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## Estimating the economic effects of deregulation: Evidence from the Turkish airline industry

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KOÇ UNIVERSITY-TÜSİAD ECONOMIC RESEARCH FORUM  
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**ESTIMATING THE ECONOMIC EFFECTS OF  
DEREGULATION: EVIDENCE FROM THE TURKISH  
AIRLINE INDUSTRY**

Tamer Çetin  
Kadir Y. Eryiğit

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# **Estimating the Economic Effects of Deregulation: Evidence from the Turkish Airline Industry**

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## **Abstract**

This paper mainly studies the effect of deregulation on prices and quantity. For this aim, we employ cointegration methodology with structural breaks to empirically investigate the simultaneous relationship between deregulation, ticket prices, and the number of passengers in the Turkish airline industry. The findings confirm that deregulation increases quantity and decreases prices through accessibility to air transport service and actual competition, respectively. Also, structural breaks suggest that deregulation of prices and entry into the market has remarkable effect on the change in ticket prices and the number of passengers.

**Keywords:** *Deregulation, Airlines, Cointegration, Structural Breaks*

**JEL Codes:** *L43, L93, C22*

## **1 Introduction**

In the literature of transportation and economics, academic writing on governmental intervention on the markets provides an invaluable opportunity to evaluate the performance of an airline industry with regulation or deregulation (Graham et al., 1983; Borenstein, 1992; Morrison and Winston, 1995; Joskow, 2005; McHardy and Trotter, 2006; Bilotkach and Lakew, 2014; Agostini et al., 2015). Researchers have extensively analyzed the effects of

airline deregulation on prices, service quality, market structure, excess capacity, passengers, capital, labor, demand, productivity, efficiency, and route structure (Reiss and Spiller, 1989; Moore, 1986; Reynolds-Feighan, 1992; Mazzeo, 2003; Gerardi and Shapiro, 2009). However, the leading query of the relevant literature is whether deregulation improves market outcomes (Joskow, 2005). Improvement in market outcomes includes a decrease in prices and an increase in quantity<sup>1</sup>. Because economists presume that the airline industries are perfect or imperfect contestable markets (Bailey and Panzar, 1981; Baumol et al., 1982; Bailey et al., 1985), they accept that removing entry and price restrictions in the industry improves market outcomes. For that reason, the aim of airline deregulation is to improve market outcomes or to ensure economic efficiency through actual and/or potential competition<sup>2</sup>. More specifically, deregulation in the airline industry has two main purposes. The first one is to make air transport service more accessible to consumers by increased availability of price/service options that will be ensured through permitting greater competition with free entry and pricing freedom (Fawcett and Farris, 1989). The second one is to drive down prices and to lead to a highly competitive market structure with increased demand (Moore, 1986).

This paper tests those hypotheses that were central to the arguments for deregulation. The primary aim of the paper is to investigate the economic effects of deregulation in the Turkish airline industry. In this context, we directly address the effect of entry and price deregulations on the change in the number of passengers and prices<sup>3</sup> through actual competition and the increased accessibility of air travel. We call this interaction the economic effect of deregulation on market outcomes, because the changes in price and quantity refer an

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<sup>1</sup> For that reason, in this paper, we use market outcomes as a term that refers to the effect of deregulation on price and quantity.

<sup>2</sup> In this paper, we focus on actual competition rather than potential competition, because the question of whether the airline industry in the literature is perfectly contestable is controversial and it is rather problematic to include the effect of potential competition into an econometric model (Morrison and Winston, 1987).

<sup>3</sup> In this paper, we accept the economic effects of deregulation as its influence on price and entry, because economic regulation means price and entry regulations in the literature of regulatory economics. In this sense, economic deregulation also means to remove entry restrictions and price controls. As a result, clearly, deregulation affects market outcomes by leading to a change in prices and quantity demanded.

improvement in market outcomes. The second aim of the paper is to develop a relatively new approach to analyze this effect. Using cutting-edge estimation methods, we employ a different approach to empirically estimate the effect of deregulation from the traditional models in the literature.

Accordingly, the paper differs from the previous empirical studies of deregulation in a few major ways. First, we introduce a different measurement approach that explains the interaction between deregulation, prices, and quantity and that estimates empirically this interaction, because there is no empirical evidence showing the simultaneous effect of deregulation on those variables, although it is extensively argued in the literature that deregulation affects prices and quantity. For this aim, as different from the traditional techniques in the literature, we employ a simultaneous cointegration methodology with structural breaks. Cointegration analysis enables us to measure the simultaneous relationship between deregulation, prices, and the number of passengers. By the estimation of structural breaks, we analyze the effect of institutional changes such as (de)regulatory policies on prices and quantity. In this paper, the analysis of structural breaks specifically helps us separately reveal the effects of price and entry deregulations in 2003 and 2007. Also, this methodology enables us to overcome the traditional problems in the study of a time series data. Second, we consider a recently deregulated airline industry and thus introduce fresh evidence into the literature. Third, the findings of the Turkish experience are coming from a country outside of North America and Western Europe that dominate the existing literature. Thus, we believe that the paper makes a strong contribution to the literature of airline transportation.

## **2 Airline Deregulation in Turkey**

The Turkish airline industry experienced two main deregulation policies after 2003. First, through a Cabinet Decision in October 2003, Turkey ruled out entry restrictions in scheduled

domestic flights. We define this policy as deregulation of entry. Second, government introduced a new pricing policy through a law enacted in 2007 and deregulated ticket prices. We define this regulatory change as price deregulation. Additionally, Turkish Airlines (THY) as a state-owned monopoly that dominated the industry until 2003 was privatized in 2004 and 2006 by the offer to the public. As expected, those institutional reforms have led to remarkable changes such as entry of new firms into the industry, increase in demand, decrease in prices, and more effective utilization of infrastructure (Çetin and Benk, 2011).

## **2.1 Accessibility**

Entry deregulation that opened the industry to competition affected many components from privatization of airports and ground-handling services to route restructure and the numbers of firms, airplanes, and flights. While there was only THY in the scheduled domestic flights in the pre-2003 term, the number of firms obtaining a license for scheduled flights reached nine in the post-deregulation period. Table 1 reports the current firms in the industry and their market activities. While the first nine firms obtained a license to transport passengers and cargo in scheduled and unscheduled domestic and international flights, three firms (MNG, ULS, and ACT) only have the right to transport cargo in the scheduled and unscheduled flights. One other firm has a license to transport passenger, mail, and cargo only in unscheduled domestic and international flights. Also, the table reports license and operation dates of current firms in scheduled domestic flights.

**Table 1. Airline Enterprises and Their Market Activities in Turkey**

<i>Firms</i>	<i>Scheduled flights</i>	<i>Unscheduled flights</i>	<i>Cargo transport</i>	<i>Mail transport</i>	<i>Operation date</i>
<i>THY</i>	*	*		*	1933
<i>Onur Air</i>	*	*		*	2003
<i>Atlas Jet</i>	*	*		*	2004
<i>Pegasus</i>	*	*		*	2005
<i>Sun Express</i>	*	*		*	2006
<i>IZair*</i>	*	*		*	2006
<i>Hurkus</i>	*	*		*	2003
<i>Borajet</i>	*	*		*	2010
<i>Turistik</i>	*	*		*	2003
<i>MNG</i>			*		1996
<i>ULS</i>			*		2004
<i>ACT</i>			*		2004
<i>Taiwild</i>		*		*	2009

\*As of January 2014, IZair doesn't operate under its own name. Instead, its flights are operated for Pegasus Airlines.

Source: [www.shgm.gov.tr/doc/hyi.xls](http://www.shgm.gov.tr/doc/hyi.xls).

In parallel with the increase in the number of firms in the industry, the number of aircraft and flights has also increased rapidly. While the number of wide-body aircraft was 150 in 2002, it is over 300 in the beginning of 2014. The seating capacity, which was 25,114 in 2002 is over 50,000 in 2014. A significant increase occurred in the number of flights. While the number of flights in the first month of 2003 was 11,428, this number was 46,359 in the first month of 2014. Whereas THY only itself flew from 2 departure points to 25 arrival points before 2003, 9 firms started to perform flights from 7 centers to 45 arrival points in 2014 (Çetin, 2014; DHMI, 2012). All these developments mean that deregulation improved market outcomes by enhancing competitive access to air transport services.

Accordingly, we investigate the effect of entry deregulation on demand through accessibility to service. Clearly, deregulation of entry enhanced the ability of passengers to access air transport service and thus, the accessibility triggered increased demand for air transport services, as in the US airline industry until 2007 (Button, 2014). We define this effect as the effect of deregulation on demand through accessibility to air transport service and include it into our estimation model as the number of flights<sup>4</sup>. Accordingly, we postulate that deregulation of entry improves market outcomes, if accessibility leads to an increase in demand.

## **2.2 Prices and Demand**

According to Law No. 2920 enacted in 1983, firms had to receive approval of the Ministry for price tariffs and to publish these tariffs to the public a maximum of 15 days after approval. Law No. 4647 enacted in 2001 established a new regulatory mechanism and removed the authority of the Ministry of Transport and Communication on price regulation. Additionally, Turkey adopted EU Council Regulation No. 2409/92 and removed the

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<sup>4</sup> Of course, we can use other variables representing accessibility such as the numbers of aircrafts, firms, and airports and seat capacity. However, because most detailed and accurate data among those variables are the number of flights in Turkey, we prefer to employ it to represent accessibility.

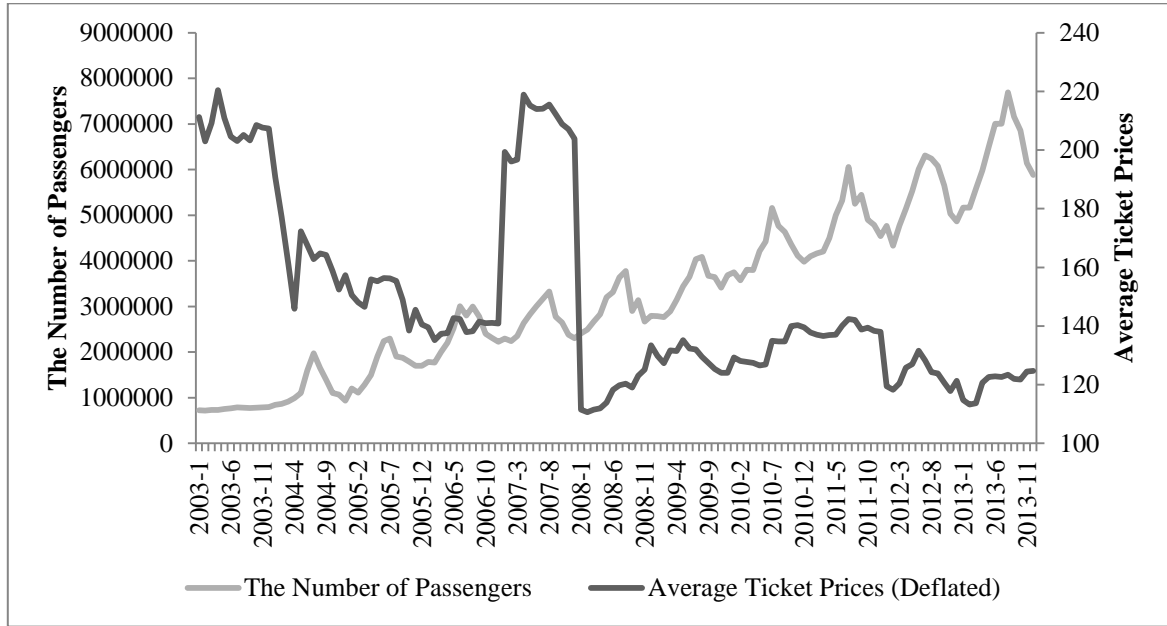


obligations that forced firms to receive the approval of a regulatory agency in their own countries. Under this new regulatory environment, firms started to publish price tariffs to the public anytime prior to implementation. However, these regulatory changes did not lead to price competition in the scheduled domestic flights due to the monopolistic structure of industry with THY as the only firm. In 2007, a new law was enacted. The new regulatory structure introduced a cost-based pricing mechanism. Firms started to determine ticket prices by taking into account their own operating costs under competitive industry structure. As a result, the law of 2007 provided considerable pricing freedom to the incumbent firms in the industry.

The deregulation of prices and entry has dramatically affected ticket prices and quantity demanded over the last decade. While the number of firms in the industry ascends through the deregulation of entry, these firms perform a cost-based pricing under competitive conditions. Figure 1 depicts the change in prices and the number of passengers during the deregulation process in the Turkish airline industry. As seen in the figure, the number of passengers dramatically increased after deregulation of entry in the end of 2003, because more passengers started to fly from more departures to more arrivals by new entrants as of 2004. The number of passengers on the scheduled domestic flights was 8,700,839 in 2002, but it reached 76,148,506 as of the beginning of 2014 by exceeding the number of international passengers (73,281,895). On the other hand, a dramatic development occurred in prices. Both deregulation of entry in 2003 and price deregulation in 2007 led to a 40% decline in real terms in average ticket prices. In particular, prices have considerably reduced after price deregulation in 2007 and prices have remained stable until 2014<sup>5</sup>.

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<sup>5</sup> On the other hand, a radical change in prices occurred in the period between 2006-10 and 2008-1, as shown in Figure 1. This spike in the ticket prices is because of the increase in the world oil prices within the same period, as depicted in Figure 6. However, it is clear that the increase in prices did not bring about change in the number of passengers. We estimate this is because of the presence of actual competition in the industry and improvement



Source: Data are taken from TUIK Statistics.

**Figure 1. The Number of Passengers and Average Ticket Prices**

### 3 Econometric Methodology

As clarified above, there is a simultaneous interaction and/or relationship among accessibility, actual competition, flight prices, and quantity. We employ an econometric methodology that enables us to simultaneously control this relationship and thus to empirically investigate the effect of deregulation. Using classical demand function, we estimate two different equations to estimate the effect of deregulation on market outcomes including the change in prices and quantity demanded. In order to measure the influence of deregulation on quantity, we estimate Eq. (1):

$$nps_t = f(prc_t, tin_t, nfl_t) \quad (1)$$

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in the economic performance of Turkey in this period. As illustrated by the graph of *tin* representing national income in Figure 6, Turkey exhibited remarkable performance in national income until 2009.

in which the number of passengers ( $nps_t$ ) as quantity demanded is a function of price ( $prc_t$ ), national income ( $tin_t$ ), and the number of flights ( $nflt_t$ ). In Eq. (1), deregulation influences demand through accessibility, because the number of flights represents the accessibility to consumers of air transport service, as clarified before. In order to estimate the influence of deregulation on price, we estimate Eq. (2):

$$prc_t = f(nps_t, fprc_t, hhi_t) \quad (2)$$

in which price ( $prc_t$ ) is a function of the number of passengers ( $nps_t$ ), fuel prices ( $fprc_t$ ), and market concentration ( $hhi_t$ ) representing actual competition. In Eq. (2), deregulation affects prices through market concentration, because actual competition is represented by HHI or concentration.

According to this methodology, because the change in prices and quantity represents the effect of deregulation, estimating the relationship among those variables will reveal the economic effects of airline deregulation in Turkey. As a fact of the matter, this approach helps us analyze this relationship between deregulation and market outcomes. Eqs. (1) and (2) together enable us to simultaneously investigate the long-term relationship between price ( $prc_t$ ) and quantity ( $nps_t$ ) affected by variables ( $nflt_t, hhi_t$ ) that proxy the effect of deregulation. We use  $tin_t$  and  $fprc_t$  as control variables. Lastly, we estimate the effect of deregulation of entry and prices as structural changes during the deregulation period through estimation of structural breaks. Thus, econometric methodology used in this paper differs from the previous literature in two main ways. First, we estimate the simultaneous relationship between the variables through cointegration methodology. Second, we reveal the effect of structural changes of deregulation process through the analysis of structural breaks.

### 3.1 Data and the Description of Variables

The data used in this study are monthly and cover the period 2003:1-2013:12<sup>6</sup>. We use the number of passengers carried by incumbent firms as quantity and average ticket fares as price. For real prices, prices are deflated by transportation price index. In order to control for changes in income, seasonal and calendar adjusted total industry product index that is highly correlated with GDP is used. Fuel prices are proxied by real jet kerosene barrel prices (USD/bbl). Following the previous literature<sup>7</sup>, we proxied market concentration by HHI and measured HHI as per the number of passengers transported by each firm. For that reason, in our model, HHI represents actual competition, but not potential competition.

Our data are obtained from four different sources: Turkish Statistical Institute (average ticket prices, transportation price index, total industry product index, and the total number of passengers), OECD/IEA statistics (jet kerosene prices), the Directorate General of Civil Aviation-SHGM (the number of flights), and General Directorate of State Airport Authority-DHMI (the number of passengers transported by each firm and the market shares of firms). All variables are used in logarithmic forms.

### 3.2 Model

The model can be written as a vector of endogenous variables as in Eq. (3):

$$Y'_t = [nps_t \quad prc_t \quad nflt_t \quad fprc_t \quad tin_t \quad hhi_t] \quad (3)$$

With expectation of the presence of two cointegrating vectors in the system, we estimate the model in Eq. (4):

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<sup>6</sup> We can only use monthly data for ten months regarding the pre-deregulation period, because there is no price data for before 2003:1. Also, there is only quarterly data for the number of passengers for before 2003:1, but not monthly data. For this reason, our analysis extensively includes the post-deregulation period for the analysis of deregulation of entry. However, data covers the pre- and post-deregulation periods for the analysis of price deregulation.

<sup>7</sup> Graham et al. (1983) take prices as a function of market concentration measured by HHI. As pointed out by Morison and Winston (1983), other empirical studies postulated that the price-cost margin as the dependent variable in their analyses was influenced by market concentration.

$$\begin{aligned}
nps_t &= \beta_{10} + \beta_{1,prc}prc_t + \beta_{1,nflt}nflt_t + \beta_{1,tin}tin_t + \gamma_{11}dum_t + u_{1t} \\
prc_t &= \beta_{20} + \beta_{2,nps}nps_t + \beta_{2,fprc}fprc_t + \beta_{2,hhi}hhi_t + \gamma_{21}dum_t + u_{2t}
\end{aligned} \tag{4}$$

where,  $\beta_i$  ( $i=1,2$ ) are long-run elasticities,  $\gamma_i$  ( $i=1,2$ ) are coefficients of period dummies, which are estimated endogenously, and  $u_{it}$  ( $i=1,2$ ) are error terms. Note that the number of passengers and average prices determine each other simultaneously. Because we expect the presence of two cointegrating vectors in the system, at least two restrictions per cointegrating vector are required for the exact identification of the long-run relationships (Pesaran and Shin, 2002). To identify the long-run relationships for the model, we employed the restrictions below in terms of economic expectations as in Eq. (5):

$$\begin{bmatrix} \beta \\ \gamma \end{bmatrix}' = \begin{bmatrix} -1 & \beta_{1,prc} & \beta_{1,nflt} & 0 & \beta_{1,tin} & 0 & \gamma_{1,1} \\ \beta_{2,nps} & -1 & 0 & \beta_{2,fprc} & 0 & \beta_{2,hhi} & \gamma_{2,1} \end{bmatrix} \tag{5}$$

In the restrictions matrix above, the first line of restrictions implies that fuel costs in airline industry and concentration index are set to zero in the first equation. The second required restriction is  $\beta_{1,nps} = -1$ , which indicates that number of passengers is normalized. The second row normalizes average prices per flights to negative one, e.g.  $\beta_{2,prc} = -1$ , with number of flights and total industry index are constrained to zero. By identifying the long-run equations correctly, these estimates can be interpreted as long-run elasticities (Johansen, 2005).

We estimate the model in Eq. (4) by using Johansen et al. (2000) multivariate cointegration approach. Before proceeding to cointegration analysis, however, it is necessary to examine the univariate time series properties of the data. Johansen et al. (2000) approach takes into consideration structural breaks in the time series. In this context, the introduction of the recent minimum Lagrange multipliers (LM) structural break unit root tests proposed by

Lee and Strazicich (2003) (here after LS) seems to be an appropriate procedure for investigating stationarity properties of the variables.

Given the non-stationarity of the variables, it is carried out with cointegration analysis in order to investigate the possibility of long-run relationships among them. However, since Johansen (1988) cointegration procedure was not applicable in the presence of structural breaks in time series data, a cointegration test proposed by Johansen et al. (2000), which is a slight modification of vector error correction models (VECM) is used.

Let  $Y_t' = [nps_t \quad prc_t \quad nflt_t \quad fprc_t \quad tin_t \quad hhi_t]$  be a vector of endogenous I(1) variables with  $r$  cointegrating relationships. The VECM, which was proposed by Johansen et al. (2000), can be written as in Eq. (6):

$$\Delta Y_t = \alpha \begin{bmatrix} \beta \\ \gamma \end{bmatrix}' \begin{bmatrix} Y_{t-1} \\ tE_t \end{bmatrix} + \mu E_t + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \sum_{i=1}^k \sum_{j=2}^q \Psi_{j,i} D_{j,t-i} + \sum_{m=1}^d \Phi_m W_{m,t} + \varepsilon_t \quad (6)$$

where,  $\Delta$  is the first difference operator; where  $k$  is lag length;  $E_t = [E_{1t} \quad E_{2t} \quad \dots \quad E_{qt}]'$  is a vector of  $q$  dummy variables with  $E_{j,t} = 1$  for  $T_{j-1} + k \leq t \leq T_j$  ( $j=1, \dots, q$ ) and zero otherwise and the first  $k$  observation of  $E_{j,t}$  is set to zero;  $E_{j,t}$  is the effective sample of the  $j$ th period. The indicator variable  $D_{j,t-i}$  is a dummy variable for the  $i$ th observation in the  $j$ th period—that is  $D_{j,t-i} = 1$  if  $t = T_{j-1+i}$  ( $j=2, \dots, q, t = \dots, -1, 0, 1, \dots$ ) and zero otherwise. Intervention dummies,  $W_{m,t}$  ( $m=1, \dots, d$ ), are included to make the residuals well-behaved, following Hendry and Mizon (1993). The vector  $\beta$  is the cointegrating vector and represents the long-run relationship,  $\alpha$  is a vector representing the speeds of adjustment toward the long-run equilibrium, and  $\gamma = [\gamma_1 \quad \gamma_2 \quad \dots \quad \gamma_q]$  is a matrix of  $(p \times q)$  dimensional long-run trend parameters. The short-run parameters are  $\mu$  of order

$(p \times q)$ ,  $\Gamma_i$  of order  $(p \times p)$  for  $i=1, \dots, k$ ,  $\Psi_{j,i}$  of order  $(q \times 1)$  for  $j=2, \dots, q$  and  $i=1, \dots, k$ , and  $\Phi_m$  of order  $(q \times 1)$  for  $m=1, \dots, d$ . The innovations  $\varepsilon_t$  are assumed to be independently and identically distributed with zero mean and symmetric and positive definite variance-covariance matrix  $\Omega$ —that is,  $\varepsilon_t \square iid(0, \Omega)$ .

Eq. (6), which is a linear trend model in which the trend and level of the cointegration relationship changes from period to period, is represented as  $H_l(r)$ . The likelihood ratio test against an  $H_l(p)$  alternative  $r$  cointegration relationship  $H_l(r)$  hypothesis is:

$$LR\{H_l(r)|H_l(p)\} = -T \sum_{i=r+1}^p \ln(1 - \hat{\lambda}_i) \quad (7)$$

where  $\hat{\lambda}_i$  are squared sample canonical correlations and  $1 \geq \hat{\lambda}_1 \geq \dots \geq \hat{\lambda}_p \geq 0$ .

In a cointegration relationship, there is no linear trend, but if only a breaking level exists, the model given in Eq. (6) can be transformed as in Johansen et al. (2000) and is denoted  $H_c(r)$ . The critical values for both  $H_l(r)$  and  $H_c(r)$  models are derived from the  $\Gamma$ -distribution, as proposed in Johansen et al. (2000).

Given the cointegration rank, further restrictions on the VECM can be tested using likelihood ratio (LR) testing. Harris and Sollis (2003) employed these tests within a standard framework. In our study,  $LR$  tests are extended for use in the models proposed by Johansen et al. (2000) as in Dawson and Sanjuan (2005).

Assume that one cointegrating vector ( $r=1$ ) and two level and trend breaks ( $q=3$ ) exist for the system  $Y_t' = [nps_t \quad prc_t \quad nflt_t \quad fprc_t \quad tin_t \quad hhi_t]$  such that:

$$\begin{bmatrix} Y_{t-1} \\ tE_t \end{bmatrix} = [nps_t \quad prc_t \quad nflt_t \quad fprc_t \quad tin_t \quad hhi_t \quad tE_{1t} \quad tE_{2t} \quad tE_{3t}]' \quad (8)$$

$$\begin{bmatrix} \beta \\ \gamma \end{bmatrix}' = [\beta_{nps} \quad \beta_{prc} \quad \beta_{nflt} \quad \beta_{fprc} \quad \beta_{tin} \quad \beta_{hhi} \quad \gamma_1 \quad \gamma_2 \quad \gamma_3] \quad (9)$$

and

$$\alpha = \begin{bmatrix} \alpha_{nps} \\ \alpha_{prc} \\ \alpha_{nflt} \\ \alpha_{fprc} \\ \alpha_{tin} \\ \alpha_{hhi} \end{bmatrix} \quad (10)$$

First, whether each variable exists in the cointegration space is tested. The hypothesis of individual exclusion of  $nps_t$ , for example, is:

$$H_0 : \begin{bmatrix} \beta \\ \gamma \end{bmatrix}' = [0 \quad \beta_{prc} \quad \beta_{nflt} \quad \beta_{fprc} \quad \beta_{tin} \quad \beta_{hhi} \quad \gamma_1 \quad \gamma_2 \quad \gamma_3] \quad (11)$$

and the likelihood ratio test statistics have a  $\chi^2$  distribution ( $LR \sim \chi^2$ ). The Second test is for weak exogeneities of the variables. To test for weak exogeneity of  $nps_t$ , for example, the null hypothesis is:

$$H_0 : \alpha_{nps_t} = 0 \quad (12)$$

and  $LR \sim \chi^2$ . Here, rejection of the null hypothesis that  $\alpha_{nps_t} = 0$  refers to the notion that number of passengers is an endogenous variable.

Last we test that is whether the structural breaks are statistically significant. Testing the first structural break for instance the null is:

$$H_0 : \begin{bmatrix} \beta \\ \gamma \end{bmatrix}' = [\beta_{nps} \quad \beta_{prc} \quad \beta_{nflt} \quad \beta_{fprc} \quad \beta_{tin} \quad \beta_{hhi} \quad 1 \quad 1 \quad \gamma_3] \quad (13)$$



and  $LR \sim \chi^2$ .

### 3.3 Empirical Findings

Before estimation of the long-run relationships among the variables, we investigate (non)stationarity properties of the series in the presence of structural breaks. Table 2 presents the LS unit root test statistics. According to LS unit root test statistics, all variables are I(1), which means that they are non-stationary with structural breaks in their levels. There is no balance problem for cointegration analysis in the system.

**Table 2. LS Unit Root Test Statistics**

<i>Series</i>	<i>Model</i>	<i>Lag</i>	<i>Break Period</i>	$\lambda$	<i>t-statistics</i>	<i>5% Critical values</i>
$nps_t$	C	1	2005:5	0.2	-4.19	-4.47
$prc_t$	C	10	2007:12	0.5	-3.33	-4.51
$nflt_t$	C	1	2007:4	0.4	-3.43	-4.50
$fprc_t$	C	11	2008:6	0.5	-3.79	-4.51
$tin_t$	C	1	2008:11	0.5	-4.07	-4.51
$hhi_t$	C	0	2006:1	0.2	-4.46	-5.74
			2009:10	0.6		

Note: Critical values were obtained from Lee and Strazicich (2003).

After investigating the stationarity properties of the series with structural breaks, Johansen et al. (2000) cointegration procedure can be applied to estimate the model. Table 3

presents the trace statistic for significant pair of breaks 2005:5-2007:12.<sup>8</sup> Since both structural breaks appear as broken level and trend,  $H_l(r)$  allowing level and trend breaks was preferred to estimate the long-run relationships in the system instead of model  $H_c(r)$ . Besides, lag length for two different pairs of structural breaks was determined as  $k = 3$ .<sup>9</sup>

**Table 3. Trace Statistics**

<i>Pair of Breaks</i>	$H_0 (H_1)$	<i>Model</i> $H_l(r)$
2005:5 – 2007:12	$r = 0 (r \geq 1)$	255.22 (173.64)
	$r = 1 (r \geq 2)$	139.35 (135.75)
	$r = 2 (r \geq 3)$	86.75 (101.89)
	$r = 3 (r \geq 4)$	53.41 (72.13)
	$r = 4 (r \geq 5)$	28.07 (46.26)
	$r = 5 (r \geq 6)$	7.41 (23.96)

Note: Critical values in parentheses at the 5% significance level were approximated by  $\Gamma$ -distribution, as explained in Johansen et al. (2000).

According to Table 3, there are two cointegrating vectors in the system for pair of breaks 2005:5-2007:12 at the 5% significance level. Because the residuals obtained from the models are normally distributed, intervention dummies were not required.<sup>10</sup> The LR-statistics of the VECM restriction tests statistics are reported in Table 4.

<sup>8</sup> Since they were estimated as statistically insignificant other structural breaks for number of flights, fuel prices, industry product index and market concentration were excluded from the analysis.

<sup>9</sup> The minimum value of Akaike Information Criterion (AIC) was adopted in order to select the optimum lag length.

<sup>10</sup> Multivariate normality test statistics for skewness, kurtosis and joint are 0.861 ( $p$ -value= 0.650); 8.418 ( $p$ -value= 0.015) and 9.279 (0.054) respectively. These results imply that the model is normally distributed.

Individual exclusion test statistics in Table 4 show that each variable maintains in the cointegration space. This implies that stationaries come from linear combinations of the variables with broken level and trend. In addition, according to weak exogeneity test statistics, the number of flights and average prices were determined as endogenous variables, while the others are weakly exogenous. Also, the tests statistics for the existence of structural breaks in the long-run equilibriums indicate that the nulls that there are no differences between the sub-samples are rejected. Thus, pair of breaks 2005:5-2008:6 are statistically significant and impact on the long-run relationship among the variables.

In the light of this information, in order to identify the model in Eq. (5), identification restriction matrix can be rewritten for  $H_l(r)$  model and extended for the pair of break 2005:5-2007:12 as follows:

$$\begin{bmatrix} \beta \\ \gamma \end{bmatrix}' = \begin{bmatrix} -1 & \beta_{1,prc} & \beta_{1,nflt} & 0 & \beta_{1,tin} & 0 & \gamma_{1,1} & \gamma_{1,2} & \gamma_{1,3} \\ \beta_{2,nprc} & -1 & 0 & \beta_{2,fprc} & 0 & \beta_{2,hhi} & \gamma_{2,1} & \gamma_{2,2} & \gamma_{2,3} \end{bmatrix} \quad (14)$$

Table 4 includes the VECM restrictions test results for the long-run between 2003:1 and 2013:12. The lower panels of Table 4 report the identified long-run equations and identification test results. All the results are significant and as expected. While the price elasticity of demand ( $\beta_{prc}$ ) is -0.112, the income elasticity of demand ( $\beta_{tin}$ ) is 0.404. In the long-run, the sensitivity of demand to income is bigger than its sensitivity to price, because a 1% decrease in average ticket prices leads to an increase a 0.11% in the number of passengers, whereas a 1% increase in income brings about a 0.4% increase in demand. Also, the findings confirm the effect of accessibility on demand, because  $\beta_{nflt}$  is 0.558.

Similarly, the results in the price equation also confirm the presence of a negative relationship between price and quantity demanded, because  $\beta_{nps}$  is -0.475. According to this finding, a 1% increase in the number of passengers results in a 0.48% decrease in average

prices. While the long-run coefficient for market concentration ( $\beta_{hi}$ ) that is 0.235 confirms the effect of actual competition on price, the coefficient value for fuel prices that is 0.245 estimates the effect of fuel prices on the final ticket prices. Clearly, there is a long-run simultaneous relationship among the variables in the model estimated by Eq. (4). Deregulation simultaneously affects price and demand through actual competition and accessibility and this effect becomes stronger in the post-2003 term. The findings corroborate this inference.

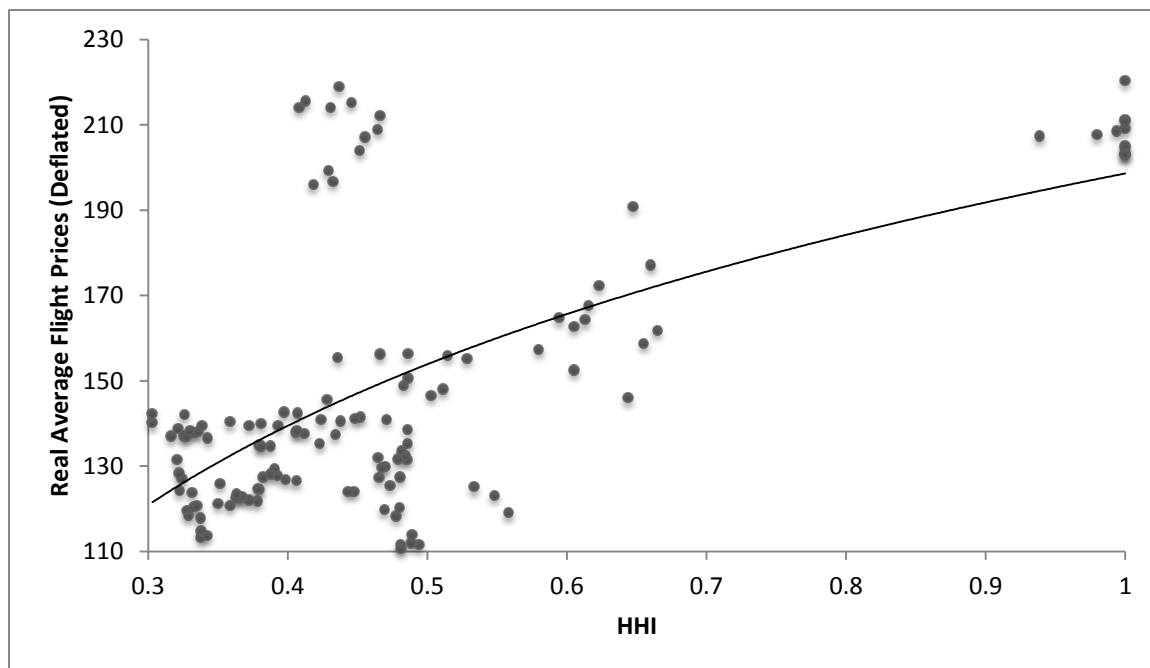
**Table 4. VECM restrictions test results and identified long-run equations.**

<i>Individual Exclusion</i>		<i>LR -</i>		<i>Weak Exogeneity</i>		<i>LR -</i>		<i>Structural</i>		<i>LR -</i>		
<i>of:</i>	$H_0$	<i>statistics</i>		<i>of:</i>	$H_0$	<i>statistics</i>		<i>Breaks</i>	$H_0$	<i>statistics</i>		
$nps_t$	$\beta_{nps} = 0$	37.665	(0.000)	$nps_t$	$\alpha_{nps} = 0$	41.129	(0.000)	2005:5	$\gamma_1 = \gamma_2$	14.910	(0.001)	
$prc_t$	$\beta_{prc} = 0$	20.185	(0.000)	$prc_t$	$\alpha_{prc} = 0$	9.956	(0.006)					
$nflt_t$	$\beta_{nflt} = 0$	11.559	(0.003)	$nflt_t$	$\alpha_{nflt} = 0$	5.212	(0.074)					
$fprc_t$	$\beta_{fprc} = 0$	23.799	(0.000)	$fprc_t$	$\alpha_{fprc} = 0$	4.814	(0.090)	2007:12	$\gamma_2 = \gamma_3$	23.853	(0.001)	
$tin_t$	$\beta_{tin} = 0$	21.772	(0.000)	$tin_t$	$\alpha_{tin} = 0$	4.459	(0.108)					
$hhi_t$	$\beta_{hhi} = 0$	19.306	(0.000)	$hhi_t$	$\alpha_{hhi} = 0$	0.108	(0.947)					
<i>Identified Equations</i>	$\beta_{nps}$	$\beta_{prc}$	$\beta_{nflt}$	$\beta_{fprc}$	$\beta_{tin}$	$\beta_{hhi}$	$\gamma_1$	$\gamma_2$	$\gamma_3$	$\alpha_{nps}$	$\alpha_{prc}$	$\chi^2_{(2)}$
<i>The Number of Passengers</i>	1	-0.112	0.558	0	0.404	0	0.022	0.015	0.007	-0.623	–	1.313
<i>Average Prices</i>	-0.475	1	0	0.245	0	0.235	-0.016	-0.026	-0.005	–	-0.226	(0.519)

Note: *p-values* are in parentheses.

For example, the sensitivity of demand to the number of flights (0.558) is greater than its sensitivity to price (-0.112). This finding affirms the role of accessibility within the effect of deregulation on demand. Furthermore, it suggests that the effect of accessibility on demand is greater than the impact of price on demand. This gain is the result of deregulation, because the reason for increase in the number of flights is deregulation. Clearly, deregulation improves market outcomes through accessibility to air transport services and this effect of deregulation is more important than the effect of price on demand.

Also, the coefficient value (0.235) for  $hhi_i$  suggests that the effect of price on demand stems from deregulation. It means that a 1% decrease in  $hhi_i$  brings about a 0.24% decrease in average ticket prices. While this finding affirms the presence of actual competition in the post-entry deregulation term, it also shows that actual competition has a negative effect on prices. Clearly, improvement in the actual competition reduces prices. More importantly, the effect of competition on prices (0.235) is bigger than the effect of price on demand (-0.112), because competition among nine firms has been sufficient to drive down prices 40 % in real terms in 10 years. Figure 2 depicts the long-run relationship between market concentration and prices in a different way. Although the interaction between concentration and ticket prices is an increasing linear relationship, the trend reflects the presence of a relatively concave relationship. This finding is compatible with the findings of the study by Graham et al. (1983) on the USA airline industry. Clearly, the increase in actual competition led to the decrease in prices in the Turkish airline industry and thus an improvement in market outcomes.



**Figure 2. Market Concentration and Prices**

Additionally, all the VECM restrictions test results are compatible with structural breaks and the analysis of sub-samples. The findings regarding sub-samples and structural breaks corroborate our assumptions and the VECM results. Table 5 reports elasticities for sub-samples in 2003:1-2005:5, 2005:6-2007:12 and 2008:1-2013:12, respectively<sup>11</sup>. The results of sub-samples suggest that the price elasticity of demand has been becoming more elastic along with competition over time, although it is inelastic in the long run. As seen in Table 5, the coefficients for sub-samples of average ticket prices are -0.090, -0.097 and -0.105 in 2003:1-2005:5, 2005:6-2007:12 and 2008:1-2013:12, respectively. While the price elasticity of demand is low in the beginning of deregulation with -0.090, in the last two sub-samples it becomes -0.097 and -0.105 in turn. It means that demand increasingly becomes more sensitive to price. Note that the coefficients for income are 0.426, 0.419 and 0.411 and the coefficients for HHI are 0.219, 0.209 and 0.230 for the same sub-periods, respectively.

<sup>11</sup> We only estimate coefficients for sub-samples for these dates, because these estimated equations occur in the presence of those sub-samples according to our model.

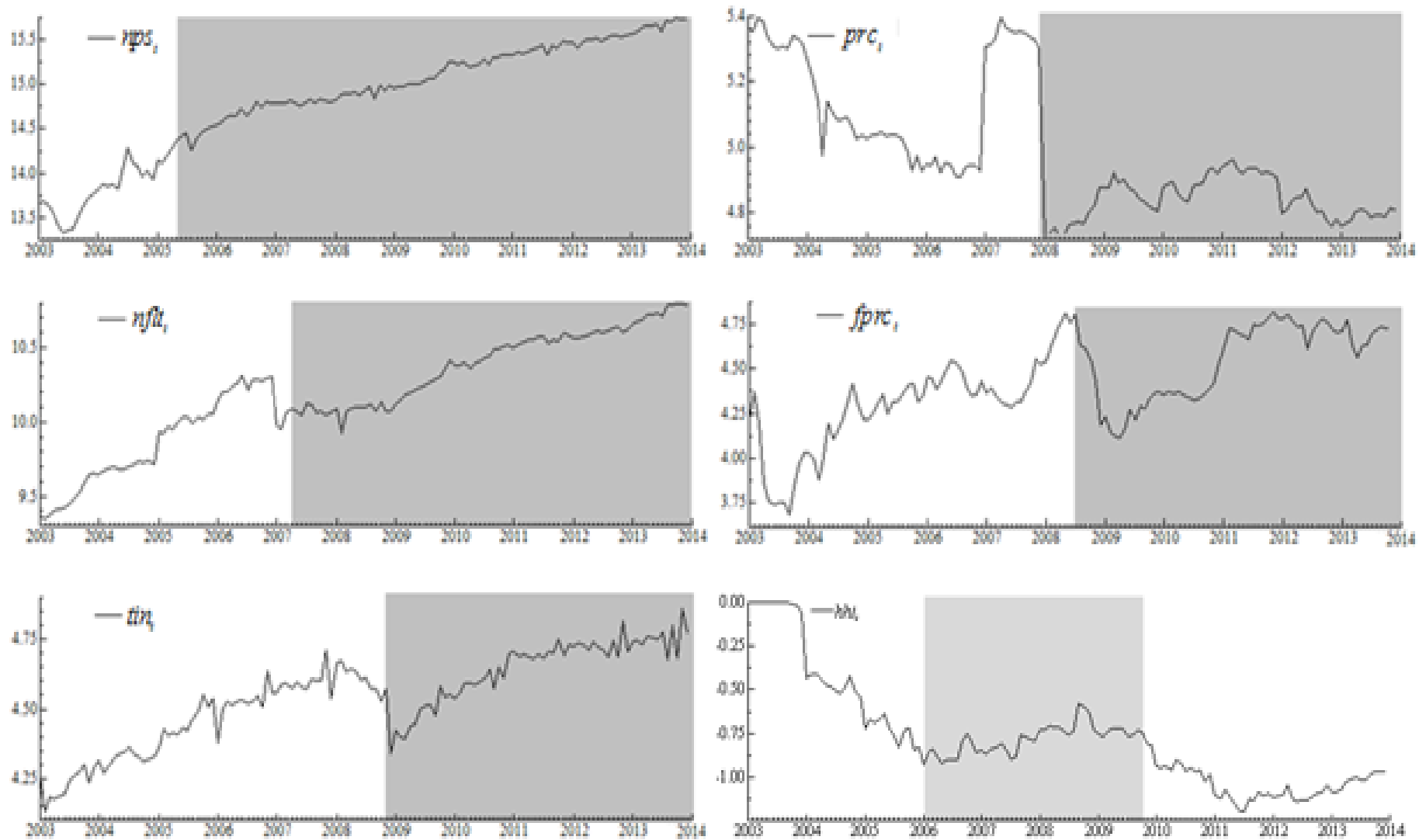
**Table 5. Elasticities for Sub-Samples**

	$\beta_{nps}$	$\beta_{prc}$	$\beta_{nflt}$	$\beta_{fprc}$	$\beta_{tin}$	$\beta_{nhi}$
<u>Sub-sample 2003:1-2005:5</u>						
<i>The Number of Passengers</i>	1	-0.090	0.580	0	0.426	0
<i>Average Prices</i>	-0.491	1	0	0.229	0	0.219
<u>Sub-sample 2005:6-2007:12</u>						
<i>The Number of Passengers</i>	1	-0.097	0.573	0	0.419	0
<i>Average Prices</i>	-0.501	1	0	0.219	0	0.209
<u>Sub-sample 2008:1-2013:12</u>						
<i>The Number of Passengers</i>	1	-0.105	0.565	0	0.411	0
<i>Average Prices</i>	-0.480	1	0	0.240	0	0.230



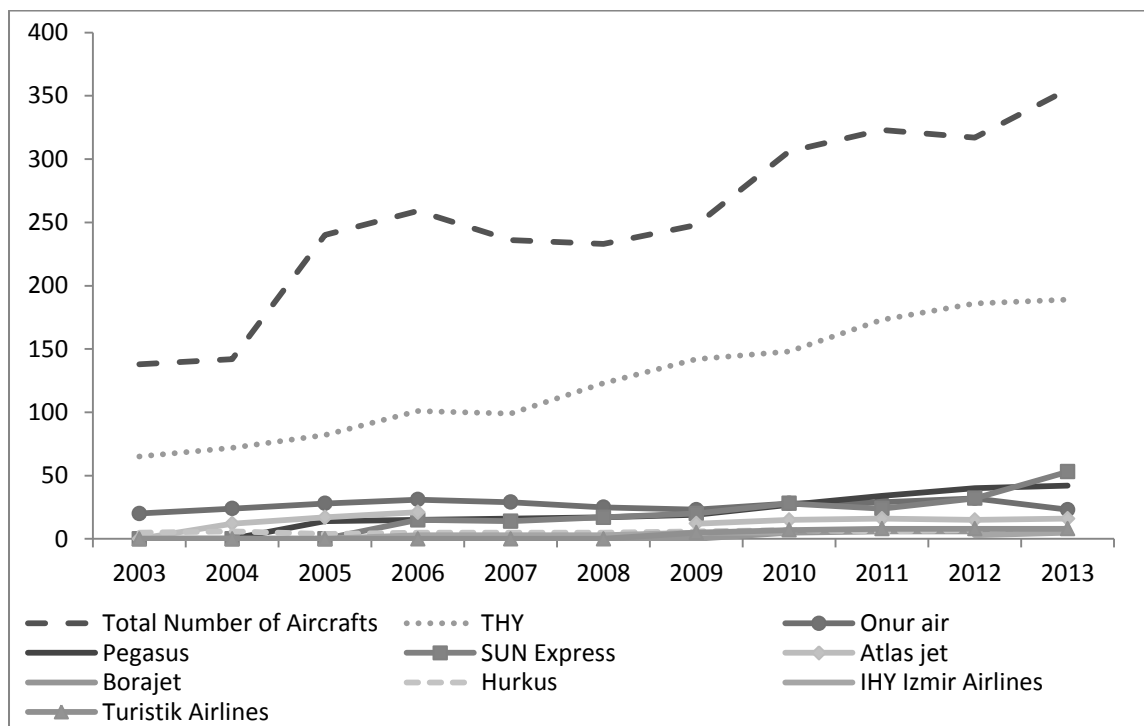
Also, these changes are simultaneous. Accordingly, if we evaluate the sub-sample findings concerning ticket prices, income, and market concentration together, we reach more interesting findings. First, because the sensitivity of price to actual competition and of demand to price has simultaneously increased over time, this finding confirms that deregulation decreases prices and increases demand through actual competition. We can interpret that deregulation improves market outcomes by simultaneously affecting prices and demand. Second, the demand for air transport in Turkey increasingly becomes sensitive to price rather than income, because the income elasticity of demand decreases and the price elasticity of demand increases in time.

Lastly, Figure 3 depicts the graphs of time series with structural breaks for the variables used in the model. The shaded areas in the graphs cover the post and inter-breaks data. By analyzing structural breaks, we can interpret the interactions among the variables in terms of conditions inherent in the Turkish airline industry. A general result regarding structural breaks is that economic conditions determine break times. More importantly, the model estimates 2005:5 and 2007:12 as structural breaks for the number of passengers ( $nps_t$ ) and for ticket prices ( $prc_t$ ), respectively. This finding is statistically and economically significant and clearly confirms the effect of entry and price deregulations on the number of passengers and ticket prices. While the number of passengers started to increase after 2005:5, prices dramatically decreased as of 2007:12, even though fuel prices continued to increase. We estimate that prices declined due to price competition caused by price deregulation in 2007 and the number of passengers increased because of deregulation of entry in the end of 2003. Structural breaks corroborate this inference. Also, this evidence showing that demand constantly increases after the deregulation movement in the end of 2003 is compatible with the coefficient  $\beta_{nft}$  (0.558) showing the long-run relationship between the number of passengers/demand and the number of flights/accessibility.



**Figure 3. The Graphs of Time Series with Structural Breaks**

On the other hand, the model estimates structural breaks for  $nflt_t$  in 2007:4 and for fuel prices ( $fp_{pc,t}$ ) in 2008:6, which show the effect of those variables on each other, in parallel with the real market developments. Accordingly, the model estimates a structural change in the number of flights in 2007:4, because the dramatic rise in fuel prices in 2007 led to firm shrinks in Turkey and the entire world. As depicted in Figure 4, the total number of aircrafts in the Turkish airline industry that was 259 in 2006 declined 236 in 2007 and 233 in 2008. However, along with the decrease in fuel prices in 2008, the number of aircraft reached 248 and then continued to increase.



Source<sup>12</sup>: SHGM, 2009; 2013.

**Figure 4. The Number of Aircraft by Year**

<sup>12</sup> Also, the following internet sources are used to gather data:  
[http://www.turkiyeegitim.com/news\\_detail.php?id=15047](http://www.turkiyeegitim.com/news_detail.php?id=15047)  
<http://en.wikipedia.org/wiki/Borajet>  
[http://www.onurair.com.tr/tarihce\\_eng.aspx](http://www.onurair.com.tr/tarihce_eng.aspx)  
<http://www.freebirdairlines.com/en/kmtaslari.asp>  
<http://www.xing.com/net/tasimacilik/hava-yolu-ulasirma-278220/lufthansa-acentesini-degistirdi-16840262>

Similarly, structural breaks suggest that there is a relationship between fuel prices and ticket prices. However, even though fuel prices affect ticket prices and the number of aircraft in the industry, it does not impact the number of passengers as seen in the graph of  $nps_t$ . That is because THY continued to grow in the same period, although the other firms shrank. As shown in Figure 4, the number of THY's aircraft which was 101 in 2006 reached 123 in 2008, although the total number of aircraft decreased in this period. The model also estimates the effect of this change on market concentration as a structural break in 2006:1 in  $hhi_t$ . Although  $hhi_t$  dramatically decreased along with deregulation until 2006, it started to increase at the beginning of 2006, because the number of passengers transported by THY increased, while the number of passengers carried by the other firms decreased in this period. However, the model estimates another structural break in  $hhi_t$  in 2009:10. This result conforms to the findings regarding the economic conditions such as fuel and ticket prices, as explained above. Along with structural break in 2008:6 in fuel prices, the numbers of aircraft increased again and market concentration started to decrease. The model estimates this development as a lagged structural break in 2010:10 for  $hhi_t$ .

Lastly, the results show structural break in 2008:11 for national income ( $tin_t$ ). This is because of the global economic crisis of 2008. This finding is also compatible with structural break in 2008:6 for fuel prices ( $fprc_t$ ). Because the global economic crisis of 2008 decreased the demand for energy and energy prices also declined for that reason, the graphs of time series for both  $tin_t$  and  $fprc_t$  have structural breaks with a negative trend within 2008. Naturally, these developments in  $tin_t$  and  $fprc_t$  affect ticket prices ( $prc_t$ ). Individual firms in the industry lower ticket prices in parallel with those changes in the economic conditions. Moreover, the model does not estimate that structural breaks in income, HHI, ticket prices, and fuel prices led to a dramatic shift in the number of passengers. Clearly, structural changes

in those variables do not dramatically affect demand in the industry. We infer that this finding suggests the effect of potential competition rather than actual competition, because THY as dominant firm meets industry demand in any case including potential changes affecting the other variables. In summary, structural break regarding the number of passengers strongly suggests that deregulation increases demand.

#### **4 Conclusions**

We have studied the economic effects of deregulation. For this aim, we analyzed the deregulation experience initiated in the Turkish airline industry. Our analysis suggests that deregulation improves market outcomes. The VECM results confirm the presence of long-run relationships among the variables and the estimations regarding sub-samples and structural breaks corroborate the findings of the VECM analysis. Deregulation has increased accessibility to air transport and increased accessibility has boosted demand. Similarly, the decrease in ticket prices has increased demand, because the model estimates the presence of a simultaneous long-run relationship between price and demand.

The results also confirm the effect of actual competition on prices. Whereas market concentration decreases along with increased competition, ticket prices appear to be positively related to market concentration. This suggests that the presence of actual competition has some disciplinary power on incumbent firms in the industry. Although THY has a dominant position, prices have lowered during the post-deregulation period. Moreover, the analysis of sub-samples and structural breaks suggests that prices have become more sensitive to actual competition and demand has become more sensitive to price changes simultaneously. Also, structural breaks confirm the effect of price and entry deregulations on the decrease in ticket prices and the increase in the number of passengers. When we evaluate all of the findings together, we conclude that the deregulation policy in the Turkish airline industry has improved market outcomes, because deregulation brings about the increase in demand

through increased accessibility to air transport and leads to the decrease in prices through actual competition and price deregulation.

Lastly, the methodology developed in this paper in order to investigate the economic effects of airline deregulation can be employed in any deregulation study analyzing the (de)regulatory processes in all the transportation industries. Because the various components such as institutional changes and economic conditions influence the deregulation processes and this interaction is a simultaneous long-term relationship, research on deregulation should include all those variables into the model. Our methodology estimate those relationships, because cointegration analysis confirms the long-term simultaneous relationship between deregulations, prices, and quantity; while structural breaks reveal the effect of (de)regulatory changes in 2003 and 2007.

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