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Evolving competition between low-cost carriers and full-service carriers: The case of South Korea

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ABSTRACT

This study explores the impact of domestic low-cost carriers (LCCs) on regional tourism and aviation industries. In particular, it articulates the changing competitive dynamics between LCCs and full-service carriers (FSCs). The Lotka-Volterra (LV) model, utilising the newly proposed moving-window concept, is used for the assessment of the influence of LCCs on the South Korean and airline industry. Analysis results demonstrate that the competitive dynamics between LCCs and FSCs are not static and have evolved over time. The study proposes an efficient and effective change analysis and enables strategic planning for aviation industries.

1. Introduction

Since the launch of Southwest Airlines in 1971, the concept of low-cost carriers (LCCs) has flourished across the globe. One of the most prominent consequences of the emergence of LCCs is the growth of the tourism industry (Chung and Whang, 2011; Olipra, 2012; Tsui, 2017). Numerous authors have explored the impact of LCCs on tourism in different countries, such as Saudi Arabia, Poland, Spain, New Zealand, and Italy (Alsumairi and Tsui, 2017; Olipra, 2012; Pulina and Cortés-Jiménez, 2010; Rey et al., 2011; Tsui, 2017; Vera Rebollo and Ivars Baidal, 2009). Regardless of the geography of the assessed markets, all these studies unanimously conclude that the introduction of the LCCs increases tourism demand. In other words, it can be said that LCCs induce their own new market. LCCs have also altered the business dynamics of the entire aviation industry by competing against the previously dominant full service carriers (FSCs) (Pels, 2008). Researchers have also explored the impact of LCCs on different aviation markets; however, the conclusions are conflicting and vary across regions. For example, some researchers reported that LCCs have failed to compete against the FSCs in Australia, as happened earlier in the USA, and UK (Forysth, 2003; Graham and Vowles, 2006; UK Civil Aviation Authority, 2006). However, studies assessing South Korea, Europe, Western Europe, South Africa, and Taiwan show LCCs competing successfully against FSCs (Alderighi et al., 2012; Chung and Whang, 2011; Dobruszkes, 2006; Fourie and Lubbe, 2006; Lu, 2017). This indicates that LCCs may have different impact on the aviation markets in different geographies, as highlighted by authors such as Zhang et al. (2008). However, few attempts have been made to refine the approach for assessing the dynamics of LCC-FSC competition and address the element of conflict; this lacuna is addressed in this study.

This study is advanced with the recognition that the success and failure of the LCCs may vary across geographies, and the dynamics of the aviation market are yet to be fully analysed. We build our study on the assumption that the competitive nature of LCC-FSC competition is not static; this leads to different conclusions, depending on the interval chosen for the analysis period. With this, we attempt to answer the following questions: 1) for the general aviation market, do LCCs induce their own new market without competing with the FSCs or do they, in fact, compete with FSCs in the same market? (2) can both these phenomena occur simultaneously because of non-static competition dynamics over time? (3) how does LCC-FSC competition fare in the presence of other means of fast transport, such as high-speed train? (4) how does the market growth (shrinking or expanding) affect the competition? To answer these questions, we apply the Lotka-Volterra (LV) model to the South Korean aviation market and address its enhanced scope by applying a moving-window LV model. The LV model is the first, and by far the most commonly used model to investigate competition dynamics. As the LV model cannot detect changes in competition dynamics over time, a moving-window technique is used to overcome this limitation.

The South Korean aviation market is ideal to find answers to the above mentioned questions because, first, it has predominant presence of LCCs and LCCs traffic data are readily available for a 10-year period. Second, South Korea has a typical leisure destination named Jeju...
Island, for which there is no other means of fast transport except air. Over 90% of travellers to Jeju Island use air transport (Chung and Whang, 2011). Third, on certain routes, the competitor is high-speed train, which allows an insight into the performance of LCCs in the presence of a competitor. Moreover, South Korean FSCs have deployed their own LCCs to compete with independent LCCs.

Our paper is organised as follows. Section 2 presents a comprehensive review of LCCs and the LV model. Section 3 describes an overview of South Korean aviation and tourism industries. Section 4 discusses the strengths of the LV model and addresses the concept of moving-window LV model. The details of experiments and results are discussed in section 5. Section 6 contains a discussion on the case studies. The analysis findings are presented in Section 7. The limitations and the aspects of future studies are given in Section 8.

2. Literature review

2.1. Low-cost carriers

Since its debut, the strategy of LCCs in the airline industry has been the focus of discussion by various researchers and analysts. The literature proposes that the emergence of LCCs has had a multidimensional impact, especially on the economy, the tourism industry, and aviation itself. This impact is usually known as “Southwest effect” as the term first coined by the US Department of Transportation (Freiberg and Freiberg, 1998). Freiberg and Freiberg (1998) explained that Southwest effect has three main elements: i) increased supply with low costs creating competition for existing airlines, ii) pre-existing airlines decreasing the air fare, and iii) sales rise for all airlines.

Donzelli (2010) explains the economic side of LCCs by presenting how LCCs have played an important role in the regional economic development by promoting an increase in traffic demand, international tourists, and job opportunities.

Based on a review of prominent literature from the last two decades, it is obvious that tourism has grown rapidly since the emergence of LCCs. Several studies, such as Bieger and Wittmer (2006), Forsyth (2006), Pulina and Cortés-Jiménez (2010), Rey et al. (2011), Vera Rebollo and Ivars Baidal (2009), and Tsui (2017) have reported LCCs as a source of tourism growth. From these studies, it can be inferred that LCCs attract new tourists, thereby supporting the argument that LCCs create their own new market.

Aviation is divided in two categories: the first, conventional FSCs, represent premium services and, the second, LCCs represent low-budget travel. Despite many studies, it is still not confirmed whether LCCs compete with FSCs or the LCCs market is completely different from the FSCs market. Some researchers concluded that LCCs do not compete against FSCs, and if they do, they do so only partially (Forsyth, 2003; Gillen and Morrison, 2003; UK Civil Aviation Authority, 2006). In contrast, some authors are convinced that LCCs have succeeded in gaining a competitive advantage over FSCs (Chung and Whang, 2011; Franke, 2004; Fu et al., 2006). Franke (2004) reported that LCCs compete with FSCs, and can deliver 80% of the service quality at half the cost of conventional carriers. In addition, Skeels and General (2005) showed that LCCs compete with FSCs, and also create their own new market demand. However, these studies lacked an explanation of how and why these two phenomena occur simultaneously. This study proposes that the literature which does not find competitive behaviour between LCCs and FSCs basically refers to the early stages of LCC development when LCCs had a very niche product. This study addresses the fact that competition dynamics may change over time, and in the case of South Korea, these two phenomena occurred in two stages; initially, LCCs competed against FSCs and once LCCs established their own new market, the LCC-FSC competition reduced.

Despite the LCCs being in operation within South Korea for a decade now, there is limited literature on South Korean LCCs. Kim and Lee (2011) analysed customer satisfaction with LCCs, while Chung and Whang (2011) describe how South Korean LCCs encouraged new travellers to visit Jeju Island. However, no work has been done in demonstrating the actual competitive dynamics between LCCs and FSCs.

2.2. Lotka-Volterra model

The LV model is often used to analyse the competition between two entities in various research problems. Also known as predator-prey equations, LV equations are used frequently in ecological systems involving predator and prey species (Plank, 1995). The use of the LV model provides two advantages. First, it can be used to evaluate competition dynamics of competing entities. Second, it can provide accurate forecasts.

Recently, the LV model has caught the attention of several researchers and has been used in a variety of non-ecological contexts. Examples include better forecasting of mobile phone services in a saturated competitive environment as compared to hass model (Chang, Li & Kim, 2014), sales forecasting (Hung et al., 2017), and modelling of cancer growth in the healthcare sector (Tannenbaum et al., 2018). The following applications of the model are relevant to our study. Lo (2012) used the LV model to analyse the competitive dynamics in transportation. Tsai et al. (2013) used the LV model to explain the market competition between liquid crystal display panels of mobile phones and personal computers.

Despite the numerous studies regarding LCC-FSC competition, no researchers have used the LV model for investigating the impact of LCCs. The application of the modified LV model, with our enhancements, to assess the change in dynamics over time is a unique idea within this field.

3. Aviation industry and tourism

Korean Air and Asiana Air led the Korean aviation market for over 40 years. But the duopoly was broken when the combined effects of Air Asia’s (pioneer LCC in Asia) success story, airline de-regulation in Asia, regional liberalisation, and increase in oil price in 2004 encouraged the deployment of LCCs in the Asian markets. By 2005, when it was already evident that the price had overtaken comfort as the main factor in the aviation market, Hansung Airlines adopted the low-cost business strategy and claimed to be the pioneering LCC of South Korea. Full emergence of LCCs occurred after the global economic crisis of 2008, when three more LCCs emerged in the South Korean aviation industry. Table 1 shows all South Korean airlines as of 2017; there are two FSCs and six LCCs. Of the later, three are FSC-owned.

The growth of aviation industry has impacted the growth of tourism industry. Fig. 1 depicts the stagnant growth of South Korean tourism revenue until 2007, after which it increased sharply, coinciding with the full emergence of LCCs in South Korea; the recent slowdown is because of the outbreak of Middle East Respiratory Syndrome (MERS) in 2015.

Fig. 2 represents the passenger load of domestic travellers at South Table 1

| Airline      | Type of Airline | Year of Operation | LCC Ownership     | Average market share 2010–2017 |
|--------------|----------------|-------------------|-------------------|-----------------------------|
| Korean Air   | FSC            | 1962              |                   | 29.90                       |
| Asiana Air   | FSC            | 1988              |                   | 19.95                       |
| Jeju Air     | LCC            | 2006              | Independent       | 13.20                       |
| Hansung Air  | LCC            | 2005–2009         | Independent       | 11.31                       |
| Air Busan    | LCC            | 2008              | FSC-owned         | 9.64                        |
| Jin Air      | LCC            | 2008              | FSC-owned         | 8.15                        |
| Easter Jet   | LCC            | 2009              | Independent       | 7.79                        |
| T’Ways       | LCC            | 2010              | Independent       | 6.05                        |
| Air Seoul    | LCC            | 2016              | FSC-owned         | 5.05                        |
Korean airports during 2017; the highest load was at Jeju airport, which is on Jeju Island. Jeju is the top tourism destination of South Korea. Gimpo airport, which stood second in terms of domestic passenger load, is situated in the capital city, Seoul. Seoul has another airport, Incheon airport, but it operates mainly international flights, and as depicted in Fig. 2 the domestic load is very low. The Gimpo-Jeju route has emerged the busiest in the world (Smith, 2016). The third-ranked airport is Gimhae, located in Busan. The Gimpo-Busan route has been shrinking after the emergence of the Korean Train Express (KTX) in 2004; however, the line between Seoul and Busan is the busiest of all lines (see Table 2). Fig. 3 shows the monthly passenger demand data for KTX on the Seoul-Busan route.

Based on the statistics depicted in Fig. 2 and Table 2, we consider three different scenarios, as illustrated in Table 3. In the first case, to get an insight into the overall market, we attempt to evaluate cumulatively the LCC-FSC competition for all the air routes originating from the Gimpo airport; the routes are highlighted by dotted lines in Fig. 2. In the second case, we analyse the busiest route in the world (Gimpo-Jeju) as it represents the South Korean tourism market from an aviation perspective; other tourism spots are usually accessed by other means of fast transport, such as rail and road. This route represents the expanding market.

In the third case, we analyse LCC-FSC competition on a business route. This case provides multiple and interesting insights for several reasons. We plotted passenger demand during the last 20 years for this case in Fig. 4; this shows that the traffic on the route fluctuated between 1997 and 2003. After 2003, it dropped remarkably till 2009 and finally began to expand after 2013. Initial fluctuations are due to improvements in bus services, particularly in 1998, whereas later drop is due to the 2004 introduction of KTX on this route. However, the market initially stabilised and finally began growing after the strategy shift of Asiana Air (premium services) to Air Busan (LCC owned by Asiana Air) in 2008–2009. As it can be observed that Asiana Air stopped its premium services right after the launch of its LCC services in the form of Air Busan, we consider Asiana Air and Air Busan as a single entity against Korean Air. Therefore, we attempt to evaluate the competition between Korean Air and Asiana Air/Air Busan in case 3 to observe how the competition dynamics change in shrinking market considering the presence of potential competition from KTX and the change in Asiana Air’s business strategy from premium services to LCC.
3.1. Data

The data used for the study are collected from the openly accessible website of Korean Airport Corporation. The descriptive statistics of the monthly demand for the three routes are presented in Table 4.

4. Methodology

This section describes the details of the general Lotka-Volterra model and the proposed moving-window LV model. A usual method to study the traveler’s mode choice and demand is “discrete choice model”, and a plenty of questionnaire survey is required to calibrate such models (Lo, 2012). In addition to “discrete choice model”, Bass (1969) and Fisher and Pry (1971) proposed models to analyse competition, however, these models do not consider the competition factor. This study offers an aggregate model based on conventional L-V model. It is the special feature of L-V model that it considers competition factor.

4.1. General Lotka-Volterra model

The general LV model can be expressed as:

\[
\frac{dx}{dt} = x(a_1 + b_1x + c_1y) \tag{1}
\]

\[
\frac{dy}{dt} = y(a_2 + b_2y + c_2x) \tag{2}
\]

where, \(x\) and \(y\) are demands of two competing entities and \(dx/dt\) and \(dy/dt\) are their growth rates during time; \(a_i\) and \(b_i\) are logistic parameters, and \(c_i\) are the interaction parameters of the two entities. In Eq. (1), \(c_1\) shows how much the growth of \(x\) depends upon the \(y\). If \(c_1\) is positive, \(x\) will have positive growth when \(y\) increases. However, if the \(c_1\) is negative, \(x\) will have a negative growth with increase in \(y\). The signs of \(c_i\) determine the type of interaction, and its magnitude depicts the strength of the interaction. Based on the combination of signs of \(c_i\), there can be three types of possible interactions—cooperation, competition and predator-prey. Cooperation and competition can each be further divided into two sub-categories. Table 5 summarizes these relationships from airline perspectives.

Using the conventional method LV data fit for case 1 is presented in Fig. 5. From the figure, it can be seen that from the beginning, LCCs has a continuous upward trend and seasonality. FSCs data are also seasonal and show that the entrance of LCC led to a drop in FSCs demand till 2012–2013 but it is now regaining its previous volumes. The interaction parameters presented in Table 6 are both positive; therefore, referring to Table 5, it can be inferred that LCCs and FSCs cooperate with each other in case 1 (mutualism). However, it can be easily observed from a visual inspection of Fig. 5 that FSCs demand fluctuated after the emergence of LCCs. Such changes in competition dynamics are not detectable by using the conventional LV model.

Table 3

Summary of case study scenarios.

| Market  | Route                          | Competing entities               | Data range | Data type |
|---------|--------------------------------|----------------------------------|------------|-----------|
| Case 1  | Expanding                      | All domestic routes from Gimpo   | LCCs vs. FSCs | 2007–2017 | Monthly   |
| Case 2  | Expanding                      | Gimpo to Jeju (leisure route)    | LCCs vs. FSCs | 2007–2017 | Monthly   |
| Case 3  | Shrinking                      | Gimpo to Busan (business route)  | Asiana Air/Air Busan vs. Korean Air | 2004–2017 | Monthly   |

Table 4

Descriptive statistics of variables.

| Variables | Mean  | Min   | Max  | St. d |
|-----------|-------|-------|------|-------|
| Case 1    |       |       |      |       |
| Change in FSC load | -15,466 | -238,978 | 257,968 | 80,988.2 |
| Change in LCC load | 85,763 | -115,837 | 235,261 | 68,015.35 |
| Total LCC load | 502,298 | 14,427 | 1,105,247 | 309,594.4 |
| Total FSC load | 774,658 | 529,690 | 1,132,190 | 133,382.3 |
| Case 2    |       |       |      |       |
| Change in FSC load | 10,462 | -104,530 | 221,676 | 56,245.01 |
| Change in LCC load | 73,059 | -144,112 | 185,798 | 58,922.88 |
| Total FSC load | 467,900 | 288,300 | 696,203 | 89,403.1 |
| Total LCC load | 434,329 | 14,008 | 982,983 | 274,646.5 |
| Case 3    |       |       |      |       |
| Change in Korean Air load | 9367 | -67,016 | 43,860 | 17,935.14 |
| Change in Asiana Air/Air Busan load | 4147 | -35,416 | 59,564 | 15,978.89 |
| Total Korean Air load | 131,277 | 76,278 | 239,672 | 42,990.3 |
| Total Asiana Air/Air Busan load | 72,898 | 24,348 | 120,156 | 23,431.9 |

Fig. 3. Monthly passenger demands for KTX on the Seoul-Busan route.

Fig. 4. Airline competition on the Gimpo-Busan route.
The conventional LV model is developed using (1) and (2) for all three cases, where the non-linear least square method is used to determine the modal parameters. The resulting equations are represented as (2), (4), (5), (6), (7), and (8). Where, f represents monthly passenger demand for FSCs, l represents for monthly passenger demand for LCCs. Similarly, K represents monthly passenger demand for Korean Air and A represents combine monthly passenger demand for Asiana Air and Air Busan. Table 6 represents the mean absolute percentage error (MAPE) between data and predicted values, and p-values for all three cases; reflecting the goodness of fit and significance of interaction parameters, respectively.

Case 1:
\[
\frac{dl}{dt} = l^+ (225300 - 0.5915 l + 0.4562 f) \\
\frac{df}{dt} = f^+ (6168 - 1.646 f + 0.1024 l)
\]

Case 2:
\[
\frac{dl}{dt} = l^+ (370200 - 0.9028 l + 0.6901 f) \\
\frac{df}{dt} = f^+ (125800 - 0.4063 f + 0.209 l)
\]

Case 3:
\[
\frac{dK}{dt} = K^+ (4175 - 0.9K + 0.02 A) \\
\frac{dA}{dt} = A^+ (83120 - 0.52 A - 0.30 K)
\]

4.2. Proposed “moving-window” Lotka-Volterra model

Conventionally, the Lotka-Volterra model is used to assess the competition dynamics; in a sense, its use is limited as it does not provide insights into the change in dynamics over time. This study addresses this limitation by integrating the moving-window technique with the LV model. This approach involves consecutively moving a data segment of a fixed length interval by one period through the entire data set to calculate the interaction parameters for each data segment, as illustrated in Fig. 6. We selected 4 years of data as the starting window and moved it by one month to calculate interaction parameters. Selection of window size is critical as too small a window may provide wider values for 95% confidence intervals (CI), which implies poor precision in the estimation of parameters. However, too wide a window may provide narrow CI but it reduces the number of observations for estimated parameters; this results in information loss. We performed experiments with 3- and 5-year windows as well, but finally selected the 4-year window based on narrow CI.

5. Experiment, results and discussion

The detailed analysis of each case is described in the following subsections. Interaction parameters (c_i) are calculated for each window in each case by using non-linear least square method.

5.1. Case 1

Fig. 7 illustrates the resulting observations of interaction parameters.
for FSCs (a) and LCCs (b) when the moving-window LV model is applied. Fig. 7 shows that the relationship is not mutualism for all periods, but rather shows a parasitic relationship (commensalism) for some time then a switch in roles halfway through; this supports our motivation of observing changing dynamics over time. Fig. 7(a) represents dependence of the growth of FSCs on LCCs demand; it shows that FSC did not gain any benefit from of LCCs initially, but began to do so later. The opposite is true for LCCs, where the dependency of LCCs growth on FSCs has decreased over time (Fig. 7(b)). We can summarise our results by saying that in the early years of the emergence of LCCs within the FSC-dominant market, a parasitic behaviour of LCCs on FSCs is observed. However, the role is reversed in the subsequent years and the competitive dynamics between FSCs and LCCs evolved to a parasitic behaviour of FSCs on LCCs. It is important to understand that dependency of the growth of LCCs on FSCs decreased over time but the growth of LCCs kept increasing (see Fig. 5), which indicates that LCCs created their own new market by attracting the new customers.

5.2. Case 2

As presented in Table 6, the $c_i$‘s in case 2 are both positive and the relationship is mutualism, as in case 1. Moving-window observations for the interaction parameters in case 2 (Gimpo-Jeju) are presented in Fig. 8 and show that there has been changing interaction between the airlines similar to case 1 (see Fig. 7). This shows that the busiest leisure route in the world and the overall domestic market of South Korea exhibit a similar relationship between LCCs and FSCs. LCCs took away FSCs passengers only in the early years; however, the relationship reversed later and LCCs created their own new market.

5.3. Case 3

By calculating the parameters of the overall data in case 3, we get predator-prey relationship between Korean Air and combination of Asiana Air and Air Busan, as per the statistical results shown in Table 6. Fig. 9 shows the interaction parameters for our moving-window LV model applied to the competition between Korean Air and the Asiana-Air Busan combination. One can clearly notice how Asiana Air’s decision to change business strategy in 2009 from FSCs to LCCs has benefited Asiana Air in the domestic market. The change in the relationship between the two carriers is linked to the shift in strategy by Asiana-Air Busan, and also to its market dominance that emerged part way through this period. This illustrates predator-prey interaction in the airline industry.
6. Discussion

This study utilized the moving-window LV model to investigate the impact of LCC's entry in the South Korean aviation market, which was earlier dominated by FSCs. The FSC-LCC competition analysis was divided into three different cases. The analysis of the overall domestic market was followed by a more in-depth analysis of Gimpo-Jeju route (expanding market) that connects the country's capital and a key national tourism hotspot (case 2). The analysis of first two cases revealed a similar mutual cooperative relationship (+, +) between LCCs and FSCs; in this situation both entities (LCCs and FSCs) benefit from each other's growth. In both of these cases the market is expanding. In this situation there is a competition between carrier types and that is the reason average fares decrease and volumes increase. So the mutual benefit is probably due to the fact that market is not saturated yet and still expanding. This situation changes over time, as was detected by the 4-year moving-window assessment to both datasets. The analysis results showed that relationship is not consistently mutual (+, +); rather, there is alternating commensalism (+, 0 to 0, +), which means FSCs growth did not depend on LCCs at first, while LCCs enjoyed a synergistic growth, along with that of FSCs. The earlier commensalism relationship (+, 0) of LCCs and FSCs is the reflection of the real-world case, where both Korean Air and Asiana Air failed to react to the sudden emergence of LCCs. Therefore, LCCs succeeded in abruptly gaining market share. In effect, LCCs generated a market of their own. Right after the economic crisis of 2008, there was an explosive growth in the

Fig. 8. Case 2: Moving-window interaction parameters plots for (a) FSCs and (b) LCCs.

Fig. 9. Case 3: Moving-window interaction parameters plots for (a) Korean Air and (b) Asiana Air-Air Busan.
aviation market. As a temporary approach to deal with the emergence of LCCs, Asiana Air and Korean Air deployed their own low-cost and premium-service flights. Meanwhile, both airlines adopted the strategy of airline-within-airline strategy as well. The effect of both the reactive measures can be observed in our LV model. The result is that FSCs now enjoy the benefit from growth of LCCs, whereas LCCs do not benefit from FSCs. Despite such a relationship, LCCs are growing consistently, which supports the argument of their own induced demand.

In the case of business route (case 3) which also represents the shrinking market, it can be observed that Asiana Air’s parasitic relationship (+, 0) to Korean Air changed to Korean Air preying on Asiana Air (−, +) after the emergence of high-speed rail—KTX—that served the same route. Eventually, Asiana Air stopped its conventional services in 2009 and then switched to LCCs by introducing its own LCC. This led to Korean Air having a parasitic relationship with Asiana Air (0, +). The latter relationship shows that Korean Air became totally dependent on Air Busan’s growth, which is also reflected in Fig. 4. It is also seen from Fig. 4 that Asiana Air struggled and always lagged behind Korean Air in terms of market gain until its transformation to Air Busan. After its transformation to an LCC, its market share increased, eventually surpassing that of Korean Air. Such a strategy change did not only benefit Air Busan itself but also stabilised the previously shrinking market owing to the presence of KTX, which further supports the argument of LCCs inducing their own market development in cases 1 and 2. It seems that an introduction of its own LCC by Korean Air, similar to Asiana Air, can excite the competition dynamics. Such step by Korean Air may help it to regain its previous market position and overall market may grow even further.

As the first step, this paper assesses the dynamics of LCC-FSC competition. The assessment has shown that the competition dynamics between LCCs and FSCs are non-static. The changing dynamics help us to understand that LCCs impact FSCs only in the early stages; later, after the creation of their own market, the impact on FSCs seems to reduce. Second, we explore how South Korean LCCs and FSCs have operated in the domestic aviation market over time. In the context of domestic tourism, we demonstrate that LCCs have flourished on leisure routes by creating their own new market. The findings show that competition dynamics change over time and provide a convincing explanation for the conflicting nature of findings about the LCC-FSC competitions discussed in past literatures. The comprehensive results of this research provide new evidence-based insight for policy makers and stakeholders in the aviation and tourism industries.

More generally, this study sheds light on the relationship between aviation and tourism industries of South Korea. The main LCCs market of South Korea is highly dependent on tourism market of Jeju Island. For LCCs it is important to understand if Jeju Island market is saturated or if any other means of fast transport emerges, the survival of LCCs market would be at risk. Moreover, dynamics are sensitive to changes in market, especially to the changes in market size. Overall, the analysis shows that the emergence of LCCs in South Korea is a prime example of Southwest effect; LCCs increased supply by offering lower prices, incumbent airlines lowered their own fares, and sales rose for all airlines in the market.

7. Conclusion

The study has presented a new, novel method of moving-window LV model; this relaxes the assumption of static competitive dynamics in the conventional LV model. The results of our paper highlight the impact of LCCs in promoting the tourism industry (case 2), and show how LCCs play a crucial role in the aviation industry’s growth (case 1, 2 and 3). The results of our analysis show that the aviation industry as a whole is changing dynamically. Comparisons of case 1 and 2 reveal that the South Korean aviation market is highly influenced by the tourism market, and the Jeju Island is the main LCC market.

The comparison between leisure (case 2) and business route (case 3) reveals that the competition dynamics may vary according to market size. The role of market size in competition dynamics is very important. Although the main LCC market of South Korea (Jeju) is currently expanding but is expected to become saturated in the next 2–3 years (Reuters, 2017). In a saturated or shrinking market, such as Busan (case 3), there is more likelihood of stiff competition. Whereas Korean Air stuck to its conventional premium services, the relatively struggling Asiana Air, which introduced its low-cost services in the form of Air Busan, surpassed the leading Korean Air, as depicted in Fig. 4. The findings of case 3 demonstrate that a change in business strategy can revitalise a shrinking market and LCCs play an important role, even in the presence of potential ground competitors such as high-speed rail.

From an academic perspective, this study presents a compelling explanation of the unexplained competition between LCCs and FSCs in prior studies. It does so by showing that the dynamics within a market change as it matures.

From a managerial perspective, it is very important to understand the non-static dynamics of LCC-FSC competition; such revelation from our study will help policy makers and new investors in decision making, as well as enable current stakeholders to make appropriate long-term decisions regarding their current business strategy.

8. Limitations and future studies

The limitations of this study are as follows. First, the findings on competitive dynamics may not be directly applicable to other markets. Another limitation is the varying width of the 95% CIs, indicating that the data is non-stationary. As the self-contained nature of the LV model assumes change to be the consequence of internal dynamics alone, there is scope for model improvement by inclusion of other external factors. For example, this approach ignores airlines’ sensitivity to general economic conditions. LCCs are beginning to compete against FSCs on international routes so there will be a new opportunity to explore the dynamic nature of the competition. The authors are working on addressing these issues in future studies.

This study can be applied to other countries, especially Japan, which has, like South Korea, a typical leisure destination (Okinawa) similar to Jeju Island. There is competition between airlines, high-speed railways (Shinkansen), and the two types of LCCs (independent and FSC-owned).

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