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I I E S S

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LONG- RUN RELATIONS BETWEEN GDP AND AIR TRANSPORTATION: A COINTEGRATION ANALYSIS FOR THE PLATA RIVER AREA

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Abstract: The commercial aviation market has given an exponential growth in recent decades, becoming a dynamic sector with strong relevance to different economies of the world. Following cointegration methodology proposed by Engle and Granger (1987), the objective of this paper is to analyze the existence of long-term relationship between air transport and GDP for the economies of the Plata River area (Argentina and Uruguay). The results show that there is a long-run equilibrium relationship between the number of passengers and the GDP level, being the direction of causality from income to air transport. The effect of changes in the GDP on the air movement is considerably steeper in Uruguay than in Argentina, which is consistent with the characteristics of the aviation market of each country.

Keywords: GDP, air transport; Engle and Granger methodology; causality analysis; Argentina; Uruguay;

JEL Classification: *L83-O40*

1. Introduction

The last 60 years, in a context of increasing globalization, showed an impressive development of air transport networks (Bowen and Rodrigue, 2013). Air travel is growing faster, with total revenue passenger kilometers (RPKs) growth of 5.9% in mid-2014, the best since 2011, moving above the 5.5% trend of the past 20 years (IATA, 2014b). Further, air transportation is an important factor for the economic development of a region (Graham and Guyer, 2000) and, conversely, economic development may impulse a region to provide increased and better air transportation.

In the new global economy, economic opportunities are related to the mobility of people, goods and information. In economies where the air transport infrastructure is highly developed and connected, economic and social benefits result in positive multipliers (Fernandes and Rodrigues-Pacheco, 2010; Bowen and Rodrigue, 2013). On the one side, air transport is a significant foreign exchange earner facilitating the growth of international trade, tourism and investment; thus, contributing to capital goods that can be used in the production process (see Van De Vijver et al., 2014). In addition, air transport stimulates other economic industries as well as supporting the generation of employment and the rise in incomes (Özcan, 2013). Lastly but not least, air transport causes positive economies of scale, helping to boost a country's competitiveness.

Conversely, the economic growth of a country can also lead to significant effects on air transport by the development of hard infrastructures such as airports. A growing country needs to be connected with the global economy; firms need to be linked with potential foreign markets. In turn, airport infrastructures give the opportunity to promote export activities, including tourism, enhance business operations and productivity, and influence company location and investment decisions (Halpern and Bråthen, 2011). On the other hand, when there is economic prosperity, unemployment rates tend downward while household income increase. This imply that people have more discretionary income, and then, they can afford more air trips (Vasigh et al., 2013). Consequently, different effects will occur on regions they reach. In addition, increased economic activity contribute to generate employment, which ultimately causes an increase in business travel, the most important segment of travellers for airlines (Vasigh et al, 2013).

The precedent relationships let seeing there is typically a strong correlation between air traffic and economic growth; however, the causation between both variables is not entirely clear. Therefore, considering that the type of causality differs from one country to another (Fernandes and Rodrigues Pacheco, 2010), this paper is a written as a contribution to a better understanding of the air transport behaviour within a cointegration analysis and Granger causality framework, taking and comparing the cases of Argentina and Uruguay. Cointegration analysis and the estimation of an Error Correction Model (ECM) allow determining long-term relationships between the variables of interest. Meanwhile, Granger causality is a statistical methodology applied in the economic context to test the relationship between two or more variables. Moreover, it is a technique for determining whether one time series is useful in forecasting another.

The structure of the paper is as follows. Section 2 presents a review of the related literature. Section 3 describes the main characteristics of air transport in both countries. Section 4 introduces data and the methodological econometric framework. Next section presents the empirical results. The final sections present a general conclusion, policy implications and future perspectives.

2. Literature on causality relationship in the air transport

Economic growth worldwide is getting a significant boost from air transport, explaining why many countries have understood this sector as a competitive advantage (Button and Taylor, 2000; ACI, 2004). Then, different issues need to be addressed when assessing the impacts of this industry on national economies. Accessibility, for instance, is essential for the growth of air transport. In a study of Japanese airports, Yamaguchi (2007) shows significant productivity gained from improvement in air transport accessibility, mostly in agglomerated areas such as the Tokyo metropolitan region. Recent issues has also favoured the positive impact of air transport. This is the case of the emergence of the called “new economies” (such high-tech) which may encourage more international trade, thus, increasing further air travel demand (Button and Taylor, 2000; Graham, 2000). A study by Button and Taylor (2000) examined the link between international air service and economic development. Using data for 41 metropolitan areas in the U.S., the authors statistically analysed the link between “high-tech” employment and the number of direct routes to Europe offered by airports in the region. The analysis found that there was a strong and significant relationship between employment and air services to Europe, such that increasing the number of European routes served from three to four generated approximately 2,900 “high-tech” jobs.

Cooper and Smith (2005) examined the contribution of air transportation to tourism, trade, location/investment decisions and productivity. The study estimated that the net contribution of air transportation to trade (i.e., export minus imports) was €55.7 Billion in 2003 across the 25 current EU members, or approximately 0.6% of GDP
Recently, Tinoco and Sherman (2014) in their empirical research study found evidence of positive influences of air transport, and airline consortia to the local economic development. Overall, Coto-Millán et al. (2013) show that a 1% increase in performance logistics index generate an increase of world economic growth of more than 0.011%.

Regarding studies from international organisms, it is also found a permanent interest in analysing the impact of the air transport sector on national economies. The study led by the World Bank (Arvis and Shepherd, 2011) provides a robust tool to incorporate in future research about transport and international trade such as the Air Connectivity Index (ACI). The authors proved for a great number of worldwide airports (211) that liberalization of air transport markets and the share in international production networks is closely correlated with the measure of connectivity.

Despite the mentioned impacts of air transport on economic development and the strong correlation between air transport demand and economic growth, there are few studies addressing the causal relationship between these variables (Green, 2007).

This kind of body of literature has emerged in the last years. Regarding air cargo demand, Chang and Chang (2009) analyse the relationship between air cargo expansion and economic growth in Taiwan under a Granger causal framework. Their results indicate that air cargo traffic and economic growths are cointegrated showing that in the short and in the long run there is a bidirectional causality. From a different geographic sphere, Fernandes and Rodrigues Pacheco (2010) and Marazzo et al. (2010) investigate the relationship between air transport demand (using domestic route passenger-kilometers data as proxy of air demand) and economic growth (GDP as proxy) in Brazil. Both studies found a co-integration between the mentioned variables and the existence of a unidirectional equilibrium relationship. Using panel data, Mukkala and Tervo (2013), conduct an empirical analysis based on data for 86 regions and 13 countries at the European level. Their results show the existence of causality from air traffic to regional growth in peripheral regions while for the core regions the causality is less evident. On the other hand, Chi and Baek (2013) analyse both the short and long run relationships between economic growth and the movement of air passenger and cargo using the ARDL dynamic model for the case of the USA. The issue of how some external shocks have effects on the air transport demand is also examined by the authors. Main results indicate that in the long-run, air passenger and cargo demand tends to increase with economic growth. Finally, in a more recent study, Hu et al. (2015) examine 29 provinces in China from 2006-2012. Main conclusions show evidence of a long run equilibrium relationship between economic growth and domestic air passenger traffic. They also found a long run bidirectional Granger causal relationship between the two variables.

This paper examines the dynamic relationship between air transport (measured as the number of aircraft passengers) and economic growth within a Latin America context, in order to answer the following questions. First, is there a long run equilibrium relationship between air transport industry and economic growth in Argentina and Uruguay? Second, if a stable long run relationship exists, what is the direction of the causal relationship between these two variables?

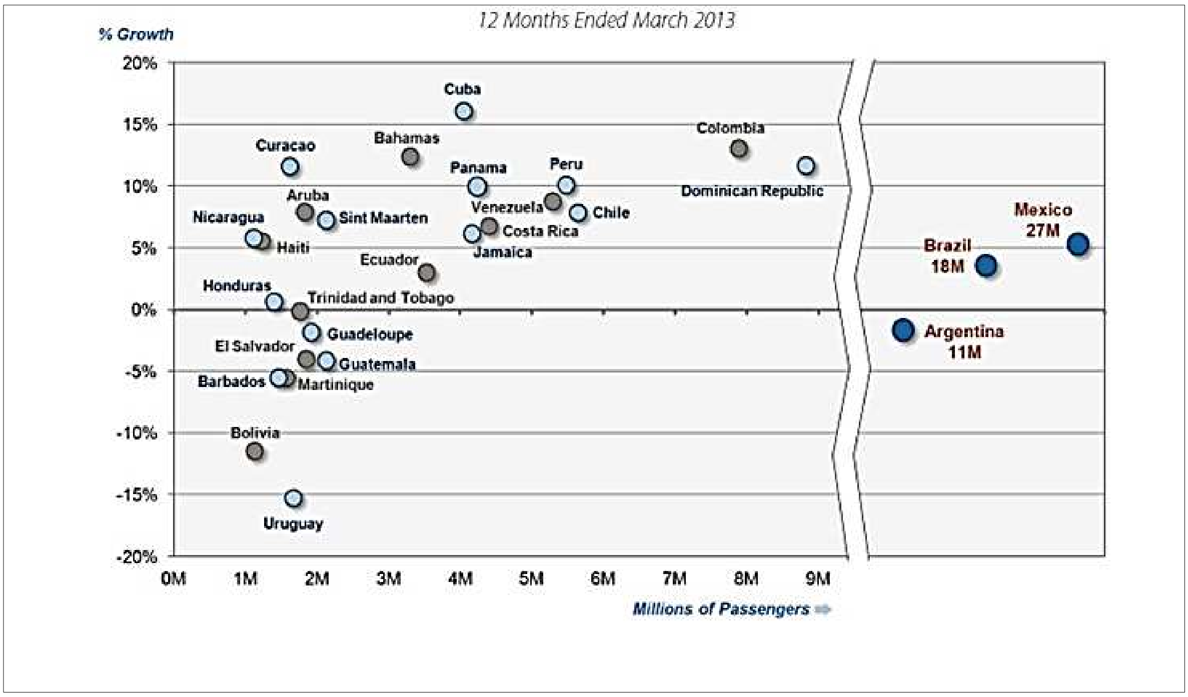
3. Context of the countries selected

In this study, it has been considered two Latin American countries located at Southern Cone region of South America: Argentina and Uruguay.

The Latin America and Caribbean (LAC) region has a small share in the international air transport market. It could be argued that there is significant room for growth, which will depend primarily on economic growth, but also on a wide combination of variables, including availability and quality of infrastructure, an efficient air traffic control system, adequate investment climate, and tourism development, among others (Serebrisky, 2012).

According to recent industry reports (ALTA, 2013), in International LAC markets, Mexico and Brazil were the two top countries, followed by Argentina, the Dominican Republic and Colombia. Mexico and Brazil showed a 5% and 3% growth during the 12 months ending March 2013 while traffic in Argentina declined by -2% (see Figure 1). The cessation of operations of the national carrier (Pluna) affected the international air travel to Uruguay, which decreased by 15%.

Figure 1. Growth in LAC passenger's traffic, 2012-2013



Source: ALTA, 2013

3.1 Argentinean Context

With an open economy integrated into the world markets, Argentina is one of the largest economies in Latin America. It has a leading role in advocating the region's policy stance, as it is one of the two countries representing South America region at the G-20. In addition, it is a founding member of the Southern Common Market (MERCOSUR for its acronym in Spanish).

Since 2003, Argentina has exhibited an outstanding economic performance with high growth rates. From 2003 to 2011, GDP grew at an average annual rate of 7.6% (World Bank). Notwithstanding the impact of the international economic crisis, the Argentine economy bounced back rapidly. During 2010, the economy grew 9.2% compared to 2009, experiencing an 8.9% growth during 2012, and a 2.9% growth during 2013 (World Bank).

Regarding the Argentine air transport context, the country has a network of 54 airports, 21 of which are international. Traffic volumes vary widely among them with Buenos Aires' two airports, Ezeiza and Aeroparque-Newbery, accounting for two-thirds of passenger traffic (Barros, 2008).

There are over 30 air carriers offering direct flights from Argentina to over 40 destinations, reaching every continent in the world. This well developed and extensive infrastructure ranks Argentina second in Latin America in the World Bank's Logistics Performance Index (Ministry of Foreign Affairs).

For a country such as Argentina, air connectivity with the major markets is essential for the productive capacity of the economy and for the long-term economic development. During the period 2002-2009, Argentine connectivity increased 12%. It is estimated that every 10% increase in connectivity, relative to GDP, boost the economy's long run productive potential by US$401 million (IATA, 2010).

Air transport not only directly contributes to the country's GDP by generating wages, profits and tax payments, but also supports jobs and value-added in the wider economy through its supply chain. In 2008, the industry supported 36.148 jobs (direct, indirect and induced) and contributed US$2,713 (0.8%) to Argentine GDP, according to the International Air Transport Association (IATA, 2010). From this contribution, US$ 522 million were directly obtained from the output of the airlines, airports and ground services.

3.2 Uruguayan Context

Uruguay is a market-oriented economy in which State has played a noteworthy role. National economy has achieved the longest period of growth in history, registering annual average growth rates of over 5.5% during the last 11 years (World Bank). This expansion has been accompanied by a growth of the GDP per capita, which grew from US$ 10,000 in 2005 to almost US$ 17,000 in 2013, allowing Uruguay's economy to stand out as having the highest GDP per capita in Latin America (Uruguay XXI).

In 2013, total international air passenger traffic to/from Uruguay was 2 million passengers (DINACIA). Uruguay's largest airport is Carrasco "General Cesáreo L. Berisso" International Airport, serving the capital Montevideo, which handled over 80% of Uruguay's international traffic. The other major airport with international traffic is "Capitan Corbeta CA Curbelo" International Airport in Laguna del Sauce (Punta del Este) which serves especially to countries at Southern Cone region of South America. Due to Uruguay's small size and relatively flat terrain, there is limited domestic air traffic in the country.

The airline, *Primeras Líneas Uruguayas de Navegación Aérea* (Pluna) was the national airline of Uruguay with a 25% state-owned until its operation cessation in July 2012. In this year national government reassumed control of Pluna after the carrier's controlling shareholder Leadgate announced that it will withdrawal from the ownership structure of the company (Uphoff, 2012).

The demise of Pluna brought implications for the small but fast-growing intra-regional international market within the Southern Cone region of South America. Pluna left a niche in this market with about 40% of its passenger traffic transiting in Uruguay to destinations in the other four Southern Cone countries of Argentina, Brazil, Chile and Paraguay (CAPA).

The major international origin/destination (O/D) markets for Uruguay is Argentina, followed by Brazil and Spain. Other major markets include the United States, Chile, Paraguay, Mexico, Italy, Peru and Panama (InterVISTAS, 2009).

4. Data and methodology

The selected variables to be considered are the number of passengers and the GDP. The first variable is obtained from the World Bank database and is defined as the total of air passengers carried, arriving or departing, by both domestic and international air carriers registered in the country. The GDP series is obtained from the Penn World Table (Feenstra, Inklaar and Timmer, 2013) and is express in Purchasing Power Parity, eliminating the effect of prices distortions between countries. The considered period is 1970 to 2011 for the case of Argentina and 1970 to 2009 in the case of Uruguay, due to lack of data for the Passengers variable for the years 2010 and 2011.

As mentioned, a cointegration analysis and an Error Correction Model will be run, following the methodology proposed by Engel and Granger (1987). At the same time, the direction of the relationship between the variables under consideration will be determined, using a Granger causality analysis.

First, the order of integration of the series is identified by applying the Augmented Dick and Fuller (ADF) unit root test following the technique of Dolado et al (1990). To improve analysis of stationarity is better differentiate the tendency and the cycle of the series using the Hodrick-Prescott (HP) filter considering a value of $\lambda = 100$. When there are two or more non-stationary series, it is possible to find a linear combination that is stationary. In this case, it is said that the series are cointegrated. To check if the series are cointegrated is necessary to apply Cointegration Tests.

If it is found that the series are cointegrated, that means that their time paths are influenced by the extent of any deviation from long run equilibrium. After all, if the system is to return to long run equilibrium, the movement of at least some of the variables must respond to the magnitude of the disequilibrium. The dynamic model related with these characteristics is called Error Correction Model. In an ECM, the short-term dynamics of the variables in the system are influenced by the deviation from equilibrium (Enders, 2003).

Considering two cointegrated series *X* and *Y*, is possible to define the short and long run relation estimating the ECM, as:

$$\Delta Y_t = \lambda + \alpha_1 \Delta Y_{t-1} + ... + \alpha_i \Delta Y_{t-i} + \beta_1 \Delta X_{t-1} + ... + \beta_j \Delta X_{t-j} + \phi z_{t-1} + \varepsilon_t \quad (1)$$

$$\Delta X_t = \lambda + \alpha_1 \Delta Y_{t-1} + ... + \alpha_i \Delta Y_{t-i} + \beta_1 \Delta X_{t-1} + ... + \beta_j \Delta X_{t-j} + \phi z_{t-1} + \varepsilon_t \quad (2)$$

where λ is a constant, both *i* and *j* are the number of lags sufficient to cause the disturbance term ε_t to be I(0), z_{t-1} is the cointegration vector. Inclusion of z_{t-1} in the ECM acts as error correction term. The coefficients β in Equation (1) reflect the immediate response of *Y* to a change in *X* and the coefficients α reflect the immediate response of *X* to a change in *Y*. The EC term represent the long rung equilibrium among the variables and the coefficient ϕ the speed of adjustment to short-run equilibrium in relation to long run equilibrium.

In the context, it is possible to test the sense of the causality through applying the Granger Causality Test. Granger causality implies that a temporal variable *Xt* causes another temporal variable *Yt* if the past information provided by *Xt* improves the predictions about *Yt* that can be done by just using the past information of *Yt*. (Marazzo et al., 2010). Note that the test is based on an improvement in prediction based on past values, it is often referred to as a test of "temporal relations" (Granger and Newbold, 1977) rather than of pure causality.

The existence of Granger causality at the presence of stationary series as in a VAR model can be analyzed considering if some parameters of the model are zero in a context of an F-test procedure. However, Toda and Phillips (1993) show that when the series are not stationary the test statistic has not a standard distributions (Rambaldi and Doran, 1996).

In this context, is necessary another test to consider the causality. The solution is the VEC Granger causality/block erogeneity Wald test for exclusion of the lagged independent variables proposed by Toda and Yamamoto (1995). This test considers if the lags of one variable Granger cause any other of the variables in the system, restricting all lags of one variable to zero in the equations of the other variables. The likelihood ratio of this test has a χ^2 distribution (Enders, 2003). This test determines, in this way, whether an endogenous variable can be treated as exogenous.

After estimating an ECM, is also possible to check the effect of a shock in one variable on the other variables. The impulse-response functions show the response of the contemporary endogenous variables to a perturbation in one of them, assuming that this perturbation disappears in subsequent periods and new perturbations not occur.

5. Results

Tables 1 and 2 show the results of the ADF test applied to the selected series, expressed in logarithm to could obtain later the elasticities. The number of residuals in the test is automatically determined according the Schwarz info criteria. We can see that both series (Log Passengers and Log GDP) for the considered countries are integrated of order 1.

Table 1: ADF Tests (Log Passengers and Log GDP series) - Argentina

Passengers	**Level**	**First differences**
Intercept and trend	-2.516 (0.319)	-6.816* (0.000)
Intercept but not trend	-1.810 (0.370)	-6.816* (0.000)
Neither intercept nor trend	1.384 (0.956)	-6.506* (0.000)
GDP	**Level**	**First differences**
Intercept and trend	-2.604 (0.280)	-3.998* (0.016)
Intercept but not trend	0.312 (0.913)	-4.042* (0.003)
Neither intercept nor trend	2.259	-3.165*

	(0.993)	(0.002)
** denotes rejection of the hypothesis at the 0.05 level. P-values expressed in brackets*		

Source: Own calculations

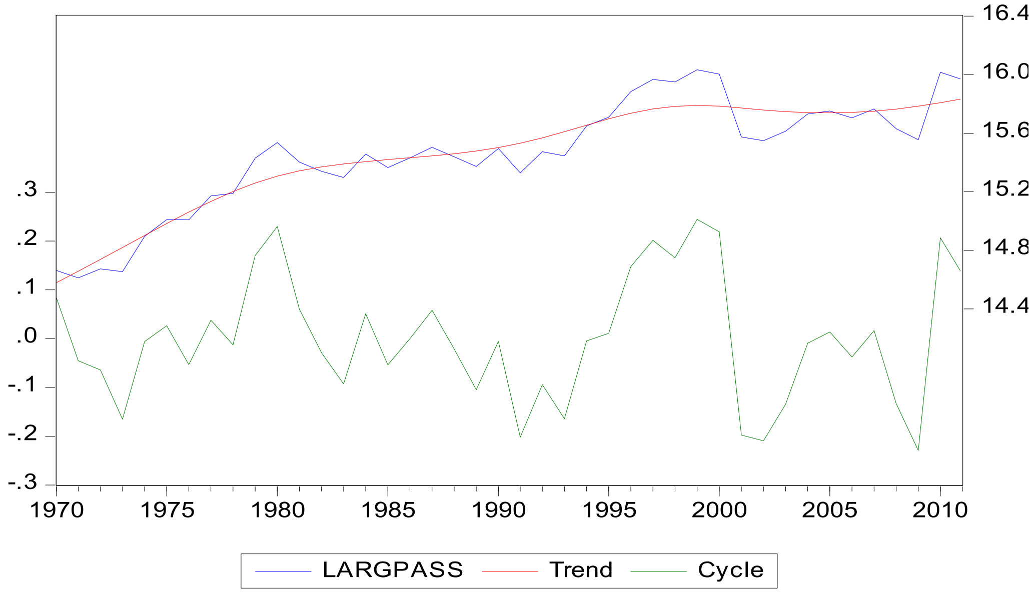
Table 2: ADF Tests (Log Passengers and Log GDP series) - Uruguay

Passengers	**Level**	**First differences**
Intercept and trend	-3.934* (0.020)	-6.055* (0.001)
Intercept but not trend	-2.046 (0.266)	-6.124* (0.000)
Neither intercept nor trend	0.643 (0.851)	-6.128* (0.000)
GDP	**Level**	**First differences**
Intercept and trend	-3.032 (0.136)	-3.571* (0.045)
Intercept but not trend	-1.102 (0.705)	-3.597* (0.010)
Neither intercept nor trend	1.106 (0.927)	-3.405* (0.000)
** denotes rejection of the hypothesis at the 0.05 level. P-values expressed in brackets*		

Source: Own calculations

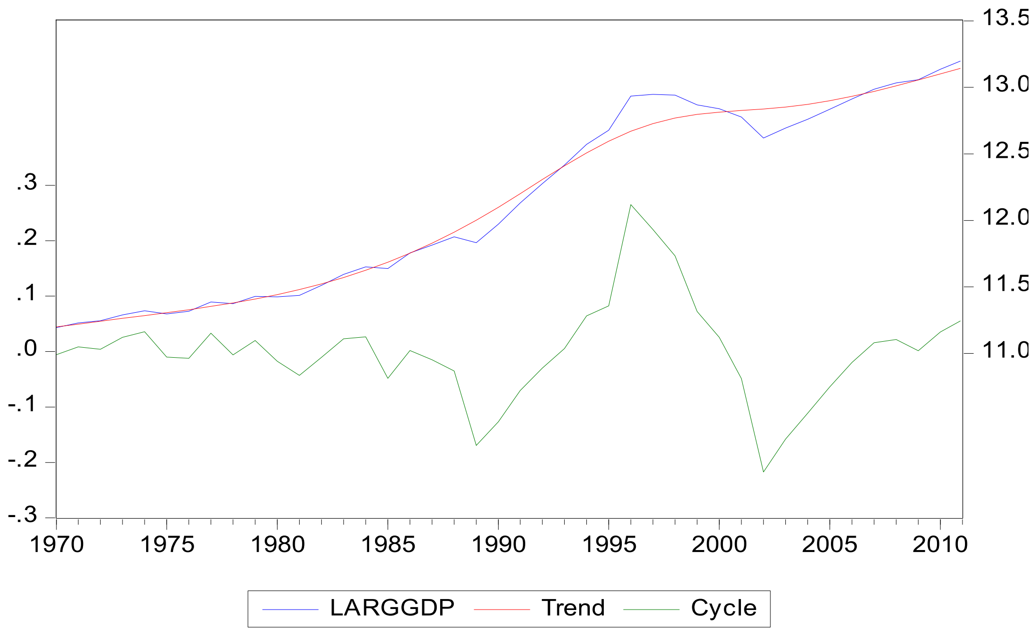
An additional element that can be included to improve the analysis is the application of the HP-test to differentiate graphically the tendency and the cycles in the series. Figure 2, in the appendix, shows the decomposition of the Passengers series according to the HP filter for Argentina while Figure 3 shows the same analysis for the GDP. Figures 4 and 5 repeat the analysis for Uruguay. These figures suggest that both series show a very similar trend in the long run for each country. At the same time, the cyclic series are stationary and also comparable, although is possible to identify considerable peaks.

Figure 2: HP filter applied to Log Passengers series - Argentina



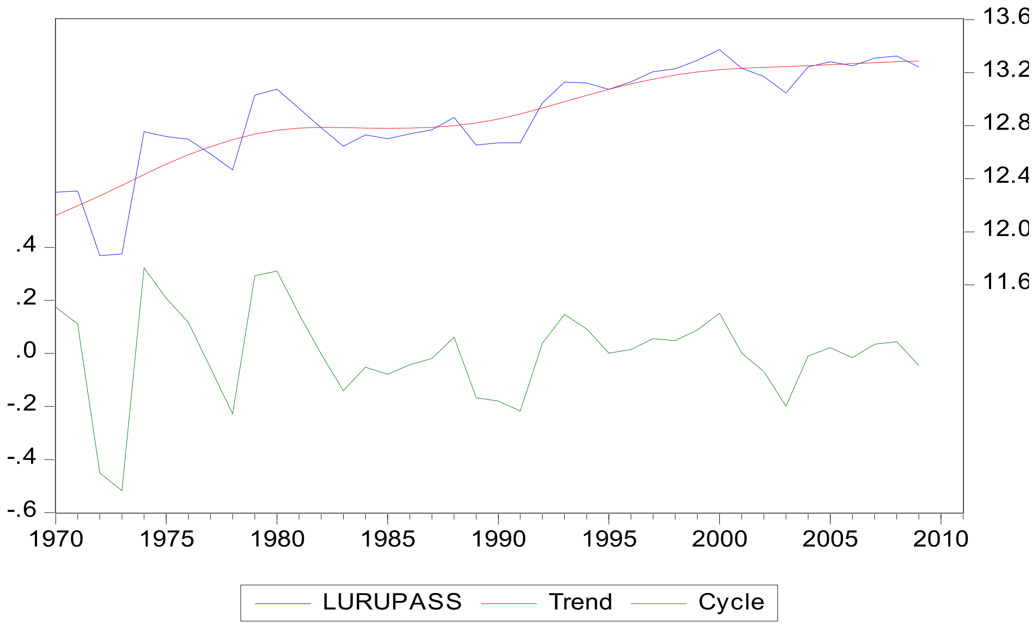
Source: Own calculations

Figure 3: HP filter applied to Log GDP serie - Argentina



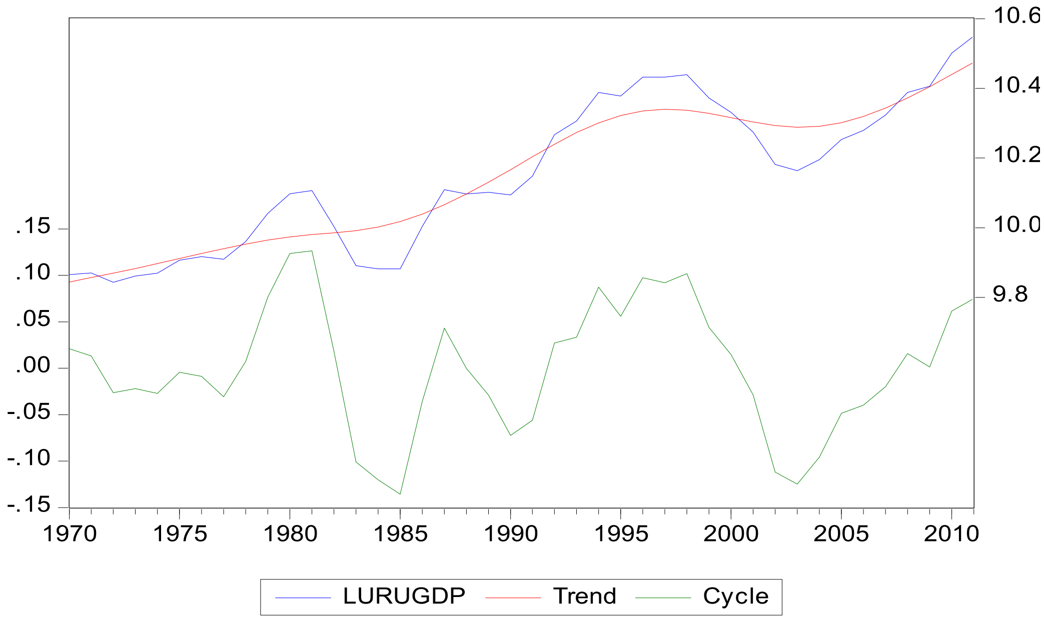
Source: Own calculations

Figure 4: HP filter applied to Log Passengers serie - Uruguay



Source: Own calculations

Figure 5: HP filter applied to Log GDP serie - Uruguay



Source: Own calculations

If two or more series are non stationary but integrated of order one, the next step consists in establish whether there is a linear combination of the series that is stationary, indicating that are cointegrated. Tables 3 and 4 show the results of the Johansenn cointegration test for each country. Results show that for both considered countries, the series are cointegrated.

Table 3: Johansen Cointegration Test - Argentina

Trace test		
Hypothesis	*Trace Statistic*	*Critical Value*
None*	16.834	15.494
At most 1	1.102	3.841
Maximum Eigenvalue		
Hypothesis	*Max-Eigen Statistic*	*Critical Value*
None*	15.731	14.264
At most 1	1.102	3.841
** denotes rejection of the hypothesis at the 0.05 level*		

Source: Own calculations

Table 4: Johansen Cointegration Test - Uruguay

Trace test		
Hypothesis	*Trace Statistic*	*Critical Value*
None*	18.496	15.494
At most 1	2.442	3.841
Maximum Eigenvalue		
Hypothesis	*Max-Eigen Statistic*	*Critical Value*
None*	16.053	14.264
At most 1	2.442	3.841
** denotes rejection of the hypothesis at the 0.05 level*		

Source: Own calculations

As there are two cointegrated series for both countries, the next step consists in the estimation of the long run relation between the variables: the ECM. Table 5 shows the results of the estimation of the cointegration relation for Argentina, while Table 6 shows the estimation for Uruguay. To simplify the presentation of results, we avoid in the tables the coefficients of the lagged variables for each model.

Table 5: Error correction model - Argentina

Error correction	D(log(Passengers))	D(log(GDP))
z_{t-1}	-0.510 (-2.979)	-0.179 (-2.063)
Constant	0.002 (0.070)	0.031 (1.971)
R squared	0.460	0.504
Adjusted R squared	0.213	0.277

Source: Own calculations

Table 6: Error correction model - Uruguay

Error correction	D(log(Passengers))	D(log(GDP))
z_{t-1}	-0.559 (-4.090)	-0.020 (-0.420)
Constant	0.038 (0.024)	0.009 (0.008)
R squared	0.563	0.275
Adjusted R squared	0.493	0.158

Source: Own calculations

A very important aspect is to determine the sense of the causality between the variables under consideration. As we mention, in this context, the appropriate methodology is the VEC Granger causality/block erogeneity Wald test for exclusion of the lagged independent variables.

Table 7: Wald test for exclusion of the lagged independent variables-Argentina

	χ^2	Probability
Dependent variable: D(log(Passengers)) D(log(GDP))	5.930	0.115
Dependent variable: D(log(GDP)) D(log(Passengers))	3.719	0.293

Source: Own calculations

Table 8: Wald test for exclusion of the lagged independent variables-Uruguay

	χ^2	Probability
Dependent variable: D(log(Passengers)) D(log(GDP))	7.750	0.020
Dependent variable: D(log(GDP)) D(log(Passengers))	0.667	0.716

Source: Own calculations

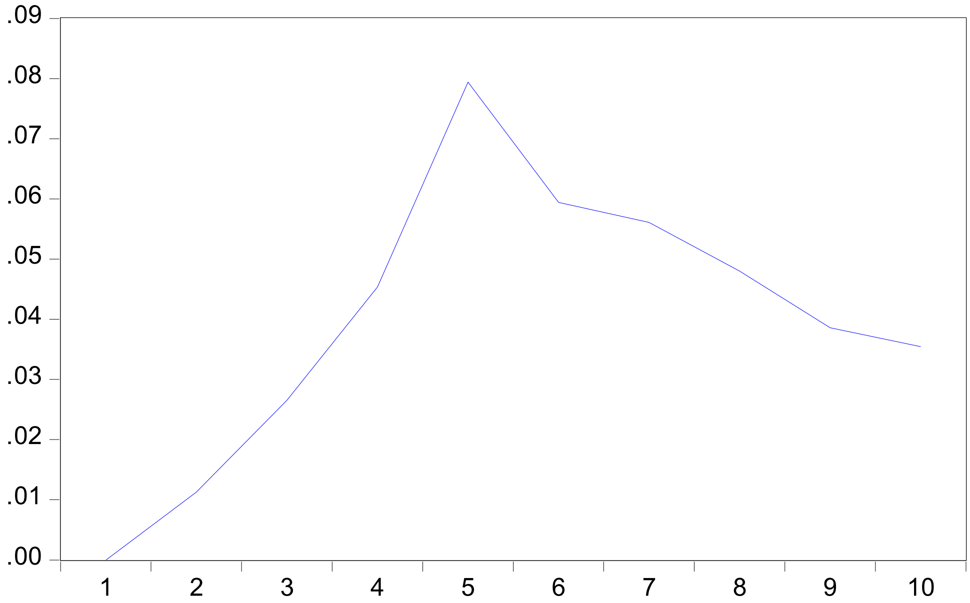
As mentioned, the above test suggest two interesting results. First, it offers the possibility to treat some of the endogenous variables as if they were exogenous. Second, it determines causality in the Granger sense between the variables.

The results of the Wald test for exclusion of the lagged independent variables in both countries show that GDP can be treated as an exogenous variable, having a relationship in advance or causality in the Granger sense regarding the number of passengers[1].

[1] In the case of Argentina, the p-value is 0.11. As this value is near the 10% of error, the null hypothesis can be rejected in the limit.

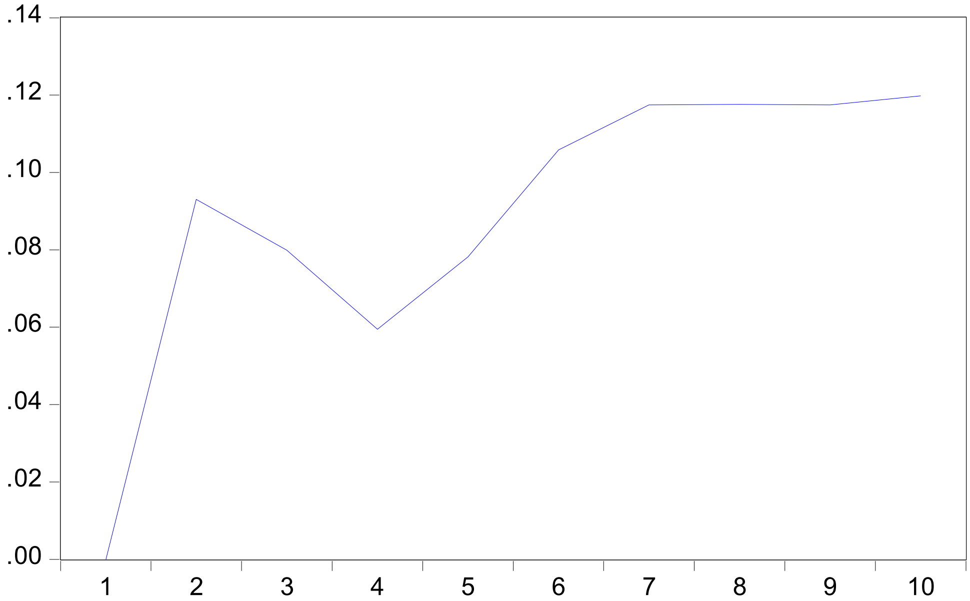
This mentioned causal link can be analyzed by considering, from the impulse response functions, the effects of a shock on GDP on the number of passengers. As shown in figure 6, in the case of Argentina, there is an increasing effect for an extended period of time, reaching a maximum of 5 times and then beginning to decline from then on. On the other hand, figure 7 shows that for Uruguay the effect is different, because a strong initial effect that persists over time is observed.

Figure 6: Impulse Response Function (shock in Log GDP on Log Passangers) Argentina



Source: Own calculations

Figure 7: Impulse Response Function (shock in Log GDP on Log Passangers) Uruguay



Source: Own calculations

The cointegration equation shows the long run relationship between the variables. Equation (3) shows the relation for Argentina while Equation (4) shows the relation for Uruguay.

$$\log(Passengers) = 12.066 + 0.283\log(GDP) \quad (3)$$

$$\log(Passengers) = -0.452 + 1.317\log(GDP) \quad (4)$$

The coefficients of log (GDP) can be interpreted as the elasticity of GDP respect to the number of passengers. It means that an increase in 1% in the GDP elevates the number of passengers in 0.28% in the case of Argentina and 1.317% in the case of Uruguay.

The different magnitude of these coefficients can be explained by the following aspects. In the case of Uruguay, as previously contextualized, due to the small size of the country and its relatively flat terrain, domestic air traffic is almost inexistent. Consequently, most of the air passenger's movements are international ones and in its turn, those are mainly tourism-motivated. Hence, this is congruent with the outstanding economic performance of the country in the last decade that has allowed Uruguayans to improve their welfare. Thus, as evidenced within the literature, international tourism trips has a higher sensitivity to income than a normal good (income elasticity higher than unity). In particular, tourism is a key factor for the

Uruguayan economy by creating value-added, employment and income (Brida et al., 2010). For the case of Argentina, the demand for the domestic air travel is strong. The proportion of total air travel accounts for 42% of Argentina's civil aviation (Ministry of Tourism).

6. Conclusions

As one of the fastest growing aviation markets worldwide, the LAC region has successfully overcome numerous challenges and is expected to continue expanding (ALTA, 2013). This article focuses on the importance that air transport has for the economies of Argentina and Uruguay. Therefore, the relationship between the aircraft passengers' movement and economic growth is analysed.

Regarding the two concerns at the beginning of this study, it can be affirmed that: First, there exists long run cointegration between air passenger traffic and economic growth in Argentina and Uruguay. In this sense, the result is in line with that found for the case of Brazil (Marazzo et al., 2010), USA (Chi and Baek, 2013), European countries (Mukkala and Tervo, 2013) and China (Hu et al, 2015). This suggests that this kind of tests jointly with sophisticated forecasting techniques can be strategic methodologies for stakeholders' decisions related to the management, planning and economic performance of air transport operations.

Second, regarding the direction of the causality, Granger causality tests shows that there is long run unidirectional causality between air transport expansion and economic growth. The absence of Granger causality from air transport to GDP could be explain by the fact that air transport sector is still growing in South America region. Thus, for the countries studied the air industry is not very developed, and aviation infrastructure investment is needed to boost economy growth.

Third, the study of the dynamic interactions of the variables, through the Impulse-response analysis, indicates for Uruguay a strong and continuous reaction of air passenger traffic to an increase in GDP. Similarly, Argentina shows a strong reaction but with a short duration effect over time.

Policy and management implications could be drawn from the overall empirical findings. First, the study provides strong evidence that GDP can be a key driving force by increasing the demand for air travel in the long run for the countries analysed. For the case of Uruguay, after its economy recovery and current outstanding performance, is likely to increase outbound travel flows. In the case of Argentina, the spectrum of positive effects reaches both domestic and international air transport flows. The causality direction found for Argentina suggest that current travel restrictions policies have little adverse or no effect on economic growth.

As further implications for the Uruguayan case, the results can offer critical inputs for regional and international airlines, which can find in the Uruguayan market an attractive target. For government and national aviation authorities the current conjuncture is a positive moment to boost the air transport sector throughout new bilateral agreements. These allow increasing foreign passengers' flows (Button and Taylor, 2000) and recovering the lost connectivity after the demise of the national carrier, Pluna.

If the previous implications are put into practice, this would naturally yield the feedback effect for the development of the air travel industry and bidirectional causality relationships between the two variables.

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