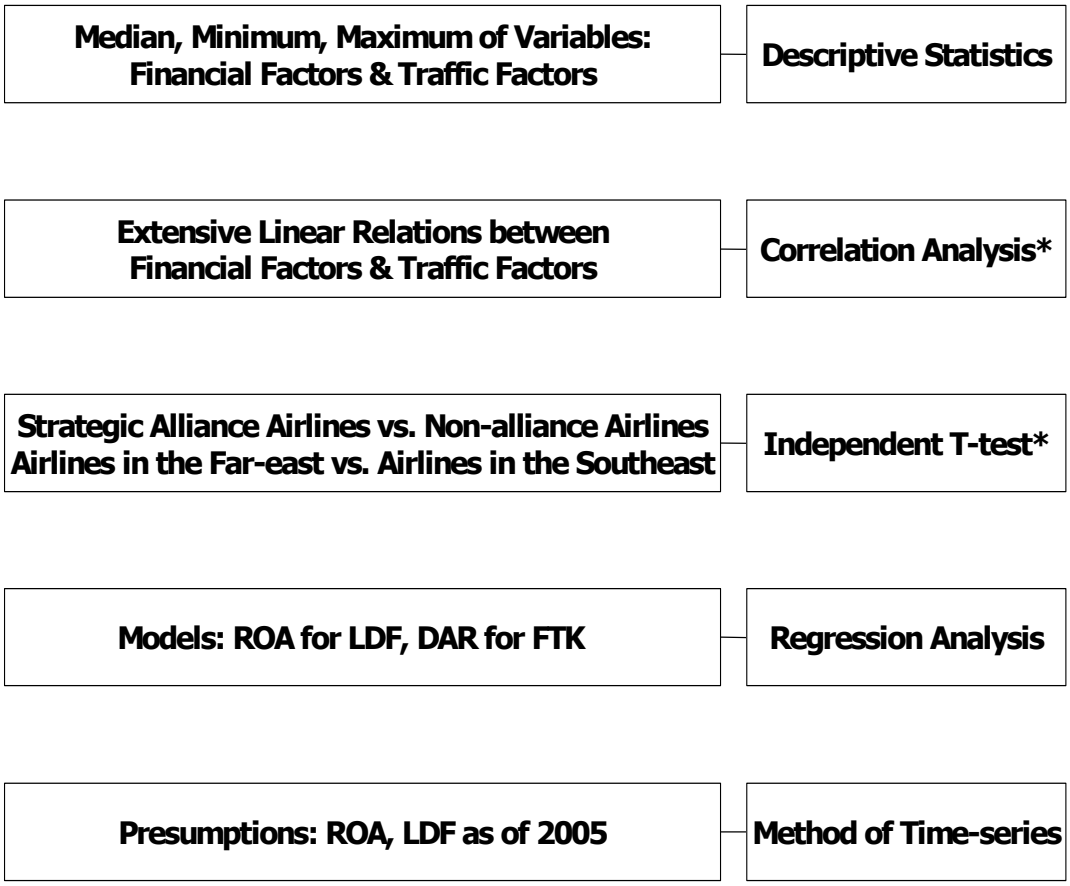
■ *t-Test*: In order to check to see whether airlines in alliances and non-alliance airlines differ, and airlines in the Far-east and airlines in

16) It might be "0", when there is none linear-relationship between two variables. Whereas it is to be "+1", when there is perfectly positive linear-relationship, and also it can be "-1", when there is perfectly negative linear-relationship.

the Southeast also differ in the light of financial/traffic performance, t-Test is applied[17]. Trochim (2005) asserts that t-Test assesses whether the means of two groups are statistically different from each other. The general formula for t-Distribution is as follow:

$$t = (Statistic - Hypothesized\ value) / Estimated\ standard\ error$$

[Figure 2] A conceptual framework: Test steps[18], [19]



17) t-Test is any of a number of tests based on the t-Distribution. The t-Distribution is used instead of the normal distribution whenever the standard deviation is estimated. And also the t-Distribution has relatively more scores in its tails than does the normal distribution.

18) Descriptive statistics outputs are included in the outputs of each testing by setting proper options for them.

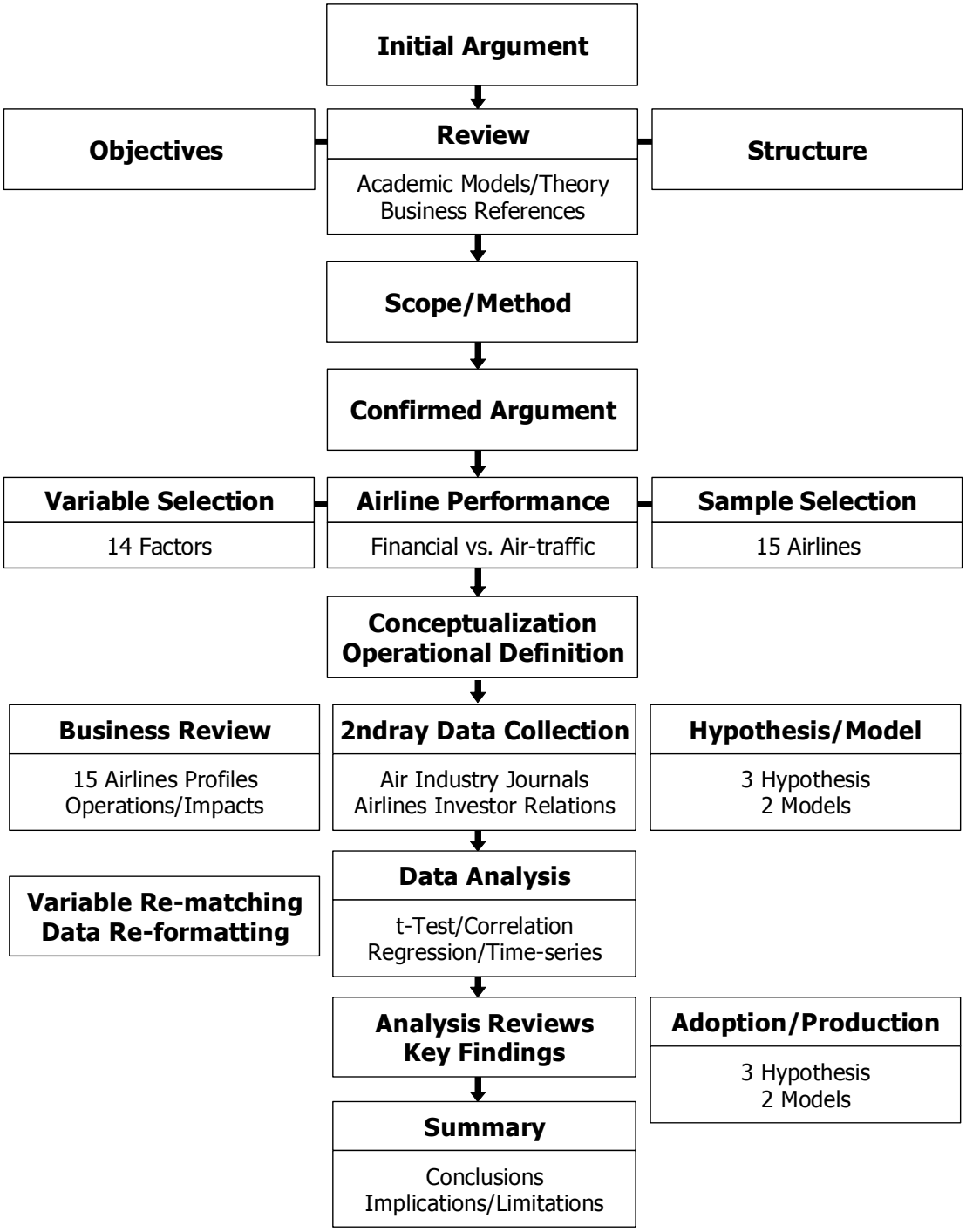
19) * : used for verifying each hypothesis.

■ *Regression:* Correlation has a limit, because it can't prove causality between two variables. It will be assumed that the relationship between the two variables is only linear, or otherwise. Although there are methods for making predictions when the relationship is non-linear, these methods are beyond the scope of this text. Given that the relationship is linear, the prediction problem becomes one of finding the straight line that best fits the data. Trochim (2005) mentions that since the terms "regression" and "prediction" are synonymous, this line is called the regression line.

■ *Time-series:* The method of Time-series which is a sequence of observations in time (even or space) analysis accounts for the fact that data points taken over time may have an internal structure (such as auto-correlation, trend or seasonal variation) that should be accounted for. 김사헌 (2002) maintains that the analysis is a kind of the regression, but time variable is used instead as independent/casual variable. In order to ROA and LDF as of 2005, this study adopts "exponential smoothing". As judging from STEPS (1997), the technique used to reduce irregularities i.e. random fluctuations, in time series data, thus providing a clearer view of the true underlying behavior of the series. It also provides an effective means of predicting future values of the time series forecasting.

In order to validate following hypotheses, the detail research processes associated with four kinds of the analytic tests by using the secondary data describe as [Figure 3] accordingly.

[Figure 3] A conceptual framework: Research processes



2. Hypotheses & Tests

The hypotheses corresponding to correlation testing between financial results and traffic results are set up.

■ *Hypothesis 1*[20]. *Regarding Returns*

▣ There is a linear relation between traffic ratios and financial ratios pertaining to assets.

▣ There is a linear relation between traffic ratios and financial ratios pertaining to equity.

■ *Hypothesis 2*[21]. *Regarding Alliance*

▣ There is a significant difference in financial ratios between strategic alliance airlines and non-alliance airlines.

▣ There is a significant difference in traffic ratios between strategic alliance airlines and non-alliance airlines.

■ *Hypothesis 3. Regarding Region*

▣ There is a significant difference in financial ratios between the Far-east Asia airlines and the Southeast Asia airlines.

▣ There is a significant difference in traffic ratios between the Far-east Asia airlines and the Southeast Asia airlines.

3. Analyses and Results

The input data edited on MS-Excel are at the Appendix A, as being separated by each year[22]. The output data produced by SPSS v.10 are shown at the Appendix B.

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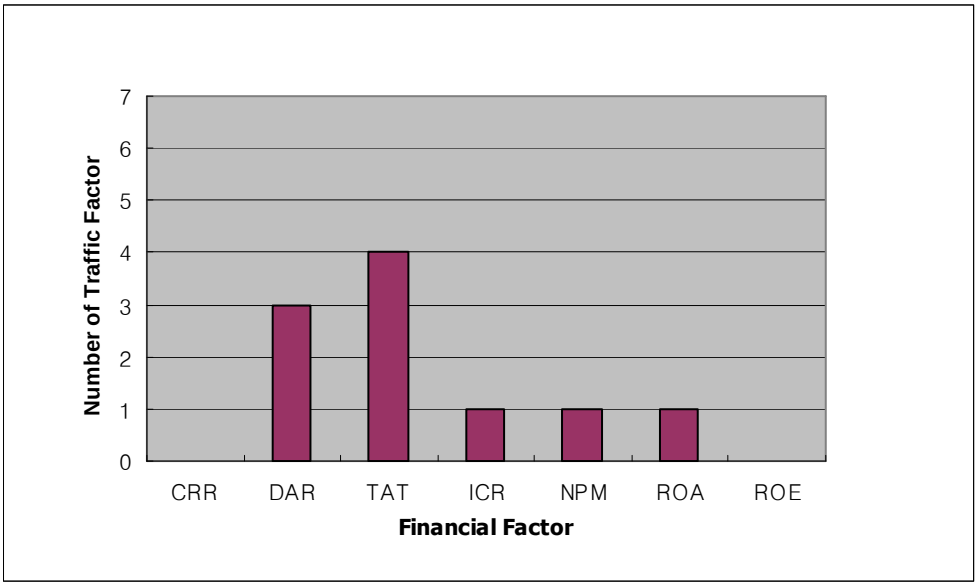
20) It is verified by correlation analysis between financial results and traffic results.
21) Together with Hypothesis 3, it is verified by t-Test.
22) The format is not the same to that of final data running on SPSS v.10.

■ *Correlation:* All factors are checked to reflect the degree to which the financial results and the traffic results are related. Pearson's co-efficient and significant values are keys to check. It is noticed that DAR has a negative relation to LDF and FTK respectively. <Table 7> sums up and [Figure 4] depicts the results of correlation testing.

<Table 7> Results of correlation: Financial/Traffic factor[23)]

Variable		Traffic Factor	Pearson's Co-efficient	Significance(Both)
Financial Factor	DAR	PAX	0.323	p=0.005
		LDF	-0.312	p=0.007
		FTK	-0.443	p=0.000
	TAT	PAX	0.382	p=0.001
		YLD	0.310	p=0.007
		RPK	0.363	p=0.001
		ASK	0.389	p=0.001
	ICR	RPK	0.308	p=0.007
	NPM	LDF	0.368	p=0.001
	ROA	LDF	0.319	p=0.005

[Figure 4] Number of traffic factor correlated to financial factor[24)]



23) The cases which satisfy $p < 0.05$ are excluded.
24) high: more than 0.6, medium: 0.3~0.6, low: less than 0.3

As <Table 7> shows, in total ten combinations among forty-nine ones available are linearly related under $p < 0.01$. Rather than equity-related factors, assets-related factors outnumber. Such an outcome means that utilization of the assets are the key to measuring airlines operation, for airlines business is relatively more dependent on the assets.

■ *t-Test*[25]*:* <Table 8> describes one of the t-Test results on the condition of $p < 0.01$, as comparing eight airlines in three strategic alliances and the rest seven airlines as non-alliance members.

<Table 8> Results of t-Test: Airlines, Alliance vs. Non-alliance

Factor	Variable	F-value	Freedom of Degree	Significance(Both)
Financial	ICR	14.105	39	p=0.007
Traffic	LDF	3.155	64	p=0.001

Only ICR among seven financial factors has a significant difference between the two groups. It implies that financing status of the alliance airlines are more satisfactory, as on the average they generate much higher EBIT with less excessive debit structure. And LDF as a traffic factor has a significant difference in means between the alliance-group and the non-alliance group. This also hints that the alliance-group carries more passengers due to networking advantage, as offering a wide selection of code-share flights and discounted package tickets.

<Table 9> contains the result of another t-Test pertaining to financial/traffic performance difference between the Far-east Asia's airlines and the Southeast Asia's airline. The outcome indicates that when $p < 0.01$, in all seven factors indicate remarkable differences in

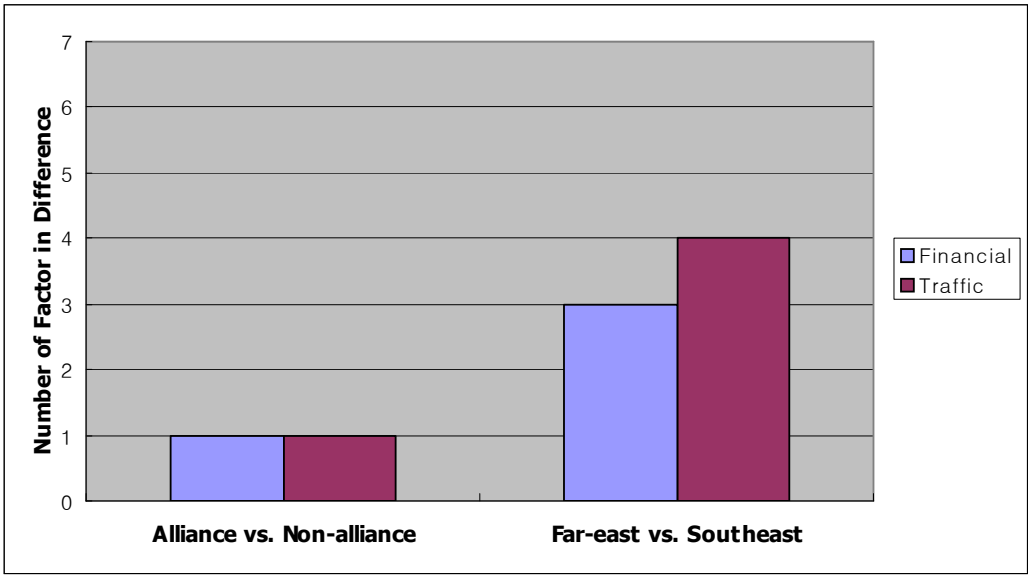
25) For the detail numbers, refer to the t-Test outputs of the Appendix B.

financial/traffic means between the two groups. Interestingly the Southeast Asia's airlines outpace the Far-east Asia's airlines in financial results, as showing 2(NPM/ROA) to 1(DAR). Contrawise the Far-east Asia's airlines surpass the Southeast Asia's airlines in traffic results, as indicating 3(PAX/YLD/FLT) to 1(LDF). Those situations interpret that seven airlines in the Far-east Asia seem to focus on operation size, whereas six airlines in the Southeast Asia tend to focalize on operation gain. [Figure 5] summarizes the outcomes from each testing.

<Table 9> Result of t-Test: Airlines, the Far-east vs. the Southeast

Factor	Variable	F-value	Freedom of Degree	Significance(Both)
Financial	DAR	18.468	43	p=0.007
	NPM	1.733	52	p=0.000
	ROA	0.330	63	p=0.000
Traffic	PAX	25.162	41	p=0.000
	LDF	0.851	63	p=0.000
	YLD	14.496	50	p=0.000
	FLT	3.887	63	p=0.000

[Figure 5] Number of factors in difference between two groups



According to the above analyses, results and outcomes, the research hypotheses turn out as follows:

■ *Verification of Hypothesis 1. Regarding Return*

▣ There is a linear relation between traffic ratios and financial ratios pertaining to assets: Under $p < 0.01$, altogether six traffic factors - PAX, LDF, FTK, YLD, RPK, ASK - are linearly related to three assets-focused financial factors - DAR, TAT, ROA -. Consequently this hypothesis can be adopted.

▣ There is a linear relation between traffic ratios and financial ratios pertaining to equity: On the contrary, only one traffic factor, LDF is linearly related to an equity-focused financial factor, NPM on the condition of $p < 0.01$. In addition, generally a great concern for shareholders is ROE. But none of the traffic factors has a linear relation with ROE. As such this hypothesis can be rejected.

■ *Verification of Hypothesis 2. Regarding Alliance*

▣ There is a significant difference in financial ratios between strategic alliance airlines and non-alliance airlines: This hypothesis can be rejected, as just ICR, as one of the seven factors, has difference in means, in comparison to the following region case.

▣ There is a significant difference in traffic ratios between strategic alliance airlines and non-alliance airlines: This hypothesis can be also rejected, as similarly only one traffic factor, LDF among seven factors has a difference in means.

■ *Verification of Hypothesis 3. Regarding Region*

▣ There is a significant difference in financial ratios between the Far-east Asia airlines and the Southeast Asia airlines: This hypothesis

can be adopted. Three financial factors - DAR, NPM, ROA - have differences in means, because this case outnumbers that of the above alliance case.

▣ There is a significant difference in traffic ratios between the Far-east Asia airlines and the Southeast Asia airlines: This hypothesis can be also adopted. Four traffic factors - PAX, LDF, YLD, FLT - have differences in means accordingly, because excelling in number that of the above alliance cases, too.

4. Models and Presumptions

■ *Regression*[26]*:* Based on the results of correlation test, DAR as Y_1 and FTK X_1 are chosen for regression to set up the first model, as [Figure 6] represents(the upper). This is mainly because, DAR and FTK show the biggest linear relationship through the testing.

▣ *Function of Model 1*: DAR = -0.0000387 * FTK + 0.830

The model says that with 19.6% power of persuasion, the size of air cargo carriers multiplied by 0.0000387 along with other 0.830 causes apart may affect less the degree of outside financing by creditors.

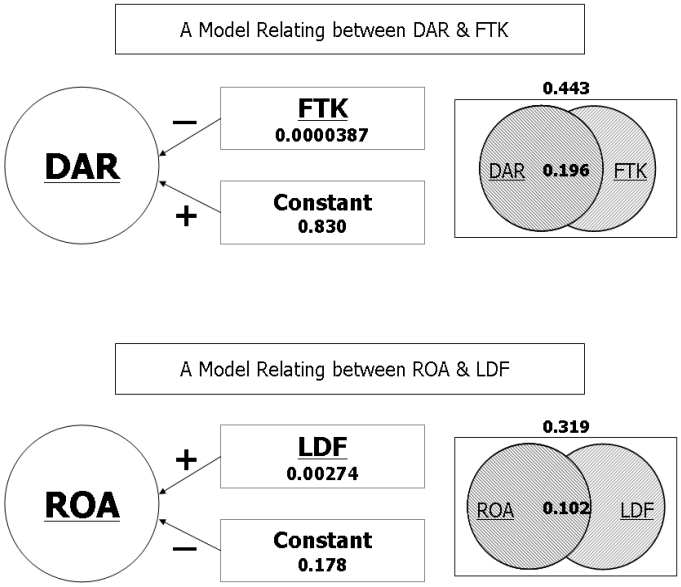
▣ *Function of Mode 2*: ROA = 0.00274 * LDF + -0.178

Further airlines are deeply related to the assets, and mostly interested in load factor. Consequently LDF as X_2 corresponding to ROA as Y_2 is also selected for the second model on the subjective basis, as [Figure 6] represents(the lower). The model implies that with 10.2%

26) The mathematical form of the regression line predicting Y from X is: Y' = bX + A where X is the variable represented on the abscissa (X-axis), b is the slope of the line, A is the Y intercept, and Y' consists of the predicted values of Y for the various values of X.

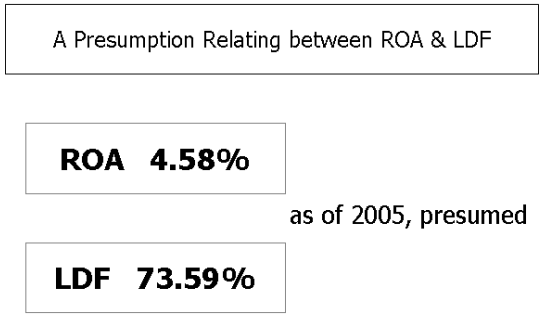
power of persuasion, the load factor multiplied by 0.00274 along with other 0.178 causes apart may affect higher retune on assets.

[Figure 6] Probabilistic regression models: DAR vs. FTK, ROA vs. LDF



■ *Time-series:* The author tries to observe whether both of the meaningful variables - ROA and LDF - are ordered in time[27] and predict ROA and LDF upon all 15 airlines as of 2005 accordingly.

[Figure 7] A set by method of time-series: ROA & LDF as of 2005



27) Based on the correlation results, it is shown that the two factors are a in deep linear relationship.

VI. CONCLUSION

1. Summary of Key Findings

Key findings of this study are summarized as follow.

(a) Traffic results is little associated with equity-related financial results: only Load Factor has a linear relation to Net Profit Margin.

(b) Traffic results is strongly associated with assets-related financial results: six traffic factors have linear relations to Debt-assets Ratio, Total Turnover Assets, and Return on Assets.

(c) A large scale of operating fleets never ensures higher financial results: the number of planes does not correlate to any financial factors.

(d) Higher transportation per kilometer is the key to higher financial results: all traffic factors upon kilometer scale closely correlate to three financial factors.

(e) Strategic alliance airlines do not show more successful operation results than non-alliance airlines: in the aspect of financial/traffic results, there are no remarkable differences between the two groups. The author believes that it results from the situation which their alliance effects were not remarkable at the moment, and even the alliance airlines could not get away from the various external impacts happening for recent five years.

(f) The Southeast based airlines do show more successful operation results than the Far-east based airlines: in the aspect of both financial and traffic results, there are striking differences between the two groups. This mentions that six airlines in the Southeast Asia conduct more substantial operation, as traditionally it is well-known to the air

transportation industry.

(g) Slightly higher LDF and ROA all over the 15 airlines will be likely happening at the end of this fiscal year.

2. Implications, Recommendations, Limitations

■ *Implications:* As expected, rather than equity elements, airline business tends to further contribute to assets elements. Because the study verifies that increasing traffic results directly has no bearing on higher equity-related factors, but they rather refer to not only higher interest-return factors, but assets-related factors. Surprisingly, physical volume expansions by increasing planes, enlarging service network, or joining alliances seem to be different in a good signal for a better operational performance.

Therefore, as long as traffic results and financial results are not closely related on the whole, sticking to one-sided aspect must be a wrong attitude for internal decision-making and external performance review for airlines.

■ *Recommendations:* The airlines in Korea, China, and Japan need to carry out bench-marking toward the Southeast airlines. Nevertheless Japan Airlines, All Nippon Airways, Korean Air, and Air China manage much bigger networks, airport facilities, fleet, and labor, their returns on financial results are noticeably inferior to the Southeast airlines led by SIA.

The airlines managements need to re-think about entering strategic alliance, especially within the Asia-pacific. Rather than a synergy effect from allying, an internal competitive effect, or a de-synergy effect may

result in lower relation with higher financial/traffic results. They also need to note that JAL does not join any strategic alliance until now[28]. Strategic alliance programming is still at the initial stage, so the airlines in the alliances need more time to generate actual outcomes based on the long term basis.

Lastly, even though external economic surroundings in 2005 look gloomy, it is recommended that their aggressive managements be going on, thanks to an on-going economic boom in the Asia-pacific. Meanwhile they should focus on financial restructuring and cost-saving in parallel to obtain positive financial performances corresponding to increasing traffic results.

■ *Limitations:* In the study, by the large, there might be three kinds of the limitations of this study. The first limit belongs to the source of data. Surprisingly hardly could the author find the clear representative channel where reliable financial results are available for the international airlines businesses. Thus the financial data collection from year of 2000 for 15 airlines had to reply on scattered journals, publications, magazines, and web-reports. Those may cause problems with reliability and accuracy. The second restriction comes from calculating financial ratio. Each 15 airlines use slightly different interest rates, corporate tax rates, and accounting standards in accordance with their local laws[29]. As a result, some financial ratios may have problems in consistency

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28) Officially 'Oneworld Alliance' has not announced, but according to the unknown reports that there is a sign of Japan Airlines' joining in the alliance sooner or later.

29) It is well-known that in the case of Southeast Asia countries such as Singapore and Thailand, the governments allow their national flags - e.g. Singapore Airlines, Thai Airways - to generous tax benefits, in the process of purchasing airplanes or acquiring/operating facilities.

across countries and time-periods of fiscal years.

The third limitation is about the scope of business. In the financial data, a few airlines such as Japan Airlines, or Singapore Airlines include indirect air businesses into their major operations. It was very hard to conduct break-down in detail and separate them from operation results. In the consequence, it might cause statistical inaccuracies, inconsistencies, and errors with significance. And also traffic factors and financial factors are clearly different scales and independent concepts to be compared each other. Nonetheless checking to see their linear relations based on business volumes and changes may be controversies on the approach.

As the last one, Asiana Airlines officially joined Star Alliance in 2003. Thus strictly to say the data of Asiana from 2000 until 2002 should have been excluded at the time of analyses of the alliance financial/traffic effects on the eight member airlines.

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APPENDICES

Appendix A.

Input data to SPSS: 2004 financial & traffic factors

Financial		CRR	DAR	TAT	ICR	NPM	ROA	ROE
JL	'04	1.20	0.90	0.98	2.73	1.41%	4.41%	17.00%
NH	'04	0.83	0.86	0.80	4.59	2.09%	1.68%	12.59%
QF	'04	0.64	0.67	0.65	-8.26	6.06%	3.69%	11.00%
SQ	'04	1.27	0.29	0.55	-54.66	11.57%	6.90%	11.60%
KE	'04	0.57	0.72	0.52	0.96	6.75%	3.50%	13.50%
CX	'04	0.89	0.39	0.67	9.00	11.30%	6.51%	13.75%
CA	'04	0.70	0.73	0.50	3.03	7.13%	3.82%	15.40%
TG	'04	0.65	0.70	0.79	8.26	11.26%	4.45%	14.94%
MH	'04	1.14	0.55	0.83	-1.35	3.73%	1.48%	3.29%
CZ	'04	0.31	0.78	0.38	0.49	-0.20%	-0.08%	-0.41%
CI	'04	0.70	0.76	0.44	2.26	4.35%	2.99%	8.28%
OZ	'04	0.60	0.77	0.80	-1.44	8.96%	7.10%	36.70%
MU	'04	0.29	0.82	0.50	1.94	2.44%	1.21%	7.47%
BR	'04	0.76	0.63	0.70	2.75	3.92%	2.76%	7.52%
NZ	'04	1.43	0.68	0.69	-30.05	6.28%	4.35%	13.68%

Traffic		RPK	ASK	FTK	LDF	PAX	YLD	FLT
JL	'04	102,354	151,902	5,076,292	67.4	59,448	11.42	209
NH	'04	55,735	85,839	1,362,861	66.7	47,683	14.51	136
QF	'04	81,276	104,200	1,601,000	78.0	30,076	7.86	190
SQ	'04	77,594	104,662	7,333,200	74.1	15,994	5.73	89
KE	'04	45,878	64,553	8,294,831	71.2	21,281	6.92	117
CX	'04	57,283	74,062	6,007,000	77.3	13,664	5.92	87
CA	'04	46,645	64,894	2,581,700	71.9	24,500	7.17	151
TG	'04	50,633	69,830	1,869,131	72.1	19,540	6.01	83
MH	'04	32,527	64,115	2,064,300	67.8	13,177	5.49	110
CZ	'04	37,196	53,769	1,344,070	69.2	28,207	6.85	231
CI	'04	29,567	38,358	5,769,000	77.1	8,919	4.94	63
OZ	'04	19,733	27,804	2,914,140	71.3	12,210	8.29	61
MU	'04	29,385	41,599	1,877,468	66.6	19,648	6.73	103
BR	'04	23,755	27,353	5,481,478	79.5	5,438	5.30	50
NZ	'04	23,393	31,984	762,000	74.0	10,721	7.10	89

Input data to SPSS: 2003 financial & traffic factors

Financial		CRR	DAR	TAT	ICR	NPM	ROA	ROE
JL	'03	0.93	0.91	0.91	-2.64	-4.59%	-4.19%	-42.90%
NH	'03	1.05	0.90	0.78	1.54	1.06%	1.58%	16.49%
QF	'03	0.83	0.69	0.67	-8.76	3.02%	2.04%	8.90%
SQ	'03	1.02	0.28	0.49	-20.9	8.70%	4.60%	7.70%
KE	'03	0.68	0.76	0.44	0.72	-3.90%	-1.71%	-7.18%
CX	'03	0.63	0.48	0.54	3.60	4.40%	1.93%	4.10%
CA	'03	0.41	0.85	0.44	1.61	0.42%	0.16%	1.28%
TG	'03	0.87	0.72	0.79	4.14	6.60%	5.22%	18.55%
MH	'03	1.18	0.54	1.30	-6.92	5.37%	6.97%	15.18%
CZ	'03	0.30	0.66	0.44	-0.49	-2.05%	-0.92%	-3.01%
CI	'03	0.85	0.75	0.40	1.11	2.34%	2.11%	3.74%
OZ	'03	0.42	0.85	0.77	-0.27	-1.52%	-1.10%	-6.40%
MU	'03	0.33	0.82	0.38	0.27	-6.65%	-2.50%	-14.9%
BR	'03	0.86	0.67	0.57	1.53	2.14%	1.22%	3.65%
NZ	'03	1.21	0.72	0.75	17.79	5.94%	4.48%	16.05%

Traffic		RPK	ASK	FTK	LDF	PAX	YLD	FLT
JL	'03	93,847	145,779	4,748,612	64.3	58,241	11.36	215
NH	'03	59,107	87,770	1,312,183	63.6	42,251	15.12	130
QF	'03	77,225	99,471	1,529,197	77.6	28,884	8.29	196
SQ	'03	63,940	88,248	6,668,705	72.2	13,885	5.37	85
KE	'03	39,981	58,738	7,066,000	68.1	21,735	6.63	117
CX	'03	42,774	59,297	5,197,000	72.2	10,059	5.60	85
CA	'03	33,457	50,738	2,176,107	66.0	18,026	6.91	131
TG	'03	50,633	69,830	1,839,000	72.5	17,301	5.96	81
MH	'03	36,797	55,704	2,175,664	67.6	15,114	5.10	109
CZ	'03	21,120	40,858	1,094,992	63.8	15,564	6.87	132
CI	'03	23,734	34,187	4,822,000	69.4	7,067	4.97	59
OZ	'03	16,725	24,715	2,716,379	68.4	11,787	8.07	64
MU	'03	19,796	30,144	1,311,217	60.9	13,854	6.79	96
BR	'03	18,113	25,026	4,713,037	72.5	4,321	4.84	45
NZ	'03	22,791	30,677	823,783	74.4	9,707	7.68	81

Input data to SPSS: 2002 financial & traffic factors

Financial		CRR	DAR	TAT	ICR	NPM	ROA	ROE
JL	'02	0.86	0.87	0.96	0.33	0.56%	0.54%	4.60%
NH	'02	1.12	0.91	0.84	-0.10	-2.32%	-1.96%	-23.17%
QF	'02	0.67	0.71	0.74	-14.15	3.91%	2.90%	12.00%
SQ	'02	0.68	0.28	0.55	-34.1	10.13%	5.90%	10.40%
KE	'02	0.62	0.74	0.46	1.05	1.79%	3.60%	14.90%
CX	'02	0.75	0.42	0.62	6.40	12.05%	5.98%	12.60%
CA	'02	0.38	0.89	0.44	2.18	0.50%	1.17%	13.35%
TG	'02	0.64	0.78	0.81	5.08	8.98%	7.32%	33.39%
MH	'02	1.04	0.54	1.56	1.59	3.83%	5.89%	13.06%
CZ	'02	0.82	0.52	0.48	2.24	3.20%	1.55%	5.99%
CI	'02	0.56	0.71	0.45	1.75	4.27%	3.56%	6.83%
OZ	'02	0.44	0.82	0.76	-1.22	5.46%	4.90%	29.40%
MU	'02	0.38	0.84	0.44	1.45	0.66%	0.29%	1.17%
BR	'02	0.78	0.70	0.56	1.78	4.08%	2.28%	7.52%
NZ	'02	1.15	0.77	1.14	-0.42	-7.23%	-3.94%	-36.29%

Traffic		RPK	ASK	FTK	LDF	PAX	YLD	FLT
JL	'02	83,727	121,222	4,450,995	68.8	36,569	10.53	173
NH	'02	56,579	87,908	1,249,767	64.4	50,916	11.07	135
QF	'02	75,134	95,944	1,598,000	78.3	27,128	7.55	193
SQ	'02	74,183	99,565	6,835,300	74.5	15,326	9.10	96
KE	'02	41,801	58,310	6,522,334	71.7	22,171	6.51	119
CX	'02	49,041	63,050	4,854,000	77.8	12,321	5.82	79
CA	'02	24,001	34,610	1,875,815	70.4	10,587	7.02	124
TG	'02	44,396	63,826	1,780,000	69.6	18,315	5.03	81
MH	'02	36,897	54,265	2,071,271	69.4	16,325	5.58	104
CZ	'02	28,910	42,772	1,005,657	65.9	21,493	6.54	122
CI	'02	26,806	35,672	4,600,112	75.1	8,136	4.75	55
OZ	'02	17,600	23,900	2,752,998	73.3	12,430	6.80	63
MU	'02	18,206	27,962	1,009,820	65.1	11,420	7.06	78
BR	'02	19,508	25,184	4,126,323	75.1	4,793	4.81	42
NZ	'02	21,482	29,714	761,000	72.3	9,098	7.81	83

Input data to SPSS: 2001 financial & traffic factors

Financial		CRR	DAR	TAT	ICR	NPM	ROA	ROE
JL	'01	0.97	0.86	0.88	-0.45	0.56%	-2.00%	-14.80%
NH	'01	0.92	0.90	0.80	0.80	-0.78%	-0.63%	-6.82%
QF	'01	0.52	0.73	0.81	-7.09	4.11%	3.35%	10.60%
SQ	'01	0.87	0.28	0.50	115.58	6.73%	3.80%	6.40%
KE	'01	0.56	0.78	0.42	-0.26	-10.40%	-5.25%	-23.35%
CX	'01	0.75	0.43	0.55	2.00	2.15%	1.07%	2.00%
CA	'01	0.42	0.90	0.39	2.49	0.28%	1.81%	24.87%
TG	'01	0.65	0.84	0.72	3.47	7.89%	5.70%	43.90%
MH	'01	0.28	0.89	0.57	-1.02	-9.97%	-5.72%	-67.98%
CZ	'01	1.21	0.49	0.55	1.58	2.02%	1.11%	3.69%
CI	'01	0.78	0.70	0.47	0.85	2.55%	3.80%	4.09%
OZ	'01	0.36	0.84	0.59	0.28	-7.20%	-4.26%	-27.01%
MU	'01	0.52	0.74	0.42	1.22	4.46%	1.89%	7.40%
BR	'01	0.74	0.74	0.46	0.01	-6.05%	-2.80%	-10.70%
NZ	'01	0.77	0.94	0.98	-0.24	-17.91%	-17.57%	-275.14%

Traffic		RPK	ASK	FTK	LDF	PAX	YLD	FLT
JL	'01	79,361	115,639	4,046,616	68.0	32,161	9.75	131
NH	'01	62,593	93,520	1,550,852	66.9	49,234	9.82	140
QF	'01	70,540	92,943	1,859,000	77.7	22,147	6.34	178
SQ	'01	69,994	94,558	5,954,300	71.1	14,765	9.00	93
KE	'01	38,447	55,802	5,570,531	68.9	21,638	6.20	119
CX	'01	44,792	62,790	3,938,000	71.3	11,269	5.86	75
CA	'01	20,409	31,215	1,605,000	63.9	9,287	6.82	118
TG	'01	46,571	63,198	1,771,000	73.7	18,619	5.06	81
MH	'01	34,708	52,594	1,759,209	66.0	15,734	4.88	101
CZ	'01	25,056	38,993	782,004	62.4	19,122	6.30	119
CI	'01	25,752	34,689	4,037,740	74.2	8,320	5.01	54
OZ	'01	15,771	22,249	2,546,000	70.9	11,900	6.60	59
MU	'01	15,194	25,813	949,889	61.6	10,263	6.54	72
BR	'01	17,776	23,728	3,278,925	70.4	4,178	4.74	37
NZ	'01	22,417	31,326	755,000	71.6	8,596	6.82	86

Input data to SPSS: 2000 financial & traffic factors

Financial		CRR	DAR	TAT	ICR	NPM	ROA	ROE
JL	'00	0.92	0.84	0.95	2.79	-1.56%	2.28%	16.20%
NH	'00	0.98	0.89	0.88	2.34	2.69%	2.78%	10.37%
QF	'00	0.52	0.76	0.76	-7.87	5.68%	4.31%	18.30%
SQ	'00	0.94	0.26	0.55	26.15	17.1%	9.70%	16.90%
KE	'00	0.51	0.69	0.45	0.25	-7.10%	-5.73%	-18.73%
CX	'00	0.99	0.40	0.65	16.40	14.46%	8.00%	16.40%
CA	'00	0.41	0.93	0.38	2.63	0.34%	2.23%	19.64%
TG	'00	0.57	0.90	0.71	1.14	1.48%	1.08%	10.71%
MH	'00	0.51	0.88	0.64	-1.55	-4.66%	-2.98%	-33.01%
CZ	'00	2.30	0.51	0.49	1.57	3.30%	1.62%	5.65%
CI	'00	0.63	0.72	0.51	1.43	3.90%	4.21%	7.19%
OZ	'00	0.38	0.78	0.53	1.07	-5.04%	-2.69%	-12.43%
MU	'00	0.82	0.74	0.39	0.96	1.56%	0.60%	2.44%
BR	'00	0.85	0.71	0.51	1.61	4.08%	2.33%	7.94%
NZ	'00	0.68	0.82	0.41	3.07	-16.11%	-6.68%	-37.74%

Traffic		RPK	ASK	FTK	LDF	PAX	YLD	FLT
JL	'00	90,490	122,776	4,579,389	71.1	33,837	10.19	138
NH	'00	60,921	93,865	1,453,067	64.9	49,887	9.88	141
QF	'00	64,149	85,033	1,718,000	79.0	20,485	5.56	147
SQ	'00	71,118	92,648	6,075,200	76.8	15,002	7.90	92
KE	'00	40,606	55,824	6,590,000	72.7	22,065	6.41	112
CX	'00	47,153	61,909	4,161,000	76.2	11,864	6.18	64
CA	'00	18,116	28,262	1,618,000	64.1	7,942	6.65	114
TG	'00	45,167	60,459	1,695,000	74.7	17,700	4.78	81
MH	'00	38,312	51,237	1,837,426	74.8	16,745	6.50	98
CZ	'00	20,999	34,788	671,000	60.4	16,125	6.04	108
CI	'00	25,967	34,012	4,489,123	76.1	8,267	5.30	53
OZ	'00	15,779	21,241	2,643,000	74.3	12,196	7.00	54
MU	'00	14,101	22,596	904,300	62.4	8,970	6.31	68
BR	'00	19,104	25,296	3,553,542	75.5	4,108	4.65	36
NZ	'00	20,978	30,114	821,000	69.7	8,104	7.07	81

Appendix B.[30]

Correlation

상관계수

		CRR	DAR	TAT	ICR	NPM	ROA	ROE	PAX	LDF	YLD	RPK	ASK	FTK	FLT
CRR	Pearson 상관계수	1.000	-.359**	.365**	.208	.243*	.218	.055	.197	-.091	.178	.228*	.254*	.002	.040
	유의확률 (양쪽)	.	.002	.001	.073	.036	.060	.638	.091	.439	.126	.050	.028	.988	.734
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
DAR	Pearson 상관계수	-.359**	1.000	.102	-.573**	-.598**	-.502**	-.239*	.323**	-.312**	.289*	-.155	-.103	-.443**	.216
	유의확률 (양쪽)	.002	.	.386	.000	.000	.000	.039	.005	.007	.012	.184	.379	.000	.063
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
TAT	Pearson 상관계수	.365**	.102	1.000	-.070	.043	.084	-.107	.382**	.073	.310**	.363**	.389**	-.186	.221
	유의확률 (양쪽)	.001	.386	.	.548	.714	.471	.359	.001	.534	.007	.001	.001	.111	.056
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
ICR	Pearson 상관계수	.208	-.573**	-.070	1.000	.374**	.317**	.127	-.086	.215	.077	.308**	.263*	.292*	-.042
	유의확률 (양쪽)	.073	.000	.548	.	.001	.006	.276	.463	.064	.513	.007	.023	.011	.723
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
NPM	Pearson 상관계수	.243*	-.598**	.043	.374**	1.000	.934**	.674**	-.070	.368**	-.110	.278*	.228*	.272*	-.086
	유의확률 (양쪽)	.036	.000	.714	.001	.	.000	.000	.549	.001	.348	.016	.049	.018	.461
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
ROA	Pearson 상관계수	.218	-.502**	.084	.317**	.934**	1.000	.822**	-.049	.319**	-.101	.248*	.203	.238*	-.063
	유의확률 (양쪽)	.060	.000	.471	.006	.000	.	.000	.675	.005	.389	.032	.081	.040	.589
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
ROE	Pearson 상관계수	.055	-.239*	-.107	.127	.674**	.822**	1.000	.039	.098	-.016	.133	.115	.140	.017
	유의확률 (양쪽)	.638	.039	.359	.276	.000	.000	.	.742	.405	.893	.255	.327	.231	.884
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
PAX	Pearson 상관계수	.197	.323**	.382**	-.086	-.070	-.049	.039	1.000	-.284*	.780**	.714**	.779**	-.050	.758*
	유의확률 (양쪽)	.091	.005	.001	.463	.549	.675	.742	.	.014	.000	.000	.000	.669	.000
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
LDF	Pearson 상관계수	-.091	-.312**	.073	.215	.368**	.319**	.098	-.284*	1.000	-.322**	.203	.080	.370**	-.179
	유의확률 (양쪽)	.439	.007	.534	.064	.001	.005	.405	.014	.	.005	.081	.496	.001	.125
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
YLD	Pearson 상관계수	.178	.289*	.310**	.077	-.110	-.101	-.016	.780**	-.322**	1.000	.518**	.573**	-.105	.530*
	유의확률 (양쪽)	.126	.012	.007	.513	.348	.389	.893	.000	.005	.	.000	.000	.368	.000
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
RPK	Pearson 상관계수	.228*	-.155	.363**	.308**	.278*	.248*	.133	.714**	.203	.518**	1.000	.988**	.321**	.654*
	유의확률 (양쪽)	.050	.184	.001	.007	.016	.032	.255	.000	.081	.000	.	.000	.005	.000
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
ASK	Pearson 상관계수	.254*	-.103	.389**	.263*	.228*	.203	.115	.779**	.080	.573**	.988**	1.000	.283*	.689*
	유의확률 (양쪽)	.028	.379	.001	.023	.049	.081	.327	.000	.496	.000	.000	.	.014	.000
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
FTK	Pearson 상관계수	.002	-.443**	-.186	.292*	.272*	.238*	.140	-.050	.370**	-.105	.321**	.283*	1.000	-.147
	유의확률 (양쪽)	.988	.000	.111	.011	.018	.040	.231	.669	.001	.368	.005	.014	.	.208
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
FLT	Pearson 상관계수	.040	.216	.221	-.042	-.086	-.063	.017	.758**	-.179	.530**	.654**	.689**	-.147	1.000
	유의확률 (양쪽)	.734	.063	.056	.723	.461	.589	.884	.000	.125	.000	.000	.000	.208	.
	N	75	75	75	75	75	75	75	75	75	75	75	75	75	75

**. 상관계수는 0.01 수준(양쪽)에서 유의합니다.

*. 상관계수는 0.05 수준(양쪽)에서 유의합니다.

30) All outputs in the Appendix B. are produced by "Korean(Hangul) Edition" of SPSS v.10 for MS-Windows. Thus the headers of row/column and the footnotes in the each tables are in printed Korean.

t-Test

집단통계량

	ALLIANCE	N	평균	표준편차	평균의 표준오차
CRR	1	40	.765400	.253190	4.003E-02
	2	35	.746763	.391116	6.611E-02
DAR	1	40	.679298	.207202	3.276E-02
	2	35	.745543	.129263	2.185E-02
TAT	1	40	.674000	.162135	2.564E-02
	2	35	.607514	.276502	4.674E-02
ICR	1	40	10.586030	20.508539	3.242685
	2	35	1.380229	1.606894	.271615
NPM	1	40	2.978E-02	7.788E-02	1.231E-02
	2	35	1.076E-02	3.726E-02	6.299E-03
ROA	1	40	1.923E-02	5.105E-02	8.071E-03
	2	35	1.231E-02	2.708E-02	4.578E-03
ROE	1	40	-6.61E-03	.481082	7.607E-02
	2	35	1.336E-02	.180238	3.047E-02
PAX	1	40	20248.85	11977.58	1893.82
	2	35	17025.89	13436.57	2271.19
LDF	1	40	72.4015	3.9503	.6246
	2	35	68.7029	5.0465	.8530
YLD	1	40	7.3807	2.2345	.3533
	2	35	6.5917	1.8903	.3195
RPK	1	40	47547.83	19904.51	3147.18
	2	35	35191.23	24068.20	4068.27
ASK	1	40	65534.40	26642.78	4212.59
	2	35	51650.03	35399.21	5983.56
FTK	1	40	3318.75	2328.97	368.24
	2	35	2813.91	1609.53	272.06
FLT	1	40	103.58	37.95	6.00
	2	35	104.26	49.95	8.44

독립표본 검정

		Levene의 등분산 검정		평균의 동일성에 대한 t-검정						
		F	유의확률	t	자유도	유의확률 (양쪽)	평균차	차이의 표준오차	차이의 95% 신뢰구간 하한	차이의 95% 신뢰구간 상한
CRR	등분산이 가정됨	2.037	.158	.248	73	.805	1.864E-02	7.518E-02	-.131190	.168464
	등분산이 가정되지 않음			.241	56.843	.810	1.864E-02	7.729E-02	-.136136	.173411
DAR	등분산이 가정됨	6.482	.013	-1.633	73	.107	-6.62E-02	4.057E-02	-.147095	1.460E-02
	등분산이 가정되지 않음			-1.682	66.352	.097	-6.62E-02	3.938E-02	-.144860	1.237E-02
TAT	등분산이 가정됨	5.363	.023	1.289	73	.201	6.649E-02	5.157E-02	-3.63E-02	.169274
	등분산이 가정되지 않음			1.247	53.328	.218	6.649E-02	5.331E-02	-4.04E-02	.173389
ICR	등분산이 가정됨	14.105	.000	2.646	73	.010	9.205801	3.478815	2.272534	16.139069
	등분산이 가정되지 않음			2.829	39.547	.007	9.205801	3.254040	2.626793	15.784810
NPM	등분산이 가정됨	11.844	.001	1.318	73	.192	1.901E-02	1.443E-02	-9.75E-03	4.778E-02
	등분산이 가정되지 않음			1.375	57.557	.175	1.901E-02	1.383E-02	-8.68E-03	4.671E-02
ROA	등분산이 가정됨	7.533	.008	.717	73	.476	6.911E-03	9.637E-03	-1.23E-02	2.612E-02
	등분산이 가정되지 않음			.745	60.898	.459	6.911E-03	9.279E-03	-1.16E-02	2.547E-02
ROE	등분산이 가정됨	2.617	.110	-.232	73	.818	-2.00E-02	8.622E-02	-.191810	.151876
	등분산이 가정되지 않음			-.244	51.010	.808	-2.00E-02	8.194E-02	-.184468	.144534
PAX	등분산이 가정됨	.111	.740	1.098	73	.276	3222.96	2934.39	-2625.27	9071.20
	등분산이 가정되지 않음			1.090	68.744	.280	3222.96	2957.18	-2676.83	9122.76
LDF	등분산이 가정됨	3.155	.080	3.556	73	.001	3.6986	1.0402	1.6255	5.7718
	등분산이 가정되지 않음			3.498	64.155	.001	3.6986	1.0572	1.5867	5.8106
YLD	등분산이 가정됨	.474	.493	1.638	73	.106	.7890	.4817	-.1710	1.7491
	등분산이 가정되지 않음			1.656	72.926	.102	.7890	.4764	-.1603	1.7384
RPK	등분산이 가정됨	.030	.863	2.433	73	.017	12356.60	5078.65	2234.86	22478.33
	등분산이 가정되지 않음			2.402	66.201	.019	12356.60	5143.50	2087.86	22625.33
ASK	등분산이 가정됨	.368	.546	1.933	73	.057	13884.37	7182.07	-429.47	28198.21
	등분산이 가정되지 않음			1.897	62.641	.062	13884.37	7317.71	-740.55	28509.29
FTK	등분산이 가정됨	9.109	.004	1.077	73	.285	504.84	468.91	-429.70	1439.37
	등분산이 가정되지 않음			1.103	69.458	.274	504.84	457.84	-408.43	1418.10
FLT	등분산이 가정됨	1.281	.262	-.067	73	.947	-.68	10.17	-20.96	19.59
	등분산이 가정되지 않음			-.066	63.006	.948	-.68	10.36	-21.38	20.02

t-Test

집단통계량

	REGION	N	평균	표준편차	평균의 표준오차
CRR	1	35	.700706	.394905	6.675E-02
	2	30	.793500	.212146	3.873E-02
DAR	1	35	.794671	.113413	1.917E-02
	2	30	.598327	.202368	3.695E-02
TAT	1	35	.603951	.206267	3.487E-02
	2	30	.649210	.244161	4.458E-02
ICR	1	35	1.203117	1.299739	.219696
	2	30	11.108597	23.151720	4.226906
NPM	1	35	1.237E-03	4.237E-02	7.162E-03
	2	30	5.290E-02	5.769E-02	1.053E-02
ROA	1	35	4.803E-03	2.912E-02	4.922E-03
	2	30	3.542E-02	3.373E-02	6.158E-03
ROE	1	35	2.257E-02	.170762	2.886E-02
	2	30	6.665E-02	.188296	3.438E-02
PAX	1	35	24704.23	15298.20	2585.87
	2	30	12208.87	4821.49	880.28
LDF	1	35	67.1846	3.7682	.6369
	2	30	73.2200	3.3143	.6051
YLD	1	35	8.1051	2.3526	.3977
	2	30	5.6727	1.1397	.2081
RPK	1	35	40275.03	25355.65	4285.89
	2	30	41486.50	17500.36	3195.11
ASK	1	35	59667.69	37116.21	6273.79
	2	30	56978.40	23522.00	4294.51
FTK	1	35	2807.26	2066.09	349.23
	2	30	4025.17	1794.19	327.57
FLT	1	35	120.00	42.37	7.16
	2	30	75.60	21.70	3.96

독립표본 검정

		Levene의 등분산 검정		평균의 동일성에 대한 t-검정						
		F	유의확률	t	자유도	유의확률 (양쪽)	평균차	차이의 표준오차	차이의 95% 신뢰구간 하한	상한
CRR	등분산이 가정됨	6.114	.016	-1.152	63	.254	-9.28E-02	8.058E-02	-.253814	6.823E-02
	등분산이 가정되지 않음			-1.202	53.622	.234	-9.28E-02	7.717E-02	-.247545	6.196E-02
DAR	등분산이 가정됨	18.468	.000	4.914	63	.000	.196345	3.996E-02	.116493	.276196
	등분산이 가정되지 않음			4.717	43.996	.000	.196345	4.162E-02	.112456	.280234
TAT	등분산이 가정됨	.571	.453	-.810	63	.421	-4.53E-02	5.586E-02	-.156883	6.637E-02
	등분산이 가정되지 않음			-.800	57.106	.427	-4.53E-02	5.659E-02	-.158579	6.806E-02
ICR	등분산이 가정됨	15.483	.000	-2.530	63	.014	-9.905480	3.915389	-17.729760	-2.081199
	등분산이 가정되지 않음			-2.340	29.157	.026	-9.905480	4.232612	-18.560122	-1.250837
NPM	등분산이 가정됨	1.733	.193	-4.152	63	.000	-5.17E-02	1.244E-02	-7.65E-02	-2.68E-02
	등분산이 가정되지 않음			-4.056	52.451	.000	-5.17E-02	1.274E-02	-7.72E-02	-2.61E-02
ROA	등분산이 가정됨	.330	.567	-3.928	63	.000	-3.06E-02	7.794E-03	-4.62E-02	-1.50E-02
	등분산이 가정되지 않음			-3.884	57.779	.000	-3.06E-02	7.883E-03	-4.64E-02	-1.48E-02
ROE	등분산이 가정됨	.958	.331	-.989	63	.326	-4.41E-02	4.455E-02	-.133095	4.495E-02
	등분산이 가정되지 않음			-.982	59.204	.330	-4.41E-02	4.489E-02	-.133888	4.574E-02
PAX	등분산이 가정됨	25.162	.000	4.291	63	.000	12495.36	2912.27	6675.66	18315.06
	등분산이 가정되지 않음			4.574	41.681	.000	12495.36	2731.59	6981.53	18009.19
LDF	등분산이 가정됨	.851	.360	-6.802	63	.000	-6.0354	.8874	-7.8087	-4.2622
	등분산이 가정되지 않음			-6.870	62.950	.000	-6.0354	.8785	-7.7911	-4.2798
YLD	등분산이 가정됨	14.496	.000	5.163	63	.000	2.4325	.4711	1.4911	3.3739
	등분산이 가정되지 않음			5.420	50.710	.000	2.4325	.4488	1.5313	3.3336
RPK	등분산이 가정됨	3.743	.058	-.220	63	.826	-1211.47	5496.01	-12194.37	9771.42
	등분산이 가정되지 않음			-.227	60.416	.821	-1211.47	5345.80	-11903.15	9480.21
ASK	등분산이 가정됨	5.719	.020	.342	63	.733	2689.29	7860.72	-13019.10	18397.68
	등분산이 가정되지 않음			.354	58.316	.725	2689.29	7602.84	-12527.70	17906.27
FTK	등분산이 가정됨	.282	.597	-2.516	63	.014	-1217.91	484.09	-2185.29	-250.53
	등분산이 가정되지 않음			-2.544	62.985	.013	-1217.91	478.82	-2174.76	-261.06
FLT	등분산이 가정됨	3.887	.053	5.182	63	.000	44.40	8.57	27.28	61.52
	등분산이 가정되지 않음			5.425	52.259	.000	44.40	8.18	27.98	60.82

Regression

진입/제거된 변수[b]

모형	진입된 변수	제거된 변수	방법
1	LDF[a]	.	입력

a. 요청된 모든 변수가 입력되었습니다.

b. 종속변수: ROA

모형 요약[b]

모형	R	R 제곱	수정된 R 제곱	추정값의 표준오차	통계량 변화량				
					R 제곱 변화량	F 변화량	자유도1	자유도2	유의확률 F 변화량
1	.319[a]	.102	.090	3.960E-02	.102	8.280	1	73	.005

a. 예측값: (상수), LDF

b. 종속변수: ROA

분산분석[b]

모형		제곱합	자유도	평균제곱	F	유의확률
1	선형회귀분석	1.298E-02	1	1.298E-02	8.280	.005[a]
	잔차	.114	73	1.568E-03		
	합계	.127	74			

a. 예측값: (상수), LDF

b. 종속변수: ROA

계수[a]

모형		비표준화 계수		표준화 계수	t	유의확률
		B	표준오차	베타		
1	(상수)	-.178	.067		-2.634	.010
	LDF	2.740E-03	.001	.319	2.878	.005

a. 종속변수: ROA

Regression

진입/제거된 변수[b]

모형	진입된 변수	제거된 변수	방법
1	FTK[a]	.	입력

a. 요청된 모든 변수가 입력되었습니다.

b. 종속변수: DAR

모형 요약

모형	R	R 제곱	수정된 R 제곱	추정값의 표준오차
1	.443[a]	.196	.185	.159971

a. 예측값: (상수), FTK

분산분석[b]

모형		제곱합	자유도	평균제곱	F	유의확률
1	선형회귀분석	.456	1	.456	17.830	.000[a]
	잔차	1.868	73	2.559E-02		
	합계	2.324	74			

a. 예측값: (상수), FTK

b. 종속변수: DAR

계수[a]

모형		비표준화 계수		표준화 계수	t	유의확률
		B	표준오차	베타		
1	(상수)	.830	.034		24.566	.000
	FTK	-3.87E-05	.000	-.443	-4.222	.000

a. 종속변수: DAR

Time-series

MODEL: MOD_1.

Results of EXSMOOTH procedure for Variable LDF
MODEL= NN (No trend, no seasonality)

Initial values:	Series	Trend
	70.67547	Not used

DFE = 74.

The 10 smallest SSE's are:	Alpha	SSE
	.5000000	1130.48991
	.6000000	1141.52196
	.4000000	1152.05139
	.7000000	1182.30839
	.3000000	1210.26932
	.8000000	1251.97890
	.2000000	1311.03148
	.9000000	1351.85899
	1.000000	1485.48839
	.1000000	1487.04318

The following new variables are being created:

NAME	LABEL
FIT_1	Fit for LDF from EXSMOOTH, MOD_1 NN A .50
ERR_1	Error for LDF from EXSMOOTH, MOD_1 NN A .50

Time-series

```
MODEL:  MOD_2.

Results of EXSMOOTH procedure for Variable LDF
MODEL= NN (No trend, no seasonality)

 Initial values:       Series            Trend
                     70.67547         Not used

DFE = 74.

The 10 smallest SSE's are:      Alpha             SSE
                              .5000000      1130.48991
                              .6000000      1141.52196
                              .4000000      1152.05139
                              .7000000      1182.30839
                              .3000000      1210.26932
                              .8000000      1251.97890
                              .2000000      1311.03148
                              .9000000      1351.85899
                             1.000000       1485.48839
                              .1000000      1487.04318

The following new variables are being created:

  NAME        LABEL

  FIT_2       Fit for LDF from EXSMOOTH, MOD_2 NN A .50
  ERR_2       Error for LDF from EXSMOOTH, MOD_2 NN A .50

1 new cases have been added.
```

Time-series

MODEL: MOD_2.

Results of EXSMOOTH procedure for Variable ROA
MODEL= NN (No trend, no seasonality)

Initial values:	Series	Trend
	.01600	Not used

DFE = 74.

The 10 smallest SSE's are:	Alpha	SSE
	.2000000	.12301
	.1000000	.12408
	.3000000	.12672
	.4000000	.13212
	.5000000	.13810
	.6000000	.14424
	.7000000	.15054
	.8000000	.15725
	.9000000	.16479
	1.000000	.17375

The following new variables are being created:

NAME	LABEL
FIT_1	Fit for ROA from EXSMOOTH, MOD_2 NN A .20
ERR_1	Error for ROA from EXSMOOTH, MOD_2 NN A .20

Time-series

MODEL: MOD_3.

Results of EXSMOOTH procedure for Variable ROA
MODEL= NN (No trend, no seasonality)

Initial values:	Series	Trend
	.01600	Not used

DFE = 74.

The 10 smallest SSE's are:	Alpha	SSE
	.2000000	.12301
	.1000000	.12408
	.3000000	.12672
	.4000000	.13212
	.5000000	.13810
	.6000000	.14424
	.7000000	.15054
	.8000000	.15725
	.9000000	.16479
	1.000000	.17375

The following new variables are being created:

NAME	LABEL
FIT_2	Fit for ROA from EXSMOOTH, MOD_3 NN A .20
ERR_2	Error for ROA from EXSMOOTH, MOD_3 NN A .20

1 new cases have been added.