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Non-Cooperative Game Theory in Measuring Strategic Interactions between Airline Joint-Venture Alliances

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Abstract:

Purpose: *The paper proposes a research method for measuring strategic interactions between airline joint-venture alliances that compete with each other.*
Design/Methodology/Approach: *The proposed method is based on the non-cooperative game theory with a Nash-Cournot equilibrium. It consists in the development of a model that compares economic performance of airline long-haul, intercontinental operations in two consecutive scenarios, before and after joining an alliance.*
Findings: *A model of strategic interactions between airline joint-venture alliances can be successfully based on the logic of the Nash-Cournot equilibrium. Furthermore, the game theory is an effective tool for analysing economic performance of airline joint business agreements.*
Practical Implications: *The method can be used in measuring bottom line performance of long-haul airline joint business agreements world-wide. For example, on the EU–US airline market, the method can be used in the analysis of the following alliances: United Airlines – Lufthansa Group; American Airlines – International Airlines Group – Finnair; Delta Air Lines – Air France KLM – Virgin Atlantic.*
Originality/Value: *This is a novel approach to research of advanced airline alliance strategies.*

Keywords: *Airline strategy, airline joint-ventures, economic performance, game theory.*

JEL codes: *B41, C72, D74, L93.*

Paper type: *Research article with a focus on methodology.*

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1. Introduction

Airlines operate on a turbulent and ultra-competitive market where desired profits are hardly attainable. Therefore, industry leaders covetously seek for strategies that would yield a buoyant competitive advantage. Creating strategies entails considerable methodological and practical efforts.

The authors of this paper have made an attempt to propose an effective evaluation method of decisions made by airline boards with regard to alliance strategy. Having discovered that the complex matrix of airline partnerships of various types results in the emergence of strategic interactions taking place between competing airline groups, we decided to focus our attention on the airline joint-venture agreements on the long-haul markets, called hereinafter 'metal-neutral pacts' or 'joint business agreements'. Therefore, the purpose of this paper is to provide readers with a proposal of a research method that can be applied in measuring strategic interactions between airline joint business formations that compete with each other.

Moreover, the review of literature returns many examples of employment of the game theory in the research on air transport market. This discovery has motivated us to propose a method based on the non-cooperative game theory with a Nash equilibrium. The goal was to create a tool to be used by an array of stakeholders – airlines, consulting firms, institutional investors, aviation authorities, lawmakers. Review of selected piece of writing on the game theory application in the research on the air transport economics is conducted in Part 3 of this paper. It follows an overview of airline alliances.

2. Airline Alliance Strategies

First, these have operated for over 20 years. They have become a distinctive feature of the airline industry as well. The most known ones are multilateral alliances, called hereinafter 'constellations' or 'global alliances', that include network carriers based world-wide. Their roots go back to 1997 when *Star Alliance* was established. Today its constellation groups 26 airlines, which serve more than 1300 airports. Members of this global alliance consist of both giants like Lufthansa, Turkish Airlines and United Airlines, and regional operators like Croatia Airlines. Together, the allies offer a global network of routes followed by a set of privileges for frequent fliers. Another global grouping, *oneworld*, was formed in 1998 and gathers today 13 members that offer connections to over 1000 destinations. Dominant roles are played there by American Airlines, British Airways and Japan Airlines, respectively. The third global alliance is *SkyTeam* founded in 2000. It holds 20 operators that connect more than 1000 airports. Air France – KLM, China Southern Airlines and Delta Air Lines are the blue-chip brands there. Together, airlines anchored in these three constellations have acquired 60% share on the global market for air transport services (Tłoczyński, 2019).

However, in the recent decade a steady erosion of airline multilateral partnerships has become evident as well. The reasons are: violations of cooperation rules, mounting conflicts of interests, different business models, increases in costs related to partnership alignment, unfair competition practices. Therefore, economic literature on the strategic management in the airline industry suggests that *constellations suffer from coopetition*, where both streams of competition and cooperation coexist between alliance members (Marciszewska *et al.*, 2013). As a result, this burden has pushed some air carriers into embarking on alternative forms of cooperation and new ways of gaining competitive advantage. These attempts particularly apply to the lucrative long-haul markets, such as the operations between the European Union and the United States of America. More considerations can be found in the research presented by Boniecki (2020), Fageda *et al.* (2019), Boniecki and Marciszewska (2019).

Secondly, in order to mitigate the stifled atmosphere in the multilateral groupings, airline joint business agreements have ventured a global expansion. A common feature of the metal-neutral formations are cost-sharing and revenue-sharing mechanisms on selected routes that dilute much of the rivalry between the allies (Fageda *et al.*, 2019). In some cases, this cooperation is followed by an equity investment of one carrier in a partner that results in a minority ownership. Importantly, metal-neutrals substitute for majority shareholding of foreign investors which, on a global level, is prohibited by the regulations introduced by the Chicago convention. Moreover, this restrictive nature of the global regulatory environment for air transport market lasts despite the liberalization efforts, initiated by the American Airline Deregulation Act (1978), and confirmed by introduction of air transport market liberalization packages in the European Union between 1987 and 1993, respectively. Finally, new age of regulatory framework for free competition on the airline market began in 2007, when the landmark ‘open skies’ agreement between the UE and the USA was signed. This deal has released the opportunity for pursuing joint-venture operations across the Atlantic. Nowadays, there do exist numerous ‘open skies’ treatments world-wide.

Strategic effects gained from metal-neutral pacts are a subject of a thorough research led by Fageda *et al.* (2019), focusing on the impact of joint ventures on the volume of traffic, as well as inter-hub and interline operations. Hoszman (2019) points at boosting role of these agreements on air transport market. It has been discovered that metal-neutrals particularly appeal to carriers who are members of those formations. The partnerships allow for a broader supply of their services as well as improve competitiveness against those operators who stay outside the club. As a result, the number of joint-venture pacts on the long-haul routes has been on the increase since 2013. Most of them are present on the routes: Europe – USA, Europe – Japan, Europe – China, USA – Japan, Europe – South-East Asia, North America – South America, USA – Australia / New Zealand.

Thirdly, joint ventures are a source of grievances too. They are launched, in most cases, between giant airline groups that belong to the same multilateral alliance. However, access to a given metal-neutral formation for a covey of regional carriers belonging to the same constellation is limited. Additionally, all airlines, regardless of their membership in a global grouping or standing aside of that, who are banned from entering a joint-venture and consequently run flights on parallel routes on their own accounts, are treated as competitors. This harbinger of the fall is visible in all three global groupings – *Star Alliance*, *oneworld* and *Sky Team* – and results in enhancing streams of coopetition that have weakened the strategic dimension of the constellations indeed even further.

In summary, the authors focus their efforts on airline joint-ventures as a partnership strategy for acquiring competitive advantage. As coopetition witnessed in the constellations creates numerous strategic interactions between airlines, our ambition was to propose an effective evaluation method of decisions made by airline boards with regards to forging a joint-venture or standing aside those pacts. Due to strategic context of the considerations presented in this paper, the game theory has been selected as the method used for development of an advanced alliance performance measurement tool, presented in the third part of the article.

3. Game Theory in the Research on Air Transport Economics

Dobson and Lederer (1993) study the scheduling and pricing done by airlines operating in a hub-and-spoke model on a liberalized air transport market. For each route, the demand is calculated as a function of the service quality and transport prices for all routes. Heuristic programming is used to identify the flight schedules and route prices that maximize an airline's profit against fixed schedules and prices of other airlines. Furthermore, a heuristic approach is used to study competition in a hub-and-spoke network system by allowing each airline to optimize its schedule and prices against those of competitors. Therefore, a Nash equilibrium in schedules and prices is sought. To simplify the modelling, three assumptions are made: first, customers travel in one cabin class only. Second, aircraft are of the same size. Third, no passenger starts or accomplishes his travel in a hub airport.

The results of the study confirm that Nash equilibrium can be used for flight schedule and route prices optimization with consideration of decisions made by competitors. Moreover, Dobson and Lederer recommend the implementation of the model in airline network based on at least 50 airports, 2 segments of passengers as well as different capacities of aircraft.

Adler (2005) presents a model that analyses hub-and-spoke airline operations in a competitive environment. The game consists of two stages. In the first stage, airlines simultaneously define their networks. In the second stage, each airline competes for market share with consideration of decisions taken by other players. There are two goals: to find strict Nash equilibriums in subgames as well as for all subgames. A simulation of the model involves eighteen hub airports in Europe and three carriers, respectively.

Work done by Adler rests on a range of assumptions: first, operating in a hub-and-spoke model reduces the total costs due to economies of scales achieved. Second, passengers accept competitively-priced multi-leg flight itineraries. Third, air carriers have full freedom in designing flight network that is based on one or two hub airports. Fourth, customers' utility is a function of flight frequency on given routes, price elasticity of demand with respect to a higher ticket price for a direct flight as well as structure of flight tariffs. Fifth, the total amount of demand is known for travel between any two airports. In addition, the airline strategy affects the volume of passengers carried by a given carrier only. Sixth, operating costs of air carriers are a function of flight frequencies and they involve parameters that are shaped by the economies of scale achieved.

The outcome of the research conducted by Adler points out that on a monopolistic market a strict Nash equilibrium for subgames exists only for one carrier that builds its network on two hub airports. In a duopoly, there exist two such equilibriums, however, there are no incentives for a third carrier to enter the market. The height of demand plays a key role in achieving operational profit. According to the author of the research, this is a more important factor than operational strategy employed by a network carrier.

Barla and Constantos (2006) showcase a model of market competition between three air carriers where two of them decide to cooperate. Carriers numbered 1 and 2 decide to forge a partnership that can be either a strategic alliance or a merger. As a result, in each case a carrier M is created that competes with carrier numbered 3. The game takes place in three stages. In the first stage, operators 1 and 2 determine the scope of the cooperation. In the second stage, players decide about the volume of supply, however, airlines 1 and 2 take this decision jointly. In the third stage, the information about volume of demand is released and carriers begin competition for their biggest share of the market according the logic of the Cournot model.

Auxiliary assumptions have been made by Barla and Constantos as well: first, in case of strategic alliance, carriers accord on the volume of supply only. Moreover, operators compete for the biggest traffic carried by their own aircraft. As a result, there does exist an element of rivalry that is not present in case of a merger where all decisions are inked jointly. Second, cost refers to offering one seat (second stage of the game) regardless whether a seat is sold or not. Third, height of unit cost is not dependent on total supply of services on a given route - for all carriers its height is the same.

The research done by the authors yields interesting conclusion: if both airlines achieve cost savings from forging a partnership, a strategic alliance will be a better option than a merger with regards to the generation of profit. The authors reveal that entering a strategic alliance is caused by strategic factors and remains irrespective of limits for mergers set by a restrictive regulatory environment. Furthermore, carriers launching either a strategic alliance or pursuing a merger will suffer from a decrease in profit if cost synergy is not achieved. Finally, existence of those synergies will be particularly important in case of a merger.

Adler and Smilowitz (2007) provide readers with a research tool that allows airlines choosing network structure and strategic allies together, recognizing the important interdependence between these two variables. Their work combines profit-maximizing objectives to cost-based network design formation within a game theoretic framework.

The modelling consists of four steps. In the first one, an analysis of market is done with the goal of collecting data about competitors, network structures, the volume of demand as well as potential partners. In the second step, network structures are analysed. P-hub medial model is used for the purpose of developing network connections that involve hubs and spokes. In the third step, the Nash-type market competition game is launched. Moreover, this step involves two stages: in the former, airlines choose partners and repeat the network analysis to choose gateways. In the latter, a market share model is developed in order to set airfares. In step four, a Nash equilibrium is sought with the use of data on pre-partnership and in-partnership levels of fixed costs and profits. Furthermore, steps two and three involve the use of a multinomial logit model based on airfares and number of legs from origin to destination. This is done to define market share structure.

The method developed by Adler and Smilowitz is employed for the measurement of interactions on the air transport market between the European Union and the United States of America. The considerations are based on the assumption of only two carriers that possess bases in hub airports – in Chicago and Los Angeles, and Chicago and Newark, respectively. Each American operator considers creating a partnership with one out of two airlines from Europe that operate a hub in London or in Frankfurt, respectively.

Interestingly, the study/simulation predicts that in the case of both American operators creating an alliance with European airlines, two players will survive on the market. In the case of a merger between one American carrier and one European airline, three players will survive. In case of no merger, the market will be shared by four players. Moreover, there does exist an equilibrium in case a cooperation is forged between one American carrier and one European airline. Alliances strongly contribute to the business results as reported by every European operator regardless of its membership in an alliance. Some improvement will be also noticed by an American carrier who is a part of a partnership agreement. Negative result will concern an US operator that has not found an ally.

Hu (2010) presents a model of competition between airlines in a duopoly. It is assumed that in a monopoly, airlines operate in a network model to minimize the risk of demand fluctuations on given markets that consist of pairs of spoke airports. Operating in a hub-and-spoke model allows filling an aircraft with passengers travelling on different air transport markets that link flight legs in a hub airport. On the contrary, running direct connections between departure and arrival airports happens in case of due average demand for travel between those points. However, it is investigated to what degree the above factors shape the route network in case of duopoly.

Hu (2010) develops a three-stage model based on game theory for a duopoly. In the first stage, airlines select their network structures based on hub-and-spoke or point-to-point operations. In the second stage, air carriers set the volume of supply. Height of demand remains unknown upon that time. In the third stage, information about volume of demand is released and players engage themselves in a Cournot game with networks and capacities defined in the former stages. Such a game is based on three airports with one of them acting as a hub.

He also confirms that market uncertainty is the driving force for running hub-and-spoke networks, while market mean is the main incentive for point-to-point operations. If fluctuations of demand are high, an equilibrium will appear in case both carriers launch networks based on hub airports. If fluctuations of demand are medium, there can exist two equilibriums: when both airlines operate in a hub model or when one of them follows hub operations and one of them operates direct flights, respectively. If the fluctuations are low, elasticity resulting from hub operations will be of minor importance. Therefore, beside the parameters mentioned above, an equilibrium can be acquired when both operators select direct flight networks. The general conclusion is that every player will maximize his profit if one operator follows network operations and another one runs direct flights, respectively. An exception is a situation when direct fights market is big enough to allow both airlines maximizing their profits from point-to-point flights.

Hu *et al.* (2013) propose a two-stage approach based on the game theory to study the operations of an airline alliance. Independent carriers, managing different booking and information systems, can collaboratively market and operate code-sharing and interline itineraries. Transfer prices between the marketing and operating carriers are defined. These partnership agreements should cover a proper balance between a revenue share per a ticket and a volume of interline traffic. To avoid such situation as a highly symmetric fare split, where the weak partner could often be the bottleneck for accepting interline or codeshare flow. In the first stage, a cooperative game framework is used to model the output of negotiations in which airlines decide to set prorate agreement rules that will be used to split the revenues from interline and codeshare pacts. In the second stage, efficiency of alliance operations is analysed as a non-cooperative game in a decentralized network. It is assumed that once a fixed revenue-sharing rule is selected in the first stage, each airline will independently and privately manage its own booking system with the aim of maximizing its expected total revenues throughout the planning horizon. The results of the study are that proposed prorate agreements can lead to a significant increase in revenues with respect to other rules commonlyin practice.

Liu *et al.* (2014) study flight frequency and profit distribution with application of the both non-cooperative and cooperative games before and after forging an alliance, respectively. The authors propose a method that allows to analyse alliance profit distribution. A payoff matrix of the flight frequencies is developed and converted into a profit distribution game. The study concludes that an alliance can increase the overall profit for airlines. The changes in the agreement price and cost combination are more favourable for larger airlines. The results of the profit distribution are in alignment with the actual development of airline business. With the agreement price increases, the proportion of profit distribution goes up in case of large airlines, while it has the opposite effect on smaller airlines. At a fixed agreement price, the change of profit distribution is consistent with the change of the combination costs in the alliance.

In conclusion, the literature review has returned clear examples of the application of the game theory in the research on the air transport economics. These tools allow for an analysis of the strategic interactions between airlines with regard to partnership strategy, spread and density of flight network, volume of air transport services supply as well as pricing strategies. Guided by the outstanding contributions by Adler, Smilowitz, Hu (2010), and Hu *et al.* (2013), the authors of this paper selected Cournot-Nash equilibrium as the research method in this paper.

4. Research Methodology

The research method follows the goal of measuring strategic interactions between airline joint-venture alliances with a particular attention paid to long-haul, intercontinental operations. We believe that the Cournot model is capable of measuring the performance of such partnership agreements by comparing economic results between stand-alone operations prior to entering a joint-venture with a foreign airline partner, and economic results achieved in joint-venture operations after the creation of the alliance. For clarity of description, we assume that 10 airlines that operated independently prior to forming alliances, are now members of one out of three existing joint ventures. Therefore, we will present two games run for two scenarios – a pre-partnership one and an in-partnership one, respectively.

Formal elements of the first game: pre-partnership scenario:
- players: $N = \{1, 2, \ldots, 10\}$,
- strategies: $S_i = [0, \infty]$ for $i \in \{1, 2, \ldots, 10\}$, where each player (an airline) decides about his volume of supply in a Cournot game ($s_i \in S_i$),
- available information: static game with complete information,
- payoffs: for $i \in \{1, 2, \ldots, 10\}$: $u_i(q_1, q_2, \ldots, q_{10}) = p(q_1 + q_2 + \ldots + q_{10})q_i - c_i(q_i)$,
- first order conditions for optimization: for $i \in \{1, 2, \ldots, 10\}$: $\frac{\partial u_i(q_1, q_2, \ldots, q_{10})}{\partial q_i} = 0$.

Formal elements of the second game: in-partnership:
- players: $N = \{1, 2, 3\}$,
- strategies: $S_i = [0, \infty]$ for $i \in \{1, 2, 3\}$, where each player (a joint-venture)

decides about his volume of supply in a Cournot game ($s_i \in S_i$),
- available information: static game with complete information,
- payoffs: for i ∈ {1, 2, 3}: $u_1(q_1, q_2, q_3) = p(q_1 + q_2 + q_3)q_1 - c_1(q_1)$; $u_2(q_1, q_2, q_3) = p(q_1 + q_2 + q_3)q_2 - c_2(q_2)$; $u_3(q_1, q_2, q_3) = p(q_1 + q_2 + q_3)q_3 - c_3(q_3)$,
- first order conditions for optimization: for i ∈ {1, 2, 3}: $\frac{\partial u_1(q_1,q_2,q_3)}{\partial q_1} = 0$; $\frac{\partial u_2(q_1,q_2,q_3)}{\partial q_2} = 0$; $\frac{\partial u_3(q_1,q_2,q_3)}{\partial q_3} = 0$.

For the comparison purpose, it is assumed that a Cournot-Nash equilibrium exists in both games. There are two arguments that support this prerequisite: first, each player strives to maximize his profit from flight operations. Second, all players offer a similar product (substitute goods).

First-order condition for optimization in the Cournot game is presented as equation 1

(D'Agata, 2007): $\frac{\partial u(Q)}{\partial Q} = p(Q) + \frac{\partial p(Q)}{\partial Q} q - \frac{\partial c(Q)}{\partial Q} = 0$ (1)

p(Q) reflects quantitative effect and is equal to current market price. $\frac{\partial p(Q)}{\partial Q} q$ reflects price effect that is proportional to the current level of production where the correlation force depends on the demand curve inclination in a given point. As a result, in a Cournot model even infinitely small growth in production results in an increase in sales revenues due to quantitative effect. This entails also a decrease in sales revenues caused by fall in prices because of an increase in production – a result of the price effect indeed. Memorizing this mechanism will be of utmost importance upon interpretation of the results acquired for both games.

Equation 1 is transformed into equation 2, where: $-\frac{\partial Q}{\partial p(Q)} \cdot \frac{p(Q)}{Q}$ is the price elasticity for demand for air transport services. In the next step CASM[3] is introduced and the

result is $p(Q) \cdot \left(1 - \frac{1}{-\frac{\partial Q}{\partial p(Q)} \cdot \frac{p(Q)}{Q}} \frac{q_i}{Q}\right) = CASM_i$ (2)

$$p(Q) = \frac{CASM_i}{1 - \frac{1}{-\frac{\partial Q}{\partial p(Q)} \cdot \frac{p(Q)}{Q}} \frac{q_i}{Q}} \qquad (3)$$

Equation 3 allows for calculation of price for each player in both games. If CASM is used as a unit cost of airline output, p(Q) will refer to RASM[4]. By convention, there is only one price for transport services in each game for all players.

[3]*Cost of Available Seatmile - a popular measure of unit cost in air transport economics.*
[4]*Revenue per Available Seatmile – a popular measure of unit revenue in air transport economics.*

The above formulae are used in the measurement of economic performance of joint-venture operations. Equation 3 is deployed in both games. Economic performance of airline services is now determined by comparing prices p(Q), measured as RASMs, acquired in both games.

Furthermore, operational results (u_i) reported by each player in each scenario can be identified too. These will be operational profits or operational loses, respectively. Two sets of calculation data are necessary: for both pre-partnership as well as in-partnership scenarios – in alignment with the calculation of prices p(Q) in the games. These two sets of data must include supply values q_i (measured as ASMs[5]), c_i (CASM) and p(Q) (RASM). In case of modelling operational result for a joint-venture, total amount of supply offered by all carriers belonging to a given metal-neutral pact is used. The formula is presented by equation 4:

$$u_i = q_i \cdot p(Q) - q_i \cdot c_i \quad (4)$$

The analysis so far relies on the following assumptions: first, existence of equilibrium in both games means that in both cases each player sells all his supply. Second, in the first game, CASM values are used, as reported by each airline on all routes. As majority of airlines in the world, which operate regular traffic, run hub-and-spoke operations, their competitiveness on the long-haul, intercontinental air transport market also depends on costs reported on short-haul flights.[6]

Furthermore, in case of some markets – the US market is a good example here – values of CASM reported by airlines can be easily acquired from public databases. In the second game, value of CASM noted on a joint-venture level is used. It is calculated with the use of weighted arithmetic mean where share of supply of a given airline in a given joint-venture is used to determine how much CASM reported by that airline affects the overall CASM level noted by the whole joint-venture. Third, as performance is measured for two separate year periods, impact of inflation must be considered as well. Prices estimated in the first game should be adjusted to the level of prices in the second game with the use of a CPI index. Fourth, price elasticity of demand for airline services are obtained from independent comprehensive air data sources. The results of the modelling are presented in Table 1.

The analysis so far clearly indicates economic effects of the strategic interactions between the airlines in this modelling. The analysis is based on two metrics: change in value of p(q) for each airline [$p(Q)_{pre\text{-}JV} - p(Q)_{in\text{-}JV}$, fourth column in Table 1] and change in value of u_i for each airline [$u_{ipre\text{-}JV} - u_{iin\text{-}JV}$, seventh column in Table 1].

[5]*Available Seat Miles – a popular measure of airline supply.*
[6]*In case of some markets – the US market is a good example here – values of CASM reported by airlines can be easily acquired from public databases.*

Table 1. *Results of the model estimation.*

Carrier	$p(Q)_{pre\text{-}JV}$	$p(Q)_{in\text{-}JV}$	$p(Q)_{pre\text{-}JV} - p(Q)_{in\text{-}JV}$	$u_{i\ pre\text{-}JV}$	$u_{iin\text{-}JV}$	$u_{i\ pre\text{-}JV} - u_{iin\text{-}JV}$
Airline 1	Value A	Value B	Value A – Value B	Value α	Value β	Value α – Value β
Airline 2	Value C	Value D	Value C – Value D	Value γ	Value δ	Value γ – Value δ
Airline 3	Value E	Value F	Value E – Value F	Value ε	Value ζ	Value ε – Value ζ
Airline 4	Value G	Value H	Value G – Value H	Value η	Value θ	Value η – Value θ
Airline 5	Value I	Value J	Value I – Value J	Value ι	Value κ	Value ι – Value κ
Airline 6	Value K	Value L	Value K – Value L	Value λ	Value μ	Value λ – Value μ
Airline 7	Value M	Value N	Value M – Value N	Value ν	Value ξ	Value ν – Value ξ
Airline 8	Value O	Value P	Value O – Value P	Value ο	Value π	Value ο – Value π
Airline 9	Value R	Value S	Value R – Value S	Value ρ	Value ς	Value ρ – Value ς
Airline 10	Value T	Value U	Value T – Value U	Value σ	Value τ	Value σ – Value τ

Source: *Own elaboration.*

The assumption at this point is that in case of joint business operations both the values of price p(Q) and total output Q have increased after all airlines had become members of a metal-neutral formation. Consequently, the increase in price was not a result of capacity discipline thus cartelization of the market did not happen. As in both games airlines were in the Cournot-Nash equilibrium, quantitative effect in the Cournot game was streamlined not only by the growth in output but also by the rise in price. Finally, in the case of these results supported the growth in operational results of air carriers in the second game, forging a joint-venture agreement is an excellent business decision.

5. Conclusions

This paper proposes a research method that could be applied to measuring strategic interactions between competing joint-venture alliances. Our proposal covers the development of a model that compares economic performance of airline long-haul, intercontinental operations in two consecutive scenarios: before and after joining an alliance. It confirms that a model of strategic interactions between airline joint-venture alliances can be successfully described using the logic of the Nash-Cournot equilibrium. Furthermore, the game theory is a valuable tool for analysing economic performance of airline joint business agreements.

This is a novel approach to research of advanced alliance strategies. The method can be used for measuring bottom line performance of long-haul airline joint business agreements that are being operated world-wide. For example, on the EU – US airline market the method can be used in the analysis of the following metal-neutral formations: United Airlines – Lufthansa Group; American Airlines – International Airlines Group – Finnair; Delta Air Lines – Air France KLM – Virgin Atlantic.

Finally, multiple practical applications of this paper's conclusions exist: board members of network carriers are supplied with a measurement tool that can be employed into evaluation of various alliance options. Investment banks can use this method to assess airline partnership strategy as a competitive factor and use the results of the modelling in considerations regarding a stock investment. Analysts at aviation authorities can use it in approval procedures for joint-venture commencement applications. Researchers on air transport economics are provided with a tool that measures strategic interactions in the global airline industry and can be a subject of due enhancement in future works. Therefore, we do believe that a non-cooperative game theory will continue to offer multiple ways of its employment in the research on air transport economics.

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