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An Empirical Analysis of the Competitiveness In the U.S. Airline Industry

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Abstract: The purpose of this paper is to investigate the competitiveness of the airline industry in the United States from 1982 to 2012. We examine the stochastic behavior of corporate profitability ratios using a balanced panel of publicly-traded U.S. Airline firms. In particular, we use a panel unit root approach to examine the persistence of profitability. Using a second generation panel unit root test developed by Pesaran (2007) that controls for cross-sectional dependence, we find some evidence that is consistent with airlines' return on assets (ROA) exhibiting mean-reversion during a part of our examination period, but not for the full period. In particular, our findings show that when ROA is used as a profitability measure, profits are mean-reverting in the earlier years of our examination period but not mean-reverting following the demand shocks of the terrorist attacks of September 11, 2011 and the 2008 recession. Therefore, our findings produce some evidence in support of the long-standing "competitive environment" hypothesis originally set forward by Mueller (1977).

Keywords: Competitiveness; Airline deregulation; Firm profitability; Unit roots; Panel data, Cross-sectional dependence

JEL Classifications: C23, D22, L25

1. Introduction

The domestic airline industry in the United States has witnessed more than its fair share of bankruptcies and financial turmoil over the past decade. Numerous airlines have filed for Chapter 11 bankruptcy in the past few years: United Airlines in 2002, U.S. Airways in 2004, Delta Airlines and Northwest Airlines in 2005, Frontier Airlines in 2008, and most recently, American Airlines in 2011. The abysmal performance of the industry has been a puzzle to many industrial organization economics and proponents of deregulation (Borenstein, 2011).

This paper attempts to explore this puzzle by examining the profit persistence of firms in the domestic airline industry in the United States. According to neoclassical economic theory, if an environment is competitive, firms in that environment cannot continue to earn excess profits indefinitely. Economic theory predicts that these excess profits will be eliminated as the profits in the environment advance toward an equilibrium level. To the extent that the Airline Deregulation Act of 1978 was effective at creating a competitive environment, we hypothesize that the firm profits in the domestic airline industry will exhibit mean-reverting behavior following deregulation. This would imply that profits are close to their equilibrium level in the deregulated environment.

In particular, using the sample of Compustat firms that are in the GICS-classified airline industry, we employ a panel unit-root approach for the time period 1982-2012 to examine the competitiveness of the industry after deregulation of the industry in 1978. The "competitive environment" hypothesis characterizes the dynamics of firm profits as a stationary, mean-reverting, stochastic process (Mueller, 1986). In theory, entry and the threat of entry eliminates such abnormally high profits, while firms that make abnormally low profits restructure or exit the industry. Although the process of "creative destruction" should drive all firms' economic profits toward zero, the "first-mover" advantages and other entry and exit barriers may protect existing firms. As such, the dynamic view is consistent with non-zero economic profits at different points in time (Cable and Mueller, 2008).

The rest of the paper is organized as follows. After an overview of the U.S. Airline industry and related research in Section 2, we describe our data and present descriptive statistics in Section 3. We discuss the methodology for testing the "competitive hypothesis" and analysis of airline industry profitability, the test for cross-section independence and methodology for panel data unit roots testing appear in Section 4. The empirical results from the application of the panel data unit-root test are presented in Section 5. The conclusions and remarks are in Section 6.

2. Literature Review and Overview of the U.S. Airline Industry

Prior to 1978, the airline industry was regulated under the Civil Aeronautics Act of 1938. The Civil Aeronautics Board (CAB) dictated the fares that airlines could charge as well as the routes they could fly, and its mission was "the promotion, encouragement and development of civil aeronautics" (49 U.S.C. §1302, 1958).

Many economists during this time argued against regulation, citing inefficiency and higher costs. Under President Jimmy Carter, liberal Cornell economists Alfred Kahn was appointed chair of the CAB in 1977. Under Kahn's leadership, the CAB underwent a series of reforms that shifted the CAB away from regulation and ultimately culminated in the passage of the Airline Deregulation Act ("The Act") on October 24, 1978. The Act was passed with enthusiastic support from both political parties (Rowan, 1983), and specified phasing out regulatory authority by January 1983 and the elimination of the CAB by 1985.

Economists predicted that was that once the regulation that constrained the airline industry was removed, fares would drop and competition would bloom under unrestricted capitalism. Under Kahn, the CAB began executing the reforms to the industry called for by the Airline Deregulation Act of 1978. The industry soon witnessed a surge of new entrants and an expansion of some incumbent carriers. There have also been a large number of bankruptcies and liquidations in the deregulated industry. Many firms that are still operating today have been through Chapter 11 bankruptcy.

In addition, new programs such as the use of loyalty programs came into play. In 1980, American Airlines paved the way with the first frequent flyer program in 1980, followed shortly by other airlines. Customer loyalty programs such as frequent flyer programs may reduce the competitiveness of the industry, as they increase the switching costs for customers (Borenstein, 2008).

One of the most significant changes that occurred under CAB deregulation was the expansion of the hub-and-spoke networks. Under this configuration, passengers fly to and from central hub airports with nonstop flights, or change planes through hub airports. Under hub-and-spoke networks, most airports can support only one large hub operation, which effectively gives a single airline significant market power at their own hubs.

Another change that has been controversial in the industry is the emergence of alliances between airlines. At the beginning of 1998, the proposal for three airline alliances between the six largest carriers was announced. The proposed alliances were the following: Continental Airlines/ Northwest Airlines (January 1998); Delta Airlines/United Airlines and American Airlines/US Airways (April 1998).

The announcement of these potential alliances was met with a lot of controversy. While the carriers and supporters claimed that the alliances would benefit consumers, the opponents argued that the alliances would reduce competition in the domestic market. Bamberger, Carlton, and Neumann (2004) examined the effects of two alliances – Continental Airlines and America West Airlines and Northwest Airlines and Alaska Airlines – and find that overall, the two alliances benefited consumers. In particular, there was a drop in average fares and an increase in total traffic. While Bamberger, Carlton, and Neumann (2004) find that for these two particular alliances, the result was favorable for consumers, it is also possible that other alliances resulted in a reduction in competition as feared by opponents in 1998. Coupled with the increased use of frequent flyer/ customer loyalty programs and the hub-and-spoke configuration, the creation of airline alliances may have led to a reduction in the competitiveness of the industry.

Economists such as Alfred Kahn predicted that competition would thrive in a deregulated market. However, with the industry becoming more concentrated following the waves of liquidation and acquisitions over the years, the expansion of the hub-and-spoke networks, the prevalence of customer loyalty programs, and the creation of airline alliances, whether or not the industry has been able to achieve such a competitive environment is an interesting research question that we attempt to explore in this study.

3. Data and Descriptive Statistics

The source of the data is the Standard and Poor's Compustat industrial and research files. In order to identify firms in the airline industry, we use the Global Industry Classification Standard (GICS). The GICS currently consists of 10 sectors, 24 industry groups, 68 industries, and 154 sub-industries. Because we are focused on the airline industry, we use the GIC Sector 20 (Industrials), Industry Group 2030 (Transportation), Industry 203020 (Airlines), and Sub-industry 20302010 (Airlines) to identify firms in the airline industry for the period 1982 - 2012. Accounting return series are used in the analysis. Profitability is measured with two of the most extensively used measures of profitability: Return on assets (ROA) and Return on investment (ROI) (Combs et al., 2005). ROA is calculated as net income divided by total assets and ROI as net income divided by total invested capital.[1] All ratios use net income before extraordinary items in the numerator and are reported in decimal form. Note that the full effects of deregulation were not realized until the mid-1980s. As such, we begin our sample in 1982 to capture the effects of deregulation.

The airline industry has witnessed a significant number of airlines entering and exiting the industry over time. We use the data for all publicly-traded airlines that stays in operation at least10

[1] Total invested capital is taken from Compustat as ICAPT. It equals the sum of total long-term debt, preferred stock, minority interest, and total common equity.

years. We partition our data for airlines into balanced panels over 10-year periods from 1982 to 2012, creating 22 samples and allowing for the inclusion of both surviving and failed firms in our analysis. Table 1 provides the detail of rolling sample periods and number of firms in operation and in samples.

Table 1. Airlines in operation (Number of firms)

Sample Period	All Airlines	Exited in Less than 10 Years	Remained in Operation More Than 10 Years	In First 9 year of operation	In Operation for 10 or More Years During the Test period
1982-91	25		25	9	16
1983-92	29	1	29	10	19
1984-93	30		30	11	19
1985-94	35	1	34	13	21
1986-95	37	3	34	12	22
1987-96	40	4	36	14	22
1988-97	39	3	36	13	23
1989-98	40	4	36	13	23
1990-99	36	3	33	13	20
1991-2000	37	4	33	15	18
1992-01	39	4	35	13	22
1993-02	41	3	38	15	23
1994-03	40	2	38	12	26
1995-04	40	3	37	11	26
1996-05	37	3	34	9	25
1997-06	39	5	34	8	26
1998-07	36	5	31	8	23
1999-08	34	4	30	8	22
2000-09	32	5	27	6	21
2001-10	29	5	24	4	20
2002-11	28	6	22	1	21
2003-12	27	1	27	5	22

Data Source: S&P Compustat Data 1982-2012 Active Status

During our examination period, no firm exited the industry until 1994. The first exits occurred in 1994. Thirty four (34) airlines exited the market over this time period. In order to investigate the reason for the disappearances, we reviewed news releases on each of the 34 missing firms and determined the cause of each disappearance. Aside from 4 cases where information on the firm was missing, we ascertained that the 18 of the firms ceased operations/filed for Chapter 11 bankruptcy and 12 were either merged with or acquired by another airline.

We examined the descriptive statistics for our 10-year rolling samples for the ROA and ROI. The statistics for pooled mean, pooled median, pooled standard deviation, minimum, maximum, skewness, and kurtosis, for each of the two measures of profitability by sample period, indicated that the ROA for the airline industry reached a peak in the period 1991 – 2000 and has generally deteriorated over time. The industry was also hit hard by the financial crisis in 2008. The 2000-2009 sample has the lowest mean for ROA. According to Borenstein, U.S. carriers reported an aggregate net loss of $14 billion on revenues of $270 billion in 2008-09 (Borenstein, 2011). He also notes that the industry has experienced two major demand shocks that have attributed to the industry's net losses over the years: the demand shock in 2001-02 following the September 11, 2001 terrorist attacks and the demand shock following the recession in 2007-2008. The effects of these demand shocks resulted in the drop in ROA beginning in 2001, with another drop observed in 2008.

In addition, the difference between the ROA for high performers and low performers in the industry has become wider over time. In the early deregulation periods, the standard deviation hovers below 0.23, whereas in the later periods, the standard deviation jumps to above 1.22. Skewness for ROA has become increasingly negative, especially after the period 1994–2003. Kurtosis for ROA has also increased significantly following the same 1994–2003 period for ROA, jumping from 33.98457 in the 1993 – 2002 period to 253.0751 in the 1993–2003 period indicating larger clustering at the two end of ROA distribution.

Similar to ROA, ROI for the industry increases following deregulation, reaching a peak in the period 1990–1999 for the mean and 1991–2000 for the median. The mean and median drop following the September 11, 2001 terrorist attacks but then increase and reach another peak in the period 1997–2006 for the mean and 1995–2004 for the median. Similar to ROA and consistent with Borenstein, the mean and median ROI drop following the demand shock from the recession in 2008–2009.

Unlike ROA, the difference between the ROI for high and low performers in the industry has not increased as significantly over time. The standard deviation for ROI reaches a peak in the period 1994–2003 and stays high until it drops in the period 1998 –2007.

We also examined the distribution of the data for each segment using Doornik-Hansen Normality Test. The results indicate that the profit series are not normally distributed for any sample period.

4. Methodological Issues and Analysis

The motivation of this study is twofold. First, unlike the prior studies that focus on the determinants of airline industry profit structure, we approach the analysis of the “competitive environment” hypothesis by assessing the stochastic properties of earnings and returns ratios using the panel unit root methodology. If the return ratio is represented by a stationary process, shocks affecting the series are transitory, and the profitability will eventually return to its equilibrium level. Thus, evidence of stationarity supports the “competitive environment” hypothesis, for it characterizes the dynamics of earnings as mean-reverting. This, in turn, could be interpreted as an indirect signal of industry stability. Conversely, if the return ratios evolve as a unit root process, shocks affecting the series have permanent effects, shifting the corporate capital structure from one level to another, which contradicts the “competitive environment” hypothesis.

Second, we directly address the question of cross-sectional dependence in panel unit root tests. The application of univariate unit root tests, such as the Augmented Dickey-Fuller (Said & Dickey, 1984) and the Phillips-Perron (Phillips & Perron, 1988) tests, is somewhat commonplace in studies using time series data. In contrast, the use of unit root tests for panel data is more recent (Levin, Lin, & Chu, 2002; Im, Pesaran, & Shin, 2003; Maddala & Wu, 1999). It is by now a generally accepted argument that the commonly used univariate unit root tests lack power in distinguishing the null hypothesis of unit root from stationary alternatives, and using panel data unit root tests is one way of increasing the power of unit root tests (Im, Pesaran & Shin, 2003; Levin, Lin & Chu, 2002; Choi 2001). Panel unit root tests exploit both the time-series ($t = 1, 2, \ldots, T$) and the cross-section ($i = 1,2,\ldots, N$) dimensions of the underlying data, thereby having more power and greater efficiency than univariate time series unit root tests (Baltagi, 2005). However, the panel unit root literature has pointed out that in many empirical applications it may be inappropriate to assume that the cross-section units are independent. Observations on firms, industries, regions and countries normally tend to be cross-correlated as well as serially dependent (Breitung & Pesaran, 2008).

There are a variety of reasons why cross-sectional dependence may exist in an industry. Commonly, cross-sectional dependence reflects the fact that firms in the same industry respond to unobserved common stochastic shocks and are linked by unobserved common stochastic trends. Common shocks and common trends spread across all firms in an industry, thus engendering the panel feature of cross-sectional dependence. For example, shocks stemming from increases in cost of fuel and security and concerns about terrorists attacks affect the profitability of all airlines. Furthermore, in a globalized economy, shocks generated in one country are known to cross national borders (Lau, Baharumshah & Soon, 2013). The global financial crisis is arguably one of the deepest exogenous shocks that recently affected the corporate sector. Common stochastic trends, on the other hand, are another source of cross-sectional dependence, as they reflect the presence of variables that tend to move together, i.e., are cointegrated in a VAR system (Granger, 1981). Empirical evidence, for instance, has found that stable relationships exist at the industry level between measures of firm performance, such as sales or profitability, and research and development expenditures (Chan, Lakonishok & Sougiannis, 2001) and between the market value added of the firm (MVA), an external measure of a firm's performance, and several internal measures, such as earnings per share (EPS), free cash flow per share (FCF), return on equity (ROE), return on assets (ROA), and economic value added per share (EVA) (Bernier & Mouelhi, 2012).

Thus, an important problem in panel unit root tests is whether the cross-sections of the panel are independent or not. On this issue, the panel unit root literature distinguishes between the first generation tests, which are developed on the assumption of the cross-sectional independence, and the second generation tests, which account for the dependence that might prevail across the different units in the panel. If the data are cross-sectionally dependent, the panel unit root literature has shown that the first generation tests can generally be misleading, in the sense that they expose the tests to significant size distortions. That is, the tests tend to reject the null hypothesis of non-stationarity too often (see, for instance, Maddala & Wu, 1999; Choi, 2001; Levin, Lin & Chu, 2002; Im, Pesaran & Shin, 2003). Moreover, Pesaran (2007) demonstrates that panel unit root tests that do not account for cross-sectional dependence when cross-sectional dependencies indeed present, are seriously biased if the degree of cross-sectional dependence is sufficiently large.

Conventional panel unit-root tests, such as Levin, *et al.* (2002), Harris and Tzavalis (1999), and Im, *et al.* (2003) receive criticism (O'Connell, 1998; Jönsson, 2005; and Pesaran, 2007, among others) for assuming cross-section independence. Cross-section dependence can arise due to unobservable common stochastic trends, unobservable common factors, common macroeconomic shocks, spatial effects, and spillover effects, which are common characteristics of the datasets employed in industry studies.

A large amount of the current research on panel data concentrates on how to deal with cross-sectional dependence. The second generation tests, such as the Seemingly Unrelated Regressions Augmented Dickey-Fuller test (SURADF) developed by Breuer, McNown and Wallace (2002), and the Cross-sectionally Augmented ADF test (CADF) proposed by Pesaran (2007) explicitly address the problem of cross-sectional dependence. However, if $N > T$, i.e., the number of cross-section units exceeds the number of time periods, the SURE approach is not feasible. This limitation is also present in the robust version of the non-parametric panel unit root test proposed by Breitung and Das (2005) to account for cross-sectional dependence.

Baltagi and Pesaran (2007) and Pesaran (2007) argue that ignoring the presence of cross-section dependence in panel unit-root tests leads to considerable size distortions and can cause adverse effects on the properties of tests, leading to invalid and misleading conclusions. That is, over-rejection of the unit-root null. Pesaran (2004) proposes a cross-section dependence (*CD*) test, which uses the simple average of all pair-wise correlation coefficients. The *CD* test provides a general test for cross-section dependence, which, as shown in Pesaran (2004), applies to a large variety of panel data models, including stationary and non-stationary dynamic heterogeneous panel with T small and N large, as is the case for our panel data. The test applies to both balanced and unbalanced panels and is robust to parameter heterogeneity and/or structural breaks, and performs well even in small samples. Under the null hypothesis $H_0 : \rho_{it} = \rho_{jt} = \text{corr}(\varepsilon_{it}, \varepsilon_{jt}) = 0$ for $i \neq j$, ε_{it} is independent and identically distributed over time periods and across cross-section units. Under the alternative hypothesis $H_1 : \rho_{it} = \rho_{jt} \neq 0$ for some $i \neq j$, ε_{it} is correlated across cross-sections, but uncorrelated over time periods. Under the null hypothesis of cross-section independence, the *CD* test statistics are distributed as standard normal for N sufficiently large.

We examine our data for cross-sectional independence using Pesaran (2004) *CD* test.

Our examination of cross-sectional independence for every 10-year rolling sample indicates the null hypothesis of, $H_0 : \rho_{it} = \rho_{jt} = \text{corr}(\varepsilon_{it}, \varepsilon_{jt}) = 0$, is rejected for airline firms and for each sample period at .001 for each of our sample periods.

Therefore, we employ a second generation panel unit root test that allow for cross-sectional dependence developed by Pesaran (2007) which accounts for cross-sectional dependence by imposing a common factor structure. Pesaran (2007) suggests a cross-sectionally augmented Dickey-Fuller (CADF) test where the standard ADF regressions are augmented with cross-sectional averages of lagged levels and first differences of the individual series. The data generating process (DGP) is a simple dynamic linear heterogeneous panel data model. The error term is assumed to have an idiosyncratic component and an unobserved common factor structure accounting for cross-sectional correlation.

In a competitive environment the firms with new innovation will earn monopoly profits and entry of competitors and imitators will erode the excess profit. In a static competitive environment, the monopoly profits will be eroded and eventually disappear. However, assuming the firm continues with new innovations a permanent profit level that is constant over time may be maintained. Therefore, the profits of firm i for a given time period may be modeled as:

$$\pi_{it} = \pi_i + \mu_{it} \qquad \text{(i)}$$

where π_{it} is current period profits for firm i, π_i the permanent rate of profit for the firm i and μ_{it} is the deviation of firm's current profit from the competitive profit in any period t .

The methodology typically applied to analyze persistence of firm profits is based on a firm-level first-order autoregressive model.[2] All studies specify a common empirical model -- a univariate AR(1) process as follows: persistence of firm profits is found in

$$\pi_{it} = \alpha_i + \lambda_i \pi_{it-1} + \varepsilon_{it} \qquad \text{(ii)}$$

where π_{it} is the (normalized) profit of firm i in period t , α_i is a firm specific constant, λ_i is the parameter that indicates the speed of convergence of profits to a mean value (equilibrium rate of return), and ε_{it} is an error term assumed N(0, σ^2) The AR(1) structure implies that the speed of

[2] The AR(1) model is based on the idea that competitive mechanisms need some time to erode the excess of profits generated by short-run rents (Mueller, 1986). Geroski (1990) justifies the auto-regressive specification theoretically as a reduced form of a two-equation system where profits depends on the threat of entry in the market, and the threat in turn depends on the profits observed in the last period.

mean-reversion is maximal at $\lambda_i = 0$. The model is estimated by OLS for each firm i and an estimate of the long-run profit ($\pi_i = \pi_{it} = \pi_{it-1}$) of each firm is obtained as:[3]

$$\pi_i = \frac{\alpha_i}{1-\lambda_i} \qquad \text{(iii)}$$

If all firms earn the competitive rate of profit, then π_i should equalize for all firms (ignoring differences in risk).[4] This long-run profit captures the static notion of the "competitive environment." The parameter estimate of λ_i is of particular interest in all these studies. If λ_i is close to zero, this indicates that firm profits display minimal persistence: profits at time t-1 do not have much impact on profits at time t. On the other hand, if λ_i is close to 1, this indicates that firm profits are highly persistent: profits at time t-1 have substantial impact on profits at time t. The limitations of this approach, however, are apparent considering that the methodology is appropriate only for stationary processes, since π_i is not defined for unit-root processes where $\lambda_i = 1$, the degenerate case of adjustment dynamics. The first order difference of profit series appears below:

$$\Delta\pi_{it} = \alpha_i + \rho_i \pi_{it-1} + \varepsilon_{it} \qquad (1)$$

where $\Delta\pi_{it}$ is $\pi_{it} - \pi_{it-1}$, π_{it} is the (normalized) profit of firm i in period t, α_i is $(1-\lambda_i)\pi_i$, a firm specific constant, ρ_i is (λ_i-1) is the parameter that indicates the speed of convergence of profit to a mean value (equilibrium rate of return), and ε_{it} is an error term distributed $N(0, \sigma^2)$.

We can examine the linear hysteretic hypothesis by means of panel unit-root tests, where the null hypothesis implies a unit root and suggest non-stationarity of profit series. Assume that, for a panel of N firms observed over T time periods, r_{it} exhibits the following augmented Dickey-Fuller (*ADF*) representation:

$$\Delta r_{it} = \alpha_i + \rho_i r_{it-1} + \sum_{j=1}^{P} \gamma_{ij} \Delta r_{it-j} + \varepsilon_{it} \qquad i = 1, \ldots, N;\ t = 1, \ldots, T \qquad (2)$$

where r_{it} denotes the profit series (*ROA*, *ROE*, or *ROI*), $\Delta r_{it} = r_{it} - r_{it-1}$, α_i is the intercept term that captures the firm-specific effects, P is the lag order in the model, and $\varepsilon_{it} \sim N(0, \sigma_{ij}^2)$. To incorporate the time-specific effects, we add a trend, $\delta_i t$, component to equation (2) as follows:

$$\Delta r_{it} = \alpha_i + \rho_i r_{it-1} + \delta_i t + \sum_{j=1}^{P} \gamma_{ij} \Delta r_{it-j} + \varepsilon_{it} \qquad i = 1, \ldots, N;\ t = 1, \ldots, T \qquad (3)$$

When $\rho_i < 0$, the processes for r_{it} defined by equations (2) and (3) are stationary, and firm profits are mean-reverting. On the other hand, when $\rho_i = 0$, the processes for r_{it} contain a unit root, and firm profits follow a random walk and display path-dependence.[5]

The dynamic notion of the "competitive environment", however, focuses on the parameter estimate of λ_i. If λ_i is close to zero, then firm profits display minimal persistence: profits at time t-1

[3] The parameter α_i includes a competitive profit and a firm-specific permanent rent over and above the competitive return. See Gschwandtner (2012).

4 Any firm-specific permanent rent must equal zero.

[5] Madsen (2010) observes that equations (2) and (3) contain two sources of persistence -- the autoregressive mechanism described by ρ_i and the unobserved individual-specific effects described by α_i. A lower ρ_i means that more persistence associates with the autoregressive mechanism and less persistence associates with the unobserved individual-specific effects. The case with $\rho_i = 0$ is the extreme case where all persistence falls on the autoregressive mechanism.

do not exert much effect on profits at time *t*. On the other hand, if λ_i is close to 1, then firm profits exhibit high persistence: profits at time *t*-1 substantially affect profits at time *t*.

5. Empirical Results

Pesaran (2007) proposes a panel unit-root test based on a single common factor specification for the cross-correlation structure. The test augments the *ADF* equations (2) and (3) with the cross-section averages of lagged levels and first-differences of the individual series. This controls for the contemporaneous correlation among r_{it} and filters out the effect of the unobserved common factor. The augmentation of lagged first-differences of the series controls for any residual serial correlation.

The individual-specific test statistic for the hypothesis $H_0 : \rho_i = 0$ for a given *i* equals the *t*-value for $\rho_i = 0$, $t_i(N,T)$ in the *CADF* regressions. The panel unit-root test for the hypothesis $H_0 : \rho_i = 0$ for all *i* against the heterogeneous alternative $H_1 : \rho_i < 0$ for some *i* equals the average of the individual $t_i(N,T)$ tests. That is,

$$CIPS(N,T) = N^{-1}\sum_{i=1}^{N} t_i(N,T) \tag{4}$$

In addition, to ensure the existence of the first and second moments of the distribution of $t_i(N,T)$, Pesaran(2007) constructs a truncated version of the $CIPS(N,T)$ test, denoted $CIPS^*(N,T)$, to avoid using extreme statistics caused by a small number of sample observations.

$$CIPS^*(N,T) = \frac{1}{N}\sum_{i=1}^{N} t_i^*(N,T)\,, \tag{5}$$

where

$$t_i^*(N,T) = \begin{cases} t_i(N,T) & -K_1 < t_i(N,T) < K_2 \\ -K_1 & t_i(N,T) < K_1 \\ K_2 & t_i(N,T) \geq K_2 \end{cases} \tag{6}$$

K_1 and K_2 depend upon the deterministic component of the models. Pesaran (2007) provides values for K_1 and K_2 obtained by simulations for models with intercept and no trend (K_1 = 6.19 and K_2 = 2.61) and models with intercept and trend (K_1 = 6.42 and K_2 = 1.70) for various combinations of *N* and *T*.[6]

We also implement the suggestion of Im, *et al*. (1997, 2003). That is, assuming that in addition to a series-specific intercept and/or trend, a time-specific intercept may exist as well. We control for this possibility by removing for each segment the cross-section means from each series. This

[6] Pesaran (2007) investigates the small-sample properties of the tests under various specifications of the *DGP*. The Monte Carlo experiments show that the tests exhibit satisfactory size and power properties even for small time dimensions (e.g., *T* = 10).

normalization, by extracting common time-specific or aggregate effects, removes the effect of the business cycle and other macroeconomic shocks.[7] This correction will not remove the potential effect of correlation between the series, but may reduce it considerably (O'Connell, 1998; Luintel, 2001).

Table 2 shows the results of the $CIPS^*$ tests for ROA and ROI measures, respectively.[8] Each profitability measure was examined using the intercept only and the intercept and trend specifications, with the related critical values (cv) at 1, 5, and 10 percent. In both specifications, we augment the *CADF* regressions with 1 lag to account for the possibility of serial correlation.

We present the results for ROA with *CIPS** test statistic (t-bar) for intercept only and intercept and trend specifications. As shown in Table 2, unit root test of ROA measure suggest rejection of the null for the three sample periods starting in 1988 and ending 1999 in both model specification.

The results for the model with *intercept only specification* reject the null of non-stationarity for 11 of 22 sample periods. The majority of the sample periods where we reject the null of non-stationarity (i.e., the industry profitability measure is consistent with the "competitive environment" hypothesis) are in the period 1987 to 2000. In other words, for the earlier periods in our examination period (prior to 2001), our results are consistent with the industry exhibiting a competitive environment. This is consistent with what economists and proponents of deregulation had predicted would happen following the Airline Deregulation Act of 1978. However, in the latter half of our examination period, 2001-2012, for the most part, we cannot reject the null of non-stationarity. In other words, following 2001, the results suggest that the industry has become less competitive. These results are consistent with Borenstein (2011), who noted that the industry experienced a demand shock first in 2001, following the 9.11, 2001 terrorist attacks and then again in 2007, following the 2007-2008 recession, which could have reduced the competitiveness of the airline industry.

The test of null hypothesis of non-stationarity after adding the time trend produces fewer rejection of the null. For twelve sample periods the results of hypothesis tests using in the intercept and trend model are consistent with the earlier findings using the intercept only model. That is, profitability shocks observed do not appear to be time-dependent.

We repeat our test of non-stationarity using ROI as the measure of profitability for airlines. The results for ROI measure are presented in Table 3. The results for two different models are consistent over 20 of 22 periods.

Both models reject non-stationarity of the ROI series at 10 percent or better significance level during only four of the twenty-two sample periods. Using ROI as our profitability measure, therefore, our results are consistent with the airline industry exhibiting persistent profits (non-stationarity) for the most part of our examination period. In other words, with ROI as the profitability measure, the industry may for the most part be characterized as non-competitive following the deregulation of the airline industry over our study period. The results may be due to the differences stemming from investment in operating assets and facilities by airlines.

[7] This approach differs from the conventional methodology, where researchers normalize profit as a deviation from an economy-wide measure of profitability in year *t*. Using the economy-wide sample mean may produce misleading implications. That is, the profit of a firm in a given industry may not exhibit abnormal behavior with respect to its own sample average, but may exhibit well above- or below-average behavior with respect to the economy-wide average profit.

[8] The PESCADF (version 1.0.3) Stata module (Lewandowski, 2006) computes the test statistics.

Table 2. Pesaran's Unit-root Test (CIPS*)

Number of Airlines	Sample Period	Return on Assets (ROA)				Return on Investment (ROI)			
		Intercept Only (Augmented by 1 lag)		Intercept and Trend (Augmented by 1 lag)		Intercept Only (Augmented by 1 lag)		Intercept and Trend (Augmented by 1 lag)	
		t-bar	Sig.	t-bar	Sig.	t-bar	Sig.	t-bar	Sig.
16	1982-1991	-2.095		-1.979		-1.583		-2.348	
19	1983-1992	-1.419		-0.933		-1.931		-2.505	
19	1984-1993	-1.781		-2.958	**	-2.15	*	-3.093	**
21	1985-1994	-2.746	***	-2.634		-2.1	*	-2.886	*
22	1986-1995	-2.054		-2.148		-1.511		-2.339	
22	1987-1996	-2.27	*	-2.412		-1.47		-2.432	
23	1988-1997	-2.614	***	-3.193	***	-1.973		-1.538	
23	1989-1998	-2.688	***	-2.84	*	-1.098		-2.013	
20	1990-1999	-2.516	***	-3.035	**	-1.216		-2.285	
18	1991-2000	-2.801	***	-2.696		-2.862	***	-2.249	
22	1992-2001	-1.889		-2.234		-1.819		-2.256	
23	1993-2002	-2.534	**	-2.185		-1.789		-2.383	
26	1994-2003	-1.376		-1.785		-2.191	*	-2.918	**
26	1995-2004	-2.189	**	-2.271		-1.339		-1.988	
25	1996-2005	-1.688		-1.737		-1.762		-1.763	
26	1997-2006	-1.301		-1.958		-1.511		-2.353	
23	1998-2007	-2.293	**	-1.881		-1.813		-1.986	
22	1999-2008	-1.776		-3.554	***	-1.485		-2.142	
21	2000-2009	-2.273	*	-2.638		-2.428	**	-3.059	**
20	2001-2010	-2.676	***	-4.248	***	-1.915		-2.65	
21	2002-2011	-1.181		-2.143		-2.002		-3.121	***
22	2003-2012	-1.084		-3.719	***	-1.183		-1.918	

Note: ***, **, and * indicate statistical significance at the level of 1%, 5%, and 10%, respectively.

6. Robustness Tests

In order to examine the source of non-competitive airline industry, we divided the firms in each sample period into two groups, "surviving" and "non-surviving" groups. Firms that continue in operation through the end of our study periods are considered the "surviving" group and those, in the samples but disappearing from Compustat prior to 2012 are considered "non-surviving" group. We provide a breakdown of the firms by sample period in Table 3.

Table 3. Surviving and non-surviving airlines in the samples (number of firms)

Sample Period	In Operation for 10 or More Years During the period (1)	Exited After the sample period (2)	Continued in Operation (3)	All Exits (4)	Less Than 9 Years in Operation (Not in Sample) (5)	Exit from the Sample (6)
1982-91	16	11	5			
1983-92	19	12	7			
1984-93	19	12	7			
1985-94	21	12	9	1		1
1986-95	22	13	9			0
1987-96	22	13	9	2	1	1
1988-97	23	13	10			0
1989-98	23	13	10	4	1	3
1990-99	20	10	10	2		2
1991-2000	18	8	10	1	1	0
1992-01	22	11	11	2	1	1
1993-02	23	12	11			0
1994-03	26	14	12	2	1	1
1995-04	26	13	13	4	1	3
1996-05	25	10	15			0
1997-06	26	10	16	3		3
1998-07	23	7	16	3	2	1
1999-08	22	6	16	3		3
2000-09	21	4	17	4	1	3
2001-10	20	2	18	2		2
2002-11	21		21	1	1	0
2003-12	22		22			0
				34	10	24

Column 4, show the number of firms that exited the industry during each sample period. As we reported earlier, firms exiting the industry in the first 9 years of operation were not included in our examinations. Table 3 shows the exiting firms not included in the sample and those in the sample in columns 5 and 6, respectively. Columns 1-3 in Table 3 show the number firms, the number of non-surviving firm, and surviving firms, respectively, in each sample period. As shown in Table 3, the data for non-surviving firms are limited (2 firms) for the sample period 2001-10 and there are no non-surviving firms in the next two sample periods.

We tested the null hypothesis of non-stationarity for each group, surviving and non-surviving, separately as in previous presentation, using intercept only and intercept and trend models. We also exclude the last three sample period for the results are identical to those in Table 2 due to very few or absence of non-surviving firms as explained above. We report the results of our tests for each group, surviving and non-surviving firms, in Tables 4 and 5, respectively.

The results in Table 4 for the *intercept only* model indicate the industry returns for the surviving firms were stationary after the early stages of the implementation of deregulation, 1985 - 2000, based on either ROA or ROI profitability measures. That is, we reject the null hypothesis of non-stationarity for sample periods starting in 1985 and ending in 2000 with the exception of one sample period, 1989-98. We cannot reject the null for any sample periods following the 1991-2000 sample period, except for the 2000-09 sample period, based on both measures of profitability.

Table 4. Pesaran's Unit-root Test (CIPS*) on airlines profitability(surviving firms)

Number of Airlines	Sample Period	Intercept Only (Augmented by 1 lag)				Intercept and Trend (Augmented by 1 lag)			
		t-bar ROA	Sig.[1]	t-bar ROI	Sig.[1]	t-bar ROA	Sig.[2]	t-bar ROI	Sig.[2]
5	1982-1991	-0.862		-1.024		-0.764		-0.805	
7	1983-1992	-1.827		-2.032		-2.764		**-3.083**	*
7	1984-1993	-1.786		**-2.556**	**	-2.501		**-3.281**	**
9	1985-1994	**-3.296**	***	**-3.156**	***	**-4.040**	***	**-3.732**	***
9	1986-1995	**-3.109**	***	**-2.426**	*	**-4.205**	***	**-4.357**	***
9	1987-1996	**-3.249**	***	**-2.481**	**	-1.690		-2.078	
10	1988-1997	**-3.051**	***	**-2.543**	**	-2.636		-2.353	
10	1989-1998	-2.018		-1.373		-2.415		-2.451	
10	1990-1999	**-3.005**	***	**-2.288**	*	-2.550		-2.096	
10	1991-2000	**-3.088**	***	**-2.506**	**	**-2.892**	*	-2.124	
11	1992-2001	-1.188		-0.574		-0.442		-0.965	
11	1993-2002	-1.616		-0.827		-1.397		1.048	
12	1994-2003	-0.814		-1.532		-0.576		**-2.984**	*
13	1995-2004	-1.347		-0.778		-0.603		-2.155	
15	1996-2005	-1.935		-1.233		-1.540		-1.455	
16	1997-2006	-1.249		-1.115		-1.780		-1.698	
16	1998-2007	-1.910		-1.392		-1.142		-0.987	
16	1999-2008	-1.874		-1.456		**-3.384**	***	-1.966	
17	2000-2009	**-2.342**	**	**-2.391**	**	**-2.796**	*	**-2.795**	*

[1]Statistical significance: *** 1% (cv = -2.850), **5% (cv = -2.470), and *10% (cv = -2.280)

[2]Statistical significance: *** 1% (cv = -3.510), **5% (cv = -3.100), and *10% (cv = -2.870)

The results of our tests, using the *intercept and trend* model, as presented in Table 4, provide evidence in support of rejecting the null for two sample periods, 1985-1994 and 1986-1995, for both profitability measures at the 1 percent level. We also reject the null, based on the ROA measure, for 1999-08 sample periods at the 1 percent level and for 1991-2000 and 2000-09 at the 10 percent level. We also reject the null hypothesis, based on the ROI measure, for 1983-92, 1994-03, and 2000-09 sample periods, at the 10 percent level.

Table 5 presents the results of our unit root tests for the "non-surviving" group during each sample period.

For the *intercept only* model, our results support rejecting the null for two sample periods, 1991-2000 and 1993-02, for both profitability measures at the 1 percent level. We also reject the null, based on the ROA measure for 1989-98, 1990-99, and 1992-01 sample periods at the 1 percent level, for 1984-93 and 1988-97 at the 5 percent level, and for the 1985-94 and 1999-08 sample periods at the 10 percent level. Based on ROI measure, we reject the null for the 1994-03 at the 1 percent level and for the 1984-93, 1987-96, and the 1998-07 sample periods at the 10 percent level.

The results of our tests, using the *intercept and trend* model, as presented in Table 5, the null hypothesis of non-stationarity is rejected for the 1991-2000 sample period based on both profitability measures at the 1 percent level. We also reject the null, based on the ROA measure, for 1992-01sample period at the 1 percent level and for the 1993-02 sample period at the 10 percent level. Using the ROI as the measure profitability, the null is rejected for 1982-91 and 1993-02 at the 1 percent level, for the1994-03 sample period at the 5 percent level, and for the1996-05 sample period at the 1 percent level.

Table 5. Pesaran's Unit-root Test (CIPS*) on airlines profitability(non-surviving firms)

Number of Airlines	Sample Period	Intercept Only (Augmented by 1 lag)				Intercept and Trend (Augmented by 1 lag)			
		t-bar ROA	Sig.[1]	t-bar ROI	Sig.[1]	t-bar ROA	Sig.[2]	t-bar ROI	Sig.[2]
11	1982-1991	-2.177		-1.990		-2.540		**-3.368**	***
12	1983-1992	-1.203		-1.635		-1.109		-1.346	
12	1984-1993	**-2.484**	**	**-2.268**	*	-2.602		-2.173	
12	1985-1994	**-2.282**	*	-1.896		-0.571		-2.755	
13	1986-1995	-1.114		-1.492		-1.120		-2.133	
13	1987-1996	-1.082		**-2.291**	*	-1.147		-2.604	
13	1988-1997	**-2.424**	**	-1.283		-2.145		-1.582	
13	1989-1998	**-2.954**	***	-0.188		-2.266		-2.085	
10	1990-1999	**-2.784**	***	-2.136		-2.284		-2.654	
8	1991-2000	**-3.113**	***	**-3.581**	***	**-3.603**	***	**-4.461**	***
11	1992-2001	**-2.989**	***	-2.161		**-3.729**	***	-2.13	
12	1993-2002	**-2.915**	***	**-2.815**	***	**-2.852**	*	**-3.344**	***
14	1994-2003	-1.766		**-2.615**	***	-2.560		**-3.021**	**
13	1995-2004	-1.340		-1.546		-1.550		-2.284	
10	1996-2005	-1.274		-2.013		-2.454		**-2.881**	*
10	1997-2006	-0.290		-1.706		-0.808		-1.870	
7	1998-2007	-1.330		**-2.392**	*	-2.433		-2.224	
6	1999-2008	**-2.439**	*	-1.612		-1.809		-1.005	
4	2000-2009	-1.703		-1.935		-1.715		-2.710	

[1]Statistical significance: *** 1% (cv = -2.660), **5% (cv = -2.350), and *10% (cv = -2.200)

[2]Statistical significance: *** 1% (cv = -3.310), **5% (cv = -2.970), and*10% (cv = -2.780)

7. Conclusion and Remarks

It has been over three decades since the airline industry was deregulated in the United States. Liberal economists and proponents of deregulation had hoped that deregulation would break down the barriers to entry and make the industry more competitive. The results of our study provide some evidence that the airline industry achieved competitiveness, or mean-reverting behavior, following deregulation. The picture that emerges from our analysis presents a reasonably competitive environment for the airline industry shortly after the full implementation of the Airlines Deregulation Act during the late 1980s and early 1990s. Nine new entrants started operation in the airlines industry during the period of 1983-89. During 1992-02 period, excluding the effect of the economic shock brought about by the September 11, 2001 terrorists' attacks, the industry appears to have become less concentrated and perhaps more competitive as indicated by our results based on the ROA measure and the number of firms entering (27) and exiting (12) the industry. During the period after 2002 through 2012, however, the industry experiences an increase in the concentration induced by the disparity between the 9 new entrants and 21 firms exiting the market.

Our analysis of surviving and non-surviving groups, as illustrated in Tables 4 and 5, indicate that the majority of exits from the industry occur during the periods when non-surviving firms', and to some extent when surviving firms, profits exhibit non-stationarity. For example, 3 firms (excluding firms that existed within the first 9 years of operation) exited 5 of our samples at the end of 1989-98, 1995-04, 1997-06, 1999-08, and 200-09 periods. These exits represent over 60 percent of 24 firms that exited the industry over our study period.

In theory, entry and the threat of entry eliminates such abnormally high profits, while firms that make abnormally low profits restructure or exit the industry. There are several potential explanations for the existence of persistence profits, such as the concentration of the industry following years of bankruptcies and consolidation, the prevalence of frequent flyer/customer loyalty programs, the expansion of the hub-and-spoke system, and the creation of airline alliances. Previous studies (Borenstein, 2009) have noted that the increased prevalence of factors such as the loyalty programs, hub-and-spoke system, and airline alliances may hinder the competitiveness of the industry by elevating the barriers to entry to industry and reducing the effectiveness of deregulation. Our study provides some evidence that despite these factors, the industry exhibits competitiveness following deregulation. This has practical implications for policy research, as some critics have called for an influx of government intervention in the airline industry given the industry's financial struggles in the past decade. In particular, Borenstein (2009) notes that some observers have asked whether there should be a change in the organization of the industry, i.e., to an oligopoly, through government intervention. Our study shows that despite these struggles, the industry for the most part does exhibit competitiveness. These results will hopefully provide policymakers and observers with more information to consider when proposing any future government intervention in the airline industry.

Because the airline industry has witnessed such a significant number of bankruptcies and liquidations, a natural extension of this paper would be to explore the survival strategies of airlines over time. In particular, utilizing the Cox Hazard model, we can examine how the use of strategies such as frequent flyer/customer loyalty programs, hub-and-spoke systems, airline alliances, cost structures, and other strategies have impacted the probability of surviving in the airline industry even during turbulent periods.

References

[1] Airline Deregulation Act, Pub. L. 95-504, 49 U.S.C. §1371 et seq. Approved October 24, 1978.

[2] Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*. New York, NY: John Wiley & Sons.

[3] Baltagi, B. H., and Pesaran, M. H. (2007). "Heterogeneity and Cross Section Dependence in Panel Data Models: Theory and Application," *Journal of Appl. Econometric*, 22(2): 229-232.

[4] Bamber, Greg J., Jody Hoffer Gittell, Thomas A. Kochan, and Andrew von Nordenflycht (2013). *Up in the Air: How Airlines Can Improve Performance by Engaging Their Employees.* ILR Press.

[5] Bamberger, Gustave, Dennis Carlton, and Lynette Neumann (2004). "An Empirical Investigation of the Competitive Effects of Domestic Airline Alliances." *Journal of Law and Economics*, 47(1, April): 195-222.

[6] Bernier, G., & Mouelhi, C. (2012). "Dynamic Linkages between MVA and Internal Performance Measures: A Panel Cointegration Analysis of the U.S. Insurance Industry." *Insurance and Risk Management*, 79 (3-4): 223-250.

[7] Borenstein, Severin (1989). "Hubs and High Fares: Dominance and Market Power in the US Airline Industry." *RAND Journal of Economics*, 20(3): 344-365.

[8]Borenstein, Severin and Nancy L. Rose (2009). "How Airline Markets Work…Or Do They? Regulatory Reform in the Airline Industry." National Bureau of Economic Research (Cambridge, MA) working paper #13452.

[9]Borenstein, Severin (2011). "On the Persistence Financial Losses of U.S. Airlines: A Preliminary Exploration." National Bureau of Economic Research (Cambridge, MA) working paper #16744.

[10] Breitung, J., & Das, S. (2005). "Panel Unit root Tests under Cross-Sectional Dependence." *Statistical Neerlandica*, 59 (4): 414-433.

[11] Breitung, J., & Pesaran, H. H. (2008). Unit Roots and Cointegration in Panels. *The Econometrics of Panel Data: Fundamentals and Recent Developments in Theory and Practice*, Springer Publishers.

[12] Breuer, J. B., McNown, R., & Wallace, M.S. (2001). "Misleading Inferences from Panel unit root Tests with an Illustration from Purchasing Power Parity," *Review of International Economics*, 9 (3): 482-493.

[13] Cable, J. R., and Mueller, D. C. (2008). "Testing for Persistence of Profits' Differences Across Firms," *International Journal of the Economics of Business*, 15 (2): 201-228.

[14] Caves, Richard (1962). *Air Transport and Its Regulators: An Industry Study*. Cambridge, MA: Harvard University Press.

[15] Chan, L.K.C., Lakonishok, J., & Sougiannis, T. (2001). "The Stock Market Valuation of Research and Development Expenditures," *Journal of Finance*, 56 (6): 2431-2456.

[16] Choi, I. (2001). "Unit root tests for panel data," *Journal of International Money and Finance*, 20 (2): 249-272.

[17] Combs, J., Crook, T., and Shook, C. (2005). "The Dimensionality of Organizational Performance and its Implications for Strategic Management Research." In: *Research Methodology in Strategy and Management*, Vol. 2, Ketchen D. J., and D. D. Bergh (Eds.). Emerald Group Publishing Limited, Elsevier, 259-286.

[18] Geroski, P. (1990). Modelling Persistent Profitability. In *The Dynamics of Company Profits: An International Comparison*, D. C. Mueller (Ed.). Cambridge: Cambridge University Press, 15-34.

[19] Granger, C.W.J. (1981). "Some Properties of Time Series Data and Their Use in Econometric Model Specification," *Journal of Econometrics*, 16 (1): 121-130.

[20] Gschwandtner, A. (2012). "Evolution of Profit Persistence in the US: Evidence from Three Periods." *The Manchester School*, 80(2): 172-209.

[21] Harris, R. D. F., & Tzavalis, E. (1999). "Inference for Unit Roots in Dynamic Panels Where the Time Dimension is Fixed." *Journal of Econometrics*, 91 (2): 201-226.

[22] Im, K. S., Pesaran, M. H., & Shin, Y. (2003). "Testing for Unit Roots in Heterogeneous Panels" *Journal of Econometrics*, 115 (1): 53-74.

[23] Jönsson, K. (2005). "Cross-sectional Dependency and Size Distortion in a Small-sample Homogeneous Panel Data Unit Root Test." *Oxford Bulletin of Economics and Statistics*, 67(3): 369-392.

[24] Jordan, William A. (2005). "Airline Entry Following U.S. Deregulation: The Definitive List of Startup Passenger Airlines, 1979-2003." *Paper for presentation at the 2005 Annual Meeting of*

the Transportation Research Forum, The George Washington University, Washington , D.C., March, 2005.

[25] Kahn, Alfred E (1971). *The Economics of Regulation: Principles and Institutions*. 2 Volumes. New York: John Wiley & Sons, Inc.

[26] Kahn, Alfred E (1988). "Surprises of Airline Deregulation." *American Economic Review Papers and Proceedings*, 78(2, May): 316-322.

[27] Keeler, Theodore E. (1972). "Airline regulation and market performance." *Bell Journal of Economics and Management Science*, 3(2, Autumn): 399-424.

[28] Lau, E., Baharumshah, A.Z., & Soon, S.V. (2013). "The Behavior of External Debt in Asian Countries: Evidence Based on Panel Unit Root Tests." *Journal of Business Economics and Management*, 14 (Supp 1): S377-S394.

[29] Levin, A., Lin, C. F., & Chu, C. J. (2002). "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties." *Journal of Econometrics*, 108 (1): 1-24.

[30] Maddala, G. S., & S. Wu, S. (1999). "A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test." *Oxford Bulletin of Economics and Statistics*, 61(1): 631-652.

[31] Madsen, E. (2010). "Unit Root Inference in Panel Data Models where the Time-series Dimension Is Fixed: A Comparison of Different Tests." *Econometrics Journal*, 13(1): 63-94.

[32] Mueller, D. C. (1977). "The Persistence of Profits above the Norm." *Economica*, 44(176): 369-380.

[33] Mueller, D. C. (1986). *Profits in the Long Run.* Cambridge, U.K.: Cambridge University Press.

[34] O'Connell, P. (1998). "The Overvaluation of Purchasing Power Parity." *Journal of International Economics*, 44 (1): 1-19.

[35] Pesaran, M. H. (2004). "General Diagnostic Tests for Cross Section Dependence in Panels." *Cambridge Working Papers in Economics*, Department of Applied Economics, University of Cambridge.

[36] Pesaran, M. H. (2007). "A Simple Panel Unit Root Test in the Presence of Cross-section Dependence." *Journal of Applied Econometrics*, 22(2): 265-312.

[37] Phillips, P. C. B. & Perron, P. (1988). "Testing for a Unit Root in Time Series Regression." *Biometrika*,75 (2): 335-346.

[38] Said, S. E., & Dickey, D. A. (1984). "Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order." *Biometrika* 71(3): 599-607.

[39] Smith, Jr., Fred and Braden Cox (2008)."Airline Deregulation". In: David R. Henderson (ed.). Concise Encyclopedia of Economics (2nd ed.). Indianapolis: Library of Economics and Liberty. [Online]Available at http://www.econlib.org/library/Enc/Airline Deregulation.html