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BACHELOR THESIS

Analysis and Prediction of Czech Airline Companies

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Declaration of Integrity

I declare that I have worked on my Bachelor thesis titled “Analysis and Prediction of Czech Airline Companies” by myself and I have used only the sources mentioned at the end of the thesis.

In Prague, on 31.3.2011

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Darius Maraulas

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Analysis and Prediction of Czech Airline Companies

Analýza a predikce českých leteckých společností

Souhrn:

Cílem této bakalářské práce je popis aktuální situace, její vysvětlení, zhodnocení a prognóza vývoje počtu cestujících, kteří byli přepraveni českými leteckými společnostmi. V teoretické části se popisuje historie letectví v naší zemi, uvádějí typy letecké přepravy - v závěru se věnuje jednotlivým leteckým společnostem.

V empirické části práce se analyzují nashromážděná data pomocí časových řad, korelačních matic, autokorelačních funkcí, regresní analýzy - včetně následné prognózy budoucího vývoje.

Na konci bakalářské práce jsou zhodnoceny a prezentovány následující závěry: popis aktuální situace a její následné prognózy čerpající z výsledků vlastní analýzy, která dochází k zjištění, že ne všechny proměnné zásadně ovlivňují vývoj počtu cestujících, nýbrž jen cena ropy. Výzkum také potvrdil a předpokládá, že vývoj počtu cestujících bude dlouhodobě rostoucí, z čehož plyne, že prognóza je potvrzena a předpoklad je, že vývoj leteckých společností bude do budoucna pozitivní.

Klíčová slova: analýza vývoje počtu cestujících, časové řady, regresní analýza, korelační analýza, prognóza

Summary:

The aim of this bachelor thesis is to describe the current situation, its explanation, evaluation and forecast of the development of the passenger numbers transported by Czech airlines. The theoretical part describes the history of aviation in our country, stating types of airline transport and at the end is looking upon individual airline companies.

The empirical part of the thesis analyzes data collected using time series, correlation matrices, auto-correlation functions, regression analysis – including a subsequent forecast of the future development.

The final part of the bachelor thesis evaluates and presents the following conclusions: description of the current situation and its subsequent forecast drawing upon results of own analysis coming to the conclusion that not all variables fundamentally influence the development of the number of passengers, just the price of crude oil makes a huge impact.

The research has confirmed and assumes that the passenger numbers will grow in time in the long run, whereof follows that the forecast is confirmed and it can be assumed that the future development of airline companies will be positive.

Key words: analysis of the passengers number development, time series, regression analysis, correlation analysis, prognosis

Contents

1. Introduction

The term “civil aviation” refers to the air-transportation service provided to the public by airlines, while “military aviation” refers to the development and use of military aircraft. First objects which actually flew were balloons. They were pioneered in 1783 in France by the Montgolfier brothers. First signs of the basic scientific principles of heavier-than-air flight laid down Sir George Cayleyn in England in the early 19th. Followed by the Otto Lilienthal in early 1890s whose made first successfully flying gliders. Next step of the development was done by the American brothers Wilbur and Orville Wright, which were inspirited by Lilienthal. In 1902 they invited and developed a fully practical biplane (double-winged) glider that could be controlled in every direction. Small engine was added and two propellers to another biplane, on Dec. 17, 1903, the Wrights made the world’s first successful man-carrying, engine-powered, heavier-than-air flight. Early development of the airline industry was affected mostly by the idea of flying to surpass long distances in short time. Now is the idea same - to surpass long distance.

Air transportation is one of the fastest and safest in the World. A significant percentage number of the market has in the Czech Republic as well as in the World. Development in recent years showed a clear trend in our country - more people are traveling with the airlines. This trend is forcing airlines to do a deeper analysis of the aviation market.

Analyzing basic statistical data provides additional information, comparing with not pure aviation data but closely related to this topic such as ticket price, crude oil price and etc. The gathered data is process through the statistical methods and shows a possible prediction. The summary of the analysis determines the best related variable to have an appropriate array to determine the forecast development in the years to come. The work shows a prognosis of future development of the companies.

2. Objectives of thesis and methodology

Main objective of this thesis is **the evaluation of development in passengers transportation** in the Czech Republic. The fact is that the number of passengers in the airline industry is continuously rising with small volatility caused by 9/11 tragedy and 2007-2008 economic crisis. It shows that the airline industry is very perspective and the evaluation of this sector has great value added. Facts are that the demand from the side of passengers is increasing, on the other hand the price of tickets are pushed by the companies lower with smaller profitability to fulfill the increasing demand by passengers. Time series shows clear increasing trend which is affected by many variables. **On the basis of the time series analysis the evaluation is presented.**

Partial goal is to **approve that all the selected variables significantly affect number of passengers**. All the variables - GDP, crude oil prices, inflation rate and air ticket price - are significant in the airline transportation industry. Hypothesis is that **all the variables significantly affect the number of passengers**.

Partial goal of this thesis is to **find the most affecting variable of increasing trend in passengers transportation**. By the evaluation of the relationship between these variables on the base of time series shows us the connection between them. **Hypothesis is that the most affecting is price of crude oil.**

Other partial goal is **the prognosis of the future development of the airline companies** in the Czech Republic. The main indicator is the number of passengers. Prognosis is based on the variables mentioned above. Exploring this problem from wide variety of aspects helps to better understanding of the trends in this sector of industry and transport services. **Hypothesis is that the future development of airline companies will be positive.**

Data for analyzing are gathered from Eurostat, Czech statistical office and Ministry of transport. The variables GDP and inflation rate were obtained only for the Czech Republic to keep the statistical reliable data. Only the prices of crude oil are international. Number of passengers is only for the Czech companies as well as the air ticket price. Distribution of data set is monthly from 01/2005 to 06/2010. Variables – ticket price and GDP are indexed data by method of Chain index - Coefficient of the growth (Index = Percentage change on previous period).

Analysis starts with the time series with linear function to show the trend. Equation with linear function will be stated to next prognosis computation. Another time series with higher quantity shows the linear trend function based on all monthly data from years 2005-06/2010. Creating equation of linear function with the value of confidence level will be stated.
Coefficient of variance shows homogenous or non-homogenous data. Table with

variable of coefficient shows if percentage is low, if the number is low it is sign of seasonality which has to be proved or disproved by the autocorrelation function. Computing the correlogram clearly shows if the chosen data set has the seasonal tendency or not. If does the sinusoidal pattern should be visible.
Precursor to modeling with regression helps with the data exploration – creating scatterplot matrix, to search for a linear relationship with the dependent variable. Correlating matrix shows relationship between variables, but not together. Significance level and R level observe which variable and how are correlated to each other. Find perfect correlation (1) or no relationship (0). Explore the increasing association or direct association. By using the Pearson correlation computation helps to find out the significant value which has to be lower than value<.500 to be significant. Regression analysis is done with the scatterplot matrix; multiple regression model helps to understand the correlation matrix and prove or disprove the significance level in the correlation matrix. Also regression model shows how the variable predicts the dependent variable. The multiple correlation coefficients show all the association among the variables together. Observing the ANOVA model says if the model is tight and well modeled, or not. From the coefficient table can be make the equation for prognosis. If there is any value with significance level higher than .500, than the regression model must be remodeled without that variable which has significance number higher, because the variable cannot be considered as a significant. Higher accuracy is achieved by the remodeling of previous model except excluded variable. Testing homoscedasticity shows a liner relationship to prove that there is no serious violation in distribution. As well it helps with measuring the fit of the Pearson coefficient. If linear data are confirmed computing the autocorrelation of standardized residuals with lag number helps to better understanding the standard deviation between numbers. Also the test of normality is used for understating the data character – if data are normally distributed or not. At the end prognosis is made. If estimated data match the requirements the equations done before are perfectly suitable, if not, ARIMA model is used for forecasting.

3. Literature Overview

An important part of industry as a whole is airline industry. The industrial boom in early 1900s helps airline industry to became one of the most exciting industries ever. Not only in recent years but for decades is airline industry in constant growth, despite a slight deviation in some years.

3.1 Industry introduction

"On 11 September 2001, one Boeing of American Airlines and one of United Airlines were diverted by terrorists to crash on the Twin Towers in New York City, and a third Boeing of America Airlines was diverted to crash on the Pentagon in Washington. For security reasons the North American air space was closed for the next five days. The revenue passenger kilometers (RPK) and the available seat kilometers (ASK) are two relevant market indicators to understand the impact of the crisis on the air-line industries. The indicators refer to the transatlantic traffic generated by European carriers to North Atlantic destinations; they are seasonally adjusted and observed as a year-to-year index.
Before the terrorist attacks, the RPK between Europe and North America had
a zero growth, afterwards RPK dropped significantly in October (−26 percent) and reached its lowest point in November (−33 percent). The European carriers' reacted to adjust their capacity in November (−15 percent). Afterwards the capacity reduction continued until January 2002, when it reached the lowest point of the crisis (−26 percent)." [1] This approves the fact that there are some subsidiary effects which are connected to the volatile numbers from some years.

Regional differences are important factor for forecasting or prediction future values of selected variables. World is becoming more mobile so the importance of the differences and variables which affect the trend is high. "Despite some regional differences, the forecast indicates that the world will continue to become more mobile. This creates enormous opportunities but also presents some challenges. In five years we need to be able to handle 800 million more passengers and 12.5 million more tonnes of international cargo. To realize the economic growth potential that this will bring, we will need even more efficient air traffic management, airport facilities and security programs. Industry and governments will be challenged to work together even more closely," said Giovanni Bisignani, IATA's Director General and CEO. The shadow of the global economic recession is expected to remain over parts of the industry for some time to come. Sluggish growth rates in Europe and North America are not only the result of being mature markets. Lingering consumer debts, high unemployment and austerity

[1] CENTO, Alessandro. *The Airline Industry : Challenges in the 21st Century*. Italy : Physica-Verlag Heidelberg, 2009. [50/184 p.] ISBN 978-3-7908-2087-4.

measures will dampen growth rates," said Bisignani. International passenger numbers are expected to rise from 952 million in 2009 to 1.3 billion passengers in 2014. This 313 million traveler increase reflects a compound annual growth rate (CAGR) of 5.9%. The fastest growing markets for international passenger traffic will be China (10.8%), the United Arab Emirates (10.2%), Vietnam (10.2%), Malaysia (10.1%) and Sri Lanka (9.5%). By 2014, the top five countries for international travel measured by number of passengers will be the United States (at 215 million, an increase of 45 million), the United Kingdom (at 198 million with an increase of 33 million), Germany (at 163 million with an increase of 29 million), Spain (123 million with an increase of 21 million), and France (111 million with an increase of 21 million). Domestic passenger numbers are expected to rise from 1.5 billion in 2009 to over 2 billion in 2014. This 488 million passenger increase reflects a CAGR of 5.7%. China will record the highest CAGR of 13.9% and contribute an additional 181 million passengers. Other countries with double digit growth include Vietnam (10.9%), South Africa (10.6%), India (10.5%), and the Philippines (10.2%). By 2014 the five largest markets for domestic passengers will be the United States (671 million), China (379 million), Japan (102 million), Brazil (90 million) and India (69 million).
„[2]

This is the World trend, and as it general true that what happened in the World, trend is copied one way or another by other continents. Following paragraph clearly confirmed this statement: "International freight volumes are expected to grow at a CAGR of 8.2% over the forecast period. Excluding the impact of the rapid post recession rebound in 2010, for the 2011-2014 period, the consensus view for air freight is that it will stabilize at 5% CAGR. This is slightly below the forecast growth in world trade (6%) suggesting a still conservative outlook after the recession shock and possibly some loss of market share to sea shipping.The top five fastest growing international freight markets over 2009-2014 will be Hong Kong (12.3%), China (11.7%), Vietnam (11.4%), Chinese Taipei (11.3%), Russian Federation (11.0%). By 2014, the largest international freight markets will be the US (8.8 million tonnes), Hong Kong (5.4 million tonnes), Germany (4.4 million tonnes), Japan (4.4 million tonnes) and China (3.8 million tonnes). The volume growth expected in China and Hong Kong will account for a third of global volume growth over the period to 2014. Asia Pacific's International passenger demand is expected to grow 7.6%. By 2014, China, Japan and Hong Kong will be the biggest international passenger markets in the region, with China being the largest international and domestic market in Asia. The region will see the highest growth rate for international freight at 9.8% with Hong Kong, Japan, China, South Korea, and Chinese Taipei comprising the region's top five markets. The Middle East is expected to have the fastest growth rate at 9.4%. The UAE, Kuwait, Jordan will be among the top 10 fastest growing countries, with the UAE ranked 7th for international passengers at 82.3 million.

[2] The International Air Transport Association (IATA) [online]. 2011 [cit. 2011-03-20]. Industry Expects 800 Million More Travelers by 2014 - China Biggest Contributor. Available at WWW: <http://www.iata.org/pressroom/pr/Pages/2011-02-14-02.aspx>.

International freight demand will grow 8.1% as freight links to and via the region continue to develop. The UAE will lead the region, handling 2.7 million tonnes of cargo. Europe: Europe will see international passenger demand growth of 4.7%. The United Kingdom, Germany, Spain, France and Italy will remain among the top ten largest international passenger markets. International freight demand for the region will grow 6.5%, with Germany, the UK and the Netherlands leading the region in size. The Russian Federation will see the fastest growth rate of 11%"[3] Not only continents and whole countries affect the airline industry, but mainly the important variables such as GDP, crude oil and etc.

If there is relationship between GDP and airline industry, there would be a strong relationship between crude oil price and airline industry too. As its shown in this quotation : "It's happening again: airline fuel costs are creeping up, and it's going to put US airlines in another crunch. The price of crude oil briefly rose above $100 a barrel on the New York Mercantile Exchange Wednesday before ending the day below the century mark. Although unrest in Libya, Egypt, and other parts of the oil-rich Middle East can cause a supply panic which can help drive up the price of futures, analysts continue to cite the increased buying power and high demand for petroleum for the burgeoning middle class of fast developing nations such as India and China. Although 2010 proved to be a banner year for airline profits after a disastrous 2009, the price of oil remains the looming specter over future success in this industry of razor thin margins and cutthroat competition. The last time the price of oil crept over $100 a barrel during March of 2008 still looms fresh in the minds of many, claiming storied (albeit small) carriers such as Aloha, ATA, and Champion within the month, mostly citing fuel costs (Among the not-so-storied was Columbus based Skybus). By the mid 2000s, fuel had eclipsed labor as the largest single expense for any air carrier. An increase of a single cent per gallon of fuel can increase an airline's yearly fuel bill in the tens to hundreds of millions of dollars, depending on size.. Although airlines have changed their business structure since 2008 to better withstand fuel cost volatility, further increases in the fuel bill could adversely affect the fortunes of less favorably positioned airlines as 2011 progresses. Passengers can certainly count on higher fares, fuller flights, and increases in airline fees as airlines struggle to make up the difference if energy prices continue to elevate."[4]

Other effects have affected the airline industry. There are more variable which needs to be included. As following paragraph states : "The decline in passenger and freight traffic growth was primarily due to the Reduction in economic growth across all regions of the world. The trend in real Gross Domestic product (GDP) significantly changed from a growth of 2.9% in 2008 to an estimated decline of 0.8% for 2009, impacting

[3] The International Air Transport Association (IATA) [online]. 2011 [cit. 2011-03-20]. Industry Expects 800 Million More Travelers by 2014 - China Biggest Contributor. Available at WWW: <http://www.iata.org/pressroom/pr/Pages/2011-02-14-02.aspx>

[4] Www.examiner.com [online]. 2011 [cit. 2011-03-22]. Rising fuel costs could thin airline herd in 2011. Available at WWW: <http://www.examiner.com/airline-industry-in-national/rising-fuel-costs-could-thin-airline-herd-2011>

traffic across all regions. The decline in passenger traffic for 2009 would have been greater than 2% had it not been for the significant improvements in traffic growth observed in the latter part of the year. This was most pronounced in the case of domestic traffic rowth which improved significantly in the emerging economies of Asia and Latin America in the latter part of 2009. The arrest of declining domestic traffic growth rates in the largest domestic market, i.e. North America, also ontributed to the severity of total passenger traffic decline being limited to around 2% in 2009. After a decline of about 0.8% in 2009, the GDP is expected to recover in 2010 and is projected to grow at 3.9%; accordingly, ICAO has forecast the world traffic to grow at about 3.3% in the same year. "[5] So the GDP is one of the variables which are needed to be observed with the research and the evaluation of the airline industry.

Hypothesis states that the chosen variables affect number of passengers, but some other factor must be included as the regulations, agreements and other boost from the EU to "kick-up" the industry after crisis in 2008. Confirm by this paragraph: "The European Commissions has estimated that the open skies agreement which came into effect between United States and Europe in March 2008 will lead to a 50 percent increase in transatlantic passenger numbers within 5 years – although quite how the palpable sense of euphoria surrounding announcement of this estimate should sit with the same body´s environmental agenda, the implications on which threaten profitable long-term air transport growth, is not clear."[6] Increase in transatlantic passengers number is affecting the European market too. The IATA states is clear and understable : "The industry consensus forecast released by the International Air Transport Association (IATA) indicates that by 2014 there will be 3.3 billion air travelers, up by 800 million from the 2.5 billion in 2009. By 2014 international aviation will handle 38 million tonnes of air cargo, up 12.5 million tonnes from the 26 million tonnes carried in 2009. China will be the biggest contributor of new travelers. Of the 800 million new travelers expected in 2014, 360 million (45%) will travel on Asia Pacific routes and of those 214 million will be associated with China (181 million domestic and 33 million international). The United States will remain the largest single country market for domestic passengers (671 million) and international passengers (215 million)."[7]

More interesting market for us is of course the EU market and exactly in the Czech Republic. Ministry of Transport doesn't neglect the duty to include this point in Transport Yearbook of 2009 : "Air transport infrastructure as the most important investment in the air transport infrastructure field in 2009 we can quote the buyout of the seat building from the Czech Airlines and buyout of lands predominantly for the

[5] ANNUAL REPORT OF THE COUNCIL. Montreal, Canada : International Civil Aviation Organization, 2009. [9/l60 p.]. Available at WWW: <http://www.icao.int/icaonet/dcs/9921/9921_en.pdf>. Doc 9921.
[6] HOLLOWAY, Stephen, Straight and Level – Practical Airline Economics 3rd Edition. Ashgate Publishing Limited 2008, [p.l00/212.] . ISBN 978-0-7546-7256-2.
[7] The International Air Transport Association (IATA) [online]. 2011 [cit. 2011-03-20]. Industry Expects 800 Million More Travelers by 2014 - China Biggest Contributor. Available at WWW: <http://www.iata.org/pressroom/pr/Pages/2011-02-14-02.aspx>.

construction of a parallel Praha Airport runway. As far as the expenditures in repairs and maintenance are concerned, the most important item was the repair of runways and taxiways on the same airport. As far as air transport in 2009 is concerned, the number of passenger carried as well as the transport performance continued in their growing trends and even a moderate increase in the growth pace has been registered in comparison to the preceding year. In 2009, the interannual increase in the number of passenger carried was 2.8% and 5.4% as regards transport performance in passenger kilometers. The number of passengers handled at the Czech airports declined in 2009 on an interannual basis by 8.4%, and it was for the first time after a long-time continuous growth, thereby achieving roughly the 2006 level." [8]

Not only whole Ministry of Transport, but the biggest airline company in the Czech Republic – CSA, confirms the following trend mentioned above in paragraphs. Quotation from Annual Report approves the worldwide trend. "The new Czech Airlines winter flight schedule comes into force toady. In it, the Airline is primarily boosting the number of flights to destinations that are in Eastern Europe, and rationalizing connections to areas that are noting smaller passenger demand. During the winter flight schedule, i.e., from 25 October 2009 to 27 March 2010, Czech Airlines, in association with its partners, will offer scheduled flights to a total of 138 destinations in 46 countries around the world. In charter carriage, Czech Airlines will offer brand new destinations, such as the Colombian island of San Andrés, and Libéria in north-west Costa Rica.During the winter flight schedule, Czech Airlines will intensify the network of its flights, primarily to Eastern Europe. The number of flights to Moscow, in particular, will increase. Czech Airlines offers three daily flights to Moscow and another one in code-share cooperation with Aeroflot. In addition, flights to Yekaterinburg, Rostov-on-Don, and Minsk will be boosted, as well as to both of the Caucasian destinations - Tbilisi and Yerevan. Also flights to Beirut, Barcelona, Bologna, and Ljubljana will be boosted, especially during the so-called winter high season. "[9]

All articles and books quotation approved that the evaluation of development of the airline industry in the Czech Republic is great theme to observe, suitable for more extensive research, and approves or disapproves stated hypothesis which has a great value added of this work. Airline industry has been on the rise for a long time and valuable evaluation of the development becomes really important business commodity.

[8] Transport Yearbook Czech Republic 2009. RNDr. Olga Kastlová, CSc., Ing. Milan Brich. Prague : Ministry of Transport, 2009. [17-18/164 p.] Available at WWW: <https://www.sydos.cz/cs/rocenka-2009/index.html>. ISSN 1801-3090.

[9] *Www.csa.cz* [online]. 2009 [cit. 2011-03-22]. Czech Airlines Will Boost Its Scheduled Service to Eastern Markets in the 2009/2010 Winter Season . Available at WWW: <http://www.csa.cz/en/portal/company/news/news_tz/news_tz_data/tz_25102009.htm>

3.2 Aeronautical history in the Czech Republic

Development of civil aviation clashed with much heavier impact than military actions did in First World War, because after the war there was no model for aviation industry at all such is in these days. More difficulties than missing model were international politics.

Inadvertently European nations made all possible obstacles to avoid progression of aviation on Europe. Regulations could be seen in list of Paris Convention in article 1 and article 2.

"The High Contracting Parties recognize that every Power has complete and exclusive sovereignty over the air space above its territory. For the purpose of the present Convention, the territory of a State shall be understood as including the national territory, both that of the mother country and of the colonies and the territorial waters adjacent thereto."[10]

"Each contracting State undertakes in time of peace to accord freedom of innocent passage above
its territory to the aircraft of the other contracting States, provided that the conditions laid down in the present Convention are observed.

Regulations made by a contracting State as to the admission over its territory of the aircraft of the other contracting States shall be applied without distinction of nationality."[1]

Simply it was sad that complete and exclusive sovereignty has every state over their airspace and its territory. Czechoslovakia agreed to join Paris Convention, but surrounding states except Poland did not and that is why they restrain the development of the aviation and the airline companies in Europe. So in the very first years only the French company "Cidna"[11] operated in aviation transport in Czechoslovakia. From home transport companies, "CSA" is the oldest. It was established on 6 October, 1923 from military transport division.

3.3 Considering the factors

Considering factors which are crucial for choosing service, there must be a split between two groups - costumers and the companies. Both are very important. Costumers use the

[10] Convention Relating to the Regulation of Aerial Navigation Signed at Paris, October 13, 1919, Article 1
[11] CIDNA - Compagnie franco-roumaine de navigation aérienne

services provide by the companies. “The three factors contributing to this measure illustrate how an airline can increase its aircraft productivity by pursuing one or more of the following strategies: Increase the number of flight departures per day with the existing aircraft fleet, by reducing turn times and/or by increasing the operation of flights at off-peak departure times. 1. Increase the average stage length for the aircraft fleet, by choosing to fly longer-distance routes and reducing the number of flights operated on short-haul routes. 2. Longer stage lengths can increase both aircraft productivity and aircraft utilization (block hours per day). 3. Increase the number of seats on each aircraft, by removing first- or business-class seats in favor of more economy-class seats and/or by reducing the “seat pitch” or distance between adjacent rows of seats.”
As the number three clearly states, there is costumers need to choose between quality or price. That is why the types of transport are distributed into four different groups of transport.

3.3.1 AirTaxi

AirTaxi is individual air passenger transport. More closely – it is a special kind of transport designated for small group of people, mostly because for its financial costliness, which a majority of them lease the entire aircraft. This service is widespread among the business community. As is quoted from the marketing poster from one company: “AirTaxi is being used worldwide not only by top managers, sport stars, celebrities and pop-stars, but by all those who appreciate speed, freedom, flexibility, privacy, confidentiality and comfort more than saving money by using standard airlines. Our client always rents the whole plane, therefore it is up to you if you prefer to travel alone, with your business partners, friends or with your family. Forget tiring waitings, delays, flight cancellations, connecting flights and other ways of wasting time. Check in at the airport is carried out separately and in preference. Our staff will take care of you from your arrival to the airport till the termination of the flight.”[12]

But not only the business clients rely on AirTaxi services, but also the rescue component, including police and emergency, which are very important for the stable functioning of the state.

3.3.2 Charter

Charter tickets are cheap tickets to charter flights, usually operating in the popular tourist destinations. Charter flights are filled by travel agencies and their customers. Flights take place outside normal schedules. Travel agency for its clients leases the whole Charter plane and flies outside the regular flights. Sometimes it may happen that the travel agency does not fill the whole plane, and will offer the remaining seats to

[12] Silesia Air - private jet service, air taxi service [online]. 2011 [cit. 2011-03-19]. Silesia Air - private jet service, air taxi service. Available at <http://www.silesiaair.cz/en/index.php>.

other passengers. Offering the remaining seats can reduce final price of the flight ticket significantly. But sometimes may happen that the travel agent fails to fill the entire plane, and will offer the remaining space to other passengers. They can get a cheaper ticket without necessity to buy whole package tour from travel agency. Charter flights are available generally to popular European destinations, i.e.. Tourist centers in Spain and the Canary Islands, Greece, Portugal, Italy, France, Bulgaria or Croatia. Many Charter flights to Egypt, Tunisia, Turkey, and, in addition to more distant destinations such as Cuba, Brazil, the Dominican Republic, Sri Lanka and the United Arab Emirates.

The question is whether the currently tense situation in the country to which tourists are significant economic benefits, such as Tunisia, Egypt and Libya, where the long run citizen riots will calm. The current complicated situation does not help Airline companies which are specialized to Charter flights all around the world. The situation varies each day, but as is clear from the reports that one of the largest travel agencies in the Czech Republic - Blue Style - option on current threat to airlines to harm the demand for the popular charter destinations of the costumers and travel agencies is certainly there.

To the problems mentioned above travel agency Blue Style declared a following statement: "CK Blue Style reports that temporarily suspended charter flights to Egypt will be implemented, starting from February 19, 2011, unchanged. We are in constant contact with our foreign partners and our delegates in Egypt and the situation is carefully monitored every day."[13]

3.3.3 Low-cost

Low-cost airlines, No frills (Extra things that are added to something to make it more pleasant or more attractive, but that are not necessary[14]), low-cost, low fare or cheap airlines, all are names that characterize for the companies offering very attractive ticket prices. One type of Low-cost is the company which has deal with other company to sell rest of the free places in the plane with some discount to filling whole plane and is use to sell tickets to European flights operated by companies providing regular flights.

Other type is virtual low-cost which is not unlikely the most of the companies. The best example is surely defunct Click4sky which will be describe in following paragraph. High risk of this sector is confirmed by the high number of companies which are based on the market come and go.

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[13] SITUACE V EGYPTĚ. Lenka Berberi. Prague : Blue Style s.r.o. , 2011. [1 p.]. Available at WWW: <http://www.blue-style.cz/tiskove-centrum/aktualni-situace-v-egypte-15-2-2011/>.

[14] Cambridge University Press. Cambridge Advanced Learner's Dictionary. Italy : LegoPrint S.p.A., 2008. [575/1647 p.] Third Edition. Available at WWW: <http://books.google.cz/books?id=fyW5QgAACAAJ&dq=Cambridge+Advanced+Learner's+Dictionary>. ISBN 978-0521-858045.

Click4Sky was a subsidiary of Prague-based flag carrier CSA Czech Airlines, marketed by its parent as "virtual low-cost airline". It used to sell tickets to European flights operated by CSA Czech Airlines. Unlike most other low-cost airlines, Click4Sky did not operate any flights - instead it was being used as a marketing brand in order to sell unsold seats on existing CSA flights. Therefore, Click4Sky offered full service - free refreshment etc. In addition, the airline used to sell all seats at a fixed price and it was not possible to buy one-way tickets.

“Click4Sky is selling tickets on flights to 34 European and African destinations from its Prague hub.”[15]

This service has been stopped in November 2009 for an unknown reason. High risk is clearly illustrated by the number of operating a low-cost airlines (104)[16] and the number of defunct (50)[19] low-cost airlines.

Very interesting is operating style of company called Ryan Air. Although this is not a Czech airline, ideas that company brought to the world market of low-cost airlines are very progressive. It will be shown in following paragraphs.

“RyanAir become the third largest airline in the world by market capitalization. Chief executive Michael O´Leary transformed the company understanding customers need and applying fundamental business principles to a once-filling airline. Ryan Air was developed into a cheap, no-frills operation, giving customers what they wanted – affordable air fares. Company cut it’s at every opportunity and developed a low cost business model that provides customer value.”[17]

“Aircraft cabin interiors may be fitted out with minimum comforts, dispensing with luxuries such as seat-back video screens, reclining seats and blinds; some airlines choose to carry advertising inside the cabin to increase revenue”[18]
Many of these progressive methods are now in use by the Czech low-cost company called Smart Wings.

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[15] Czech Airlines Annual report 2009. Prague : Czech Airlines, 2009. [60 p.]. Available at WWW: <http://www.csa.cz/en/portal/company/news/vyrocnizpravy.htm>.
[16] Wikipedia.org [online]. 2011 [cit. 2011-03-19]. Category:Low-cost airlines. Available at WWW: <http://en.wikipedia.org/wiki/Category:Low-cost_airlines>
[17] DRUMMOND, Graeme; ENSOR, John. Introduction to marketing concepts . London : Elsevier Butterworth-Heinemann, 2005. [101/283 p.].. Available at WWW: <http://books.google.com/books?id=Th54pUFEo6EC&dq=Introduction+to+Marketing+Concepts&source=gbs_navlinks_s>. ISBN 0-7506-5995-5.
[18] BBC NEWS [online]. 2011 [cit. 2011-03-19]. Ryanair 'to cut frills further'. Available at WWW: <http://news.bbc.co.uk/2/hi/business/3489761.stm>

3.3.4 Regular

Regular flights are more expensive than charters. This is because the regular lines are available long-term or over time, whether in a month, or maybe selected days a week. Regular flights are equipped with all comforts as a pick between the first and second class and next high standard services, as in a low-cost or charter flights are disregarded.

3.4 Basic characterization of Czech airline companies

These days companies provide transport connections to most European capitals and to the other cities all around the world. In the Czech Republic there are 13 airlines at the present time - ABA Air, ABS Jets, Central Connect Airlines – CCA, CSA, DSA, Grossman Jet Service, LR Airlines, Silesia Air, Silver Air, Smart Wings, Time Air, Travel Service and VAN AIR Europe. From which company CSA is one of the regular, SmartWings among low-cost, Travel Service, Central Connect Airlines, VAN AIR Europe and the rest of the charter the AirTaxi.

3.4.1 ABA Air

The company ABA Air was founded in 1996, to supplement a branching network of Earth's assistance services. It is considered as AirTaxi. Company´s goal is to deliver the speed of intervention, to save human lives in acute danger and at the same time to carry the wounded from the whole of Europe. In the season, there are at least three rescue flights a week. Events of 11 September 2001 gave a strong financial blow, and therefore, in 2002, the company was reduced

3.4.2 ABS Jets

ABS Jets is an internationally jet operator with bases at Prague Ruzyne Airport and Bratislava Airport. ABS Jets was founded in 2004. Company belongs to AirTaxi. One of the newsletter is informing that: “ABS Jets is one of the few companies in Central Europe, which has financial and human resources to support and introduce systems that require the operation of aircraft at the highest levels of safety and protection.”[19]
ABS Jets received the "Best Company in the field of Aviation Business Jets" in 2009 by the prestigious magazine “Overseas Living”. Other prizes are stated from official internet pages. "Valuation of Overseas Living magazine is certainly a great pleasure for us, because it reflects customer satisfaction with our services."[20]

[19] ABS Jets [online]. 2011 [cit. 2011-03-19]. ABS Jets ve zkratce. Available at WWW: <http://www.absjets.cz/cs/o-nas/abs-jets.php>.
[20] ABS Jets [online]. 2011 [cit. 2011-03-19]. Ocenění a certifikáty. Available at WWW:

3.4.3 Grossman Jet Service

Grossman Jet Service was set up in the Czech Republic in 2004. The company operates its business all around the world as the AirTaxi. “Private flights are all direct, eliminating layovers and baggage transfers that can often double travel time. There are thousands of smaller airports all over the world that big airlines don't have access to on contrary to business jets.”[21] Apart from Executive Charter Flights the company also offers Aircraft Management, Brokerage and consultancy services.

3.4.4 Silesia Air

Silesia Air was founded in 2002. The company concentrates on individual air passenger transport, mainly is considered as AirTaxi. Home base is in Prague Ruzyne Airport. “Typical destinations are airports in Europe, Africa, Asia, the Near East and the Middle East”[22] according to the website.

3.4.5 Silver Air

Silver Air Company was founded in 1995 to provide services in civil aviation, particularly in the field of aircraft maintenance planning charter companies. In 2004 Silesia Air began to fly in Italy for the company Miniliner. In 2009 was cooperation terminated because of the inslovence of Miniliner. Latest reports say that this season starts with new operations in Bulgaria on the 8th of March, 2010. “Our aircraft on routes will operate between Sofia, Skopje, Tirana and Budapest Five Times a week.”[23] But still is consider as AirTaxi mainly. The company is incidentally also engaged in commercial air transport, aerial work, and aircraft maintenance.

3.4.6 Time Air

Time Air was founded in 2001. The aim was to offer the European market services to clients who recognize the value of time and decided to easily obtain a highly efficient manner - using commercial aircraft. Company is specified as AirTaxi.

<http://www.absjets.cz/cs/o-nas/oceneni-certifikaty.php>.

[21] *Grossman JEt Service* [online]. 2011 [cit. 2011-03-21]. About Us. Available at WWW: <http://www.grossmannjet.com/en/about-us>.

[22] Silesia Air - private jet service, air taxi service [online]. 2011 [cit. 2011-03-19]. Silesia Air - private jet service, air taxi service. Available at <http://www.silesiaair.cz/en/index.php>.

[23] Silver WEB [online]. 2011 [cit. 2011-03-19]. Few words about us. Available at WWW: <http://www.silverair.cz/index.php>.

3.4.7 Travel Service

Travel Service a.s. is the Czech airline with its basis in Prague. It was founded in 1997 and now is a part of Unimex Group (significant ownership). Its aircraft service mainly Charter flights for tour operators and currently it is the largest charter carrier in the Czech Republic. The company also has a folder for scheduled air transport, low-cost brand Smart Wings, which has been in service since 2004 by several European destinations. In 2008, the airline carried 2.3 million passengers and in 2007 it was almost 2.2 million[24]. The company operates several Boeing-737-800, two Boeings-737-500 and two Cessna 680. Company´s branch office is at the airport in Warsaw.

3.4.8 Central Connect Airlines

CCA is an airline based at the airport in Leos Janacek´s in Ostrava. Together with the JOB of AIR-Central Europe, Aircraft Maintenance, AIR Logistics and Czech JOB Connect Airlines is a member of a group of CCG (Central Connect Group), which shares links to financial companies Geofin, a.s. in Ostrava.
Since summer 2009 it has begun to operate seasonal flights from Ostrava to Split and since June 2010 from Brno to Zadar. Since October 2010 has CCA launched regular flights (shared with CSA) to German Leipzig.

3.4.9 Smart wings

Smart Wings is a Czech low cost airline based in Prague. This is a brand operated by an airline Travel Service. In 2004 the company was founded. Smart Wings is operating in a low-cost scheduled flights to several European airports. After the collapse of SkyEurope Airlines, the company began to operate regulary route to Paris (some days 3 times a day) and Rome (once a day) but major part of business is the low-cost. As its main hub Smart Wings is using the airport Prague-Ruzyne, airport in Budapest, Hungary Ferihegy. As well Brno and Ostrava are in use.

3.4.10 CSA

The company of the Czechoslovak State Airlines, Czech Airlines (CSA) was founded in 6. October 1923. Despite the many problems that were caused in the 90 years in this decade of economic difficulties and political influences, CSA is ranked in the world and particularly the European air transport of the leading companies in terms of quality, frequency, and transport security. CSA acquired in recent years a number of awards, both

[24] Annual Report of Travel Service 2007. Prague : Travel Service a.s., 2007. [12/45 p.]. Available at WWW:
<http://www.justice.cz/xqw/xervlet/insl/getFile?listina.@slCis=100384921&listina.@rozliseni=pdf&listina.@klic=a4537d927ad266eb7a33791365e3cf48>.

directly from passengers and from prestigious international organizations, journalists and other air evaluation of important subjects (Best Airline on the Czech market ranked by company TTG Czech Republic, and also won the Best Airline in Central and Eastern Europe).

CSA's main business activity has always been a passenger on scheduled airlines. And it is confirmed by following quote from Miroslav Dvorak – Chairman of the board of Directors and president of Czech Airlines. “Czech Airlines will continue to increase its focus on its core area of business activities, regular air transport.”[25] In addition, the increasing weight and irregular shipments of so-called charter and freight and mail. CSA is one of the traditional airlines, which are increasingly competing with low-cost airlines they receive each year a greater proportion of the total volume of air transport. The problem is trying to CSA in 2007 deal own low-cost virtual company called Click4Sky.

After the joining Czech Republic into the European Union, CSA a approaches completely a new market, managed to pass the international quality and safety audit IOSA(the IATA Operational Safety Audit). In July 2006, CSA, in collaboration with the Russian airline Aeroflot has extended the range of common destinations in the Russian Federation (Irkutsk, Kemerovo, Omsk, Barnaul). In the same year, the CSA have shown for the first time in history to carry a record 5.5 million passengers. According to a survey of the International Airline Transport Association IATA in 2006 belonged to passenger satisfaction with the services of Czech Airlines to the highest in Europe.

Today is company flying to 66 destinations including 7 seassonal.

The year 2003 was significant due to the CSA ceremony of laying the foundation stone of CSA Cargo, which took place in February. It was opened in January of the following year. The economic difficulties of this terminal caused in sell of it in four years later. Following statement confirms the difficulties with the CSA Cargo: “Czech Airlines general meeting in early August finally approved the sale of the cargo terminal at Ruzyne airport. The purchaser is Central European Handling (CEH), which offered the highest price on the electronic auction. Sale terminal is part of the curative treatment of CSA. According to unofficial reports, the proceeds from the sale of the cargo terminal at Ruzyně be CZK 763 million, while its 750 million construction cost. According to the CSA president Radomir Lašák cargo terminal was never fully utilized capacity and bound investment funds without generate adequate profits and free cash flow. CSA capacity building was used only about half full and "not able to assess your own investment in cargo terminal as its efficient use."[26]

[25] Czech Airlines Annual report 2009. Prague : Czech Airlines, 2009. [4/60 p.]. Available at WWW: <http://www.csa.cz/en/portal/company/news/vyrocnizpravy.htm>

[26] Videožurnál studentů žurnalistiky FSV UK [online]. 2007 [cit. 2011-03-20]. ČSA prodává cargo. Available at WWW: <http://videozurnal.fsv.cuni.cz/carolina.php?id=669#667>.

3.4.11 LR Airlines

LR Airlines story is interesting; the company was founded March 12, 1997 by famous Czech entrepreneur Aleš Buksa, who is in the subconscious of many Czechs as a patron LR Health & Beauty Systems. Company is called Airline despite only use is as AirTaxi and mostly only for Aleš Buksa. Company owns only one Aircraft "Lady Racine" (Type 410 UVP-E). "On board the Lady Racine, we expect first-class facilities associated with a first class service. The eight luxurious and comfortable chairs you can really enjoy the flight. Exclusive and always fresh meals are served on china at the mahogany table."[27]

3.4.12 VAN AIR Europe

VAN AIR Europe was founded in year 2004 and it is an airline based at Brno-Turany. VAN AIR Europe uses only one favorite type of aircraft - Let L-410 Turbolet.

3.5 Methodological background

3.5.1 Quantitative research

At first must be mention what the research is. By the definition from the lectures of Empirical Research in Economics is stated: "Research is gathering, processing and interpreting data; then intelligently and cogently communicating the results in a report. Research is process of systematically acquiring data to answer a question or solve a problem. Set of easily understood procedures. Scientific method: approaches a research problem without any preconceived answers to avoid subjective bias. Research methodology refers to the steps involved in a given approach preparing operational definitions forming hypotheses and theories applying qualitative or quantitative method of data analysis."[28]

Than to describe what quantitative research is. One explanation is: "Explaining phenomena by collecting numerical data that are analyzed using mathematically based methods (in particular statistics)."[29] And second is confirm the previous one – "Research strategy that emphasizes quantification in the collection and analysis of data." [30]

[27] Samuraj.cz [online]. 2007 [cit. 2011-03-20]. Buksova Lady Racine - odvaz za 66 milionů korun. Available at WWW: <http://www.samuraj.cz/clanek/buksova-lady-racine-odvaz-za-66-milionu-korun>.
[28] ŠOBROVÁ, Lenka. *Empirical Research in Economics* [online]. 2011. Prague :CULS. 2011 [cit. 2011-03-22]. Research, Study materials from 2nd year of AEM.
[29] MUIJS, Daniel. *Doing quantitative research in education*. London : SAGE Publications Ltd, 2004. [1/228 p.]. ISBN 0-7619-4382-X.
[30] ŠOBROVÁ, Lenka. *Empirical Research in Economics* [online]. 2011. Prague :CULS. 2011 [cit. 2011-03-22]. Research, Study materials from 2nd year of AEM.

The explanation shows us an element which is "explaining phenomena". In our case is phenomena continuously rising of numbers of passengers. Research helps us to explain defined problem which was mentioned above. Quantitative research is dependent on collected data. Gathered data are closely connected to the analysis. To be able to do right research with some value added data must be in numerical form to explain a particular phenomenon, particular goals and to prove or disprove hypothesis.

By the mean “selecting instruments” is stated proper usage of the statistical procedures to obtain reliable data to analyzing. “Once you have selected a suitable experimental design, you need to select or develop appropriate pre- and post-test measures. This is crucially important, as neither a high-quality experimental design nor sophisticated statistical analyses can make up for bad measurement. In just the same way a carpenter also needs proper tools – imagine trying to build a car with a hammer, some nails and a plank of wood and you will see what I mean! The measurement instruments must first of all measure what we want them to. This is known as validity. Secondly, our instrument must be reliable.”[31] In following chapters, there are some methods used in my research.

3.5.2 Time series theory

Description of a time series is: “A time series is a set of observations x1, each one being recorded at a specified time t. A discrete-time series is one in which the set T0 of times at which observations are made is a discrete set, as is the case for example when observations are made at fixed time intervals. Continuous-time series are obtained when the observations are recorded continuously over some time interval, e.g. when T0= [0,1]. We shall use the notation x(t) rather than xt if we wish to indicated specifically that observations are recorded continuously.”[32]

Basic index compute coefficients and average coefficient of the growth.(

$$k_i = \frac{y_i}{y_{i-1}}$$ [33]

- k_i...relation between year and base

[31] MUIJS, Daniel. *Doing quantitative research in education*. London : SAGE Publications Ltd, 2004. [1/228 p.]. ISBN 0-7619-4382-X

[32] BROCKWELL, Peter J.; DAVIS, Richard A. *Time Series : Theory and Methods*. New York : Springer-Verlag, 1987. [1/519 p.]. ISBN 0-387-96406-1.

[33] HAMILTON, James D. Time Series Analysis. New Jersey : Princeton University press, 1994. 407 p. ISBN 0-691-04289-6.

- y_i...value of the measured year
- y_{i-1}...value of the year stated as base

Coefficient of the growth:

$$k_i' = \frac{y_i}{y_{i-1}} \cdot 100 \ [\%] \quad (43)$$

Average coefficient of the growth:

$$\bar{k} = \sqrt[n-1]{\frac{y_n}{y_1}} = \sqrt[n-1]{k_1 \cdot k_2 \cdot \ldots\ldots \cdot k_{n-1}} \quad (34)$$

Chain index compute an index and the tempo of a growth.

$$r_T = \frac{x_T}{x_{T-1}} \quad (44)$$

- rT...ratio of two year T and T-1
- xT...value of T-year

3.5.3 Exploratory data analysis

"Exploratory Data Analysis (EDA) is an approach for data analysis that employs a variety of techniques to maximize insight into a data set, uncover underlying structure, extract important variables, detect outliers and anomalies, test underlying assumptions, develop parsimonious models and determine optimal factor settings."[35]

[34] HAMILTON, James D. Time Series Analysis. New Jersey : Princeton University press, 1994. 407 s. ISBN 0-691-04289-6.
[35] *Engineering Statistic Handbook* [online]. 2011 [cit. 2011-03-24]. What is EDA?. Available at WWW: <http://www.itl.nist.gov/div898/handbook/eda/section1/eda11.htm>.

Using of EDA we try to reveal possible errors in the data, e.g. outliners. It determines whether parametric or non-parametric tests should be used in future analysis.

The Kolmogorov-Smirnov test (KS-test) determines if datasets differ significantly. KS tests will be used if the data is greater than number 2000.

Shapiro-Wilk test determines if the null hypothesis is that the population is normally distributed, if the p-value is less than the chosen alpha level (confidence interval of mean = 95%), then the null hypothesis is rejected (i.e. one concludes the data are not from a normally distributed population). If the p-value is greater than the chosen alpha level, then one does not reject the null hypothesis that the data came from a normally distributed population. E.g. for an alpha level of 0.05, a data set with a p-value of 0.32 does not result in rejection of the hypothesis that the data are from a normally distributed population. SW tests will be used if the sample size is between 3 and 2000.

3.5.4 Autocorrelation function

The autocorrelation function of a random process is defined as the average value of the product of the value of the signal sampled at time t1 and the value of the signal sampled at time t2 (where t2 = t1+dt and dt is an increment of time). Therefore, for a process described by some value x (where x could be acceleration or displacement etc.) varying with time t the autocorrelation function is the average of x(t)*x(t+dt) for many values of t and many values of dt.

More simplified version is "A mathematical representation of the degree of similarity between a given time series and a lagged version of itself over successive time intervals. It is the same as calculating the correlation between two different time series, except that the same time series is used twice - once in its original form and once lagged one or more time periods."[36]

Other definition is: "The autocorrelation function can be used for the following two purposes -To detect non-randomness in data, to identify an appropriate time series model if the data are not random. Definition : Given measurements, Y1, Y2, ..., YN at time X1, X2, ..., XN, the lag k autocorrelation function is defined as

$$r_k = \frac{\sum_{i=1}^{N-k}(Y_i - \bar{Y})(Y_{i+k} - \bar{Y})}{\sum_{i=1}^{N}(Y_i - \bar{Y})^2}$$

Although the time variable, X, is not used in the formula for autocorrelation, the

[36] Investopedia [online]. 2011 [cit. 2011-03-27]. Autocorrelation. Available at WWW: <http://www.investopedia.com/terms/a/autocorrelation.asp>

assumption is that the observations are equip-spaced.

Autocorrelation is a correlation coefficient. However, instead of correlation between two different variables, the correlation is between two values of the same variable at times Xi and Xi+k.

When the autocorrelation is used to detect non-randomness, it is usually only the first (lag 1) autocorrelation that is of interest. When the autocorrelation is used to identify an appropriate time series model, the autocorrelations are usually plotted for many lags."[37]

Another useful statistical method to find out if data are reliable is the coefficient of variation expresses the standard deviation as a percentage of the sample mean.

3.5.5 Regression analysis

Regression analysis is observing the relationship between a dependent variable and one or more independent variables. More specifically the analysis helps one understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. "Most commonly, regression analysis estimates the conditional expectation of the dependent variable given the independent variables — that is, the average value of the dependent variable when the independent variables are held fixed"[38]

"The performance of regression analysis methods in practice depends on the form of the data-generating process, and how it relates to the regression approach being used. Since the true form of the data-generating process is not known, regression analysis depends to some extent on making assumptions about this process. These assumptions are sometimes (but not always) testable if a large amount of data is available. Regression models for prediction are often useful even when the assumptions are moderately violated, although they may not perform optimally. However, in many applications, especially with small effects or questions of causality based on observational data, regression methods give misleading results."[39]

[37] Box, G. E. P., and Jenkins, G. (1976), Time Series Analysis: Forecasting and Control, Holden-Day. ISBN 0-470-27284-8
[38] Wikipedia [online]. 2011 [cit. 2011-03-27]. Regression Analysis. Available at WWW: <http://en.wikipedia.org/wiki/Regression_analysis>
[39] COOK, R. Dennis; WEISBERG , Sanford. Residuals and Influence in Regression : Monographs on Statistics and Applied Probability. England : Springer, 1982. 25/240 p. ISBN 978-0412242809

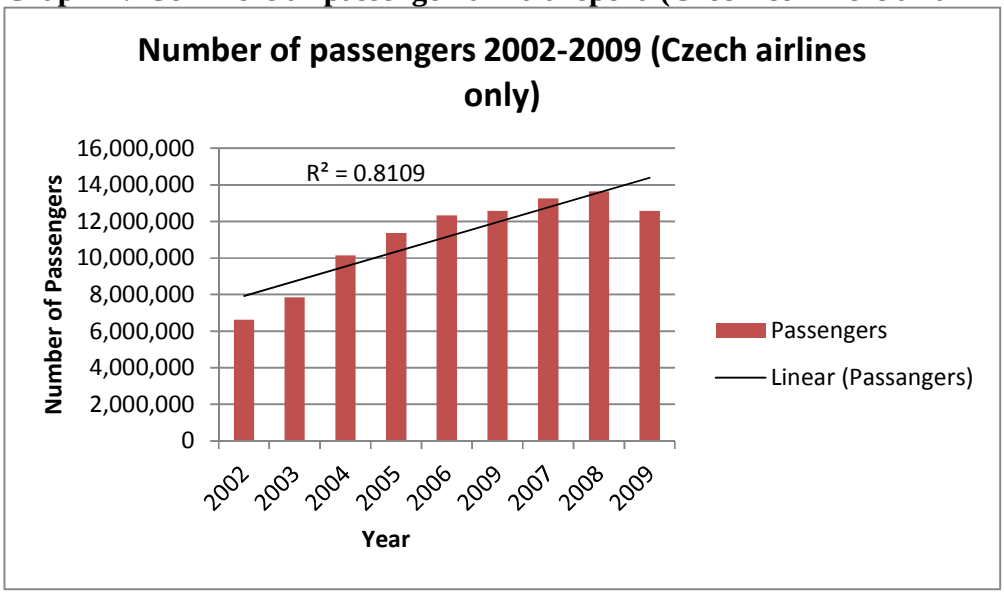
4. Empirical part

4.1 Aviation in the Czech Republic in present day

"Companies provide transport connections to most European capitals and to the other cities all around the world. In the Czech Republic there are 13 airlines at the present time - ABA Air, ABS Jets, Central Connect Airlines – CCA, CSA, DSA, Grossman Jet Service, LR Airlines, Silesia Air, Silver Air, Smart Wings, Time Air, Travel Service and VAN AIR Europe. From which company CSA is one of the regular, SmartWings among low-cost, Travel Service, Central Connect Airlines, VAN AIR Europe and the rest of the charter the AirTaxi."[40]At this point it is necessary to recall some of the extinct - Air Espe, Air Georgia, Air Moravia, Air Ostrava, Air Skoda, Air Terrex, Air Vitkovice, CMA = Cargo Moravia Airlines, CLS = Czechoslovak airline, Discovery Travel, Egretta, Ensor Air, Fischer Air, IDG Technology Airlines. The enumeration of the last 10 often successful airlines completes a considerable risk in this business field. However, many successful businessmen or companies tried to establish airlines or made effort to become a piece of chain which is here to ensure the aviation transportation functional in all aspects

The trend of increasing passenger numbers clearly confirms the accuracy of dealing with the development and that prognosis of Czech airline companies is correct. Long-term statistics of the Ministry of Transportation clearly confirmed it. See the following table.

Graph 1: Commercial passenger air transport (Czech commercial airlines only)



[40] Chapter 3.4 – Basic characterization of Czech airline companies

Source: Own processing, data from Eurostat

Number of passengers has almost doubled since 2002, although the year 2009 saw a slight decline in passengers caused by the unclear future of the CSA and highly volatile prices of the tickets.

When the company's annual report for 2010 is available, we can expect a further decline in passenger numbers, especially because of the eruption of the volcano Eyjafjalla in Iceland. News from 16 April shows what damage caused the natural phenomenon.

"Airspace over the Czech Republic was closed on Friday at 13 o´clock due to the occurrence of volcanic ash. The largest domestic airport in Prague Ruzyne was closed. Dozens of arrivals and departures had to be cancelled."[41]

How cash flow can be affected explains The International Air Transport Association, which said that as a result of volcanic dust that spread from Iceland to the interior of the continent, companies record the forced loss of over 200 million dollars per day due to airline traffic restrictions.

Not only natural disasters severely affect passenger numbers, but in recent weeks also very rampant government and military coups in the popular year-round resorts such as Egypt or Tunisia. There will be strong correlation between these variables.

But on the other hand, long-term statistics are very powerful tool and all the stats are confirmed with the ones provided by Czech statistical office: "Employment in airline companies is around 0.2% share of total employment in the Czech Republic economy, which approximately corresponds with the situation in developed countries. Air transport, however, is constantly on the rise and growth of the number employed in the next few years is likely to increase fast. This trend is supported by the expected expansion of airport capacity – by the European Union; air transport in the year 2020 will be doubled compared to the year 2008. The labor market in the Czech Republic, the sector of air transportation employment, should be decently affected. The trend in air transport will further strengthen transportation costs and the expansion of related logistics services, passenger transport will increase the number of passengers due to increasing household incomes (more people will use air travel for holidays), due to a higher intensity of international trade."[42]

[41] ČTK. Novinky.cz [online]. 16.4. 2010 [cit. 2011-03-19]. Vzdušný prostor nad Českem je uzavřen. Available at WWW: <http://www.novinky.cz/ekonomika/197716-vzdusny-prostor-nad-ceskem-je-uzavren.html>.

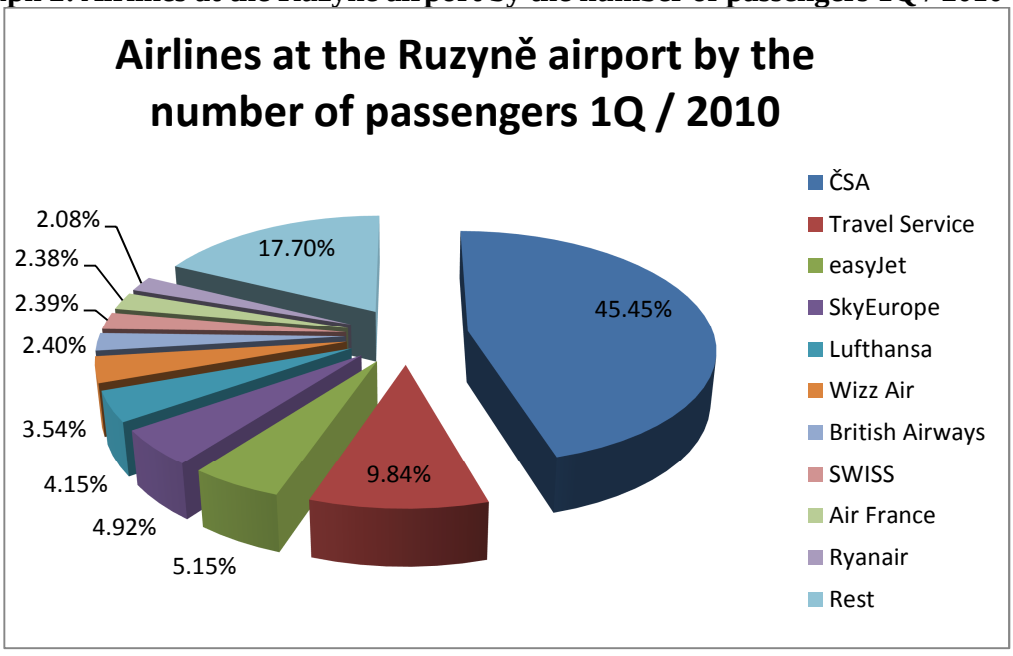
[42] Unemployment in the Czech Republic as Measured by Labour Force Sample Survey - annual averages 2009 : Employment in civil sector - Status in employment in sectors. Prague : Czech Statistical Office, Prague 2009. 1, Tab. 301 . Available at WWW: <http://www.czso.cz/csu/2010edicniplan.nsf/t/060025178E/$File/31151031.xls>

Although doing business in this branch is very unpredictable, its importance is clear and this is a topic for very long discussion. Statistics show a long-term increase in the use of air transport as a solid, fast, convenient and safe means of transport, which has certainly its strong position in future international traffic, with the possibility of minor fluctuations caused by natural phenomena or civil unrest in the world.

Choosing companies which are characterized in this section was carried out according to clearly specified criteria. The first criterion was, of course, if we talk about the Czech airline companies, more than 50% percent of the company ownership held by Czech owners. Other investors or participants may not exceed majority stake, because they will turn to a "foreign" companies.

There are 13 active airlines that operate at the airport Ruzyne. They more or less affect the overall composition of the passenger traffic in the main air flow. If we look at the statistics published for the first quarter of 2010, we can clearly see the absolute supremacy of CSA Czech Airlines in the field of international and even domestic traffic. Despite all its financial capital, which is huge - in entering a strong financial group Unimex Group this year, CSA received 10 per cent across the border, driven by strong "charter" of its fleet of aircraft. There are still lengthy discussions on the future fusion of Travel Service and CSA, respectively. Privatization of the former CSA and then fusion with Travel Service, the next steps which depend primarily on the decision by members of the political spectrum and of course experienced managers of CSA, it is hard to estimate future developments in the ownership structures of their respective companies.

Graph 2: Airlines at the Ruzyne airport by the number of passengers 1Q / 2010



Source: Airport Prague-annual report-company Profile Company's 2009 - 2010 [43]

Table 1: Airlines at the Ruzyne airport by the number of passengers 1Q / 2010

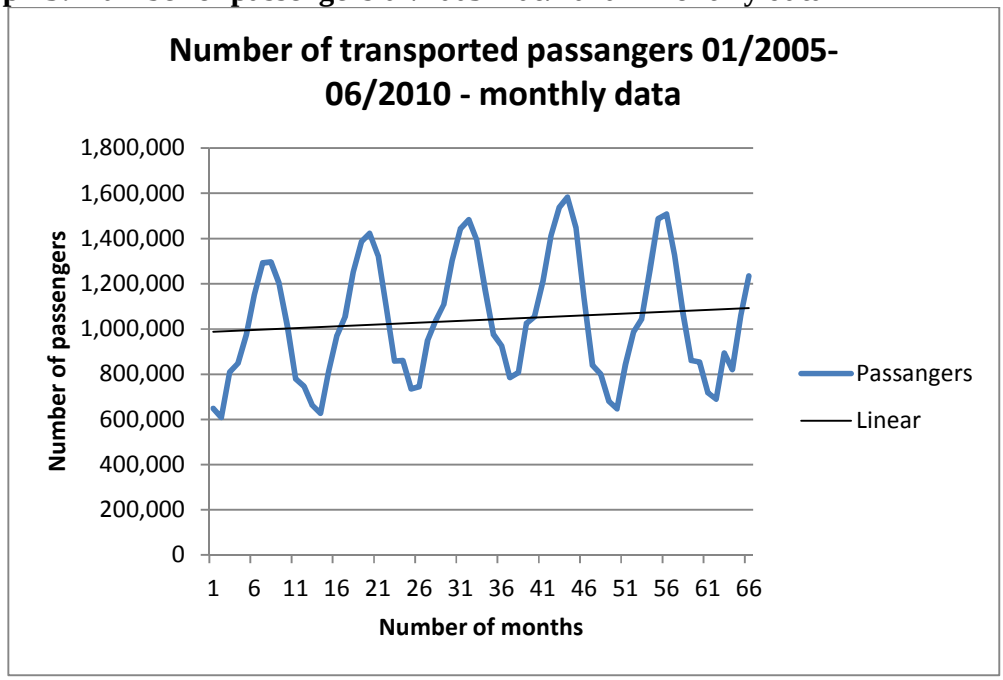
Company	ČSA	Travel Service	easyJet	SkyEurope	Lufthansa	Wizz Air	British Airways	SWISS	Air France	Ryanair	Rest	Total
Pasangers	1,319,600	285,695	149,525	142,847	120,491	102,780	69,682	69,391	69,101	60,391	513,902	2,903,405

Source: Airport Prague-annual report-company Profile Company's 2009 - 2010

The following chart shows that the majority owner of the airspace over the Czech Republic has CSA Czech Airlines.

4.2 Analysis of passengers number

Graph 3: Number of passengers 01/2005 – 06/2010 – monthly data



Source: Own processing, data provided by Eurostat

[43] COMPANY PROFILE. Prague : PRAGUE AIRPORT, 2009. [3/10 p.]. Available at WWW: <http://www.prg.aero/cs/o-letisti-praha/tiskove-centrum/vyrocni-zpravy/Contents/1/D52281DA7104B24BFDAD530A89222A70/resource.pdf>

Monthly data of transported passengers are showing the increasing trend, despite the trendline is linear, and level is increasing. Simple equation for the prognosis is:

$$Y = 1609 * x + 985419$$

Value of confidence level R(.013) tells that the equation is really only for trendline purposes. Equation cannot be used for prognosis.

Table 2: Coefficients of variance

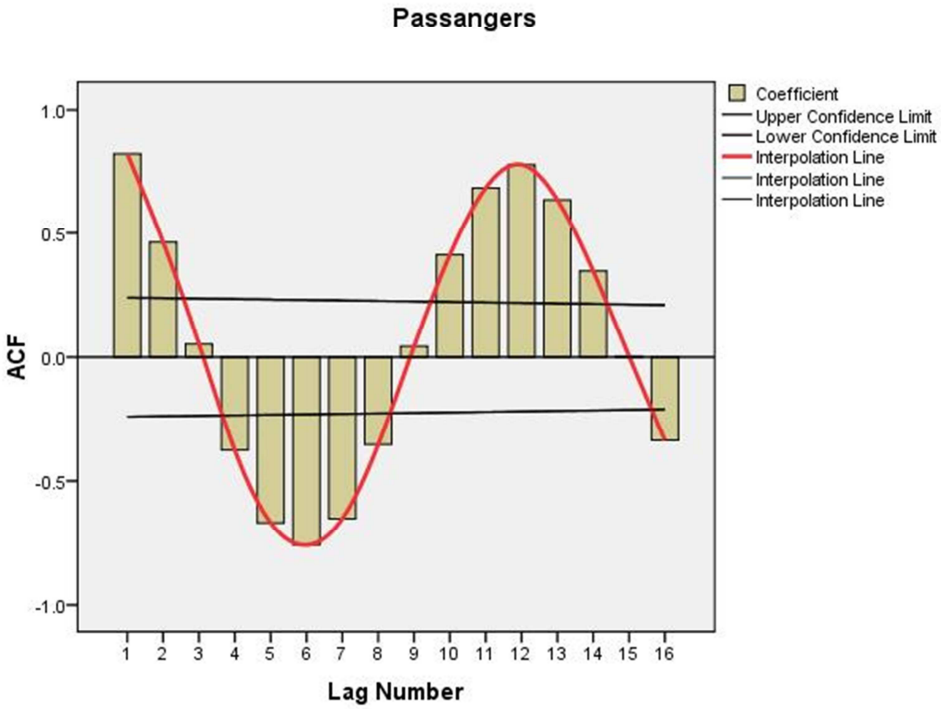
	Arithmetic mean	Standard deviation	VOC
Passengers	1,039,321	268,330	25.82%
Crude oil	64.11	20.38	31.78%
GDP - index	94.71	3.18	3.35%
Inflation rate	2.75	2.03	73.80%
Ticket - index	89.10	10.15	11.40%

Source: Own processing, data provided by Eurostat

Table 3 shows non-homogeneous coefficients of variation. Only homogenous is GDP rate. It point to that data supposed to be seasonal.

Linear line in Graph 3. is influenced by seasonality of data which is shown in next paragraph. R squared number cannot be considered as significant due its linearity and data supposed to be more or less seasonal because traveling in summer and in Christmas is boosted with the charter flight during the summer and winter holidays.

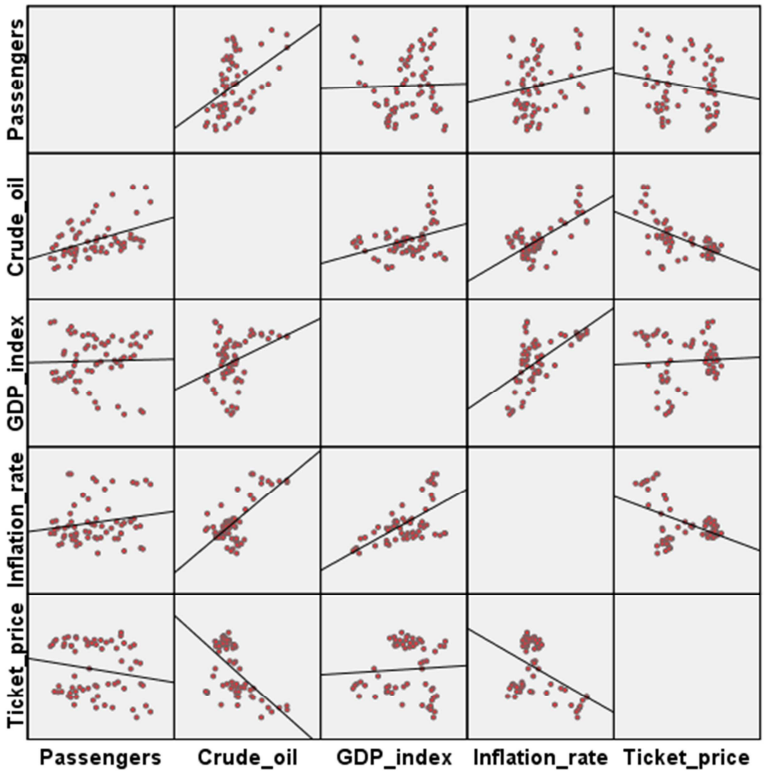
Graph 3: Correlogram – Passengers 01/2005-06/2010



Source: Own processing using SPSS, data Eurostat

ACF approved that the data set of number of passengers among the month during the year are strongly seasonal. Lagged periods along the graph is describes best as the red sinusoid. Its exemplary seasonal variation oscillation in correlogram is at the same frequency (sinusoidal pattern). Table II. (See supplements) interprets the lag value (1,6,12) as .820, -.758, .777. Lag 1 number (.820) represents very positive correlation. Increase in these time series lead to proportionate increase in the other time series. Lag 6 number (-.758) represents very negative correlation which tells that increase can be seen in one time series result in a proportionate decrease in the other time series.

Graph 4: Scatter matrix with linear line



Source: Own processing using SPSS, data provided by Eurostat

Graph 4 shows a scatterplot matrix and observing the linear relationships between the passengers number (dependent) and variables. As it shows in graph, most significant distinct linear relationship is between dependent variable and crude oil.

Creating correlation matrix observes the coefficients of correlation between all variables. Table III. (See supplements) shows the significant level of the relationship between passengers and crude oil confirmed by the positive value (.452) of Pearson Correlation. In example – the higher the cost of crude oil is the higher number of passengers is transported. The significance number between these two variables is under .500 so the correlation considers statistical significant correlation. On the other hand the relationship between number of passenger transported and GDP index is strongly insignificant (.824 > .500). In the case of ticket index (.163<.500) and inflation rate (.145<.500) are the values acceptable so the correlation can be considered as significant. Crude oil, inflation rate and ticket index is associated with number of passengers transported. So GDP is not related to the passengers number due its insignificance level. Interesting correlation value is between ticket price and the crude oil. It shows that the lower price of crude has barely any impact on the change in the ticket price.

Multiple regression model summary (Table IV. – see supplements) shows how the variables predict the number of passengers. The multiple correlation coefficient(R) is equal to .516. It observes all of the associations among the variables together. Maximum value is 1. R squared (.267) shows that there is 26,7 % of the variance in passenger number can be predicted by the combination of all the variables.

Next step is to look at if the model fits well. Observing the ANOVA model (Table V. – see supplements) shows that the significance level (.001) is much less than 0,5 which means that the 5% false positive rate is sing of very tight and good model.

Exploring the coefficient table (Table VI. – see supplements) reveals that the constant value is 1,365,091 which means when all the predictors are equal to 0, which actually is not possible, number of passengers start with the number of 1,365,091. Simple equation shows the number of passenger with the level of confidence around 51%.

Equation 1. (

$$Number\ of\ passengers = -1365091 + 9666 * Crude\ oil\ price - 15125 * GPD\ index - 15473 * Ticket\ index + 5943 * ticket\ index$$

But important is to look at the significance column. All the variable should be generally less than 0,5 to mark them as significant variable in mean they are reliable to prediction. All the variable has the significance level less than 0,5 except the inflation rate(.549). To compare it with the correlation matrix (Table III.) where the significance number of inflation rate is (.181) the number in coefficient table (Table IV.) shows that inflation rate is no longer significantly associated. The reason of that is because the multiple regressions look at the combination of the four variables to predict the outcome. This is the contribution of each variable, but only in combination with each other. That's one of the reason why it more reliable to look at the multiple regression model.
Remodeling the multiple regression model excluding the inflation rate should shows positive change in R square (Table IV.).

Very small negative change (Table VII.) in the multiple correlation coefficient (R) - (.512) and in the R squared still shows that there is 26,2% change in variance in passenger number that can be predicted by these three variables.

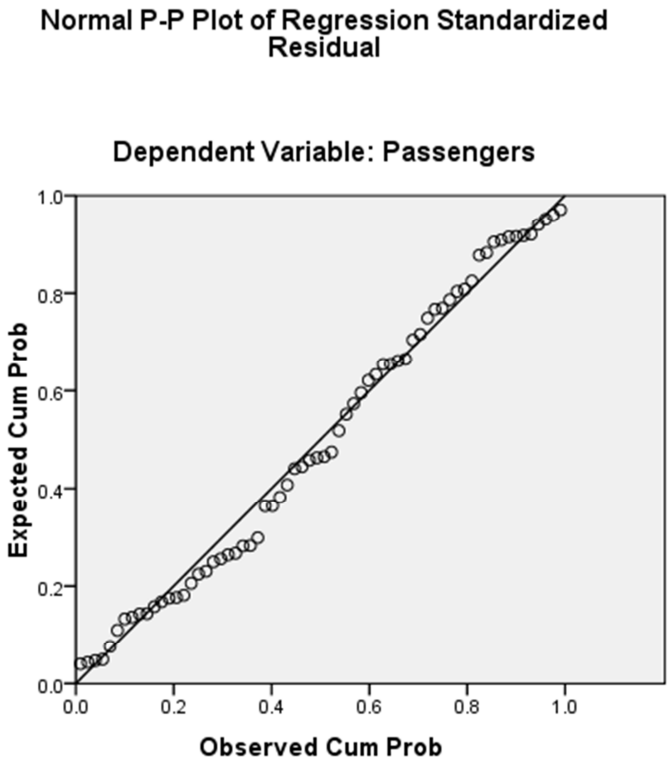
Improving the ANOVA table model (Table VIII.) shows positive improve in significant level which is after excluding the inflation rate equal to .000 which means that the model is now very good. Important part of the re-modeling the multiple regression model is high positive change in the significance level in the coefficient table (Table IX.). The constant change from .226 to .058, GDP_index .268 to .063 and ticket index from .159

to .084 which clearly shows the positive effect of excluding the inflation rate.

The number of passengers in next month can be considered as an equation of:

Equation 2.

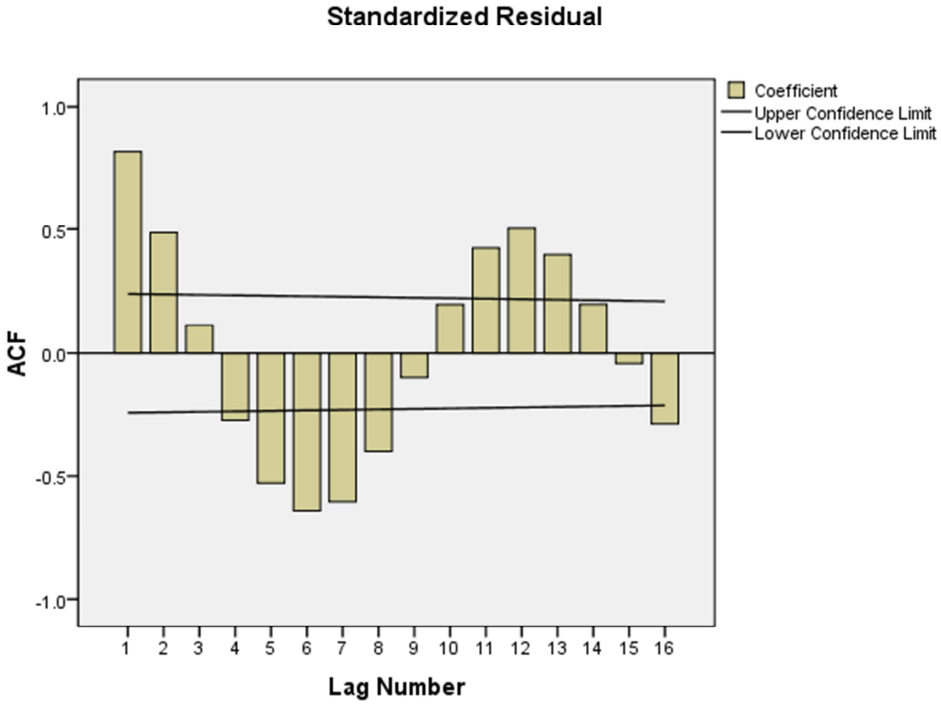
Graph 5: Testing homoscedasticity



Source: Own processing using SPSS

Graph 5 shows there are no serious violation in distribution, so there possibly cannot be an overestimating the goodness of fit as measured by the Pearson coefficient. Relationship is linear. It is confirmed by following Graph 6.

Graph 6: Autocorrelation of residuals



Source: Own processing using SPSS.

Residuals indicates that the model is a good fitted. Prognosis and forecast shows significant outcomes.

As first step of Analysis is the data analyzing. Using Explanatory data analysis with Shapiro-Wilk test is first step to approve that the set of data are normally distributed. Significance level shows if data are correct.

Confidence level is 95%(alfa value, that means there is 95% chance of getting right answer. If significance value is less than 0,5 rejecting the null hypothesis. If the significance value is greater or equal 0,5 null hypothesis must be accepted. The Shapiro-Wilk test is used to answer the question whether the data should be changed due theirs normal distribution.

Table 3: Tests of normality – KS and SW test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Passangers	.125	66	.013	.954	66	.016
Crude_Oil	.163	66	.000	.893	66	.000
GDP_index	.085	66	.200*	.958	66	.026
Inflation_rate	.213	66	.000	.863	66	.000
TIcker_index	.207	66	.000	.884	66	.000

Source: Own processing using SPSS. Data provided by Eurostat and Czech Statistical Office

Shapiro-Wilk test significance level does not the mean value of 0.5 so rejecting the hypothesis written above approved the normal distribution of the data set. In the case of price of crude oil, inflation rate and ticket index there are no significant deviation, as well the data set of GDP index and passengers number is clearly approved despite small deviation in significance level.

4.3 Prognosis

Prognosis is based on data set which is presented as relevant and data set are comparing only with significant variables.

Table 4: Comparing R and Sig. values from passengers analysis function

	R	Sig.
Linear Graph	0.013	x
MR	0.516	0.54
MR_exl	0.512	0.051

Source: Own processing

All the equations are not significant due its R value. For the data prognosis for next 6 months ARIMA model is used.

Table 5: ARIMA model statistic

Model Statistics							
		Model Fit statistics		Ljung-Box Q(18)			
Model	Number of Predictors	Stationary R-squared	R-squared	Statistics	DF	Sig.	Number of Outliers
Passengers-Model_1	0	.598	.981	24.178	16	.086	0
Crude_oil-Model_2	0	.236	.899	14.342	17	.643	0
GDP_index-Model_3	0	.486	.966	13.648	16	.625	0
Ticket_index-Model_4	0	.000	.950	26.565	18	.088	0

Source: Own processing using SPSS

For all the variables is R squared higher than .899, that means the chance of getting the right outcome for next month is 89,9% with the ARIMA model.

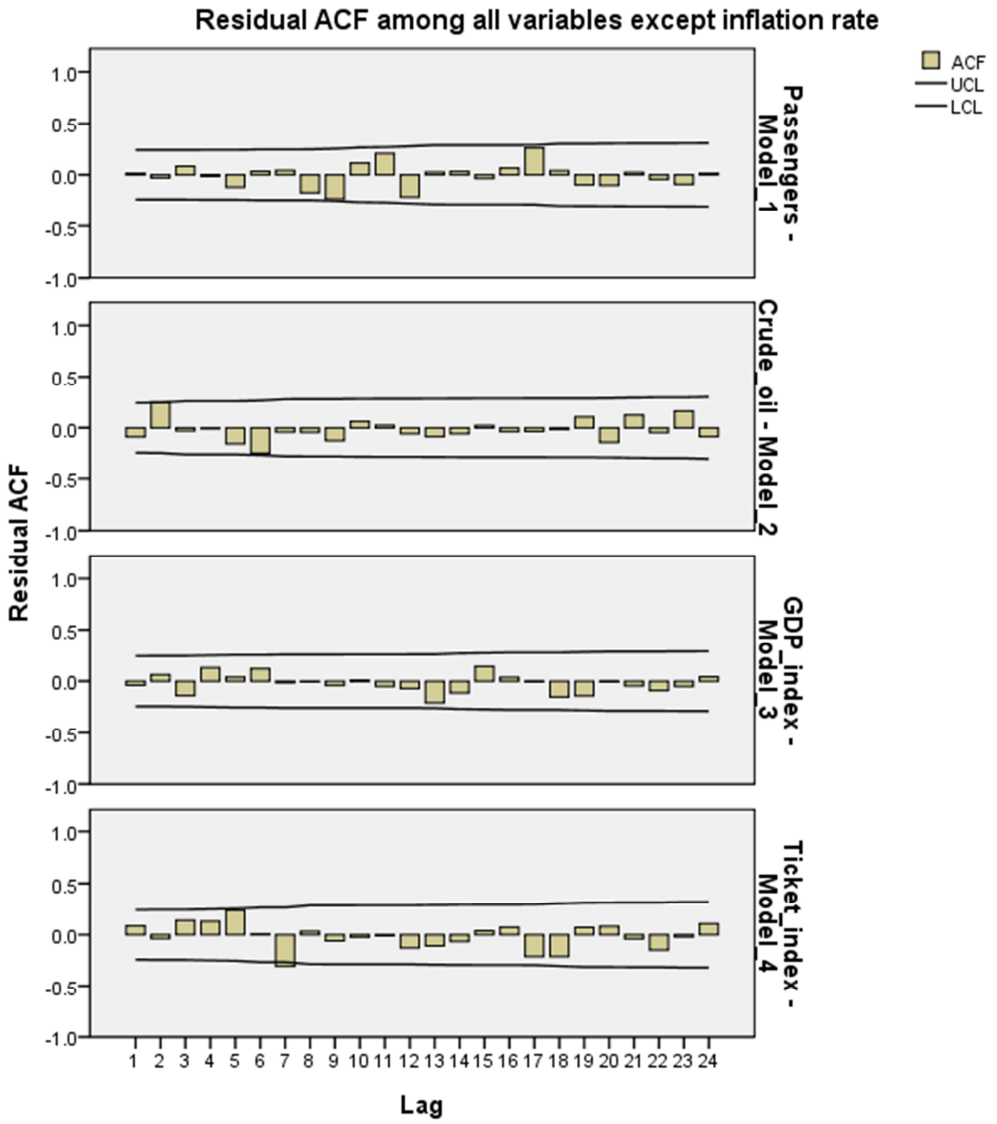
Table 6: ARIMA model forecast

Forecast							
Model		Jul 2010	Aug 2010	Sep 2010	Oct 2010	Nov 2010	Dec 2010
Passengers-Model_1	Forecast	1392995.72	1422130.18	1301696.35	1060428.50	825956.16	800740.38
	UCL	1468451.94	1514238.06	1407875.83	1179021.51	955781.13	940900.09
	LCL	1317539.49	1330022.30	1195516.87	941835.49	696131.19	660580.68
Crude_oil-Model_2	Forecast	67.54	67.74	67.84	67.88	67.90	67.92
	UCL	80.58	91.04	100.11	107.97	114.87	121.03
	LCL	54.50	44.44	35.57	27.80	20.94	14.80
GDP_index-Model_3	Forecast	95.24	95.31	95.54	95.56	95.01	94.57
	UCL	96.37	97.36	98.41	99.15	99.24	99.37
	LCL	94.11	93.26	92.67	91.97	90.79	89.76
Ticket_index-Model_4	Forecast	83.25	82.99	82.74	82.48	82.23	81.98
	UCL	87.81	89.45	90.65	91.62	92.44	93.16
	LCL	78.68	76.54	74.83	73.35	72.02	70.79

Source: Own processing using SPSS

Prognosis estimates that the development starts with increase in first two months and then is followed by decline to 800,740 passengers in December 2010.

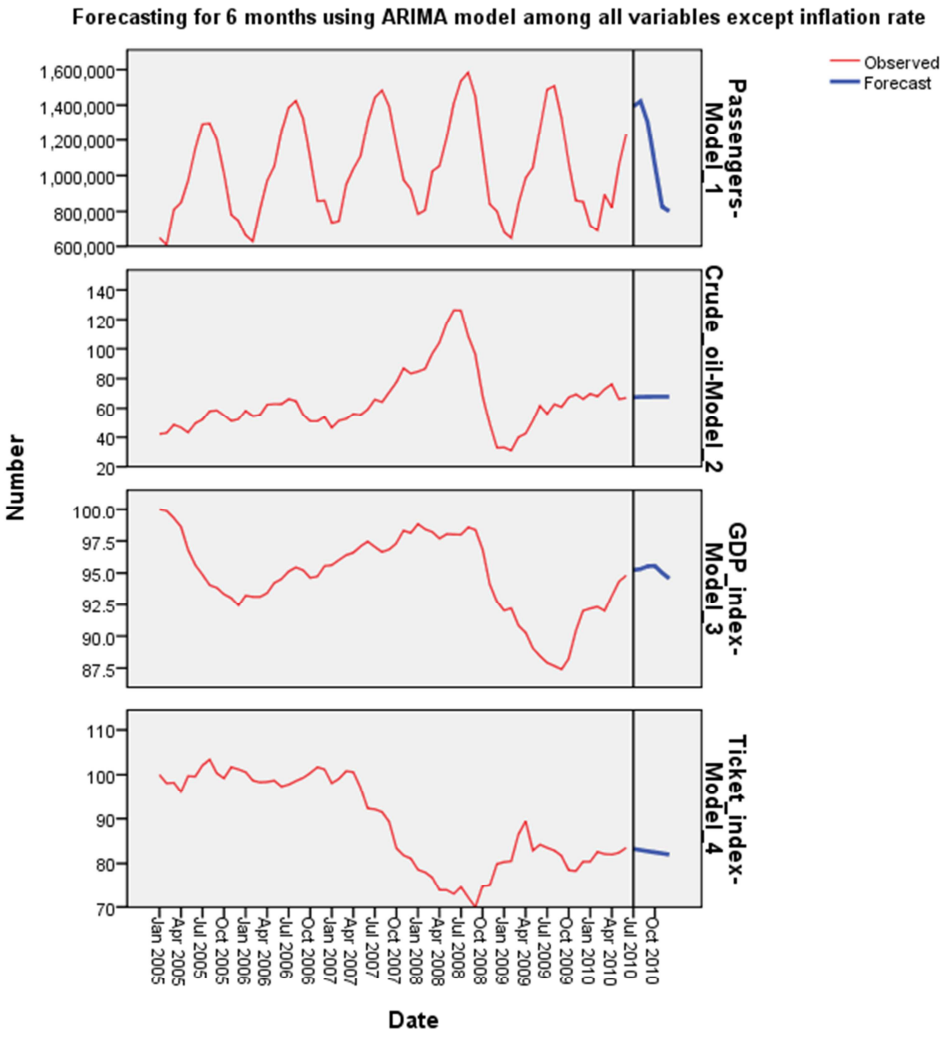
Graph 7: Residual ACF among all variables except inflation rate



Source: Own processing using SPSS

On the autocorrelation of residuals is shown that All residuals are in coefficient of significance (variable <.500) which shows that the model is tight and very good.

Graph 8: Forecasting for 6 months using ARIMA model among all variables except inflation rate



Source: Own processing using SPSS

Forecasting graph shows time series observed with forecasted. Number of passengers transport almost copying the seasonality trend. Prognosis is that the decline of passengers transported in August is continuously dropping to value of 800,740 in December 2010. However the forecasted trend is declining it shows that the prognoses number in December 2010 is higher than in 2009.

5. Discussion

Main objective of this thesis is the **evaluation of development in passengers transportation on the basis of the time series.**
Graph 1. shows a linear trend function with increasing number of transported passengers in years 2002 to 2009. Confirmation inside the thesis: "Number of passengers has almost doubled since 2002, although the year 2009."
Other evaluation verifies the previous one. In graph 3. there is same linear function with lower confidence level, caused by seasonality of the data. Correlogram in graph 3. proved previous two statements and shows strong seasonality which is represented with the sinusoidal display in the graph.
Graph 4 shows a scatterplot matrix and observing the linear relationships between the passengers number (dependent) and variables. As it shows in graph, most significant distinct linear relationship is between dependent variable and crude oil. **Evaluation was done from wide variety of angels and it was based on the time series.**

Approve that all the selected variables significantly affect number of passengers. Hypothesis is that all the **variables significantly affect the number of passengers.**
Correlation matrix observes the coefficients of correlation between all variables. Table III. shows the significant level of the relationship between passengers and crude oil(.452), ticket index (.163) and inflation rate (.145) confirmed by the positive value of Pearson Correlation. The relationship between number of passenger transported and GDP index is strongly insignificant (.824 > .500). Coefficient table (Table IV.) shows that inflation rate is no longer significantly associated due its significance level. The reason of that is because the multiple regressions look at the combination of the four variables to predict the outcome. **The hypothesis is REJECTED.**

Find the most affecting variable of increasing trend in passengers transportation. Hypothesis is that **the most affecting is price of crude oil.**
Table III. shows the significant level of the relationship between passengers and crude oil(.452). **Hypothesis is APROVED**.

Prognosis of the future development of the airline companies is another one from partial goals. **Hypothesis is that the trend is increasing.**
Forecasting graph shows that the number of passengers transported almost copying the seasonality trend. Prognosis is that the decline of passengers transported in August is continuously dropping to value of 800,740 in December 2010. However the forecasted trend is declining it shows that the prognoses number in December 2010 is higher than in 2009. **Hypothesis is APROVED.**

6. Conclusion

The Bachelor thesis is not just thesis but it is long distance run. As the airline industry tried to surpass long distances in early development the thesis does it too.

Main objective of the Bachelor thesis is **the evaluation of development in passengers transportation** in the Czech Republic. The partials goals and hypothesis were set as following - approve that all the **selected variables significantly affect number of passenger**. The **hypothesis is that all the variables significantly affect the number of passengers**. **Find the most affecting variable** of increasing trend in passengers transportation. The hypothesis is that **the most affecting variable is price of crude oil**. Last partial goal was the **prognosis of the future development** of the airline companies. The hypothesis is that **the trend is increasing**. For the evaluation were used these methods – time series analysis, correlation analysis, regression analysis and ARIMA model.

Early take-off with the introduction, through the objectives and methodology used, literature overview which sum up airline industry as a whole in actual situation and future development, history of aviation in our country, types of airline transportation which are used, describing the basic characterization of the Czech airline companies. In methodology background are stated fundaments of statistical methods used in the thesis, stronger knowledge of statistics is recommend but not necessary. Low fly-by to the empirical part is presented as scientific work on the Bachelor thesis level but the explanation of every single step is easy to understand without lowering the value added. Why is theme so significant and deserve more complex manipulation is shown i*-n the statistical methods through time series analyzing variables affecting the number of passengers, than overpassing variety types of correlations with regression model, preparing to land with the forecast using ARIMA model. In the discussion are explored the entire hypothesis some with positive and some with negative hypothesis testing. Long-time flight is reaching its finish, the Bachelor thesis does not consider itself as a “low-cost” but as a first class travelling. Finishing the long distance run is like a smooth landing and it is happening just right here…

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8. Abbreviations

IATA - International Air Transport Association
ICAO - International Civil Aviation Organization
CAGR - Compound Annual Growth Rate
RPK - Revenue Passenger Kilometres
ASK - Available seat Kilometres

9. List of figures

10. List of tables

Supplements

Data set for time series

Data set for time series					
	Passengers	Crude oil($)	GDP - index	Inflation rate	Ticket index
2005/01	647,685	42.21	100	1.7	100
2005/02	608,386	42.91	99.87	1.7	98.1
2005/03	809,743	48.55	99.3	1.5	98.2
2005/04	848,185	46.63	98.62	1.6	96.1
2005/05	973,051	43.27	96.79	1.3	99.7
2005/06	1,151,901	49.56	95.61	1.8	99.6
2005/07	1,292,271	52.13	94.87	1.7	102.1
2005/08	1,296,303	58.07	94.05	1.7	103.4
2005/09	1,202,176	58.56	93.84	2.2	100.3
2005/10	1,010,307	55.12	93.33	2.6	99.2
2005/11	780,199	51.18	93.03	2.4	101.7
2005/12	746,474	52.31	92.43	2.2	101.2
2006/01	662,733	58.3	93.23	2.9	100.6
2006/02	627,400	54.65	93.13	2.8	98.7
2006/03	811,225	55.42	93.13	2.8	98.3
2006/04	971,111	62.5	93.43	2.8	98.4
2006/05	1,053,513	62.94	94.23	3.1	98.7
2006/06	1,252,057	62.85	94.53	2.8	97.3
2006/07	1,387,088	66.28	95.13	2.9	97.8
2006/08	1,423,442	64.93	95.44	3.1	98.6
2006/09	1,324,527	55.73	95.23	2.7	99.3
2006/10	1,098,371	50.98	94.62	1.3	100.4
2006/11	857,516	50.98	94.73	1.5	101.7
2006/12	860,392	54.06	95.55	1.7	101.2
2007/01	735,146	46.53	95.62	1.3	98.1
2007/02	745,264	51.36	96.01	1.5	99.1
2007/03	949,792	52.64	96.4	1.9	100.8
2007/04	1,036,418	56.08	96.59	2.5	100.6
2007/05	1,108,766	55.43	97.08	2.4	97.1
2007/06	1,302,257	59.25	97.46	2.5	92.3
2007/07	1,442,882	65.96	97.04	2.3	92.1
2007/08	1,483,032	64.23	96.64	2.4	91.5

2007/09	1,391,503	70.94	96.84	2.8	89.3
2007/10	1,171,179	77.56	97.33	4	83.4
2007/11	975,950	86.92	98.32	5	81.8
2007/12	924,554	83.46	98.12	5.4	81.1
2008/01	785,074	84.7	98.83	7.5	78.6
2008/02	807,156	86.64	98.42	7.5	78
2008/03	1,024,612	96.87	98.2	7.1	76.8
2008/04	1,053,192	104.31	97.69	6.8	73.9
2008/05	1,213,431	117.4	98.04	6.8	73.9
2008/06	1,413,126	126.33	98.01	6.7	73
2008/07	1,538,203	126.16	98	6.9	74.6
2008/08	1,583,219	108.46	98.57	6.5	72.2
2008/09	1,447,655	96.13	98.38	6.6	70
2008/10	1,137,084	68.5	96.86	6	74.8
2008/11	839,542	49.29	94.13	4.4	75
2008/12	801,501	32.94	92.74	3.6	79.9
2009/01	680,304	33.07	92.01	2.2	80.3
2009/02	646,452	31.04	92.19	2	80.5
2009/03	842,360	40.13	90.83	2.3	86.5
2009/04	986,975	42.45	90.28	1.8	89.4
2009/05	1,044,136	51.27	89.05	1.3	82.9
2009/06	1,266,220	61.71	88.44	1.2	84.2
2009/07	1,487,917	56.16	87.91	0.3	83.5
2009/08	1,508,034	62.8	87.67	0.2	82.9
2009/09	1,325,999	60.98	87.4	0	81.7
2009/10	1,068,580	67.43	88.24	-0.2	78.5
2009/11	859,954	69.43	90.44	0.5	78.3
2009/12	854,167	66.33	91.99	1	80.4
2010/01	718,780	69.85	92.17	0.7	80.4
2010/02	690,187	68.04	92.31	0.6	82.6
2010/03	893,393	72.9	91.99	0.7	82.1
2010/04	820,817	76.31	93.2	1.1	82
2010/05	1,060,719	66.25	94.33	1.2	82.4
2010/06	1,233,606	67.12	94.8	1.2	83.5

Source: Own processing, data provided by Eurostat, Czech Statistical Office, Ministry of Transportation

Table I. – VOC values for all variables 01/2005 – 06/2010

	Arithmetic mean	Standard deviation	VOC
Passengers	1,039,321	268,330	25.82%
Crude oil	64.11	20.38	31.78%
GDP - index	94.71	3.18	3.35%
Inflation rate	2.75	2.03	73.80%
Ticket - index	89.10	10.15	11.40%

Source: Own processing, data Eurostat

Table II. ACF – Passengers 01/2005 – 06/2010

Autocorrelations

Series:Passangers

Lag	Autocorrelation	Std. Error[a]	Box-Ljung Statistic		
			Value	df	Sig.[b]
1	.820	.120	46.431	1	.000
2	.463	.119	61.474	2	.000
3	.053	.118	61.670	3	.000
4	-.376	.118	71.926	4	.000
5	-.668	.117	104.721	5	.000
6	-.758	.116	147.687	6	.000
7	-.651	.115	179.908	7	.000
8	-.354	.114	189.596	8	.000
9	.044	.113	189.746	9	.000
10	.412	.112	203.357	10	.000
11	.682	.111	241.354	11	.000
12	.777	.110	291.483	12	.000
13	.634	.109	325.531	13	.000
14	.348	.108	335.973	14	.000
15	.004	.107	335.974	15	.000
16	-.337	.106	346.147	16	.000

Source: Own processing using SPSS, data provided by Eurostat

Table III. Correlation matrix – Correlations among the variables - 01/2005 – 06/2010

Correlations

		Passangers	Crude_Oil	GDP_index	Inflation_rate	Tlcker_index
Passangers	Pearson Correlation	1	.452**	.028	.181	-.174
	Sig. (2-tailed)		.000	.824	.145	.163
	N	66	66	66	66	66
Crude_Oil	Pearson Correlation	.452**	1	.363**	.697**	-.603**
	Sig. (2-tailed)	.000		.003	.000	.000
	N	66	66	66	66	66
GDP_index	Pearson Correlation	.028	.363**	1	.615**	.056
	Sig. (2-tailed)	.824	.003		.000	.655
	N	66	66	66	66	66
Inflation_rate	Pearson Correlation	.181	.697**	.615**	1	-.461**
	Sig. (2-tailed)	.145	.000	.000		.000
	N	66	66	66	66	66
Tlcker_index	Pearson Correlation	-.174	-.603**	.056	-.461**	1
	Sig. (2-tailed)	.163	.000	.655	.000	
	N	66	66	66	66	66

Source: Own processing using SPSS, data provided by Eurostat

Table IV. Multiple regression model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.516[a]	.267	.219	2.39027E5

a. Predictors: (Constant), Ticket_index, GDP_index, Crude_oil, Inflation_rate

Source: Own processing using SPSS

Table V. Multiple regression – ANOVA table

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.267E12	4	3.167E11	5.544	.001[a]
	Residual	3.485E12	61	5.713E10		
	Total	4.752E12	65			

a. Predictors: (Constant), Ticket_index, GDP_index, Crude_oil, Inflation_rate

b. Dependent Variable: Passengers

Source: Own processing using SPSS

Table VI. Multiple regression – coefficients –all the variables

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1365091.792	1116550.939		1.223	.226
	Crude_oil	9666.183	2263.419	.734	4.271	.000
	GDP_index	-15125.922	13541.024	-.179	-1.117	.268
	Inflation_rate	-15473.465	25703.562	-.117	-.602	.549
	Ticket_index	5943.214	4167.540	.225	1.426	.159

a. Dependent Variable: Passengers

Source: Own processing using SPSS

Table VII. Multiple regression coefficients – excluding inflation rate

		Model Summary		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.512[a]	.262	.227	2.37794

Source: Own processing using SPSS

Table VIII. Multiple regression – ANOVA table – excluding inflation rate

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.246E12	3	4.154E11	7.346	.000[a]
	Residual	3.506E12	62	5.655E10		
	Total	4.752E12	65			

a. Predictors: (Constant), Ticket_index, GDP_index, Crude_oil

b. Dependent Variable: Passengers

Source: Own processing using SPSS

Table IX. Multiple regression – coefficients – excluding inflation rate

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1752072.282	908232.877		1.929	.058
	Crude_oil	9137.219	2075.147	.694	4.403	.000
	GDP_index	-20124.144	10641.766	-.238	-1.891	.063
	Ticket_index	6816.354	3886.867	.258	1.754	.084

a. Dependent Variable: Passengers

Source: Own processing using SPSS