The relationship between liquidity and profitability

An exploratory study of airline companies between 2005 and 2008

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Supervisor: Sune Tjernström
Author: Renato Schwambach Vieira
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Renato Schwambach Vieira
ABSTRACT

This thesis analyzes the relationship between liquidity and profitability in a group of companies comprising the major airline carriers in the world between 2005 and 2008.

The aim of this work is to verify the relationship between these two indicators over the short and medium term, and also to observe how this relationship was affected by the financial crises of 2008.

Using the financial data published by the companies, the relationship was studied with the help of statistical procedures and also a two-dimensional analysis.

Surprisingly it was observed a significant positive correlation between liquidity and profitability on the short run, contradicting the main literature.

For the medium run it was confirmed that the relationship is positive. It was observed that in almost 2/3 of the cases companies with a bad indicator of profitability or liquidity faced a deterioration of the other indicator. Thus and equilibrium between liquidity and profitability seems to be a condition for financial stability over the medium run.

Finally it was observed that during the year of 2008 companies with a high liquidity indicator had a much better performance than the less liquid companies.

The study had an exploratory nature and its conclusions are restricted to the group of companies and to the periods examined.

Keywords: Corporate Finance, Financial Analysis, Profitability, Liquidity, Airline companies, Financial Crises.
TERMINOLOGY

**Accounting Liquidity**

Measures the company's ability to meet its short-term obligations using its most liquid assets. That is, accounting liquidity is the ease with which a company can pay its bills and liabilities over the next year, especially if it must convert its assets into cash in order to do so. Two common ways to measure accounting liquidity are the current ratio and the quick ratio. (financial-dictionary.thefreedictionary.com, 2010)

**Profitability Ratios.**

A class of financial metrics that are used to assess a business's ability to generate earnings as compared to its expenses and other relevant costs incurred during a specific period of time. For most of these ratios, having a higher value relative to a competitor's ratio or the same ratio from a previous period is indicative that the company is doing well. (www.investopedia.com, 2010)

**Correlation**

A statistical relation between two or more variables such that systematic changes in the value of one variable are accompanied by systematic changes in the other. (wordnetweb.princeton.edu).
# TABLE OF CONTENTS

1. INTRODUCTION ........................................................................................................ 1  
   1.1 Inspiration ........................................................................................................... 1  
   1.2 Background and main questions ......................................................................... 1  
   1.3 Justification and Purposes of the study .............................................................. 2  

2. RESEARCH CONSIDERATIONS ............................................................................ 4  
   2.1 Scientific Method ............................................................................................... 4  
   2.2 Scientific Approach ........................................................................................... 4  
   2.3 Ex-post facto research ....................................................................................... 5  

3. LITERATURE REVIEW ......................................................................................... 7  
   3.1 Operational definitions ...................................................................................... 7  
      3.1.1 Profitability .................................................................................................. 7  
      3.1.2 Liquidity ...................................................................................................... 7  
   3.2 The tradeoff liquidity-profitability ........................................................................ 8  
   3.3 Hirigoyen Hypothesis ......................................................................................... 9  
   3.4 Pimentel, Braga and Casa Nova results ............................................................... 10  
   3.5 Integrated performance of profitability and liquidity ......................................... 11  
   3.6 The financial crises of 2008 and the airline industry ......................................... 11  

4. RESEARCH METHODS ......................................................................................... 14  
   4.1 Construction of the hypothesis ......................................................................... 14  
      4.1.1 Hypothesis 1: ............................................................................................... 14  
      4.1.2 Hypothesis 2: ............................................................................................... 14  
      4.1.3 Hypothesis 3: ............................................................................................... 14  
   4.2 Operation of the variables ................................................................................ 15  
      4.2.1 Profitability .................................................................................................. 15  
      3.3.2 Liquidity ...................................................................................................... 15  
   4.3 Sample selection and data collection ................................................................. 16  
      4.3.1 Critique of used sources ............................................................................. 17  
   4.4 Data procedures ................................................................................................ 17  
      4.4.1 Statistical correlations ............................................................................... 17  
      4.4.2 Two-dimensional analyzes ........................................................................ 18  
      4.4.3 Financial Crises analyses ........................................................................... 19  

5. DATA ANALYSES AND RESULTS .................................................................... 20  
   5.1 Data analysis ..................................................................................................... 20  
      5.1.2 Liquidity ...................................................................................................... 20  
      5.1.3 Profitability .................................................................................................. 21  
   5.2 Testing Hypothesis 1 ......................................................................................... 21  
      5.2.1 Others observations.................................................................................... 23  
   5.3 Testing Hypothesis 2 ......................................................................................... 23  
   5.4 Testing hypothesis 3 .......................................................................................... 23
1. INTRODUCTION

This chapter will give the reader a short background for the chosen topic, and also present the main questions I will try to answer over this study.

1.1 Inspiration

This work is majorly a replication of Pimentel, Braga and Casa Nova (2005) study over the relationship between liquidity and profitability on the short and long run. On their article, it was developed an exploratory research with a group of retailing companies in the Brazilian market. The objective was to analyze the interaction between the accounting liquidity and the performance of the companies on the short and medium run. They studied a period of 4 years (2000 to 2003) and found out a negative correlation on the short term, and refute a positive correlation on the medium term.

The idea of this study is to replicate the same procedure of their article, however for a different group of companies from a different business segment and into a different period. Thus I will compare the findings of both studies.

1.2 Background and main questions

According to Shapiro (2006, p.30) financial management is usually divided in two main separated functions: acquisition and investment of funds. Thus it is part of the financial management decisions the attributions to obtain the necessary resources and apply them in order to achieve the profit maximization or the maximum value for shareholders.

The management of working capital is the part of the financial management responsible for the control of the gross current assets, which includes the firm’s cash, account receivables and inventories (Beranek, 1966, p. 3).

One of the main issues regarding the working capital management is the tradeoff between the lower profitability of current assets and the financial slack provided from it (Beranek, 2003, p.18). According to Assaf Neto (2003, p.22), the liquid assets are usually less profitable then the fixed assets. Investments in working capital do not generate production or sales.

According to Eljelly (2004, p.2) the management of working capital becomes even more important during crises periods, “liquidity management is important in good times and it takes further importance in troubled times.” Also according to him, the efficient management of the liquidity levels of a company is of extreme relevance for the firm’s profitability and well being.

Ross (2000) and Gitman (2003) also corroborate this idea, confirming a tradeoff between high amounts of net working capital and maximizing profitability. This dilemma would be a consequence of the fact that high values used in current assets tend to generate costs for maintenance, not directly adding value to the company and thereby generating profitability. It is thus a dilemma for managers between liquidity and
profitability demonstrated by a negative relationship between two variables.

However, Hirigoyen (1985) argues that over the medium and long run the relationship between liquidity and profitability could become positive, in the sense that a low liquidity would result in a lower profitability due to greater need loans, and low profitability would not generate sufficient cash flow, thus forming a vicious cycle.

Pimentel et al. (2005, p.86) states that in his article Hirigoyen only develops this idea into a theoretical way, grounding his theory in order to deduce, logically, the results of this possible long term influence, without, however, apply it empirically in companies.

Thus, the empirical investigation of this theoretical construction will be the main aim of this study. First I will try to observe if it is true that on the short run it is observed a negative relationship between liquidity and profitability, and then if on the medium term this correlation becomes positive.

So the 2 first questions for this research are:

1) Is there a negative relationship between liquidity and profitability on the short run?

2) Is there a positive relationship between liquidity and profitability on the medium to long term?

Also the studied period covers 2008, which was the outbreak of a huge financial crisis. After the bankruptcy of the American hedge found and the Lehman Brothers investment bank the market faced a credit crunch that leads to the decrease of production, sales and the availability of funds for corporations. (The New York Times, 2009)

Thus another question that rises from this scenario is:

3) Did the companies with a better liquidity ratio have a better performance during the financial crises of 2008?

1.3 Justification and Purposes of the study

The work is justified because all the researched concepts are widely known and accepted, i.e. there is a wide literature inside the financial management area regarding the concepts of liquidity and profitability.

Some studies were made in order to observe the interaction between these two variables, such as Pimentel et al. (2005), Marques and Braga (1995), Blatt (2001) and Perobelli et al. (2007). However my research differs from these previous studies in the aspects that it uses more recent data, also including a crises period in the analyses. Also my sample consists of much larger companies, since I took the data from the main airline carriers of the world.
Thus the problem the study deals with is to empirically test the theoretical hypothesis regarding the relationship between liquidity and profitability. First it will be tested the tradeoff in the short term, then the positive interdependence on the medium to long term, and finally the relationship during the crises year.

By dealing with these problems it is expected to improve the general knowledge of Working Capital Management, and thus contribute to the development of this financial activity.

Since the study is partially a replication of Pimentel et al. (2005) previous research, the objective of the study is to directly compare the results observed on both researches. Thus, by this direct comparison the conclusion of their work will be grounded and/or confronted.
2. RESEARCH CONSIDERATIONS

This chapter presents the theoretical considerations, i.e. the philosophic perspectives and the scientific approach that were used to support the formulation of this thesis.

2.1 Scientific Method

According to Wolfs (1998, appendix e) “The scientific method is the process by which scientists, collectively and over time, endeavor to construct an accurate (that is, reliable, consistent and non-arbitrary) representation of the world.”

The steps for the execution of the scientific method includes the collection of data that can be made by observation and experimentation, the formulation of the hypothesis that will aim to explain the observed phenomena, and the testing of hypotheses, that will confirm or reject the proposed hypothesis. (Ibid)

The observed reality of my research will be the financial ratios of a group of companies, then, supported by the financial literature, I will formulate a few hypotheses to explain the relationship of these ratios, and finally I’ll test my hypothesis by the execution of statistical procedures.

2.2 Scientific Approach

My research wishes to find the interdependence between two financial variables, liquidity and profitability for a selected group of companies. I wish to observe the existence, direction and strength of this relationship for the short and medium term, and also observe if it suffered any significant change during the financial crises of 2008.

In order to answer these inquires I intend to develop a deductive scientific approach, relating the theory with the results of my research. The theoretical hypothesis will be tested observing the norms of natural scientific model under a positivism ideology, considering social reality as an objective reality (Bryman, 2003, p. 63).

After collecting the data and making the statistical procedures I will be able to confirm or reject my hypothesis, which will enable me to contribute to general understanding of reality.

Regarding epistemological issues, i.e. what is the acceptable knowledge for the discipline, I will apply the positivism approach, which means that the natural science methods will be applied over the social reality. According to Bryman (2008, p. 13) the positivism follows the following principles:

-Only phenomenon and hence knowledge confirmed by the sense can genuinely be warranted as knowledge.

-The purposes of theory is to generate hypothesis that can be tested and that will thereby allow explanations of laws to be accessed

-Knowledge is arrived at through the gathering of facts that provide the basis for laws
- *Science must be conducted in a way that it is value free, i.e. objective.*

- *There is a clear distinction between scientific statement and normative statement and a belief that the former are the true domain of the scientist.*

I agree with these principles and think they fit well with my research; I will base my theory in the published and verified literature, formulate the hypothesis to explain the observed and unique reality, and then test the hypothesis which can be accepted or rejected.

An opposing epistemological approach is hermeneutics, which considers that the preconceptions of the researcher are an essential aspect of the analysis (Patel and Davidson 2003, p. 30 quoted in Lamberg and Valming, 2009, p. 15). Since my study will be based on statistical procedures executed over the officially published data, I do not believe my previous ideas and principles will affect the analyses.

For the ontological perspective, i.e. the nature of social entities (Bryman 2008, p. 22), I will consider the position of objectivism, which considers that social phenomena are external facts beyond the influence of the actors. It means that for this research the firms will be considered to have an existence that is external to the individuals who inhabit it. (Ibid)

Regarding the research approach, I will execute a deductive research, which means that the theory will be the starting point and I will test the hypothesis in order to ground or confront the theory (Saunders, Lewis & Thornhill, 1997, p.70).

Thus, based on the philosophies of positivism combined with a deductive approach, the research will follow the procedures of an ex-post-facto research.

### 2.3 Ex-post facto research

According to Gil (1991 p. 32) an ex-post-facto research is defined as an experiment to be held after the occurrence of the event. It is not like an experiment, since the researcher does not have total control over the variables.

On this method, events that have already took place, are taken as experimental and thus the researcher work with these phenomenon as it was submitted to his or her control.

The ex-post-facto procedure is widely used by social sciences since usually it’s impossible to isolate and control the studied object. For the economic and global groups studies it is hard not to use the ex-post-facto approach, since it is the unique way to consider historical background which is of fundamental importance in the comprehension of the social construction. (Gil, 1991, p.33)

According to Gil, the ex-post-facto research must observe the following steps:

- a) identification of the problem;
- b) formulation of the hypothesis;
- c) operation of the variables;
d) identification of research groups;

e) data collection;

f) analyses and interpretation of the data;

g) conclusions;

This research was elaborated following these steps mentioned above.

The identification of the problem was covered from the literature review presented on chapter 3. Chapter 4 presents steps “b” to “e”, i.e. the construction of the hypothesis, the operation of the variables, the selection of the research group and the data collection. Chapter 5 treats the analyses and interpretation of the data, and finally chapter 6 will show the final conclusions of the study.
3. LITERATURE REVIEW

In this chapter I will present the theoretical concepts of the studied field, the definition of the main variables, as the main theories and researches relating the relationship between liquidity and profitability.

3.1 Operational definitions

Before proceeding to the theoretical literature review I’d like to first define the main variables of this study:

3.1.1 Profitability

Profitability can be defined as the final measure of economic success achieved by a company in relation to the capital invested in it. This economic success is determined by the magnitude of the net profit accounting (Pimentel et al, 2005 p.86).

To achieve an appropriate return over the amount of risk accepted by the shareholders, is the main objective of companies operating in capitalist economies. After all, profit is the propulsive element of any investments in different projects.

The assessment of profitability is usually done through the ROA (Return on Assets = Net Income / Total Assets) and ROE (Return on Equity = Net Income / Equity), which is the ultimate measure of economic success.

3.1.2 Liquidity

According to Shim and Siegel (2000, pp.46-47) accounting liquidity is the company’s capacity to liquidate maturing short-term debt (within one year). Maintaining adequate liquidity is much more than a corporate goal is a condition without which it could not be reached the continuity of a business.

Solvency and liquidity are two concepts that are closely related and reflect upon the actions of company’s working capital policy. A low liquidity level may lead to increasing financial costs and result in the incapacity to pay its obligations. (Maness & Zietlow 2005, p.25)

It is common to find reference to the fact that it is desirable to keep the company liquidity ratio higher than 1.00. That would prove the firms ability to repay short-term commitments, with the liquidation of short term assets. Any ration below 1.0 may mean that the business may not be generating cash enough to meet the short term obligations (Morrel, 2007, p.62). However as Matarazzo (2003, p.54) had stressed, "if an analyst is observing a company's balance sheet and face a liquidity ratio of less than 1.00 he shall not, in principle, consider it to be unable to pay its debts on time." The liquidity ratio would, according to the author, most appropriately be interpreted as an indicator of the degree of independence of the company against creditors and its ability to face crises and unexpected difficulties.
Another common assertion is that high liquidity is as undesirable as a low liquidity, meaning financial mismanagement. According to Matarazzo (2003, p.55), high liquidity is not always a sign of financial mismanagement. If the high current ratio during a low-current liabilities, it may be a sign of a wise administration, which avoids financial costs of bank loans, or even a strategy to get good discounts with suppliers for cash payments.

It can also be the case that a high level of inventory is part of the operational characteristics of the company. For example, firms that need to maintain significant value in stocks, demanded by customers quickly, as the case of commercial companies. Another example would be companies which stocks have high value-added, as resellers of electronics, vehicles etc. (Pimentel et al. 2005, p.87)

3.2 The tradeoff liquidity-profitability

The management of working capital is one of the most important aspects of Financial Administration, according to Gitman (2003, p.608), net working capital is the amount by which a firm’s current assets exceed its current liabilities. If the company fails to keep a satisfactory level of working capital, it will probably become insolvent. The current assets of enterprises must be at a level that can cover the liabilities at reasonable margin of safety.

According to Chandra (2001, p.72), normally a high liquidity is considered to be a sign of financial strength, however according to some authors as Assaf Neto (2003, p.22), a high liquidity can be as undesirable as a low. This would be a consequence of the fact that current assets are usually the less profitable then the fixed assets. It means that the money invested in current assets generates less returns then fixed assets, representing thus an opportunity cost. Besides that, the amounts employed in current assets generate additional costs for maintenance, reducing thus the profitability of the company.

However Arnold (2008, p.537) points that holding cash also provides some advantages, such as (1) provides the payment for daily expenses, such as salaries, materials and taxes. (2) Due to the fact that future cash flows are uncertain, holding cash gives a safety margin for eventual downturns. And finally (3) the ownership of cash guarantees the undertaken of highly profitable investments that demands immediate payment.

Thus it is an important task for the financial manager to achieve the appropriate balance between the adequate liquidity and a reasonable return for the company. Thus, according to Perobeli, Pereira and David (2007, p3) the decision about the liquidity level should be based in the following dilemma:

- The larger the applied resources in current assets, the lower the profitability (however also is lower the solvency risk);
- However a lower level of Net working capital by the same time that it increases the profitability it also increases the solvency risk of the firm, by reducing the long term funds that could be transferred to less profitable assets.
Also, according to the economic theory, risk and profitability are positively related (the more risky the investment, the higher the profits it should offer), thus since higher liquidity means less risk, it would also mean lower profits.

According to Assaf Neto (2003, p.22), the greater the amount of funds invested in current assets, the lower the profitability, and by the same time the less risky is the working capital strategy. In this situation, the returns are lower in the case of a greater financial slack, in comparison to a less liquid working capital structure. Conversely, a smaller amount of net working capital, while sacrificing the safety margin of the company, by raising its insolvency’s risk, positively contributes to the achievement of larger return rates, since it restricts the volume of funds tied up in assets of lower profitability. This risk-return ratio behaves in a way that no change in liquidity occurs without the consequence of an opposite move in profitability.

This way each company should choose an amount of net working capital that better fits its risk accessibility and profit margins.

Marques and Braga (1995) confirmed this inverse relationship between liquidity and profitability for a sample of food companies. Blatt (2001), also called a negative relationship between liquidity and profitability, measured by Dynamic Model and profitability.

However, Perobelli et al. (2007, p.7) argue that on the long-term there is a necessity to achieve a balance between the financial and economic profile. For these authors, liquidity and financial position reflected in return on equity, which also contains the effect of financial leverage, are two sides of a coin which is the economic and financial health of companies. One thing to note is that the appropriate return allows the self-financing of business operations through the retained portion of net profit. Thus, good profitability increases the liquidity and marketability promotes proper growth and future profitability.

Thus the Optimal level for liquidity would be obtained by a trade-offs between the low return of current assets and the benefit of minimizing the need for external finance (Kim, Mauer, and Sherman, 1998, p.335).

Eljelly (2004) examined the relation between profitability and liquidity measured by current ratio and cash gap (cash conversion cycle) on a sample of joint stock companies in Saudi Arabia using correlation and regression analysis. They found a negative relationship between profitability and liquidity indicators, and it was found that CCC had a bigger impact over profitability then Current ratio. Also it was observed that there was great variation among industries with respect to the significant measure of liquidity.

García-Teruel and Solano (2007) studied the effects of working capital management over companies ROA. They observed 8872 enterprises and found out that shortening cash conversion cycle had significant effect over companies’ profitability.

Smith and Begemann (1997) studied if the maximization of the firm's returns could threaten its liquidity, and the pursuit of liquidity had a tendency to dilute returns. They analyzed the relation between working capital measures and return on investment (ROI) for a sample of industrial firms listed on the Johannesburg Stock Exchange (JSE). The
statistical test results showed that a traditional working capital leverage ratio, current liabilities divided by funds flow, displayed the greatest associations with return on investment. Traditional liquidity ratios as current and quick ratios registered insignificant associations.

Raheman and Nasr (2007) studied the relationship between Working Capital Management and profitability for 94 Pakistani companies listed on Karachi Stock Exchange. Between their findings, it was observed a significant negative relationship between companies liquidity and profitability.

Thus we observe that the literature considers that there is an inverse relationship between liquidity and profitability, and this relationship has been tested and confirmed in several studies in different markets.

3.3 Hirigoyen Hypothesis

This dilemma between profitability and liquidity is largely demonstrated in the literature (Pimentel et al, 2005, p 84). However, Hirigoyen (1985) questioned if this tradeoff is also valid in the medium and long-run. According to this author, there shall be an interaction between liquidity and profitability, so that a low liquidity will eventually compromise high profitability and low return ends making it harder to achieve a high liquidity level.

A company with low liquidity and high profitability has to increase its borrowing leading to an increase of the financial costs. This would certainly lead to increasing interest rates, since the cheaper sources are quickly exhausted. Furthermore, having increased its debt, the company raises its credit risk, causing an increase in interest rates charged by their financiers. Under these conditions, the company has to get more time from suppliers, resulting in the acquisition of raw materials at higher prices. Also it will fail to achieve financial discounts offered by the anticipation of payments and incur interest and penalties for late payments of various bills, taxes and so on. After all this process the liquidity problems would become even worse. (Ibid, p.128)

Moreover, a firm with low profitability and high liquidity does not generate enough own resources (cash flow = Net income + Depreciation - Dividends) to finance the expansion of its needs for working capital, purchase new fixed assets, outstanding loans, etc. And it ends up compromising liquidity.

Thus, for Hirigoyen (Ibid) the profitability and solvency are necessary condition for the healthy existence of the company and both are conditioned by the strategy adopted in the medium and long term.

On his work Hirigoyen was based on three premises, namely:

(1) The profitability ensures the development of the company. However the obsessive quest for profitability may undermine the solvency of the company;
(2) The solvency reduces the total risk of the company, showing that the net working-capital can reduce the risk of bankruptcy. However, a very large safety margin restricts profitability;
(3) The profitability and solvency are conditioned by the company's strategy. The company's growth brings with it a progressive increase in financial needs for the operational cycle, leading to a change in the solvency capacity.

According to this premises we can expect that a company that have a low level of liquidity, will see on the medium run a deterioration of its profitability, and on the same way a company with a low profitability will have its profits reduced over the medium term.

Hirigoyen (1985) concludes his study showing that profitability and liquidity are determinants of the company’s equilibrated survival. These two factors are at the same time, the results (consequences) and restrictions (constraints). Therefore, the integration of both should lead to the goal of flexibility.

3.4 Pimentel, Braga and Casa Nova results

In order to test Hirigoyen hypothesis, Pimentel et al (2005) performed an empirical study with a sample of retailing companies in the Brazilian market for the period of 2000 to 2003.

The authors found out for the analyzed sample that the larger the current ratios, the smaller the ROE, thus there would be a negative correlation among liquidity and profitability on the short run. This result supports the main literature of the area showing a dilemma between a liquidity and profitability.

For the medium run they analyzed Hirigoyen Hypothesis that the companies with high liquidity but low profitability would have its current ratio reduced, and that companies with low liquidity and high profitability would have the returns reduced. They rejected this hypothesis based on two-dimensional analyses, which showed that 72% of their sample moved in disagreement with this theoretical prediction.

3.5 Integrated performance of profitability and liquidity

Previous studies have dealt with the financial analysis of companies, seeking to integrate aspects of profitability and liquidity as Fleuriet et al. (2003). Some used integrated models, like Du Pont’s and Fleuriet’s Models, which tried to evaluate financial and economic aspects reflected in the financial statements in order to verify the economic-financial status of the firm.

Braga, Nossa and Marques (2004) developed a model called Indicator de Saúde Econômico-Financeira das Empresas (Financial-economic indicator of firm’s healthiness) or ISEF, which makes it possible to evaluate, together, liquidity and profitability. Based on this framework the variables are evaluated as well as their relationship.
Few studies attempted to integrate the analysis of two multidimensional indicators for assessing performance, demonstrating thus an open area for researches and scholars in the field of financial administration.

3.6 The financial crises of 2008 and the airline industry

In September 2008 the bankruptcy of Lehman Brothers was the critic point of the subprime mortgage crisis of the American real state market. It triggered world’s worst downturn since 1929 (Foster & Magdoff, 2009, p. 11). The channels of credit have been severely constricted, cutting off crucial funds to all kind of market player, from families to large enterprises.

The consequences over real economy were intense, figure 1 shows the growth rate for a group of countries in 2007 and 2008, and it shows that all countries faced a reduction on the growth rate, even considering that in 2008 during 8 months the economy was running in a similar level as 2007:

![Figure 1 - Real GDP growth rate (2007 and 2008)](image)

In the airline sector the crises started before September. For the airline companies one of the main issues is the oil price, since a considerably amount of the companies expenses comes from the fuel costs, which is straightly related to the oil price (Lufthansa, 2006, p.66). In 2006 the average price of oil barrel was of 58.3 USD, the fuel expenses represented 16.5% of Lufthansa expenses and 35% for Ryanair. In 2008 the average price for the oil barrel went up to 91.4 USD, raising Lufthansa and Ryanair fuel expenses to respectively 20.7% and 44% of total expenses.

Figure 2 shows the daily oil price, and how it severely rose in 2008, reaching almost 150 USD per gallon in April.
As we can see the oil price rapidly fell after August 2008, however this period coincides exactly with the critical point of the financial crises, the bankruptcy of Lehman Brothers that lead to the financial panic and an extreme restriction over credit access.

The economic downturn strongly reduced the demand for airline tickets, from September 2008 until August 2009 the number of passengers was continuously reduced (IATA, 2010, p3).

Figure 3 show shows the key financial statistics for the airline industry published by the International Air Transport Association (IATA). In 2007 the total net profit of the airline sector was of 12.9 billions USD, in 2008 this same number fell to a total loss of 15.9 billions USD. This was a direct consequence of two main factors:

- the fuel expenses that rose from 134 to 189 billion dollars
- the number of passengers that started to fell in August 2008

In 2009 the consequences of the financial crises became even worse, the total revenues suffered a reduction of 15%, the result was not worse because the fuel expenses felt 40% in consequence of the oil price reduction.

Unfortunately for my research it was not possible to collect data for all individual companies of my sample for the year of 2009, so despite the fact that the numbers for this year must be extremely interesting it was not included in the analyses.
### Figure 3 - Airline industry statistics

<table>
<thead>
<tr>
<th>System-wide global commercial airlines</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009E</th>
<th>2010E</th>
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<tr>
<td>REVENUES, $ billion</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>% change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger</td>
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<td>405</td>
<td>510</td>
<td>504</td>
<td>479</td>
<td>522</td>
</tr>
<tr>
<td>Cargo</td>
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<td>353</td>
<td>439</td>
<td>397</td>
<td>395</td>
</tr>
<tr>
<td>Cargo tonne, millions</td>
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<td></td>
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</tr>
<tr>
<td>Freight tonne, millions</td>
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<td>Word economic growth, %</td>
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<td>3.7</td>
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<td>Passenger yield %</td>
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<td>Cargo yield %</td>
<td>2.4</td>
<td>6.9</td>
<td>5.9</td>
<td>10.2</td>
<td>-14.2</td>
<td>3.1</td>
</tr>
<tr>
<td>EXPENSES, $ billion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td>400</td>
<td>450</td>
<td>490</td>
<td>573</td>
<td>450</td>
<td>513</td>
</tr>
<tr>
<td>% of expenses</td>
<td>8.9</td>
<td>10.1</td>
<td>9.8</td>
<td>16.9</td>
<td>-16.2</td>
<td>7.0</td>
</tr>
<tr>
<td>Crude oil price, Brent, $/b</td>
<td>84.5</td>
<td>88.0</td>
<td>73.0</td>
<td>89.9</td>
<td>82.3</td>
<td>78.0</td>
</tr>
<tr>
<td>Non-Fuel</td>
<td>318</td>
<td>343</td>
<td>326</td>
<td>354</td>
<td>387</td>
<td>382</td>
</tr>
<tr>
<td>cents per atk (non-fuel unit cost)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break-even weight load factor, %</td>
<td>82.0</td>
<td>81.3</td>
<td>82.8</td>
<td>63.8</td>
<td>62.9</td>
<td>63.9</td>
</tr>
<tr>
<td>Weight load factor achieved, %</td>
<td>82.6</td>
<td>83.3</td>
<td>83.2</td>
<td>62.3</td>
<td>62.9</td>
<td>84.9</td>
</tr>
<tr>
<td>OPERATING PROFIT, $ billion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% margin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NET PROFIT, $ billion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Source: IATA fact sheet industry fact sheet, April 2010
4. RESEARCH METHODS

Based on the theoretical review made on last chapter and following the research considerations of chapter 2, in this chapter I will formulate the research structure of the thesis. I.e., this chapter will present the construction of the hypothesis, the operation of the variables; the data collection issues and the procedures I will execute in order to test the hypothesis.

4.1 Construction of the hypothesis

In the introduction chapter the main questions of the research were raised, which were:

1) Is there a negative relationship between liquidity and profitability on the short run?

2) Is there a positive relationship between liquidity and profitability on the medium to long term?

3) Did the companies with a better liquidity ratio have a better performance during the financial crises of 2008?

In order to try to answer these questions and based on the studied literature, I’ll build the hypothesis that will be tested in this research:

4.1.1 Hypothesis 1:
- On the short term the relationship between liquidity and profitability is negative

Since the current assets are usually less profitable then fixed assets (Assaf Neto, 2003, p.22), a company that wishes to keep higher levels of current assets have to abdicate more profitable investment in fixed assets.

4.1.2 Hypothesis 2:
- On the medium term a low liquidity level will derail the upkeep of high profitability, and also a low profitability will derail the upkeep of a high liquidity

Hirigoyen (1985) argued that on the medium to long term the liquidity is dependent of profitability, and vice-versa. The profits would guarantee the resources for the liquidity stability, and a safe margin of working capital would avoid increasing financial costs, leading to a stable profitable performance.

4.1.3 Hypothesis 3:
- Over the year of 2008 the companies with higher liquidity would be able to achieve a better performance.
With the trigger of the financial crises in 2008 the access to credit became considerably more expensive, increasing the financial costs of companies, thus the firms with a safer liquidity would be better prepared to deal with the hard times.

These 3 hypotheses will be verified by the data analyses; and they can be confirmed or rejected.

4.2 Operationalization of the variables

The relevant indicators for this study are the profitability and the liquidity of the companies, thus in order to make the statistical procedures this indicators must be represented by a measurable variable.

4.2.1 Profitability

In order to measure the profitability of the company the most usual indicator is the return over equity (ROE), which is obtained by divided the net profit over the total shareholder’s equity.

However some of the companies in the studied sample had very small values for equity (sometimes even negative values), so in order to go around this problem the return over assets (ROA) could be used as a measure of profitability. This indicator is obtained by dividing the net profit of the period by the total assets of the company. Unlike the ROE the ROA is not a measure of firm’s efficiency to generate profit from the invested capital, thus it cannot be used to compare the companies performance against other kinds of investments, such as bonds. Also ROA is not the best indicator in order to compare the performance of companies in different industries, since the scale factors and capital requirements may differ, however this ratio is good to compare the profitability between companies inside the same sector.

The ROA can be used on my research because all the companies of the sample operate in the same industry. Thus by analyzing the different ROA of the firms I will be able to verify if the profitability is in someway related to the liquidity levels. The ROE would not provide a good comparison because the small and the negative equity levels of some companies would generate distorted indicators of profitability.

The ROA is calculated by dividing the net income of each period over the total assets of the companies. Since both numbers could be easily found on the financial statements on the annual reports it was hard to make a table with this ratio.

4.2.2 Liquidity

To measure the liquidity level of the companies the current ratio (CR) was chosen. This ratio measures the size of the short current assets in terms of the current liabilities. Both these values are also easily found on the balance sheet on the annual reports.

Another possible indicator of liquidity is the quick ratio (QR), which is obtained dividing the current assets minus the inventories over the current liabilities. For some
companies the inventories can not be easily converted in cash, thus the quick ratio would be a better measurement of their liquidity. However for the airline companies the inventories are usually very small comparing to total amount of current assets. I analyzed a group of 5 companies inside my total sample, and found out that the average proportion of inventories over current assets was of 3%, and for none of these companies the inventories represented more then 7.4% of the current assets. Also the inventories level was not found on the balance sheet for all the companies of the sample. Thus in other to use the quick ratio I would have to or to exclude some of the companies from the sample or to find other financial reports that includes the inventory levels. Since the inventories do not seem to represent a significant difference between the companies the CR was kept as liquidity ratio.

4.3 Sample selection and data collection

I decided to use the airline sector for this study because the service offered by all the different companies is quite homogeneous and the data from a reasonable number of companies would easy to find.

The sample was selected picking up the largest airline companies over the world. In order to observe this criterion, the International Air Transport Association (IATA) data about the number of passengers carried by each company was the parameter for the selection.

In consequence of the time limitation to finish my thesis I decided to pick a sample of only 48 companies, however this number is good enough for the statistical procedures.

Thus, looking for the number of passengers carried according to Air Transport World’s (ATW) Airline Report (2008) I picked up for my sample the largest airline carriers in the world. Also intend to include at least one company of each continent, and at least to have half of the companies from Europe, since in the other continents the larger airlines are concentrated in a few countries. Thus the sample includes airlines from all continents, being of 25 European companies, 12 North Americans, 3 from South America, 1 African, 4 Asians and 3 from Oceania. According to ATW report, together the companies of my sample carried in 2007 1.26 billion passengers, what represents 57% of world’s total flying passengers at that year.

I understand that this was not a random sample selection, however the main objective of my research is not to generalize the results for other cases, but to observe how the relationship between liquidity and profitability occurs for the studied group, and then compare the result with the other researches.

With the companies selected I downloaded the annual reports of 2006 and 2008 from the firm’s websites. With that in hands it was possible to obtain the financial data necessary for the study for the years of 2005 to 2008.
4.3.1 Critique of used sources

Regarding the trustworthiness of my sources I have no reasons to doubt the authenticity, since all the material was extracted from the official reports of the companies which were all audited by reliable accounting auditing firms. Also this financial data is over constantly vigilance from the market agents that has interest on this information, such as shareholders, government and competitors.

All data that will be used on the hypothesis testing were collected directly from the companies’ annual reports; no information was taken from any other source.

Also, all companies follow the International Financial Reporting Standards, thus it was possible to extract exactly the same information from all reports.

There is also the possibility of transference errors, such as typing the wrong number on the spreadsheet. To avoid this kind of mistake the data was doubly checked, however there is always the possibility that something has gone unnoticed, I take full responsibility for any mistake of this kind.

Anyway considering the high reliability of the sources and a systemic checking of the transferred data I’m fully confident in the veracity of the information used in the study.

4.4 Data procedures

In order to execute the statistical procedures, the following series were made from the collected data:

\[ \text{CR}_{2005} \]: The companies’ current ratios for the year of 2005
\[ \text{CR}_{2006} \]: The companies’ current ratios for the year of 2006
\[ \text{CR}_{2007} \]: The companies’ current ratios for the year of 2007
\[ \text{CR}_{2008} \]: The companies’ current ratios for the year of 2008
\[ \text{ROA}_{2005} \]: The companies’ ROA for the year of 2005
\[ \text{ROA}_{2006} \]: The companies’ ROA for the year of 2006
\[ \text{ROA}_{2007} \]: The companies’ ROA for the year of 2007
\[ \text{ROA}_{2008} \]: The companies’ ROA for the year of 2008

Appendix 1 shows the ratios for all the companies of the sample.

Since this study is a replication of Pimentel et al (2005) study, the same procedure made by them will be applied in my study.

4.4.1 Statistical correlations

From the Current ratio and ROA series collected from the sample it will be possible to establish the correlation coefficient between these series.

The following correlation coefficients will be used to test hypothesis 1, regarding the short term relationship of liquidity and profitability.

\[ \text{corr(} \text{CR}_{2005}, \text{ROA}_{2005} \text{)}; \text{ corr(} \text{CR}_{2006}, \text{ROA}_{2006} \text{)}; \text{ corr(} \text{CR}_{2007}, \text{ROA}_{2007} \text{)}; \]
### 4.4.2 Two-dimensional analyzes

In order to observe the medium term relationship between the variables, a two-dimensional analyzes will be made.

The companies will be classified according to its liquidity and profitability, and according to these values they will be put in different quadrants. So the companies will receive a classification according to the place they occupy, as in Table 1.

**Table 1 - Division of the companies in quadrants**

<table>
<thead>
<tr>
<th>Profitability</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquidity</strong></td>
<td><strong>h</strong></td>
<td><strong>I</strong></td>
</tr>
<tr>
<td><strong>H</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>L</strong></td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Classification is made obeying the following rules:

- For the liquidity, the companies with a current ratio higher then 1 are considered to have a high liquidity (H), and companies with current ratio below 1, a low liquidity (L)
- For the profitability, the classification is made according to average ROA for the sample during the year, companies are classified as having a high profitability (h) if their ROA is higher then the average ROA, and a low profitability (h) in the other case.

A company with high liquidity and high profitability is classified as ‘Hh’ i.e. it goes to quadrant 1, another firm with low liquidity and high profitability is ‘Lh’ i.e. it goes to quadrant 3, and so on.

According to Pimentel et al (2005) the companies on the quadrant 1 are considered to be in good financial position. On the other side the companies located on the quadrant 4 were considered to be in bad financial condition. The companies in quadrants 2 and 3 were considered in intermediate condition.

The company’s movements between 2005 and 2007 (2008 was not considered because of the crises, thus its results were supposed to be specific) will be observed in order to test hypothesis 2. If Hirigoyen’s theory is correct we should observe the following movements:

- Companies initially on quadrant 2 (HI), would migrate to quadrants 3 (IH) or 4 (LI).
- Companies initially on quadrant 3 (Lh) would migrate to quadrants 2 (Hl) or 4 (Ll).

Both movements would occur because the low level of one of the indicators would deteriorate the other one.

- Companies initially on quadrant 1 (Hh) or 4 (Ll) would stay in the same place

These companies are already in extreme positions, i.e. the indicators are either good or bad, and thus it would be harder to them to change their position according to the hypothesis.

On the other side the movements that contradict Hirigoyen theory would be:

- Companies located on quadrant 2 (Hl), going to quadrants 3 (Lh) or 4 (Ll).
- Companies located on quadrant 3 (Lh) going to quadrants 2 (Hl) or 4 (Ll).

These movements oppose his theory because they mean that companies with a bad indicator are actually improving the other one.

And also other movements that contradict the theory are:

- Companies initially on quadrant 1 (Hh) or 4 (Ll) going to a different quadrant

4.4.3 Financial Crises analyses

In order to test hypothesis 3, the companies will be divided in 2 groups, the ones with a high liquidity (following the same procedure for the two dimensional analyses), and the others with a low liquidity, and thus the average return rate of 2008 from both groups will be compared.

If Hypothesis 3 is correct, it is expected that companies with a higher liquidity present a significant better performance then the low liquid companies.
5. DATA ANALYSES AND RESULTS

On this section the analysis of the collected data will be executed. Also the hypothesis will be tested through the procedures explained on the previous chapter.

5.1 DATA ANALYSES

Table 2 summarizes the relevant statistical findings for the collected data

<table>
<thead>
<tr>
<th></th>
<th>Liquidity (CR) %</th>
<th>Profitability (ROA) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>89.0</td>
<td>105.3</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>34.0</td>
<td>39.6</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>37.9</td>
<td>37.6</td>
</tr>
<tr>
<td>Minimum</td>
<td>22.3</td>
<td>20.6</td>
</tr>
<tr>
<td>1st Quartile</td>
<td>65.4</td>
<td>84.8</td>
</tr>
<tr>
<td>Median</td>
<td>89.1</td>
<td>100.7</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>105.9</td>
<td>124.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>173.9</td>
<td>211.4</td>
</tr>
<tr>
<td>Range</td>
<td>151.6</td>
<td>190.8</td>
</tr>
<tr>
<td>1st to 3rd Quartile Range</td>
<td>40.6</td>
<td>39.2</td>
</tr>
</tbody>
</table>

5.1.2 Liquidity

On the first 3 years the average and median current ratios were pretty close to 100%. This result shows that usually the airline companies tend to equilibrate the current liabilities in a similar level as the current assets.

In-between 2007 and 2008 the average liquidity was reduced by 17%, falling from 1.05 to .89. A similar but not so intense decrease occurred for the median, which went from 1.0 to .89.

From the coefficient of variation we can see that the deviation for the liquidity is much smaller then the one observed for the profitability. The average coefficient for the 4 years was 42%, while the same average for the profitability was 220%. It means that usually liquidity levels are not extremely far from 1.0.
We can also confirm this inference from the 3rd quartile numbers, which were never higher than 1.25, a liquidity value substantially close to 1.0, meaning that at least three quarters of the companies did not have an extreme high liquidity over the period.

It’s interesting to observe that while the reduction of the median and the 3rd quartile between 2007 and 2008 was respectively of 17% and 13%, the 1st quartile faced a much bigger reduction, decreasing almost 30%. This indicates that the companies that already had a low liquidity ratio faced a bigger reduction of its solvency during the crises.

5.1.3 Profitability

The average ROA was into an increasing trend between 2005 and 2007, going from 1.9% to 3.7%, however in 2008, the year of the crises, it suffered a big drop reaching -3.6%. Also 2008 was the year with the highest standard deviation showing that even it was a bad year, some companies were able to achieve a good performance.

As we can see from the 1st quartile data, in 2005 and 2006 more than 25% of the companies had a negative return, however in 2007 this number became positive, showing that this year at least 75% of the companies reached a positive result; on the other side in 2008 even the median was negative, showing that more than half of the companies had losses.

2008 was also the only year with a considerable difference between the median and the mean, which were respectively -0.6% and -3.6%, indicating that the companies with the worst losses had extremely bad performance during this year.

5.2 Testing Hypothesis 1

- *On the short term the relationship between liquidity and profitability is negative*

In order to test this hypothesis I will verify the correlation coefficients between current ratio and ROA for the years of 2005, 2006 and 2007. The year of 2008 was not included because of the financial crises, thus the results of these should be considered specific. Anyway the correlation for 2008 will be observed while testing hypothesis 3.

Pearson correlation coefficient is the most common tool to measure the relationship between two variables. It measures the linear dependence between two series. The coefficient is a value between +1 and −1 inclusive. A value of 1 implies that a linear equation describes the relationship between the 2 series perfectly, i.e. the first series increases in the same proportion as the second one. A value of −1 implies that all data points lies on a line for which if the first series increases the second have a perfectly proportional decrease. A value of 0 implies that there is no linear correlation between the variables. The other values are a mean term between these results. E.g. a coefficient of 0.4 means that there is a positive but not perfect relationship between the series, a coefficient of 0.8 means the same thing however a 0.8 means a stronger relationship then a 0.4 coefficient.
The interpretation of the correlation is subjective. A correlation of 0.9 can be considered low while verifying a physical law with high-quality instruments, however for a social sciences relationship it will usually be considered high, since the series are usually dependent of a variety of factors that are impossible to be observed. (StatSoft, 2010)

An important aspect to be considered is that the Pearson correlation coefficient presupposes that the series are normally distributed, specially for samples smaller then 100 observation (Ibid). So in order to verify if this is valid for the studied sample the Jarque-Bera test for normality was made for each of the series.

The Jarque–Bera test is a goodness-of-fit measure of departure from normality, based on the sample kurtosis and skewness (Wessa, 2010). The test was made for a significance rate of 5%, which for a sample of 48 observations requires a JB statistic of no more then 5.99.

The results of the test are presented on table 3:

<table>
<thead>
<tr>
<th>Current Ratio</th>
<th>ROA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>2008</td>
</tr>
<tr>
<td>2007</td>
<td>2007</td>
</tr>
<tr>
<td>2006</td>
<td>2006</td>
</tr>
<tr>
<td>2005</td>
<td>2005</td>
</tr>
<tr>
<td>JB statistic</td>
<td></td>
</tr>
<tr>
<td>1.14</td>
<td>17.90</td>
</tr>
<tr>
<td>2.61</td>
<td>4.90</td>
</tr>
<tr>
<td>29.28</td>
<td>11.90</td>
</tr>
<tr>
<td>61.30</td>
<td>0.17</td>
</tr>
<tr>
<td>14.54</td>
<td>1.49</td>
</tr>
</tbody>
</table>

In bold the values that support the normality assumption for the series.

As we can see from the table some of the series cannot be considered normally distributed, since they have a JB statistic higher then 5.99.

Another way to verify the correlation is the Spearman’s correlation coefficient, which does not require a normal distribution of the series (StatSoft, 2010). This coefficient is a non parametric statistic measure of correlation between two series; it uses a monotonic function to describe the relationship between two variables. Just like Pearsons coefficient it ranges from -1 to 1, and have a similar interpretation for its values. However it is less sensitive to outliers’ observations.

The Spearman’s correlation coefficient was calculated using Wessa’s free Statistic software; table 4 shows correlations coefficients found and their significance:

<table>
<thead>
<tr>
<th>CR</th>
<th>ROA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>2007</td>
</tr>
<tr>
<td>2006</td>
<td>2006</td>
</tr>
<tr>
<td>2005</td>
<td>2005</td>
</tr>
<tr>
<td>0.628</td>
<td>0.520</td>
</tr>
<tr>
<td>0.659</td>
<td>0.407</td>
</tr>
<tr>
<td>0.322</td>
<td>0.283</td>
</tr>
<tr>
<td>1</td>
<td>0.484</td>
</tr>
<tr>
<td>0.574</td>
<td>0.653</td>
</tr>
</tbody>
</table>

Significant correlation at 1%
Significant correlation at 5%
Non Significant correlation at 5%
Short-term correlation
As we can see the relevant coefficients for hypothesis 1 are all significant at 1% confidence, however, for a positive value

corr(CR_{2005}, ROA_{2005}) = 0.381

corr(CR_{2006}, ROA_{2006}) = 0.382

corr(CR_{2007}, ROA_{2007}) = 0.520

It means that yes, there is a significant correlation between liquidity and profitability into the analyzed companies, but this relationship is opposed to the expected according to the hypothesis statement. This result contradicts not only the research hypothesis but all the studied literature.

Thus we can clearly reject hypothesis 1, that is: the relationship between liquidity and profitability on the short term is not negative. In fact it was found a significant positive relationship between the indicators.

5.2.1 Others observations

It’s also interesting to notice that the corr(CR_{t+1}, ROA_{t}) was also positive and significant. This may indicate that from one year to another, liquidity is a consequence of ROA, i.e. the companies that were able to reach positive income results over a certain year were able to keep a higher liquidity level on the following year.

Also the highly significant and positive correlation between CR, and CR_{t+1}, shows that the liquidity ratio is highly dependent of its own previous year ratio. The same can be said about profitability; i.e., for the companies of the sample the liquidity and profitability ratio were quite stable through the years.

5.3 Testing Hypothesis 2

- On the medium term a low liquidity level will derail the upkeep of high profitability, and also a low profitability will derail the upkeep of a high liquidity

According to the procedure described on section 4.4.2, the companies were divided into quadrants according to their liquidity and profitability. The quadrant distribution for the years of 2005, 2006, 2007 and 2008 are exhibited ahead:

<table>
<thead>
<tr>
<th>Table 5 - Quadrant distribution of the companies in 2005</th>
<th>Table 6 - Quadrant distribution of the companies in 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="Table 5" /></td>
<td><img src="#" alt="Table 6" /></td>
</tr>
<tr>
<td><img src="#" alt="Table 5" /></td>
<td><img src="#" alt="Table 6" /></td>
</tr>
</tbody>
</table>
Table 7 - Quadrant distribution of the companies in 2007

<table>
<thead>
<tr>
<th>Liquidity</th>
<th>Profitability</th>
<th></th>
<th></th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>H</td>
<td>15</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>6</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>21</td>
<td>27</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 8 - Quadrant distribution of the companies in 2008

<table>
<thead>
<tr>
<th>Liquidity</th>
<th>Profitability</th>
<th></th>
<th></th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>H</td>
<td>15</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>16</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>31</td>
<td>17</td>
<td>48</td>
</tr>
</tbody>
</table>

When testing hypothesis one, it was observed a positive relationship between liquidity and profitability during the same year. This fact explains why the quadrants Hh and Ll usually have more companies than the quadrants Hl and Lh.

The number of firms in a good financial position, (high profitability and high liquidity) stood fairly stable during the 4 years. On the other hand the companies in a bad position (low liquidity and low profitability) had a significant drop in 2006, going from 16 in 2005 to 12 in the next year. However in 2007 the number of companies in this quadrant went back 17 and stood practically stable in 2008.

However it’s important to stress that, since the profitability classification is based on the sample average, this ‘good’ or ‘bad’ position is in comparison with the other companies of the sample results. It means that even that 2008 was a really bad year for almost all the firms it doesn’t mean that the number of companies in a ‘bad position’ will increase, since the average will also decrease.

However the reason to use this classification is to observe the migration of the companies between the different quadrants. By doing this we can see for example if companies in a good situation tend to keep it, or if companies with high profitability and low liquidity are able to keep this scenario after a few years. This is how we will test hypothesis 2.

The classification of each company in 2005 will be compared the company’s position in 2007.

According to the hypothesis on the medium term the companies on the quadrants Lh and Hl are not able to keep their position, thus they tend to migrate to other quadrants that not the Hh. I.e. companies from group Hl should tend to move to groups Lh or Ll; and companies initially on the Lh group would move to Hl or Ll groups. Also we can consider from the hypothesis that companies initially located on both the Hh and Ll quadrants are supposed to stay in the same place after some years, since their position is extremely good or bad, it would be harder to change it.

However companies initially on quadrants 2 (Hl) and 3 (Lh) that stay in the same place or that move to quadrant 1 (Hh), would be in disagreement with the hypothesis, since even that they had a bad variable it would not lead to the deterioration of the other indicator.
Also companies on the Hh or Ll quadrants that change their position will also contradict the hypothesis, since or the both good indicators were not enough to keep the company in a good financial position or even with both bad indicators the company was able to improve at least one of them.

Thus the movements that supports and the ones that goes against the hypothesis are summarized on table 9:

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hh</td>
<td>Hh</td>
<td>Hh</td>
<td>Hi, Lh, Ll</td>
</tr>
<tr>
<td>Hl</td>
<td>Lh, Ll</td>
<td>Hl</td>
<td>Hh, Hl</td>
</tr>
<tr>
<td>Lh</td>
<td>HI, Ll</td>
<td>Lh</td>
<td>Hh, Lh</td>
</tr>
<tr>
<td>Ll</td>
<td>Ll</td>
<td>Ll</td>
<td>Hh, Hl, Lh</td>
</tr>
</tbody>
</table>

Thus, comparing the position of the companies in 2005 and 2007 the following migrations were observed:

<table>
<thead>
<tr>
<th>Quadrant migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
</tr>
<tr>
<td>Hh</td>
</tr>
<tr>
<td>Hh</td>
</tr>
<tr>
<td>Hl</td>
</tr>
<tr>
<td>Lh</td>
</tr>
<tr>
<td>Ll</td>
</tr>
</tbody>
</table>

| Lh     | 10   |
| Hh     | 2    |
| Hl     | 4    |
| Lh     | 2    |
| Ll     | 2    |

| HI     | 6    |
| Hh     | 2    |
| Hl     | 0    |
| Lh     | 4    |
| Ll     | 0    |

| LI     | 17   |
| Hh     | 1    |
| Hl     | 3    |
| Lh     | 2    |
| Ll     | 11   |

It was observed that from the 48 observed companies, 23 (48%) held the same quadrant position between 2005 and 2007. Inside this group 21 (91.3%) were or in the Hh or the Ll group, which was expected from the hypothesis since companies inside each of these groups are in extreme positions, thus it should be harder to change their financial condition.
There were 16 (33%) companies on the groups Hl or Lh in 2005.

From the 10 companies initially on the Lh group, 6 (60%) moved as expected from the hypothesis, and the other 4 (40%) against it.

From the 6 companies on the HI quadrant in 2005, 4 (66%) moved according to the hypothesis and 2 against it (33%).

From the 15 companies initially on the Hh quadrant, 10 (66%) moved according to the hypothesis, and 5 (33%) against it.

From the 17 companies on the Ll quadrant, 11 (64.7%) moved according to the hypothesis, and 6 (35.3%) against it.

Thus we can see that in all groups around 2/3 of the firms migrated according to the hypothesis, and 1/3 moved in opposition to its predictions. Actually from the 48 companies, 31 (64.5%) moved as predicted, and 17 (35.5%) in a different way.

This result seems to show that, for the studied sample Hirigoyen theory seems to be true, i.e. for the majority of the companies it was not possible to keep a high liquidity with a low profitability, and vice versa, also the companies with both good or bad liquidity and profitability usually kept this same figure for these two variables. Thus we can confirm hypothesis 2, that is, on the medium term liquidity and profitability are interdependent, and an equilibrated balance between them is condition for the financial health of the firm.

5.4 Testing hypothesis 3

- Over the year of 2008 the companies with higher liquidity would be able to achieve a better performance.

In order to test this hypothesis the companies were divided in 2 groups according to their current ratio in 2008:

(A) companies with current ratio higher then 1 (companies with high liquidity);
(B) companies with current ratio lower then 1 (companies with low liquidity).

Group (A) accounts for 16 companies (33%) and group (B) for 32 companies (66%). The idea is to compare the ROA for both groups and see how it can be related to the hypothesis.

The relevant statistics for both groups are displayed in table 11:

From the average and median statistics we can observe that high liquidity companies usually had a better performance then the low liquidity group, both statistics were positive for group (A), and negative for group (B), however the difference between the averages were much higher then for the medians.
Table 11 - High and low liquidity companies' ROA statistics

<table>
<thead>
<tr>
<th></th>
<th>High Liquidity (A)</th>
<th>Low liquidity (B)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of companies</td>
<td>16</td>
<td>32</td>
<td>48</td>
</tr>
<tr>
<td>Average</td>
<td>1.7%</td>
<td>-6.2%</td>
<td>-3.6%</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>4.4%</td>
<td>10.6%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-5.2%</td>
<td>-30.6%</td>
<td>-30.6%</td>
</tr>
<tr>
<td>1st quartile</td>
<td>0.1%</td>
<td>-12.5%</td>
<td>-6.4%</td>
</tr>
<tr>
<td>Median</td>
<td>1.0%</td>
<td>-3.9%</td>
<td>0.6%</td>
</tr>
<tr>
<td>3rd quartile</td>
<td>2.3%</td>
<td>0.7%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Maximum</td>
<td>14.4%</td>
<td>9.6%</td>
<td>14.4%</td>
</tr>
<tr>
<td>Firms with ROA &gt; 0</td>
<td>12</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Firms with ROA &lt; 0</td>
<td>4</td>
<td>21</td>
<td>25</td>
</tr>
</tbody>
</table>

The variation was much higher for group (B), as we can see from the standard deviation. From the quartiles analyzes we can observe that this higher variation majorly comes from the worse results for group (B), which were extremely lower then the minimum value observed for group (A). The difference between the first quartiles was of 12.6%, on the other side the difference for the 3rd quartiles was of only 1.6%.

This results indicates that the best performances of low liquidity groups were not much different then best performances for group (A), however the worst performances of group (B) were much worse then the worst companies of group (A).

Finally it’s interesting to note that from the high liquidity group, only 4 companies (25%) presented losses in 2008, on the other side for the low liquidity group, 21 firms (65.6%) had a negative income.

From these numbers it seems to be clear that there was a difference between the performance of High liquidity companies and low liquidity companies during the year of 2008, but in order to measure the significance of this difference I’ll execute a hypotheses test procedure.

My null hypothesis is that the average ROA for both groups is the same, and my alternative hypothesis is that the ROA for group (A) is higher then for group (B), Thus:

\[ H_0: \mu_a = \mu_b \]
\[ H_a: \mu_a > \mu_b \]

Since the ROA distribution for 2008 couldn’t be considered normal, I can not use the t statistic to test the hypothesis, thus I need a non parametric distribution, which according to StatSoft (2010) can be the Mann-Whitney u test.

The Mann-Whitney u test was executed with Lowry online statistical test page; it found a U statistic of 381, which for the sample size was able to reject the null hypothesis at significance level of 1%. Also the alternative hypothesis was accepted for the same significance.

From this result I’m able to confirm hypothesis 3, i.e. the companies with higher liquidity were able to achieve a better performance in 2008 then the companies with lower liquidity.
6. DISCUSSION OF THE RESULTS AND CONCLUSIONS

On this section I will compare the results found on the last chapter with the literature and also elaborate my final conclusions.

6.1 Discussion of the results

6.1.1 Hypothesis 1

- On the short term the relationship between liquidity and profitability is negative

This hypothesis was completely rejected for the studied group; for all the analyzed years the correlation between the two variables was significantly positive.

This result goes against the studied literature. Assaf Neto (2003, p.22) stated that, the more one invests in current assets, the lower his/her returns. This would be a consequence of the fact that a higher amount of net-working capital would mean a reduction of the risk, and according to the economic theory, profits are a direct and positively related to risk. Thus companies would face a dilemma between liquidity and profitability on the short term.

Pimentel et al. (2005) found in their research a result that supported this Hypothesis. For a sample of retailing companies in the Brazilian market, they found a negative correlation for the indicators of liquidity and profitability. Marques e Braga (1995) and Blatt, quoted in Perobelli et al (2007, p.7) also found this negative correlation results for different samples.

My main hypothesis for this different result is that the airline sector may differ from the segments analyzed in other studies. The operation of the airline sector demands a high amount of current expenses (fuel, maintenance, etc) thus a higher level of Working Capital may be directly related to the capability of reducing the costs, and thus being able to obtain higher profits.

Also the airline carriers included in my sample are generally much larger companies then the ones observed in the other studies. Huff, et al. (1999, p.104) found that smaller firms more often present extreme liquidity levels, (very low and very small), while larger companies tend to have a more stable and around 1.0 current ratio. Thus I suppose that it’s more significant for smaller firms the lower return ratio of current assets, while for larger companies the benefits of a safer liquidity margin are more significant, i.e. for smaller firms the dilemma between liquidity and profitability may be stronger then for larger companies, and for the big companies this tradeoff may not even exist.

Considering that, it is not surprising that for the considerably large companies of my sample, the firms with higher liquidity were able to achieve a better performance even during the years of economic growth (2005 to 2007).
6.1.2 Hypothesis 2:

- On the medium term a low liquidity level will derail the upkeep of high profitability, and also a low profitability will derail the upkeep of a high liquidity

Since the 1st hypothesis was rejected, and it was observed a positive relationship on the short term, the confirmation of this hypothesis loses its “inversion in the relationship characteristic”. Anyway following the procedure developed by Pimentel et al (2005), the hypothesis was tested by the observation of the movement of the companies according to their liquidity and profitability levels.

From the 48 companies, it was observed that 31 (64.5%) had their position in the two-dimensional distribution changing according to this hypothesis prediction, thus I could confirm it.

The idea behind this hypothesis is that a company needs a balanced level of working capital in order to achieve a stable long term performance, and also good profits would be an important condition to accumulate some extra working capital, forming thus a virtuous cycle of financial prosperity. This seems to be the case of the studied companies, since two thirds of the companies in a good financial position in 2007 had both high indicators of liquidity and profitability.

This result also differs from the one found by Pimentel et al (2005), in their study the proportion of companies obeying the hypothesis was of only 32%, leading them to reject the hypothesis. Since we also observed a different result for the first hypothesis, a common result for both studies is that the observed relationship after a few years is in the same direction of the one observed for the short term. Thus I have two main hypotheses for this fact:

- The procedure of observing the migration between 2 or three years is not long enough to eliminate the short term impact over the relationship.
- The medium term relationship is a consequence of the short term one, and even for a longer period the result would be the same, thus the results difference would again be a consequence of the different characteristics of the analyzed industry

I tend to believe on the first hypothesis, since a the necessity of a balance between working capital and profits in order to reach a good financial standard seems to be relevant independently of the business segment, however further researches should be made to observe it.

6.1.3 Hypothesis 3:

- Over the year of 2008 the companies with higher liquidity would be able to achieve a better performance.

Since the first hypothesis was rejected, this hypothesis also looses its original sense, since it was expected that while the relationship would be negative on the years of prosperity and then become positive on the years of economic decline.
Thus the confirmation of this hypothesis with the rejection of the first one indicates that the relationship stood in the same direction both before and during the first year of the crises.

Anyway it was observed that the companies with a higher liquidity had in general a much better performance than the low liquid companies. Only 4 companies over 16 with a current ratio higher then 1.0 had losses over the year of 2008 year, which was a really hard year for this industry. On the other side 21 out of 32 companies with a current ratio lower then 1.0 had losses during this year.

It’s interesting to observe that the correlation coefficient was higher in 2008 (0.529) then on the previous years (average of 0.42), showing that this positive correlation became stronger on this year.

The hypothesis was strongly accepted, clearly companies with higher liquidity had a better performance in 2008, even if the relationship was already positive before it, this result confirms that the importance of the management of the working capital increases during hard times. As the current ratio is a safety margin for operations, and the financial crisis is a moment of turbulence over the market, thus it’s not surprising that companies with solid financial foundations have a safer security margin and thus were able to achieve a better performance during the bad times.

6.2 Conclusions

This work examined the relationship between profitability and liquidity on a group of airline companies operating all over the world for the period of 2005 to 2008. Based on the classification of companies as their performance in terms of liquidity and profitability and with the help of statistical procedures, I sought to examine the relationship between these variables for the short and long term, and also how the short term relation was affected by the financial crises of 2008.

Thus recovering the main questions presented on the introduction chapter, the study suggests the following answers to each one of them:

- Is there a negative relationship between liquidity and profitability on the short run?

No, it was observed for all the studied years a significant and positive correlation between the liquidity and the profitability variables.

The results indicated that for the studied companies, on the short term the higher the liquidity level of the company, the higher its profitability. It contradicts the usual findings from the literature, indicating that for this sample of airline carriers the dilemma between liquidity and profitability on the short term do not exist.

- Is there a positive relationship between liquidity indicators and profitability indicators on the medium to long term?

Yes, it was observed that companies with a poor indicator of liquidity or profitability are usually not able to upkeep the other indicator in a high level; also the companies
with both high or low liquidity and profitability were stable in the same position after a
few years.

This answer comes from the two-dimensional analysis of the companies, that tested
Hirigoyen theory that a company with a poor indicator of liquidity or profitability would
have the other indicator deteriorated on the medium term, indicating a positive
relationship between liquidity and profitability on the medium term. Around 2/3 of the
companies migrated into the two-dimensional classification according to the hypothesis
prediction. However since the first questions received a negative answer, this positive
answer for this second question looses part of its meaning, since it was not observed an
inversion of the correlation direction, but the upkeep of a positive correlation on the
short and medium term.

- Did the companies with a better liquidity ratio have a better performance during the
financial crises of 2008?

Yes, the average profitability of the high liquidity companies was much higher then the
low liquidity ones, also the proportion of companies which faced losses during the
crieses was much higher among the less liquid companies. Even that the relationship
between liquidity and profitability was already positive before the crises, it became even
more significant during it.

The study was exploratory in nature and its conclusions are restricted to the group of
companies and the periods examined, that is, the 48 airline carriers between 2005 and
2008. However it has its relevance while increasing the comprehensive knowledge over
the relationship between the studied financial indicators.

It’s hoped that the study has given its contribution to the financial area knowledge by
observing that for the international airline carriers there is not a dilemma between
liquidity and profitability on the short term, maybe this is also true for other industrial
segments, or maybe it just a specificity of the airline sector. Also it has demonstrated
that the management of working capital indeed achieves a higher importance over
troubled times, the results shows that companies with a safer liquidity margin were
much more able to achieve a better performance during the crises. Thus, the research
emphasizes the importance of the active management of working capital, by showing
objectively the benefits of it during the crises time.
7. TRUTH CRITERIA AND SUGGESTIONS FOR FURTHER RESEARCH

The truth criteria of the research is the critical analyses of the problem, processes and choices faced during the research. From the quantitative nature of the study the main aspects to be observed are reliability, validity, replication and generalization.

8.1 Reliability

Reliability refers to the possibility that the results of the research can be repeated (Bryman, 2003, p33). An important aspect to be observed regarding reliability is if the study is executed again the results will be the same.

Since the research was based on audited an official data and the hypothesis were tested through accepted statistical procedures, the only point that could lead to some different result would be if one chooses a different sample then mine. However if the statistics of my sample is compared to the total population of airline companies we can observe that they do not differ significantly. It is expected since my sample represents more the 50% of the airline sector in terms of carried passengers.

8.2 Validity

A high validity comes from the correct choice of the variables to measure the observed phenomena.

The internal validity observes how the concepts and operational definitions are related (Ibid, p.34). My chosen ratios to measure the studied variables, i.e. ROA for profitability and current ratio for liquidity are widely known and accepted by the literature. For the two dimensional analyses the main points to be observed are the criteria to divide the groups. For the liquidity measurement a current ratio of 1.0 is the natural choice, one group has positive net working capital and the other has a negative value. For the profitability an alternative option could be a 0 ROA, thus the division would be profitable and unprofitable firms, however for the years of 2005 to 2007 the number of companies that faced losses was too small comparing to the other group, thus the average ROA seems to divide well the companies in order to compare each one with the other firms in the same industry.

External validity observes how the material and data was collected (Ibid, p.34). Since all data comes from audited annual reports, I do not have any reservations with the external validity of my research.

8.3 Replication

Replication regards the possibility of a replication of the study for a similar but different data. (Ibid). Since my study is already a replication of a previous research I have no doubts about the possibility of replication. Even for the procedures that differ from Pimentel et al. (2005) article, I believe they were well explained and can be duplicated by another researcher.
7.4 Generalization

Generalization concerns the extent of how the conclusions can extend outside of the studied population (Ibid, p.35). Thus, for my research it is not observed a good generalization. The results are restricted to the analyzed sample, and can be at most extended to the total airline industry since the sample represents a significant part of this industrial sector. However due to the no-randomness of the sample selection even this generalization should be made with reservations.

7.5 Recommendations for further research

This studied analyzed the relationship between liquidity and profitability for airline companies between 2005 and 2008, and it is far from covering all the research possibilities offered from this study area. So I’d like to suggest some ideas for possible future researches on this area:

The first idea is to replicate this study for a different group of companies, it can be a different industrial segment or a more generic group, and thus compare the results with the ones I found for the airline carriers.

Also a longer period of analyses would be interesting, specially to observe the long term movement of the companies over the two-dimensional analyses for liquidity and profitability.

The financial crises of 2008 did not end in December 2008, its consequences are developed through the years that followed, and even now we are far from being sure when the prosperity times will be back. Thus the incorporation of the 2009 and 2010 data would be of high value for the understanding of the crises and its consequences.

Also I think it would be really interesting to execute a qualitative research in order to answer how the firms’ managers observe the relationship of liquidity and profitability, i.e. if they observe a dilemma between these two financial indicators or they think they are interdependent.

Finally I believe that some more elaborate statistical procedures, such as regressions and time series analyses would be able to give a deeper explanation regarding the relationship of these two financial indicators.
8. REFERENCES

Books


Scientific articles


Thesis

**Web pages**


9. APPENDIX

Appendix 1 - Companies' Current Ratio and ROA (2005 - 2008)

<table>
<thead>
<tr>
<th>Company</th>
<th>Current Ratio</th>
<th>ROA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lufthansa</td>
<td>0.865 0.997 0.971 1.001</td>
<td>0.027 0.074 0.041 0.024</td>
</tr>
<tr>
<td>2 Air France-KLM</td>
<td>0.864 1.221 1.075 1.057</td>
<td>-0.022 0.045 0.032 0.035</td>
</tr>
<tr>
<td>3 Ryanair</td>
<td>1.739 2.114 2.350 3.056</td>
<td>-0.015 0.087 0.079 0.072</td>
</tr>
<tr>
<td>4 EasyJet</td>
<td>1.546 1.877 2.136 2.149</td>
<td>0.027 0.061 0.044 0.036</td>
</tr>
<tr>
<td>5 BA</td>
<td>0.566 0.970 1.151 1.059</td>
<td>-0.005 0.050 0.051 0.033</td>
</tr>
<tr>
<td>6 Iberia</td>
<td>1.381 1.859 1.641 1.699</td>
<td>0.006 0.055 0.015 0.094</td>
</tr>
<tr>
<td>7 SAS</td>
<td>0.978 1.086 1.180 0.966</td>
<td>-0.146 0.013 0.093 0.004</td>
</tr>
<tr>
<td>8 Air Berlin</td>
<td>0.663 0.927 0.881 0.794</td>
<td>-0.031 0.008 0.032 -0.109</td>
</tr>
<tr>
<td>9 Turkish Airlines</td>
<td>1.600 1.250 0.800 0.690</td>
<td>0.144 0.054 0.040 0.036</td>
</tr>
<tr>
<td>10 Austrian</td>
<td>0.412 0.591 0.927 0.458</td>
<td>-0.196 0.001 -0.040 -0.041</td>
</tr>
<tr>
<td>11 Aerlingus</td>
<td>1.360 1.924 1.757 1.288</td>
<td>-0.052 0.056 -0.036 0.060</td>
</tr>
<tr>
<td>12 Aeroflot</td>
<td>1.058 1.282 1.121 1.377</td>
<td>0.011 0.092 0.107 0.117</td>
</tr>
<tr>
<td>13 Finnair</td>
<td>0.720 1.188 0.839 1.164</td>
<td>-0.020 0.048 -0.008 0.038</td>
</tr>
<tr>
<td>14 TAP</td>
<td>0.683 0.823 1.190 0.869</td>
<td>-0.127 0.010 0.004 -0.007</td>
</tr>
<tr>
<td>15 Flybe</td>
<td>1.011 1.001 1.218 0.746</td>
<td>0.013 0.110 -0.048 -0.038</td>
</tr>
<tr>
<td>16 Norwegian</td>
<td>0.951 1.037 1.009 1.068</td>
<td>0.001 0.036 -0.021 0.041</td>
</tr>
<tr>
<td>17 Czech</td>
<td>0.592 0.532 1.171 1.239</td>
<td>0.008 0.008 -0.034 -0.041</td>
</tr>
<tr>
<td>18 Transavia</td>
<td>1.029 1.307 1.320 1.381</td>
<td>0.010 0.016 0.025 0.013</td>
</tr>
<tr>
<td>19 Aegean</td>
<td>1.547 1.668 0.841 0.619</td>
<td>0.067 0.101 0.160 0.114</td>
</tr>
<tr>
<td>20 LOT</td>
<td>0.659 1.266 1.340 0.717</td>
<td>-0.264 0.009 0.163 0.028</td>
</tr>
<tr>
<td>21 Jet2</td>
<td>0.527 0.444 0.406 0.581</td>
<td>0.094 0.032 0.056 0.056</td>
</tr>
<tr>
<td>22 Transaero</td>
<td>0.897 0.914 1.074 0.761</td>
<td>0.005 0.009 0.042 0.040</td>
</tr>
<tr>
<td>23 MALEV</td>
<td>0.402 0.538 0.626 0.998</td>
<td>-0.304 0.011 -0.156 -0.017</td>
</tr>
<tr>
<td>24 Croatia</td>
<td>0.621 0.661 0.617 0.578</td>
<td>-0.049 0.001 0.015 -0.011</td>
</tr>
<tr>
<td>25 Cyprus</td>
<td>1.062 1.035 0.408 0.404</td>
<td>0.008 0.005 -0.038 -0.183</td>
</tr>
<tr>
<td>26 Southwest</td>
<td>1.031 0.918 0.901 0.941</td>
<td>0.012 0.038 0.037 0.035</td>
</tr>
<tr>
<td>27 AA</td>
<td>0.633 0.852 0.812 0.745</td>
<td>-0.082 0.018 0.008 -0.029</td>
</tr>
<tr>
<td>28 Continental</td>
<td>0.972 1.025 1.044 1.008</td>
<td>-0.046 0.036 0.030 -0.006</td>
</tr>
<tr>
<td>29 us airways</td>
<td>0.794 1.312 1.237 0.962</td>
<td>-0.306 0.053 0.040 -0.077</td>
</tr>
<tr>
<td>30 air canada</td>
<td>0.273 0.419 0.584 0.503</td>
<td>-0.090 0.036 -0.006 -0.004</td>
</tr>
<tr>
<td>31 airtran</td>
<td>0.821 0.943 1.058 1.436</td>
<td>-0.132 0.025 0.010 0.007</td>
</tr>
<tr>
<td>32 jetblue</td>
<td>0.890 0.889 1.085 0.939</td>
<td>-0.013 0.003 0.000 -0.005</td>
</tr>
<tr>
<td>33 skywest</td>
<td>0.874 0.908 1.260 0.619</td>
<td>0.096 0.085 0.063 0.037</td>
</tr>
<tr>
<td>34 republic</td>
<td>0.917 1.296 1.359 0.713</td>
<td>0.030 0.034 0.078 0.078</td>
</tr>
<tr>
<td>35 Alaska</td>
<td>1.109 1.012 1.272 1.322</td>
<td>-0.028 0.028 -0.013 -0.002</td>
</tr>
<tr>
<td>36 Hawaiian</td>
<td>0.896 0.837 0.882 1.033</td>
<td>0.031 0.009 -0.049 -0.018</td>
</tr>
<tr>
<td>37 Westjet</td>
<td>1.252 1.215 0.983 0.848</td>
<td>0.054 0.065 0.042 0.011</td>
</tr>
<tr>
<td>38 TAM</td>
<td>0.828 1.453 1.630 1.243</td>
<td>-0.108 0.052 0.106 0.070</td>
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