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Article

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Contemporary Economics

Provided in Cooperation with:

University of Finance and Management, Warsaw

Suggested Citation: Szopiński, Tomasz Stanisław; Nowacki, Robert (2015) : The influence of purchase date and flight duration over the dispersion of airline ticket prices, Contemporary Economics, ISSN 2084-0845, Vizja Press & IT, Warsaw, Vol. 9, Iss. 3, pp. 353-366, <https://doi.org/10.5709/ce.1897-9254.174>

This Version is available at:

<https://hdl.handle.net/10419/141913>

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Primary submission: 17.03.2015 | Final acceptance: 10.08.2015

The Influence of Purchase Date and Flight Duration over the Dispersion of Airline Ticket Prices

Tomasz Stanisław Szopiński¹, Robert Nowacki¹

ABSTRACT

For many years, the air travel market has been the most regulated sector of the economy. Within the last few decades, it has undergone profound change, which is largely a consequence of changes in the law. Another factor that exerted influence on the market was the popularization of new information and communication technologies that affected the interaction between service providers and clients. Due to the application of modern technologies, it is easier for tradesmen to implement pricing policies to maximize profits or minimize losses. In turn, customers acquired a tool for comparing prices, which aids them in selecting the most advantageous offer from their point of view. This study aims to provide an answer to the following questions: how does flight duration affect the price dispersion of airline tickets and does price dispersion increase as the date of departure approaches. To answer these questions, airline ticket prices for flights on the route: Warsaw-London-Warsaw and the route: Warsaw-New York-Warsaw were observed between August 14 and November 14, 2014. Price dispersion increased on both routes as the date of departure approached. Analysis of price variation over time has revealed that longer flights (WAW-ZYP-WAW vs WAW-LHR-WAW) were less dispersed in terms of prices in the period under analysis.

KEY WORDS:

airline ticket dispersion, air transport market, price comparison, pricing policy

JEL Classification: D120, F120, L81

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Introduction

The development of civilization in the contemporary world and the increased affluence of societies have led to changes in the operation of today's markets. New consumption trends are emerging and are related to the development of higher-order needs. Meeting these needs depends on modern technologies, including transport and communication technolo-

gies. As far as transport is concerned, the dynamic development of the air travel market has manifested itself through an increasing number of airlines, airports, flight routes as well as through the passengers using them. Air transport is a significant factor that has contributed to the development of many sectors of the economy, including global tourism (Martin-Consuegra, Molina & Esteban, 2006). For many years, it has been the most regulated sector of the economy (Button, 2009). As a result, the monopolistic position of many national carriers in the majority of countries contributed to the very high price of air

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travel and consequently – to a relatively low interest in it (Pijet-Migoń, 2012). The answer to this problem was the liberalization of the air travel market (Button, 2009; Grotte, 2013; Pijet-Migoń, 2012; Valdes, 2015). Along with the extension of the European Union, this specific revolution in passenger air transport has spread to new Member States in Central and Eastern Europe. Its most visible manifestation was the emergence of low-cost airlines in the Polish market (Pijet-Migoń, 2012). The development of the Internet is also a significant factor that has contributed to changes in the operation of the air travel market. It has revolutionized marketing communication and become the basic source of information for air services as well as a distribution channel for flight tickets.

The development of modern information and communication technologies, including the dynamic expansion of the Internet, has led to a change in business models and influenced interactions between market participants (Szopiński, 2012). Modern technologies have contributed to the gradual transformation in the manner business is conducted by exerting influence over the relationships of firms with suppliers, clients, production processes, other companies as well as over the manner of financing (Castells, 2003). The development of the Internet has also contributed to changes in the operation of the air travel market. It has revolutionized marketing communication and become the basic source of information for air services as well as a distribution channel for flight tickets. Unlike any other tool, the Internet offers abundant possibilities for information management. It is an effective tool that helps the development and operation of the modern economy and contributes to the emergence of new services, including information management services.

For example, some websites allow users to compare prices and select the parameters of goods or services, including both those offered via traditional channels and those sold via the Internet. The development of the Internet has changed the market for firms in many sectors, including the tourist and transport industries. Modern information and communication technologies have offered new marketing and management tools for tourism (Buhalis & Law, 2008) and contributed to the emergence of many new types of services on the tourism market (Kabassi, 2010). The propensity to use travel websites to book tickets is the most

visible among the youth, students, or educated people with high earnings, who often travel, have no problems with trip reservation, and often use low-cost airlines (Castillo-Manzano & López-Valpuesta, 2010). According to Wang and Law (2007), the application of information and communication technologies helps save time which may later be used for additional activities outside home, such as recreational activities, which simultaneously promotes the propensity to travel.

Consumers' choice to use air travel is strongly influenced by flight ticket prices and the convenience of making online purchases. These factors may motivate making new purchases later (Bigne, et al., 2010). The price is particularly important in such a case. According to Elhaj (2012), the price is the most significant factor that determines whether reservations are made in a traditional or Internet-based manner. Magnini and Carande analyzed consumer behaviors when buying tourist services through various distribution channels. In contrast to consumers who used the telephone to buy hotel services and flight tickets, consumers who made purchases via the Internet took into account a larger number of possibilities, displayed less loyalty towards a brand, were more infrequent users; and saw a greater level of risk in the unavailability of a tourist service sought (2011). Paradoxically, these differences were caused by the abundance of information which the recipient had access to through the Internet and did not foster more rational decision-making. This is relevant for price comparison websites, among other things. In principle, such websites should contribute to the simplification of the decision-making process and the rationalization of purchase decisions by comparing many offers and supplying the potential buyer with detailed recommendations. Unfortunately, the effectiveness of such websites is currently limited. Consumers may not trust them because owners of such comparison websites receive sales commission for the services that they render. Furthermore, price comparison websites often provide no more than a fraction of the offers available on the market and thus do not present the whole range of possibilities. The reason for this is that price comparison websites aggregate data relating only to the suppliers with which they have agreements. Moreover, different search engines are based on distinct mechanisms for searching through offers available on the market. To be fully effective, compari-

son websites must compare non-price factors, such as product quality and post-purchase services (Gamper, 2012). Using comparison websites may offer even better results, if services undergo comparison. Services may not be stored. With the use of the Internet, companies that offer transport services may more effectively reduce this problem through the use of dynamic prices. Brynjolfsson, Dick, and Smith (2010) claim that contrary to wide-spread belief, the intensity of searching is not correlated with a higher sensitivity to the price. Instead, consumers who look through many offers place a relatively greater value in non-price factors, such as the brand. The carrier's brand has a significant positive influence on purchase intention in the air travel market (Graham & Bansal, 2007; Wang, 2014). As research by Brunger and Perelli (2009) has shown, the primary motivation for using the Internet to search for flight tickets is not the price. The purchase of airline tickets through the Internet was perceived as an experience in itself. What is more, buyers gained control over the price because they could choose when to make the purchase (Brunger & Perelli, 2009). This is perfectly evident in the Polish market. On one hand, the development of air travel services and the increase in consumer interest in these services are noticeable, but on the other hand, the limited transparency of this market, e.g., as far as prices of air services are concerned is a problem. Existing systems that offer price information, including the aforementioned price comparison websites, do not function in an optimal way and carriers can pursue a very elastic pricing policy. Further, the relevant literature lacks analysis of flight ticket prices and the factors that shape them in the Polish market, which has inspired this study.

The pricing policy of carriers and middlemen regarding trade in airline tickets – review of the relevant literature

Airlines follow various pricing strategies. The closer the date of departure, the higher the price of a given flight (Bilotkach, Gorodnichenko & Talavera, 2010). The carriers may set different prices depending on the number of days between departure and arrival (Alderighi, Cento & Piga, 2011) and depending on the date of purchase (Mantin & Koo, 2010). This allows airlines to categorize clients according to differ-

ent price elasticity. Narangajavana et al. (2014) isolated three methods of setting airline ticket prices: the long term prices (so called strategic prices), prices calculated based on demand, and short term prices based on yield and the conditions of producer.

Price dispersion is encountered in both offline and online selling systems. A factor that exerts substantial influence over price dispersion is the number of reviews posted by clients (Petrescu, 2011). The results that Nelson, Cohen, and Rasmussen obtained from their analysis of cross-sectional data revealed that the level of price dispersion had a positive influence on the price of a product and the number of sellers and that this dispersion was lower for products purchased several times a year (Nelson, Cohen, & Rasmussen, 2007). If consumers face information overload or conflicting information on the electronic market, price dispersion increases (Grover, Lim & Ayyagari, 2006). According to research by Szopiński and Nowacki (2014) concerning ticket prices on routes from Warsaw (WAW) to the most popular destinations, such as London, Frankfurt, Munich, and Paris, airline ticket price dispersion is observable among various Internet websites offering the option to purchase tickets online for the same routes with the same departure and arrival dates.

One factor that allows such freedom in the setting of prices is the market power of the seller, which allows the seller to distinguish between clients characterized by different ticket price elasticity. Consequently, clients who wish to buy a ticket shortly before departure fall within the category of low price elasticity of demand. The seller is aware of the lack of substitutes for their offer, which results in a monopolization of the market and a higher price for the customer who wishes to make the purchase late than for the client making it very early (Gaggero & Piga, 2011). Lott and Roberts claim that the reason behind differences among airline ticket prices may be – apart from different price elasticity of demand – the cost of preservation of a certain number of tickets for the purpose of keeping them available (Lott & Roberts, 1991).

Clients who purchase tickets through the Internet pay lower prices for similar journeys than people who buy them through traditional distribution channels. Clients buying on the Internet pay less for tickets even though fees and the range of services offered by airlines on all distribution channels are the same. The

Internet Price Effect (IPE) provides an explanation for this fact: it may be because of the different characteristics of clients who buy through the Internet or through traditional travel agencies. For instance, it turned out that clients visiting traditional travel agencies were more often members of the Frequent Flyer Program and more often bought tickets which did not have additional fees in case of changes, e.g., the date of departure (Brunger, 2010). Bachis and Piga (2011) analyzed the price strategies of low-cost airlines. They found that different prices are offered by the same e-seller on the same website and at the same time for exactly the same product.

Airlines that possess a large number of loyal clients are reluctant to use middlemen such as online travel agencies (OTAs), e.g., Expedia or Travelocity. Some carriers, such as Southwest Airlines and Ryanair do not use OTAs because, among other things, they can control prices offered to loyal clients on their own websites (Koo, Mantin & O'Connor, 2011). Various agents selling flight tickets online offer identical tickets at different prices (Lin, Chen & Song, 2009). Sengupta and Wiggins (2012) claim that price dispersion is lower in the online market than offline.

The choice of offers may be affected by the airline's reputation. Consumers are willing to pay more for the better reputation of a corporation (Graham & Bansal, 2007) or manner of ticket price presentation (Palmer & Boissy, 2009). With respect to danger, the customer is not able to evaluate the safety of the services offered by the airlines and is thus eager to pay a higher price for using the services rendered by big carriers rather than smaller, regional ones (Squalli, 2005). A study conducted in Spain shows that the main predictors of airline ticket online purchase intention are, by degree of importance: habits, money saving, performance expectancy, and ease of using the offer (Escobar-Rodríguez & Carvajal-Trujillo, 2013). According to Sam and Tahir (2009), service providers that wish to enhance their clients' purchase intentions should exercise empathy when rendering services and increase the trust that customers place in them.

Alderighi et al. (2012) discovered that competition among full-service carriers affected the price levels in the business and the leisure segments asymmetrically. An increase in competition exerted a greater influence on price reduction in the business class than

in the tourist class. However, increased competition in the low-cost airline market reduced fees for business tourists and people travelling for pleasure to a similar extent.

Low-cost airlines have become a major player that offers transport services on domestic and international markets (Dobruszkes, 2013; Pijet-Migoń, 2012). They offer over 30 percent of seats in the European market (Dobruszkes, 2013). The existence of low-cost airlines in the market has led to an increase in the number of people travelling by air (Lian & Denstadli, 2010; Pijet-Migoń, 2012).

Global distribution systems and travel agencies operating on the Internet have become a significant intermediary. Technological development, in turn, has facilitated price comparison for clients. Travel service providers have suffered losses because of that the ease of price comparison. To protect themselves against losses, providers try to vary offers by adding or removing certain components of a service (Granados et al., 2012a; Granados et al., 2012b). Isler and D'Souza (2009) argue that the reason for wide-spread implementation of global distribution systems is to allow airlines to practice price discrimination.

A characteristic feature of services rendered by airlines is the commoditization of offers. Airlines must attempt to vary their offers (Rothkopf & Wald, 2011). Demand for flight tickets bought for business reasons is less elastic than the demand for tickets bought for tourist reasons (Brons, et al., 2002). People travelling for business are willing to pay a higher price for an airline ticket because they need to be able to change their travel plans (Brons, et al., 2002). Typically, the longer the journey, the smaller the price elasticity for clients buying airline tickets. This is because of the lack of substitute transport on long-distance routes (Brons, et al., 2002).

Studies on the relationships between the price dispersion of flight tickets and competition in air travel offer various conclusions. According to Borenstein and Rose, price dispersion is present on routes which have greater competition or a lower density of connections. On routes serviced by more than one carrier, mean price dispersion among companies is lower than the mean difference between prices paid by different clients for the same route to the same carrier. If the number of airlines increases and the total number of

flights on a given route remains unchanged, price dispersion increases. In turn, a greater number of flights on a given route lowers price dispersion (Borenstein & Rose, 1994). Similar conclusions on the correlations between competition and price dispersion were drawn by Stavins (2001). Price dispersion that manifests itself by restrictions on the use of purchased tickets increases if the market becomes more competitive.

By contrast, Geradi and Shapiro show that the greater the competition on a given route, the smaller the price dispersion on the market distinguishing between business and leisure clients (Gerardi, Shapiro, 2009). However, Obermeyer, Evangelinos, and Püschel (2013) demonstrated a non-monotone relationship between price dispersion and competition. While investigating the European market, they discovered a relationship resembling a reversed letter U between the level of competition and price dispersion in the economy class. Similar results were found by Roma, Zambuto, and Perrone in the Italian airline ticket market (2014). An analogous tendency was also observed in the American air travel market by Dai, Liu and Serfes (2014). Chellappa, Sin, and Siddarth (2011) discovered that price dispersion increased when the date of departure approached. Domínguez-Mencheró, Rivera, and Torres-Manzanera (2014) analyzed flight connections from Madrid to London, Frankfurt, New York, and Paris and found that the time margin allowing later purchase of a flight ticket at a price which had not increased significantly was 18 days before departure. Chakrabarty and Kutlu (2014) examined three forms of competition: inside a company, between flights, and regarding flight frequency. They found an S-shaped relationship between market concentration and price dispersion. There are two-way dependencies between the level of competition among flights on a given route and price dispersion as well as the frequency of flights and price dispersion. The size of a plane also has a positive influence on dispersion. However, this relationship becomes negative for large planes.

Research methodology

The authors of this paper asked the following research questions:

- Does distance influence the price dispersion of airline tickets?

- Does price dispersion increase as the date of departure approaches?

To provide answers to these questions, airline ticket prices were observed on the following routes: Warsaw (WAW) – London (LHR) – Warsaw (WAW) and Warsaw (WAW) – New York (ZYP) – Warsaw (WAW). Analysis was based on ticket prices provided on latamy.pl which is a website aggregating offers from various carriers. For flights to London and flights to New York, ticket prices for a flight on November 15, 2014 with a return date of November 22, 2014 were examined. Ten carriers that offered (direct or change) flights on the routes between Warsaw and London and Warsaw and New York were selected for analysis.

A person looking for a ticket for a specific route on a given day on the price comparison website latamy.pl is presented with 10 flights, offered by various carriers, which are the most attractive in terms of price. Only one of the ten carriers on the route WAW-LHR-WAW offered a direct flight. Thus, price dispersion analysis was carried out on the nine remaining carriers: LOT, Air France, KLM, Alitalia, Brussels Airlines, Lufthansa, Jat Airlines, Swiss Air, and SAS. Offers from these carriers were listed in the price comparison website on the first day of observation, which was August 14, 2014. They offered the opportunity to change flights on the WAW-LHR-WAW route. Direct flights were not taken into account in the study. Therefore, only 9 offers underwent analysis. The other flight taken into account in the study was the Warsaw (WAW) – New York (ZYP) – Warsaw (WAW) route. As was the case in the observation of flights on the WAW-LHR-WAW route, flight ticket prices offered by ten carriers were analyzed, which offers were found on latamy.pl (a price comparison website); the offers were presented as the best prices available on the first day of observation, which was August 14, 2014. The airlines offering flights were as follows: KLM, Airberlin, Air France, Delta, Lufthansa, American Airlines, British Airways, Swiss Air, Austrian, and United Airlines. None of the carriers offered a direct flight. In both cases, price dispersion observations were conducted between August 14 and November 11, 2014. The dates were selected randomly. They are neutral – not related to any exceptional event which would radically influence the prices, such as Christmas or Easter.

Research results

For flights on the WAW-LHR-WAW route, the mean price range was between PLN 762.30 (Air France) and PLN 1114.20 (SAS). The coefficients of variation estimated for each carrier strongly varied and ranged between 0.054 for Brussels Airlines and 0.265 for Alitalia (see Table 1). Two groups of carriers stood out. The first group was airlines with low price dispersion (coefficient of variation below 0.10). In addition to Brussels Airlines, this group included LOT, Lufthansa, Jat Airways, and Swiss Air. The second group included airlines that offered ticket prices that were changed considerably throughout the three-month period under analysis (coefficient of variation above 0.10): next to Alitalia, these were KLM, Air France, and SAS. The prices of the most expensive carrier (SAS) and the two cheapest ones – whose average price was the lowest among the airlines under analysis – (Air France and KLM) fluctuated frequently.

For the Warsaw – New York – New York route, the range of mean prices offered by the particular carriers was between PLN 2422.81 (Delta) and PLN 2115.90 (Airberlin). The range between the coefficients of variation was only 0.132. Table 2 demonstrates that the lowest value observed was for the British Airways (0.026) and the highest was for KLM (0.158). Thus, a considerably smaller range of values of the coefficient of ticket price dispersion for each carrier is observable on the WAW-ZYP-WAW route in comparison to the WAW-LHR-WAW route. Higher levels of the coefficient of dispersion were observable in cases of airlines that offered higher average prices, though this group included the cheapest carrier as well.

Much more characteristic correlations were revealed during the analysis of differences in prices over time. Table 3 presents changes in the price dispersion of airline tickets offered by airlines on the routes WAW-LHR-WAW and WAW-ZYP-WAW between August 14 and November 14, 2014 for a flight on 15/11/2014 with a return date set for 22/11/2014. Analysis was concerned with mean prices published on a given day, which were calculated as an arithmetic mean of prices offered by each carrier. Throughout the three-month observation, the lowest mean price was PLN 789.43 and the lowest prices were offered more or less 30 days before departure. Table 3 shows that the flights on the route WAW-LHR-WAW were the most expensive on

the day before departure – PLN 1193.60. Additionally, the coefficient of variation was the highest for that day – 0.307. Its smallest value – 0.076 was recorded 24 days before departure. In analyzing the fluctuations in the values of this indicator, a long phase of relative stability that lasts until about the middle of the period under analysis is noticeable, i.e., till about the 30th day before departure; then a phase of relatively large fluctuations lasting approximately the next 20 successive days, with a phase of definite increase in prices in the last ten days before departure. Time influences the range of fluctuations in prices.

Analysis of variation in prices over time showed that the more distant the flight, the less varied the price was (see Table 3). For the route WAW-ZYP-WAW, the lowest value of the mean price of all the carriers on a given day was PLN 2047.30, and the highest – PLN 2675.67. Table 3 shows that the most attractive prices were offered about two months before departure, and the least attractive price was recorded on the tenth day before the flight. The coefficient of variation ranged between 0.023 and 0.142. The lowest dispersion was recorded in the period in which low prices were offered (i.e., approximately 60 days before departure), the highest – about four weeks before the flight. Analysis of the trends of the coefficient of variation clearly expose a period of relative stability (the first six weeks under observation), a 20-day phase of gradual growth in prices, a 1-week period of decreasing prices, and a three-week period with a slight tendency for growth and singular occurrences of a downward trend.

Subsequently, linear regression was conducted, which was concerned with the dependency between the time remaining before departure and ticket prices offered by a given carrier on different days. Time was the factor which best accounted for changes in ticket prices on the route WAW-LHR-WAW in the case of Alitalia. Nearly 60% of changes in the prices offered by Alitalia were accounted for by a change in time (see Table 4). A change in time by one day translated into a change in price by PLN 9.90. The case was similar for the airlines such as KLM and Air France. For Air France, a change in time accounted for almost 50% of changes in prices. A change in time by one day translated into an almost 5% change in price. For KLM, a change in time accounted for ap-

Table 1. Comparison of airline ticket price dispersion of the particular carriers on the WAW-LHR-WAW route

Stat.	LO	AF	KL	AZ	SN	LU	QJ	LX	SK
Std.	50.84	121.94	183.74	233.49	45.99	58.78	80.02	83.61	176.59
Avg	836.33	762.27	810.75	881.69	848.15	904.63	986.48	897.27	1114.18
coeff. of var.	0.061	0.160	0.227	0.265	0.054	0.065	0.081	0.093	0.158

Table 2. Comparison of airline ticket price dispersion of the particular carriers on the WAW-ZYP-WAW route

Stat.	KL	AB	AF	DL	LH	AA	BA	LX	OS	UA
Std.	371.81	287.84	170.59	291.05	229.01	72.37	58.26	284.93	310.09	185.75
Avg	2355.50	2115.90	2207.69	2422.81	2263.51	2186.94	2204.26	2394.81	2363.92	2211.79
coeff. of var.	0.158	0.136	0.077	0.120	0.101	0.033	0.026	0.119	0.131	0.084

proximately 45% of changes in prices. A change in the day of purchase of a ticket by one day translated into a change in the price by nearly PLN 7. The regression model accounted for the dependency between time and changes in prices offered by Brussels Airlines the least. Time accounted for only approximately 7% of changes. The case was similar for Lufthansa. Time accounted for only 9% of changes.

Analysis of linear regression describing the influence of a change in time over changes in prices offered by 10 carriers for flight tickets on the route WAW-ZYP-WAW demonstrated that time accounted for over 40% of changes in price for airlines such as KLM, Air France, Delta, Lufthansa, and Swiss and Austrian (see Table 5). For American Airlines and British Airlines time accounted for over 10% of changes in prices. Only one of the ten airlines under analysis (United Airlines) had no statistically significant correlation between the date of ticket purchase and its price.

Comparing both connections – to London and to New York – a much higher level of stability in ticket prices is evident in the case of the latter. Dispersion measured with the coefficient of variation is considerably smaller for flights on the route WAW-ZYP-WAW than WAW-LHR-WAW. Examination of dispersion

within the time frame of the study revealed that the average value of the coefficient of variation in prices for the flights on the route WAW-ZYP-WAW was 0.077, while it was twice as much for the flights to London – 0.158. The range of fluctuations was characterized by similar relationships – 0.119 for New York and 0.231 for London.

Examination of the correlation between the number of days before departure and the mean flight ticket prices offered by various carriers on the route WAW-LHR-WAW revealed that the correlation was two-tailed, significant at the level of 0.01, and negative (the Pearson's coefficient: minus 0.554), which signified that the price of the flight visibly increased as the number of days before the departure decreased. Linear regression showed that if the time before departure was shortened by one day, the average price changed by PLN 2.25. In the case of flights on the route WAW-LHR-WAW, time accounted for almost 30% of variation in mean prices. However, if we look at the data in table 6, there is no significant correlation between the number of days remaining before the flight and the coefficient of variation in price. The correlation measured with the Pearson's coefficient was merely minus 0.238 and was not statistically sig-

Table 3. Comparison of airline ticket price dispersion on the WAW-LHR-WAW and WAW-ZYP-WAW routes offered between August 14 and November 11, 2014 for the flight on 11/15/2014.

No.	date of observation	WAW-LHR-WAW			WAW-ZYP-WAW		
		Std	Avg	Price dispersion coefficient	Std	Avg	Price dispersion coefficient
1.	8/14/2014	134.28	882.13	0.152	89.52	2155.90	0.042
2.	8/15/2014	134.28	882.13	0.152	89.41	2149.10	0.042
3.	8/16/2014	134.28	882.13	0.152	89.41	2149.10	0.042
4.	8/17/2014	134.28	882.13	0.152	89.41	2149.10	0.042
5.	8/18/2014	124.97	839.29	0.149	89.41	2149.10	0.042
6.	8/19/2014	142.30	833.89	0.171	83.90	2163.90	0.039
7.	8/20/2014	141.40	833.00	0.170	87.23	2163.50	0.040
8.	8/27/2014	134.37	848.71	0.158	82.98	2208.33	0.038
9.	8/28/2014	136.45	856.25	0.159	88.18	2235.56	0.039
10.	8/30/2014	147.17	897.00	0.164	92.55	2175.89	0.043
11.	8/31/2014	134.34	853.29	0.157	76.97	2143.40	0.036
12.	9/1/2014	126.18	856.50	0.147	79.93	2138.44	0.037
13.	9/8/2014	159.34	886.63	0.180	90.13	2093.40	0.043
14.	9/15/2014	119.58	843.78	0.142	107.10	2068.56	0.052
15.	9/16/2014	120.42	855.00	0.141	118.14	2096.80	0.056
16.	9/17/2014	122.88	872.75	0.141	116.22	2092.56	0.056
17.	9/18/2014	116.26	857.22	0.136	110.67	2092.70	0.053
18.	9/19/2014	149.82	884.78	0.169	82.52	2057.10	0.040
19.	9/21/2014	155.25	905.00	0.172	57.01	2074.60	0.027
20.	9/22/2014	148.65	884.00	0.168	48.08	2049.30	0.023
21.	9/23/2014	149.96	885.78	0.169	51.85	2057.80	0.025
22.	9/24/2014	146.29	864.56	0.169	51.68	2054.40	0.025
23.	9/25/2014	153.39	883.25	0.174	51.13	2047.30	0.025
24.	9/26/2014	110.71	841.57	0.132	95.40	2118.40	0.045
25.	9/28/2014	115.47	860.43	0.134	49.95	2049.30	0.024
26.	9/29/2014	119.52	863.86	0.138	132.59	2135.78	0.062
27.	9/30/2014	135.98	858.57	0.158	88.66	2099.00	0.042
28.	10/1/2014	116.93	833.38	0.140	106.27	2134.67	0.050
29.	10/2/2014	153.49	860.67	0.178	129.98	2248.33	0.058

Table 3. Comparison of airline ticket price dispersion on the WAW-LHR-WAW and WAW-ZYP-WAW routes offered between August 14 and November 11, 2014 for the flight on 11/15/2014. (Continued)

No.	date of observation	WAW-LHR-WAW			WAW-ZYP-WAW		
		Std	Avg	Price dispersion coefficient	Std	Avg	Price dispersion coefficient
30.	10/6/2014	132.79	853.14	0.156	131.88	2198.80	0.060
31.	10/8/2014	121.19	865.43	0.140	163.68	2258.11	0.072
32.	10/10/2014	92.01	804.50	0.114	213.86	2193.33	0.098
33.	10/11/2014	97.73	809.50	0.121	262.03	2250.38	0.116
34.	10/15/2014	91.72	797.88	0.115	257.31	2267.44	0.113
35.	10/16/2014	94.25	803.63	0.117	265.30	2272.67	0.117
36.	10/17/2014	189.55	855.00	0.222	283.48	2269.33	0.125
37.	10/18/2014	94.40	801.29	0.118	322.64	2264.67	0.142
38.	10/19/2014	171.44	910.88	0.188	292.86	2277.44	0.129
39.	10/20/2014	94.40	801.29	0.118	263.94	2243.56	0.118
40.	10/21/2014	69.05	789.43	0.087	263.75	2276.44	0.116
41.	10/22/2014	62.13	818.57	0.076	323.08	2369.56	0.136
42.	10/23/2014	111.86	854.78	0.131	291.64	2325.11	0.125
43.	10/24/2014	86.42	838.00	0.103	251.38	2256.11	0.111
44.	10/25/2014	82.30	825.25	0.100	260.71	2285.22	0.114
45.	10/26/2014	82.30	825.25	0.100	201.75	2439.89	0.083
46.	10/27/2014	106.85	869.11	0.123	201.24	2423.22	0.083
47.	10/28/2014	167.22	904.88	0.185	176.76	2386.56	0.074
48.	10/30/2014	239.04	965.50	0.248	205.84	2473.89	0.083
49.	10/31/2014	164.64	903.38	0.182	209.86	2441.22	0.086
50.	11/1/2014	199.38	914.13	0.218	251.30	2486.33	0.101
51.	11/2/2014	152.61	918.00	0.166	246.29	2443.22	0.101
52.	11/3/2014	199.04	931.25	0.214	250.41	2526.22	0.099
53.	11/4/2014	95.97	911.00	0.105	327.19	2675.67	0.122
54.	11/5/2014	100.62	904.00	0.111	259.07	2574.11	0.101
55.	11/6/2014	126.31	920.00	0.137	348.00	2611.22	0.133
56.	11/7/2014	165.62	1033.29	0.160	291.33	2611.67	0.112
57.	11/8/2014	195.65	970.50	0.202	351.55	2535.00	0.139
58.	11/9/2014	195.65	970.50	0.202	213.97	2447.33	0.087

Table 3. Comparison of airline ticket price dispersion on the WAW-LHR-WAW and WAW-ZYP-WAW routes offered between August 14 and November 11, 2014 for the flight on 11/15/2014. (Continued)

No.	date of observation	WAW-LHR-WAW			WAW-ZYP-WAW		
		Std	Avg	Price dispersion coefficient	Std	Avg	Price dispersion coefficient
59.	11/10/2014	204.50	980.50	0.209	340.31	2486.56	0.137
60.	11/11/2014	197.28	1005.38	0.196	253.95	2522.00	0.101
61.	11/12/2014	244.24	1070.38	0.228	271.38	2559.89	0.106
62.	11/13/2014	254.93	1106.13	0.230	328.09	2583.67	0.127
63.	11/14/2014	366.59	1193.63	0.307	310.26	2585.67	0.120

Table 4. The results of linear regression between time remaining before departure and the prices of tickets on the WAW-LHR-WAW route offered between 14 August, 2014 and 14 November.

Airline codes	LO	AF	KL	AZ	SN	LH	QJ	LX	SK
Beta/r	-0.472**	-0.712**	-0.681**	-0.771**	0.286*	0.323**	-0.395**	0.636**	-0.430**
b (regression coefficient)	-1.314**	-4.741**	-6.835**	-9.903**	0.728*	1.036**	-1.742**	2.814**	-4.259**
Const.	870.71**	913.75**	1029.22**	1210.41**	825.72*	871.25**	1043.17**	805.38**	1273.36**
R ² -adjusted	0.20	0.499	0.455	0.587	0.066	0.09	0.142	0.395	0.162
F	9.757**	62.674**	52.859**	81.987**	5.071*	7.109**	10.906**	39.463**	8.37**
df	34	61	61	56	57	61	59	58	37

Note: * Correlation significant at the level of 0.01

** Correlation significant at the level of 0.05

nificant. For flights on the route WAW-ZYP-WAW, there was a strong correlation between the date of departure and the average price level. It was -0.864 and statistically significant. Regression function showed that if the time before departure was shortened by one day, the average price increased by nearly PLN 8.5. For flights on the route WAW-ZYP-WAW, time accounted for almost 75% of variation in the mean price. Moreover, a statistically significant cor-

relation was found between time and the coefficient of variation in price. Linear regression showed that if time before departure was shortened by one day, the price changed by 0.165% of the average price. For flights on the WAW-ZYP-WAW route, time accounted for 63% of variability in the coefficient of variation. For flights on the WAW-ZYP-WAW route, time better accounted for changes in the mean price than it did for flights on the route WAW-LHR-WAW.

Table 5. Juxtaposition of correlations between the number of days before departure and prices of tickets offered by each carrier on the route WAW-ZYP-WAW

Airline codes	KL	AB	AF	DL	LH	AA	BA	LX	OS	UA
Beta/r	-0.886**	-0.571**	-0.719**	-0.842**	-0.655**	-0.372**	-0.415**	-0.713**	-0.741**	-0.259
b (regression coeff)	-16.331**	-8.968**	-6.641**	-13.139**	-8.170**	-1.467**	-1.311**	-11.080**	-12.535**	3.142
Const.	2914.16**	2402.89**	2420.31**	2840.59**	2530.20**	2230.890	2246.02**	2740.61**	2765.044**	2329.31**
R ² -adjusted	0.781	0.315	0.509	0.704	0.420	0.124	0.158	0.499	0.542	0.049
F	168.766**	29.529**	64.361**	138.623**	42.924**	9.777**	12.288**	56.840**	74.272	3.607
df	46	61	60	57	57	61	59	55	61	50

Note: **Correlation significant at the level of 0.05

Table 6. The results of linear regression between time remaining before departure and the average price of tickets offered on a given day by different airlines, and the time remaining before departure and the coefficient of variation for the flights for November 15, 2014.

Statistics	WAW-LHR-WAW		WAW-ZYP-WAW	
	Avg.	coeff. of var.	Avg.	coeff. of var.
Beta/r	-0.554**	-0.238	-0.864**	-0.799**
b (regression coeff)	-2.250**	-0.001	-8.476**	-0.00165**
Const.	975.16**	0.175**	2546.98**	0.130**
R ² -adjusted	0.296	0.041	0.743	0.633
F	27.015**	3.669	179.798**	107.863**
df	63	63	63	63

Note: **Correlation significant at the level of 0.05

Conclusions and recommendations

The analysis in this paper demonstrates that as the date of departure approaches, price dispersion of airline tickets offered by various airlines on the routes WAW-LHR-WAW and WAW-ZYP-WAW increases. Analysis of price variability over time demonstrates that more distant flights show less variation. In comparing both connections – to London and to New York, a much higher level of stability in ticket prices is evident on

the Warsaw-New York-Warsaw route. Price dispersion measured with the coefficient of variation is much smaller for ticket prices on the Warsaw-New York-Warsaw route than for the Warsaw-London-Warsaw route.

Research on marketing strategies in the passenger air transport market in Europe is lacking. Studies that examine the American and Asian markets dominate. The European market is different. One example is dissimilar productivity. Analysis of the results generated

in the European and American markets from 2001-2008 revealed that European airlines were more effective. Additionally, in terms of productivity growth, European airlines perform slightly better in most years (Assaf & Josiassen, 2012).

Flights on only two routes were analyzed. More in-depth analysis is needed to verify whether tickets offered for longer routes are actually characterized by lower price dispersion. The factor that hinders analysis of airline ticket prices offered on given routes by various carriers is the lack of knowledge about the conditions underlying cooperation between a price comparison website and each carrier. The amount and manner of calculation of the commission may occasionally influence the manner of presentation of the results to the consumers' queries about specific flights.

It would be interesting to carry out research investigating the dispersion of airline ticket prices in different seasons of the year based on a fixed period between the date of registration of a price and the date of departure. Another interesting issue is the price dispersion of airline ticket prices on the following routes: Warsaw Chopin Airport (WAW)-London and Warsaw Modlin Airport (WMA)-London. There is competition between the Warsaw Chopin Airport and the recently opened Warsaw Modlin Airport, which is trying to attract carriers, often at the expense of the Warsaw Chopin Airport.

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