ANALYSIS OF THE DETERMINANT FACTORS OF THE HISTORICAL DEVELOPMENT OF AIR TRANSPORT: AN EMPIRICAL APPLICATION TO TURKEY

KİRACI Kasım

İskenderun Technical University, Aviation Management Department, Turkey

Abstract:

The aim of this study was to empirically examine the development of air transport in Turkey in the period between 1980 and 2015. The study intended, within its scope, to determine the developments experienced in air transport in Turkey and the probable causes of the structural changes. Moreover, it was aimed at highlighting the years in which the structural changes in air transport were realized. In line with this objective, the one-break Zivot Anderews (1992) unit root test, the two-break Clemente-Montañés-Reyes (1998) unit root test, and the one-break and two-break LM were applied to the domestic and international air transport data of the 1980-2015 period. The results of the study show that there were substantial economic and political developments both at home and abroad in the years that the significant structural breaks that affect air transport took place.

Key words: Airline Transport, Unit Root Test, Structural Breaks, Zivot and Andrews, Clemente-Montanes-Reyes

1. Introduction

Air transport is one of the main sectors operating on a global scale that is significantly affected by the positive and/or negative changes and developments that occur both within the country and internationally. In this connection, the air transport sector is one of the most affected by incidences of war, terrorist attacks and crises as well as disease epidemics. Besides this, the sector is known to be significantly affected by economic regulations that are subject to strict legal dictates that may facilitate or restrict entry into the market. This study intended to investigate the probable causes of the significant changes experienced in the air transportation in Turkey and to highlight the years in which they were realized. In other words, it was aimed to examine the possible effects of domestic and international developments in the Turkish air transportation in the 35 year period between 1980 and 2015. To this end, the domestic

and international data obtained from the General Directorate of State Airports Authority of Turkey was used to examine the dimensions of the experienced changes.

Initially, the study will examine the development of air transport in Turkey. In this context, legislative changes directed towards air transport, as well national and international developments that are supposed to affect air transport will be taken into consideration. Further, the study will consider the body of literature that has examined the effects of liberalization in air transport. The fact that no empirical work was found during the literature review on the development of air transport in Turkey attests to the important role that this paper will play in filling a significant gap in literature. In addition, details of the data and methods used in the study are outlined. The results obtained from the empirical application are presented in table forms. The final section of the study discusses the results.

2. Developments Affecting Air Transport in Turkey

The developments affecting air transport in Turkey can basically be classified under two main headings. The first is the legal amendments to the sector that directly affect air transport and the developments in the legal regulations. The second are factors that are assumed to affect air transport indirectly such as terrorist attacks, economic crisis and wars. In this section of the study, developments, after 1983, when the first legal regulation on civil aviation operations was enacted, and which are assumed to directly or indirectly affect air transport in Turkey will be considered.

An examination of the historical development of civil aviation in Turkey reveals that almost all of the air transportation activities, until the beginning of the 1980s, were conducted by Turkish Airlines (THY), which is a public enterprise. The principles and procedures for private sector airline companies to operate in the market were only determined with the adoption of the Civil Aviation Law No. 2920 in 1983. With this regulation, private sector airlines were granted the right to operate on domestic and international routes. Consequently, the Civil Aviation Act No. 2920 issued in 1983 represents a turning point in the Turkish civil aviation.

After the legal amendment of 1983, it observed that many airline companies started operating in the aviation market. However, the highly flexible nature of the conditions for entry into the market and the inexperience of private sector airline companies led to the collapse of most of these companies within a short duration. During the period of 1983-2002, 34 private sector airline companies were established, but 28 of these airlines had to terminate their operations owing to various reasons (Battal & Kiracı, 2015). The main problems faced by the airline companies can be listed as lack of sufficient working capital, the disadvantages of working with relatively older aircrafts, insufficiency of repair- maintenance and other infrastructure *services*, the difficulties encountered in procuring qualified personnel at every stage of operations, as well as the lack of adequate sectoral support (DPT, 2001, s. 42). In addition, it is believed that the seasonal fluctuations experienced in the sector and the

low sectoral profit margins played a role in driving the airline companies to terminate their operations within a short period of time.

Another important development that affected Turkish air transport occurred towards the end of the 1980s. The 1988-89 economic crises in Turkey is considered to have negatively affected the demand for air transport. In addition to this, the Gulf War at the beginning of the 1990s is thought to have particularly affected international passenger and cargo transportation in Turkey.

The termination of the of the operations of private sector airlines only a short duration after entry into the market brought with it new regulations in the air transport in Turkey in the 1990s. In this regard, the law that regulates the conditions to be fulfilled to be granted permission, and acquisition of business license were changed in 1992. As a result, the article strictly regulated the number of aircrafts in the fleet, the letter of guarantee to be issued, and the amount of paid-up capital that an enterprise must hold before they can start operations (Özsoy, 2010, p. 102). This amendment was intended to bring the financial and operational competencies of airlines under control. However, the Turkish economic crisis of 1994 and the legislative regulation on air transport in 1996 made it almost impossible for private sector airlines to operate domestically. The effected amendments, at the same time, gave a number of privileges to the national flag carrier, THY, in contradiction to the free market and competition conditions. Another important development in this period was the Asian crisis, which started in 1997 and led to shrinking demand all over the world. As the ripple effect from the Asian crisis continued, the Turkish economy experienced a considerable decrease as a result of the economic crises of 1998-99.

At the beginning of the millennium, two important developments affecting air transport came into play. The first of these was the severe economic crisis that hit in Turkey in early 2001. This crisis led the Turkish economy to shrink by 9.1%. The second development was the terrorist attacks of September 11, 2001. These developments are believed to have negatively affected both domestic and international air transport.

On April 2001, in order to streamline the operations of airline companies in Turkey, an article that strictly regulates flights and tariffs came into effect. However, this regulation did not have much impact on the development of air transport. By 2003, the Ministry of Transport completely lifted the legal regulations that made it difficult for private airline companies to operate domestically. In addition to this, the General Directorate of State Airports Authority reduced some of the service fees levied on airline companies at airports, discounted some tax items and completely removed some taxes included in the domestic ticket prices (Özsoy, 2010, p. 105). The legal amendments and subsidies made in 2003 further reduced the costs on airlines. Airline companies were granted the ability to determine tariffs and frequency of flights. This consequently enabled the airlines to reduce their costs and set ticket prices at relatively lower prices.

3. **Summary of Literature**

Several studies have been conducted on developments affecting the air transport industry. Some of these studies examined the effect of the economic crises on air transport. Other studies considered the effect of the September 11 terrorist attack on the air transport, while other studies discussed the effects of the liberalization of airline transportation.

Among the studies considered, Pearce (2012) examined the state of the air transport market and the airline industry after the financial crisis of 2008-2009. The study reached the conclusion that the demand for air transport did not fall in the face of the shocks, an indication that it was stable. Dobruszkes and Hamme (2011) examined the impact of the global financial crisis on countries. The study emphasized that there is a strong relationship between the development of air transport and economic growth. In addition, the study showed that economic crises are more likely to affect airway transport in some countries than others. Moschovou (2017) found out that the air transport in Greece showed poor performance after the 2009 crisis. Diaconu (2012) examined the extent to which low-cost airlines operating in Europe were affected by the 2001 and 2007 crises and the strategies they implemented to overcome these crises. The study shows that the low-cost airlines successfully got through the 2001 and 2007 crises. Goyol and Negi (2014) focused on the impact of the 2008 global crisis on the airline industry. The findings of the study emphasized that the global recession had an effect on the poor performance of air transport. However, he pointed out that this recession was the result, and not the cause of the economic crisis. Oprea (2010) analyzed the impact of the global economic crisis of 2007 on the air transport sector of EU countries. The study concluded that the effect of the global economic crises significantly changed from destination to destination.

In literature, there are studies that examined the effects of the September 11 terrorist attacks on air transport. For instance, Ito and Lee (2005) found that the September 11 terrorist attack had a 30% negative shock on airline demand in the US. Lai and Lu (2005) reached the conclusion that the September 11 terrorist attack significantly affected the demand for domestic and international air transport in the United States. Ingladaa and Rey (2004) examined the effects of the terrorist attack on air transport in Spain. The study emphasized that airline demands in Spain were affected by the terrorist attacks, but not to the extent of the USA.

It is observed in literature that there are many studies on the deregulation and liberalization of air transport. The studies conducted examined the effects of liberalization in air transport from different aspects and dimensions. Among these, Morrell (1998), discussed the *process* of liberalization of air transport in Europe and how it affected competition, Graham (1998) examined the impact of air transport liberalization in Europe, with respect to regional development and geographical demand, while *Schipper et al. (2002) conducted empirical studies on the effects of bilateral agreements and prosperity relative on the liberalization of air transport in Europe*. Others include an examination of the effects of liberalization of air transport in

Europe on competition by (Dobruszkes, 2009), the benefits accrued to passengers as result of the competition brought by the deregulation as presented by (McHardy and Trotter, 2005) and an evaluation by (Forsyth, 1998) of the resulting benefits from the liberalization of air transport.

Some studies in literature were found to have dealt with the liberalization of air transport from the perspectives of different countries. Daramola and Jaja (2011) examined the impact of the liberalization of air transport in Nigeria on network structure, while Dresner and Oum (1998) conducted studies examining the impact of air transport liberalization in Canada on international air traffic with respect to bilateral agreements, and Dobruszkes and Mondou (2013) conducted studies examining the impact of deregulations on aviation on the international tourism from the European Union countries to Morocco. Similarly, Eriksson and Pettersson (2012) examined the impact of liberalization in air transport in Sweden between the period 1989 and 2008 on inter-regional passenger transport in sparsely populated areas, Akpoghomeh (1999) discussed the development of air transport in Nigeria, Ehmer (2001), the impact of the liberalization of air transport on the market in Germany, and Papatheodorou and Arvanitis (2009) looked at the developments in passenger traffic as a result of liberalization in Greece between 1978 and 2006.

Other areas covered in literature include the future trends in liberalization of international air transport (Lyle, 1995), the effect of liberalization of air transport on air passenger traffic (Inglada et al., 2006) and airline competitiveness (Fu et al., 2010), and the liberalization of air transport in Europe and America, and its effects on small communities (Reynolds-Feighan, 1995). However, no studies were found in literature that empirically studies the development of air transport in Turkey. We, therefore, believe that this study has an original value in filling this gap in literature and determining the structural breaks experienced in air transport in Turkey.

4. Methodology

Zivot and Andrews (1992) criticized Perron's (1990) assumption of exogenous breakpoints and developed, using the data employed by Perron (1990), a new unit root test method under the alternative hypothesis that allows for one break in the estimation of the trend function (Yavuz, 2006: 165). According to the unit root test propounded by Zivot and Andrews (1992), structural breaks in time series are determined internally (Çatık, 2007: 109). The Zivot and Andrews (1992) unit root test, for detecting structural breaks in the estimated period, was developed to solve the problem of endogenously determining the break time and to establish the year of the structural break in the series. The Zivot and Andrews unit root test is based on the following three models (Zivot and Andrews, 1992: 253-254).

Model A:

$$y_t = \hat{\mu}^A + \hat{\theta}^A DU_t(\hat{\lambda}) + \hat{\beta}^A t + \hat{\alpha}^A y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^A \Delta Y_{t-j} + \hat{e}_t \qquad (1)$$

Model B:

$$yt = \hat{\mu}^B + \hat{\beta}^B t + \hat{\gamma}^B DT_t^*(\hat{\lambda}) + \hat{\alpha}^B y_{t-1} + \sum_{j=1}^{k} \hat{c}_f^A \Delta Y_{t-j} + \hat{e}_t \tag{2}$$

Model C:

$$yt = \hat{\mu}^C + \hat{\theta}^C DU_t(\hat{\lambda}) + \hat{\beta}^C t + \hat{\gamma}^C DT_t^*(\hat{\lambda}) + \hat{\alpha}^C y_{t-1} + \sum_{j=1}^{k} \hat{c}_f^C \Delta Y_{t-j} + \hat{e}_t \tag{3}$$

In the equation, t = 1, 2, 3, ..., T where denotes the estimation period, TB is the break date, λ = TB / T is the break point, and the dummies in the equation, $DU_t (\hat{\lambda})$ and $DT_t^*(\hat{\lambda})$, show the break at the intercept and the break in the slope of the trend function. $DU_t (\hat{\lambda}) = 1$ if t > Tλ otherwise $DU_t (\hat{\lambda}) = 0$ when t < Tλ. All the models were estimated using EKK from, j = t to j = (T-1) / T. By determining the number of delayed terms extended up to k, the value of each λ is tested using a t-statistic that computes whether $\alpha \wedge i = 1$. Structural break in the relevant period corresponds to the period of minimum t statistic. If the value in the calculated absolute value of t statistic is greater than Zivot Anderews (1992) critical value then H_0 is rejected (Temurlenk ve Otlular, 2007: 4).

The model developed by Clemente-Montañés-Reyes (1998) was essentially intended for the improvement of a test advanced by Perron and Vogelsang (1992), which is used when there are two average changes in the variance (Clemente et al., 1998:176). The Clemente-Montañés-Reyes (1998) unit root test has characteristics that give it the ability to be tested in two different situations; structural breaks in the slope and structural breaks at the *level*. Accordingly, innovational outliers (IO) are used to detect sudden changes in the series, while additional outliers (AO) are used to detect gradual breaks in the series. The equation of the model in question is as shown below (Saatçioğlu and Korap, 2008: 40, Kiracı, 2013: 31-32).

$$yt = \mu + d1DU1t + d2DU2t + \hat{y}_t \tag{4}$$

then the following model is used for α =1 hypothesis by looking for the smallest t − ratio

$$\tilde{y} = \sum_{j=0}^{k} \omega_{1i} DTB_{1t-i} + \sum_{j=0}^{k} \omega_{2i} DTB_{2t-i} + \alpha \tilde{y}_{t-1} + \sum_{j=1}^{k} \theta_i \Delta \tilde{y}_{t-i} + e_t \tag{5}$$

And if two breaks of additional outliers (AO) are taken into account, the unit root hypothesis can be tested by the *first estimates method* in the model below.

$$y_t = \mu + \alpha y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DTB_{2t} + d_1 DU_{1t} + d_2 DU_{2t} + \sum_{j=1}^{k} c_i \Delta y_{t-i} + e_t \tag{6}$$

In the equation shown above, TBi (i = 1,2), is 1 when t = TBi +1 and if 0, the pulse variables become 1. Otherwise, the DUi is shown as described above and TB1 and TB2 represent the date of the change in the defined interval. In addition to this, the unit root hypothesis is tested at α = 1 point where the t-statistic for all break points has the minimum value.

Lee and Strazicich (2003, 2004) developed a Lagrange Multipliers (LM) based unit root test as an alternative to the single and two structural break unit root tests. For the LM unit root test, a regression model like the one below should be used (Yılancı, 2009: 330-331).

$$y_t = \delta Z_t + e_t \qquad\qquad e_t = \beta e_{t-1} + \varepsilon_t \qquad\qquad (7)$$

Where Z_t is the vector containing the exogenous variables, ε_t iid denotes the residuals with N $(0, \sigma^2)$. For the unit root test that allows only one break in the intercept (level), Model A is obtained by inserting $[1, t, D_t]'$ in the place of Z_t in the model (7), where D_t is a dummy variable which takes the value 1 when $t \geq T_B + 1$ otherwise it is 0. Here, T_B shows the break date. For the unit root test that allows two breaks at the level, Model AA is obtained by using $[1, t, D_t, DT_t]'$ in the place of Z_t, a dummy variable D_{jt}, which takes the value 1 when $t \geq T_B + 1$ otherwise 0 for j=1,2. Model C, which allows for one break at the intercept and at the slope is obtained by using $[1, t, D_t, D_t]'$ in the place of Z_t, which is the dummy variable D_{jt}, which takes the value $t - T_B$ when, $t \geq T_B + 1$ otherwise it is 0. Model CC which allows for two breaks at the intercept and at the trend function is obtained by using $[1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$ in the place of Z_t a dummy variable D_{jt}, which takes the value $t - T_{Bj}$, $t \geq T_{Bj} + 1$ otherwise 0 for j=1,2.

While the data creation process involves breaks under the basic hypothesis ($\beta = 1$), the alternative hypothesis is the form of ($\beta < 1$). The LM unit root test statistic is obtained by using the following regression (Tırasoğlu and Yıldırım, 2012: 113-114, Yılancı, 2009: 330-331).

$$\Delta Y_t = \delta_j' \Delta Z_t + \phi \tilde{S}_{t-1} + u_t \qquad (8)$$

In the equation above (8) $\tilde{S}_t = Y_t - \tilde{\Psi}_x - Z_t \tilde{\delta}$, $t = 2, ..., T$, $\tilde{\delta}$, represents the coefficients obtained from the regression of ΔY_t against ΔZ_t. $\tilde{\Psi}_x$ is calculated as $Y_1 - Z_t \tilde{\delta}$. The LM test statistic is obtained by the $\tilde{\tau}$ t statistic which tests the unit root hypothesis. The breakpoints are determined by selecting the minimum point of the $\tilde{\tau}$ t statistic.

$$LM_\tau = \inf_{\lambda} \tilde{\tau}(\lambda)$$

T observations for j=1,2 are expressed as $\lambda_j = T/TB_j$ which represents the breakpoints of TB_j. The point of the structural break is realized at the clipping region of (0.15 * T-0.85 * T). Critical values for the one break LM unit roots test are obtained from Lee and Strazicich (2004). Whereas the critical values for the two break LM unit root tests are obtained from the values of Lee and Strazicich (2003). In the event of a test statistic greater than the critical value in the analysis result then the unit root hypothesis of the structural break is rejected.

5. Data Set and Empirical Findings

In this study, the data on air transport from the 1980-2015 period were examined empirically. In the study, unit root tests based on structural breaks were applied to the number of domestic passengers (DP), the number of international passengers (IP), the domestic cargo volume (DF) and the international cargo volume (IF) series for the period of 1980-2015 obtained from the Turkey Statistical Institute (TURKSTAT). Within the scope of the study, Zivot Andrews (1992), Clemente-Montañés-Reyes (1998) and one and two break LM unit root tests were used.
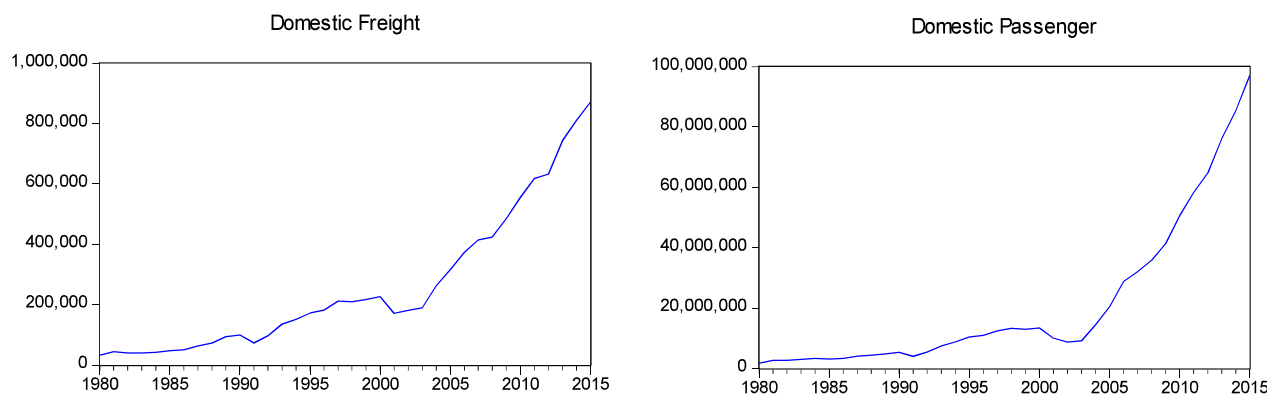

Figure 1. Domestic Freight Volume and Number of Passengers in Turkey

Figure 1 shows the amount of freight and the number of passengers on domestic flights in Turkey. As can be understood from the figure, the amount of freight and the number of passengers on domestic flights in Turkey have increased considerably over the years. On the contrary, there is a downward trend in the early 1990s and early 2000s.
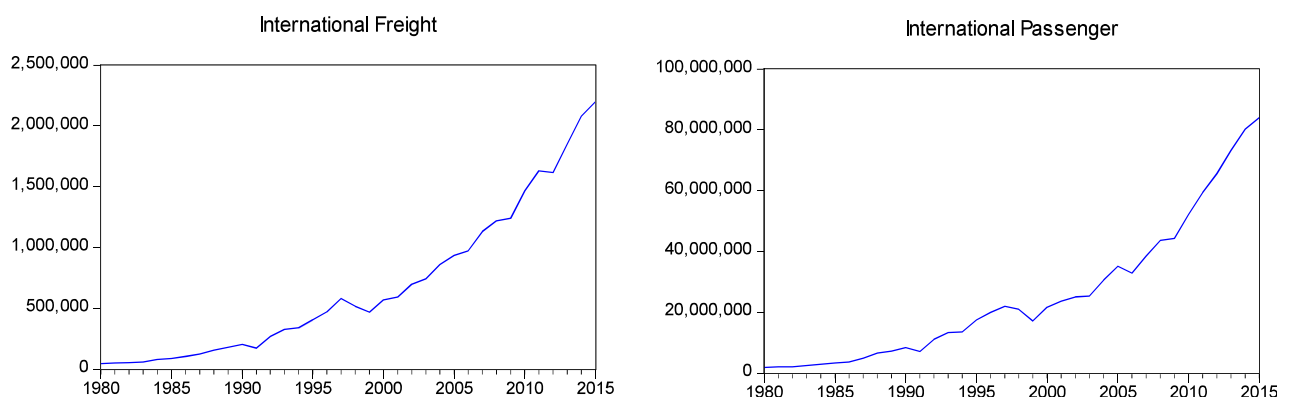

Figure 2. International Freight Volume and Number of Passengers in Turkey

Figure 2 shows the amount of freight and the number of passengers on international flights in Turkey. As can be seen from the figure, the amount of freight and the number of passengers on international flights in Turkey are on an increasing trend. Contrarily, there is a downward break in both series in the early 1990s and 2000s. Similarly, a downward trend is seen in 2008-2009.

In the study, Zivot Andrews (1992) unit root test was initially applied. The structural breaks in the time series are known to be determined endogenously in the Zivot Anderews (1992) unit root test. According to the unit root test, the break year is the year in which the model with the smallest t value is found. Below are the results for the break years for the domestic flight traffic, international flight traffic, domestic passenger traffic, international passenger traffic, domestic freight traffic and international freight traffic in Turkey.

Table 1. Zivot Andrews (1992) Test Results

Variables		Model A	Model C
Domestic Freight	Test Statistic	-6.1326*	-6.1486*
	Lag Length	1	1
	Break Date	2001	2001
Domestic Passenger	Test Statistic	-3.1156	-5.5181*
	Lag Length	1	1
	Break Date	1999	2001
International Freight	Test Statistic	-3.3326	-6.4757*
	Lag Length	0	0
	Break Date	1992	1998
International Passenger	Test Statistic	-3.7254	-5.6736*
	Lag Length	0	0
	Break Date	1987	1998

Note: The Zivot Andrews (1992) critical values for model A are -5.34 at the 1% significance level, -4.93 at the 5% significance level and -4.58 at the 10% significance level. For Model C, it is -5.57 at the 1% significance level, -5.08 at the 5% significance level and -4.82 at the 10% significance level. ***$p < 0,1$, **$p < 0,05$, *$p < 0,01$

Table 1 shows the results of Zivot Andrews (1992) test statistics for air transport data in Turkey. Due to the fact that the obtained test statistic is smaller than the critical value at the 1% level of significance, the hypothesis that the realized breaks are stable in the relevant years is accepted. Consequently, the basic hypothesis that there is no unit root in the series in the presence of a structural break is accepted. According to Model A, the findings show that there was a significant structural break in the Domestic Freight series in 2001. This is an indication that the economic crisis experienced in Turkey in 2001 and the September 11 terrorist attacks significantly affected the domestic cargo transportation. The findings of the study show that there were significant structural breaks in Model C in all the series. There were structural

breaks in the Domestic Freight and Domestic Passenger series in 2001, and in the International Freight and International Passenger series in 1998. As stated earlier, it is believed that the main reason for the structural changes that took place in 2001 was the economic crisis that took place in Turkey. The structural breaks that took place in 1998 may be assumed to originate from the economic crisis experienced in Turkey in 1998-99 as well as from the economic crisis which started at around the same period in Asian countries and affected the whole world.

One of the main advantages of the Clemente-Montañés-Reyes (1998) test is the fact that it operates in a similar manner as tests conducted under the assumption that there are two structural breaks in a series. The Clemente-Montañés-Reyes unit root test can be tested for both structural breaks at the slope and at the intercept (level). The results of the Clemente-Montañés-Reyes (1998) Innovational outliers (IO) unit root test used to determine the sudden change in the series are shown below.

Table 2. Clemente-Montañés-Reyes (1998) IO Test Results

Variables	t-stat	Break Point (1)	t-stat	Break Point (2)
Domestic Freight	---	1999	1.803	2002
Domestic Passenger	---	1990	8.225*	2002
International Freight	---	1982	0.390	1990
International Passenger	2.033	1985	1.810	2006

Note: The critical value of Clemente-Montañés-Reyes (1998) at %5 significance level is -5.490 ***p < 0,1, **p < 0,05, *p < 0,01

Table 2 shows the results of the Clemente-Montañés-Reyes (1998) IO test statistic for air transport in Turkey. As previously mentioned, Innovative Outliers (IO) is a test statistic used when a sudden change is detected in the series. According to this test, there was a significant structural break in the domestic passenger transport in Turkey only in 2002. The main reason for this sudden change is assumed to be the economic crisis in Turkey in 2001 and the September 11 terrorist attacks.

Table 3. Clemente-Montañés-Reyes (1998) AO Test Results

Variables	t-stat	Break Point (1)	t-stat	Break Point (2)
Domestic Freight	8.754*	1989	8.679*	2005
Domestic Passenger	8.223*	1994	8.024*	2007
International Freight	9.228*	1989	7.174*	2003
International Passenger	9.784*	1989	6.449*	2005

Note: The critic values for the Clemente-Montañés-Reyes (1998) at %5 significance level -5.490'dır. ***p < 0,1, **p < 0,05, *p < 0,01

Table 3 shows the results of the Clemente-Montañés-Reyes (1998) AO test statistic on air transport in Turkey. Clemente-Montañés-Reyes (1998) additional

outliers (AO) test statistic is used to determine gradual breaks in the series. It is important to note that all the series analyzed by the test statistic are significant at 1%. According to this test, in Turkey, there were significant structural breaks in the domestic freight transport in 1989 and 2005, in domestic passenger transport in 1994 and 2007, in international freight transport in 1989 and 2003 and in international passenger transport in 1989 and 2005. When the break dates are examined, three of series are observed to have their breaks in1989. The break date for the other series was in 1994. This shows that the domestic passenger transport in Turkey was significantly affected by the economic crises that happened in the same year. The second break dates in the series are also included in the table. The occurrence of the break dates after the liberation period in 2001 and 2003 generally indicates that the second structural breaks are the results of the positive events in the air transport.

Table 4. One Break LM Unit Root Test Results

		Model A	Model C
Domestic Freight	Test Statistic	-4.072***	-3.668*
	Lag Length	1	1
	Break Date	2001	2001
Domestic Passenger	Test Statistic	-2.806*	-3.470*
	Lag Length	1	1
	Break Date	1999	2005
International Freight	Test Statistic	-6.624	-6.813
	Lag Length	0	0
	Break Date	2011	2010
International Passenger	Test Statistic	-2.126*	-4.015*
	Lag Length	0	0
	Break Date	1987	1998

Note: The Lee and Strazicich (2004) critical values for Model A are -4.239 at the 1% significance level, -3.566 at the 5% significance level and -3.211% at the 10% significance level. For Model C, the place value of the breaking date is 0.583, 0.694, 0.500, 0.500. ***$p < 0,1$, **$p < 0,05$, *$p < 0,01$.

Table 4 shows the results of LM unit root test which allows for one break and that is determined endogenously in the series, for data on air transport in Turkey. There were significant break dates in the Domestic Freight variable in 2001, Domestic Passenger variable in 1999, and International Passenger variable in 1987 according to Model A. When the break dates are examined, it can be said that Turkey's economic crisis in 2001 and the September 11 terrorist attacks may have caused the structural break in the Domestic Freight variable. The findings in the table also show that there was a structural break in 1999 in the Domestic Passenger variable. This may be attributed to the economic crisis in Turkey in 1998-99 or the economic crisis which began in the Asian countries around the same time causing shrinking demand around the world. Model A findings also show the occurrence of a structural break in 1987 in

the International Passenger variable. Model C results, however, show that there were significant structural breaks in 2001 in the Domestic Freight variable and in 1998 in the International Passenger variable. It may be concluded that the breaks are the results of the economic crises in Turkey and in the world (Asian crisis). Model C results also show that there was a break in Domestic Passenger variable in 2005. It is assumed that the break is positive and attributable to the legal amendments of 2001-2003. Indeed, it is known that as a result of these legal amendments low-cost airlines in Turkey expanded their scope of operation and started to carry out flights in national/international markets from 2005.

Table 5. Results of Two Break LM Unit Root Test

		Model AA		Model CC	
Domestic Freight	Test Statistic	-4.271***		-5.969***	
	Lag Length	1		1	
	Break Dates	2001	2006	1991	2001
Domestic Passenger	Test Statistic	-3.276**		-6.139	
	Lag Length	1		1	
	Break Dates	1991	2005	2000	2008
International Freight	Test Statistic	-7.136		-7.527	
	Lag Length	0		0	
	Break Dates	2004	2011	2000	2006
International Passenger	Test Statistic	-2.436*		-5.579**	
	Lag Length	0		0	
	Break Dates	1987	1998	1987	1999

Note: The Lee and Strazicich (2003) critical values for Model A are -4.545 at the 1% significance level, -3.842 at the 5% significance level and -3.504 at the 10% significance level. For model C, it is -6.41 at the 1% significance level, -5.74 at the 5% significance level and -5.32 at the 10% significance level (λ = .2). ***p < 0,1, **p < 0,05, *p < 0,01.

Table 5 shows the results of the LM unit root test which allows for two structural breaks in the series, for data on air transport in Turkey. Accordingly, there were structural breaks in the Domestic Freight variable for Model AA in 2001 and 2006, and in 1991 and 2001 for Model CC. It is thought that the break in 1991 was mainly caused by the Gulf War that took place in the same year. As previously stated in this study, the break in 2001 may be attributable to the economic crisis that took place in Turkey in the same year and the September 11 terrorist attacks. There was a structural break in the Domestic Freight variable in 2006. It is assumed that the break is positive and is the result of the legal amendments of 2001-2003. There were significant structural breaks in the Domestic Passenger variable in 1991 and 2005 according to Model A. The first of the breaks may be attributed to the Gulf War while the second may be due to the movements towards the liberalization of air transport. There were significant structural breaks in the International Passenger variable 1987 and 1998

according to Model AA, and in 1987 and 1999 according to Model CC. The structural breaks that took place in 1998-99 may be assumed to have resulted mainly from the economic crisis that happened at the same time in Turkey and in the world (the crisis which began in the Asian countries). In addition, there was a significant structural break in 1987 in the International Passenger variable.

6. Results

Zivot Andrews (1992) unit root test which allows for one structural break, the Clemente-Montañés-Reyes (1998) unit root test which allows for two structural breaks, the LM Unit root test which allows for both one and two structural breaks were applied on data on air transport in Turkey for the period 1980-2015. The study intended, within its scope, to empirically investigate the effects of the legal amendments in air transport in Turkey and the liberalization movements, as well as economic crises and other important events happening inside and outside the country. Air transport, which is an open system, is not only influenced by the legal changes in the sector, but it is also significantly impacted by the developments in the country and in the world (crisis, war, terrorist attack etc.). This study plays an important role in its efforts to determine the structural breaks experienced in air transport as well as enumerating the developments that affect air transport in Turkey.

When the results Zivot Andrews (1992) unit root test, which shows only one structural break in the study series, are analyzed, it is seen that there was a significant structural break in the Domestic Freight variable in 2001 according to Model A and Model C. This situation shows that the economic crisis that hit Turkey in 2001 and the September 11 terrorist attacks significantly affected Domestic Freight. According to the findings of the study, just as in Domestic Freight, Model C shows the presence of a significant structural break in the Domestic Passenger variable in 2001. This result shows that the economic crisis of 2001 affected the Domestic Passenger significantly, in other words, there was a structural change. In addition to this, according to Model C, there were structural breaks in the International Freight and International Passenger variables in 1998. This indicates that the economic crisis in Turkey in 1998-99 and the economic crisis that started in Asia and with effects felt throughout the world impacted the data on international air transport in Turkey.

The study also used the Clemente-Montañés-Reyes (1998) unit root tests. According to the results of the Clemente-Montañés-Reyes (1998) Innovational Outliers (IO) test which is used to detect sudden changes in the series, only one break date was significant. According to this test, there was a significant and sudden structural change in the Domestic Passenger variable in 2002. It is assumed that the economic crisis in Turkey in 2001 and the September 11 terrorist attacks, which have been emphasized earlier, had a significant impact on this as well. When the findings for Additional Outliers (AO) test, used to determine the gradual structural breaks in the series, are examined, it is seen that there were significant structural breaks for all the variables. Accordingly, there were significant structural breaks in all variables except

the Domestic Passenger variable in 1989. When the history of crises in Turkey is examined, it is found that there was as the economic crisis in 1988-99. Consequently, it is thought that the breaks in the variables in 1989 were due to the economic crisis. The results of the study show that there was a significant structural break in the Domestic Passenger variable in 1994. It is believed that the break experienced on this date is also the result of the economic depression experience Turkey at the time. When the second break dates of the variables were examined, significant structural breaks are found to have occurred in Domestic Freight and International Passenger variables in 2005, Domestic Passenger variable in 2007 and International Freight variable in 2003. When the break dates are examined, it is thought that the movements for the liberation of air transport in Turkey in 2003 may be effective in causing these breaks. In this context, the removal of entry barriers to private sector companies in 2003 and the provision of certain subsidies played an important role in the development of air transport, and therefore these breaks are assumed to be positive.

According to the results of the LM unit root test, which permits only one endogenously determined break, on Turkish air transport data, there were significant structural breaks in the Domestic Freight variable in 2001 for Model A and Model C. As emphasized in the previous sections of the study, it is thought that this break was the result of the economic crisis in Turkey and the September 11 terrorist attacks. In the study, there were structural breaks in the Domestic Passenger variable in 1999 according to Model A and in 2005 according to Model C in 1999. It is assumed that the break in 1999 was due to the economic situation in Turkey and the Asian crisis during the same period. The break in 2005 is thought to be the result of the developments in the air transport and hence positive. The findings of the study show that there were significant structural breaks in the International Passenger variable in 1987 and 1998. The break in 1998 is thought to result from the Asian crisis and the economic crisis experienced in Turkey in 1988-99. When the findings of the second LM unit roots test, which allows two structural breaks in the series, on Turkish air transport data, are examined, it is seen that there were structural breaks in the Domestic Freight and Domestic Passenger variables in 1991. It is thought that the Gulf War, which took place in 1991, had a significant effect on structural breaks. In addition to this, there were significant structural breaks in the Domestic Freight variable in 2001 for Model AA and in 2006 for Model CC. The break in 2001 is believed to be as a result of economic and terror reasons while the break in 2006 is believed to be positive and resultant from the developments in air transports. The findings of the study also show that there were significant structural breaks in the International Passenger variable in 1989 and 1998-99. As is frequently mentioned in the previous sections of the study, it is assumed that the breaks in 1998-99 resulted from the economic crisis in progress in Turkey at the time and the Asian crisis that also started in the same period.

In this study, where structural break tests were applied on air transport data, it is observed that there were a number of significant structural breaks in the Turkish air transport data. It is important to note that some of the breaks were caused by legal amendments in air transport in Turkey while the others were the result of Turkey's

economic outlook. Additionally, the main causes of some of the structural breaks are developments outside Turkey leading to the observation that air transport in Turkey can be affected by developments both in Turkey and all over the world either directly or indirectly. Future studies may be directed at determining the extent of the impact of the breaks as well as to determine other factors not established in this study.

7. References

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