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How Much Does Distance Matter? An Empirical Assessment of Price Formation in Ryanair Flights

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Abstract:

Purpose: *The purpose of this study is to examine the relationship between flight distance and ticket prices in the low-cost airline sector, using Ryanair routes from Gdańsk, Warsaw and Berlin as a case study. The research aims to determine whether distance is a significant and stable predictor of airfare levels and to what extent it explains price variation in the Low-Cost Carriers (LCC) business model.*

Design/Methodology/Approach: *The analysis uses cross-sectional data on the lowest and highest available fares for all direct Ryanair flights from three European airports in September 2024. Distances were calculated using great-circle metrics. The study applies descriptive statistics, Pearson correlation coefficients and single-equation linear regression models to quantify the distance–price relationship and evaluate the explanatory power of distance for airfare formation.*

Findings: *The results indicate a positive but moderate relationship between route length and airfare levels. Correlation coefficients vary substantially between airports, with the strongest effect observed in Warsaw. Regression models confirm statistical significance of distance; however, their explanatory power differs markedly, reaching a high level only for Warsaw. The estimated slope parameters suggest that average airfares increase by approximately 11.5–19.1 PLN (3.1-5.2 USD) per additional 100 km. For Gdańsk and Berlin, intercept values reveal the presence of substantial fixed cost components unrelated to distance.*

Practical Implications: *The analysis shows a clear but moderate positive relationship between route distance and ticket prices across all three airports. The lowest fares were identical in all cases (65 PLN ≈ 17.86 USD), indicating uniform minimum pricing regardless of origin. However, the range of minimum fares differed by airport. Linear regression models confirmed statistically significant effects of distance, with slope coefficients between 0.115 and 0.191, meaning that every additional 100 km increased fares by 11.50–19.10 PLN (3.16–5.25 USD). Long-haul routes above 2000 km exhibited visibly higher average prices, rising from around 70–82 PLN (19–23 USD) on short routes to 172–259 PLN (47–71 USD) on long ones.*

Originality/Value: *This study provides an up-to-date empirical assessment of distance-based pricing in the European low-cost airline market, using three distinct airport profiles and a*

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uniform dataset collected on a single reference date. It contributes to the literature by quantifying the structural differences in distance sensitivity across airports and by demonstrating the limited explanatory power of distance in LCC price formation.

Keywords: *Low-cost airlines, Airfare pricing, Flight distance, Ryanair, Air transport market.*

JEL Code: *R41, L93.*

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1. Introduction

The pricing of air transport services remains one of the most dynamic and strategically important areas within the economics of aviation. Understanding how airfares are formed is essential for analysing market efficiency, competition between carriers, and consumer behaviour. Low-cost carriers (LCCs) play a particularly significant role in shaping price structures due to their distinctive business models and the scale of their operations.

Despite extensive global research on drivers of airline pricing, the extent to which flight distance determines prices within the LCC segment remains insufficiently explored, especially across different airports serving diverse market environments. This gap highlights the importance and topicality of the present study.

The research seeks to answer a central question: To what extent does the length of a flight influence airfare levels offered by a low-cost airline? The study aims to verify whether distance can be considered a significant and stable determinant of ticket prices in the context of LCC operations.

To achieve this aim, the analysis compares price–distance relationships for direct Ryanair flights departing from three airports characterised by different market sizes and competitive conditions: Gdańsk, Warsaw, and Berlin.

The study applies descriptive statistics, correlation analysis, and single-equation linear regression to evaluate the strength and direction of the relationship between the variables. Data sources include the official booking system of Ryanair, from which the lowest and highest available fares for all destinations in September 2024 were collected, and an external tool for calculating great-circle distances between airports. The research is delimited to one carrier, one month of operations, and direct flights only, which ensures methodological consistency but also defines the contextual boundaries of the findings.

The novelty of the study lies in its comparative approach across three different airport markets and in the simultaneous consideration of minimum and maximum fares, allowing for an assessment of both baseline and peak-pricing behaviours. The research contributes to the literature by providing new empirical evidence on whether—and to what degree—LCC pricing follows a distance-based pattern.

It also raises several problem questions relevant to the discipline: How large are the differences in price levels across airports? Does distance affect cheaper and more expensive fares in the same way? Are short-haul or long-haul LCC flights more sensitive to distance-based pricing mechanisms? Addressing these questions provides deeper insight into the determinants of LCC airfare structures and expands the empirical foundation for future theoretical and applied research within air transport economics.

2. Literature Review

Pricing in the airline industry has long been of interest to both economists and transport researchers, as understanding the mechanisms behind airfare formation is crucial for airlines seeking to maximise revenues and for passengers searching for the most advantageous offers. Low-cost carriers (LCCs) have become a central component of the contemporary aviation market, reshaping travel patterns and price structures across Europe.

As highlighted by Belobaba and Wilson (1997) and Doganis (2010), airline pricing is a complex process shaped by both cost-related and demand-driven factors. In the specific context of LCCs, Gillen and Hazledine (2015) emphasise the dominant role of dynamic revenue management, while Mazumdar (2020) points to price as a key determinant of consumer decision-making.

Price itself is one of the most fundamental economic categories (Schumpeter, 1954; Friedman, 2007; Księżyk, 2017). It influences demand, revenue and profitability, serves an informational function by signalling value and quality, and reflects a firm's pricing strategy (Mazumdar, 2020). It is also a marketing instrument — an element of the marketing mix (Kotler, 2003).

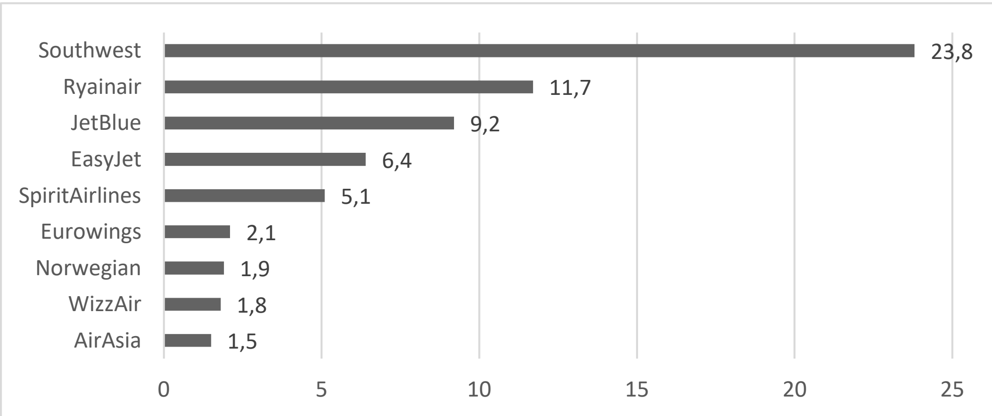
The price-setting process is therefore multifaceted (Fatuła, 2011) and must account for internal and external conditions shaping the level of prices in the market (Dyhdalewicz, 2011). Airline pricing policies are particularly complex (Suntsova, 2016; Gillen and Hazledine, 2015), which has led to numerous studies examining the determinants of airfares (Belobaba and Wilson, 1997; Narangajavana *et al.,* 2014;

Bilotkach *et al.,* 2015; Hazledine, 2011; Studzieniecki and Marciszewska, 2017). These findings have strong practical relevance for both travellers and carriers. Modern revenue-management strategies (Kayhan *et al.,* 2023; Lu *et al.,* 2017) rely heavily on predictive models and algorithms, enabling carriers to differentiate prices across passengers to maximise overall flight revenues (Kozłowska, 2016; Belobaba and Wilson, 1997).

Cost and demand estimation is central to these strategies. A price set too low may fail to cover costs, whereas a price set too high suppresses demand. Consequently, firms must align their pricing policies with strategic objectives such as market penetration or profit maximisation (Tłoczyński, 2011; Kozłowska, 2016).

The emergence of the low-cost business model transformed the global air transport sector (Graf, 2005; Kazda & Mrazova, 2015; Buton, 2012), originating with Southwest Airlines in 1971 (Olipra, 2011). Today more than 300 low-cost carriers operate worldwide, including over 100 in Europe (ICAO, 2024), with Ryanair being the leading LCC in Europe in terms of revenue.

Figure 1. *Revenues of low-cost airlines worldwide in 2022 (in billion USD)*



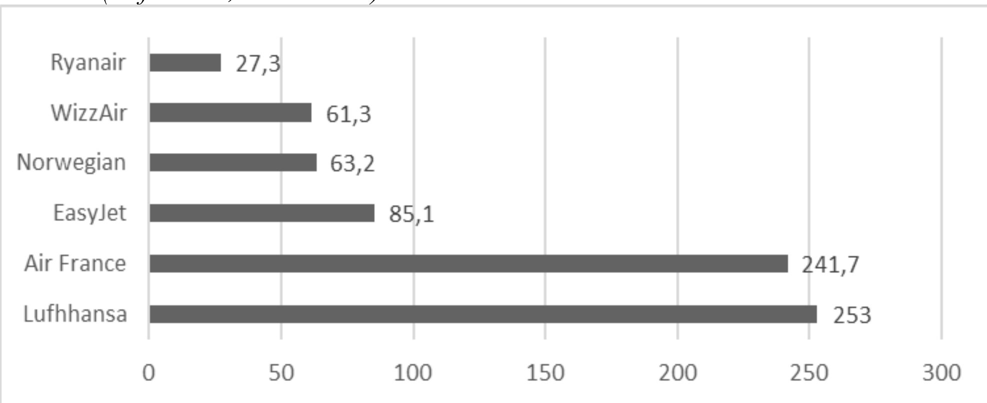
Source: *Statista (2024b).*

This dominance is illustrated in Figure 1, while Figure 2 shows that the average Ryanair ticket price remains substantially lower than that of legacy carriers and most LCC competitors.

Lower fares in the LCC sector, however, come at the cost of reduced service levels (Truong *et al.,* 2020; Herjanto, 2022). Online-only booking, limited airport services and additional fees are standard elements of the LCC model. Although commonly perceived as "budget airlines", LCCs often operate newer, more fuel-efficient fleets than full-service carriers (Scheibler and Puchała, 2021).

Economically, the model is more efficient for short-haul routes, while long-haul operations remain challenging (Morga, 2018). According to Arthur D. Little (2024), four general pricing models exist in passenger transport systems, summarised in Table 1, among which the distance-based model is the closest analogue to airline practices.

Figure 2. *Average ticket prices in 2021 offered by low-cost airlines and traditional carriers (Lufthansa, Air France) in Euros.*



Source: *Statista (2024b).*

Table 1. *Pricing models in passenger transport*

No.	Model	Description
1	Geographic zone	The area is divided into geographic zones; each zone has a fixed fare
2	Distance-based	The fare depends directly on the travel distance.
3	Personal zone	The fare depends on the passenger's individual mobility zone
4	Flat zone	A uniform fare applies across the entire service area

Source: *Arthur D. Little (2024).*

Airline pricing depends strongly on cost structures (Doganis, 2010). Fixed costs decrease with distance, whereas variable costs—particularly fuel consumption—increase with flight length (Gil and Ignaciuk, 2014; Bronk, 2014; Tłoczyński, 2014). Because of these relationships, the link between airfare and flight distance has attracted substantial academic attention. Several studies confirm the presence of a positive—but not strictly proportional—relationship between fare and distance (Lin, 2022; Narangajavana *et al.,* 2014; Abdella *et al.,* 2021).

Mathisen (2014) found a strong, stable fare–distance relationship across both regulated and unregulated transport markets in Norway, demonstrating that even firms with full pricing freedom adopt pricing structures similar to regulated systems. Collins et al. (2010), using Australian domestic flight data, showed that the price per kilometre is higher on short routes than on long ones, while Abdella *et al.* (2021) found that short-haul flights exhibit greater price elasticity due to stronger competition from alternative transport modes.

Szopiński and Nowacki (2015) observed smaller fare variability on long-distance routes than on short ones. Fageda and Flores-Fillol (2024) further demonstrated that while prices increase with distance across both short- and long-haul segments, the effect depends on market structure and competition levels. Their findings also indicate that flight frequency rises with distance on short routes but decreases on long routes, highlighting strategic differences between LCCs and network carriers.

From an econometric perspective, the fare–distance relationship is typically modelled using linear, log-linear or exponential forms (McCarthy, 2001; Hensher and Brewer, 2001; Jørgensen and Preston, 2007). Each functional form carries distinct interpretative properties: absolute effects in linear models, elasticities in log-linear models and percentage changes in exponential models. These methodological insights provide a conceptual foundation for the empirical analysis conducted in this study and motivate the modelling approach discussed in the subsequent section.

3. Research Methodology

This article fits into the broader research on identifying the determinants of airline ticket prices and focuses exclusively on the effect of the distance between airports. The study aims to verify how flight distance influences ticket prices in the low-cost airline segment. In particular, it examines whether route length is a significant and stable predictor of the price levels offered by a low-cost carrier.

The analysis covers direct flights operated by Ryanair from three airports of different scales and characteristics: Gdańsk and Warsaw in Poland, and Berlin in Germany. The dataset includes the lowest and highest available ticket prices for all connections offered by the carrier in September 2024. Data collection was carried out on 1 September 2024.

Both minimum and maximum prices were compared, as well as the distance of each route, to assess the nature of any relationship between the variables.

Basic descriptive statistics, such as the mean and the relative standard deviation (RSD), defined as the ratio of the standard deviation to the mean expressed as a percentage, were used to describe the obtained results. Statistical charts were also applied to illustrate the relationships.

To analyse the impact of flight distance on ticket prices, a simple linear regression model was employed. A linear model of the form

$$\hat{y} = a_0 + a_1 x$$

was estimated, where y is the dependent variable representing the ticket price, x is the independent variable capturing flight distance, and a_0 and a_1 are the structural parameters corresponding to the intercept and slope, respectively.

Model evaluation included the t-test (individual parameter significance) and the F-Wald test (joint significance of parameters). The adjusted coefficient of determination, $\acute{R}^2$, was used to assess the model's goodness-of-fit. This measure indicates the proportion (0–100%) of variance in the dependent variable explained by the model.

The higher its value, the better the model describes the behaviour of the phenomenon. The parameter a_0(intercept) in the linear model may be interpreted as the expected value of the dependent variable for a zero value of the independent variable—in this case, the average ticket price for a hypothetical zero-distance flight or the fixed component of ticket cost.

The parameter a_1(slope) is a proportionality coefficient describing the change in the dependent variable for a one-unit increase in the independent variable. In other words, it indicates how much the ticket price increases on average when flight distance rises by 1 kilometre (for interpretative clarity, the coefficient was recalculated per 100 km).

4. Research Results and Discussion

Information on flight distances and ticket prices from the three analysed airports is presented in Tables 2–4. Ticket prices were taken from the official Ryanair website. Distances between airports were calculated using the Airport Distance Calculator (2024), which determines the "great circle distance", i.e. the shortest path between two points on the Earth's surface based on the geographic coordinates of airports.

Table 2. *Airfare prices for direct Ryanair flights from Gdańsk Airport in September 2024, in PLN*

No.	Destination	Distance	The cheapest ticket	The most expensive ticket
1.	Billund (DK)	612	65	883
2.	Gothenburg-Landvetter (SE)	530	65	491
3.	Copenhagen (DK)	396	65	301
4.	Cracow (PL)	487	65	284
5.	London Stansted (GB)	1244	65	692
6.	Riga (LV)	447	65	176
7.	Wroclaw (PL)	380	65	176
8.	Oslo Sandefjord (NO)	732	68	458
9.	Lublin (PL)	440	69	151
10.	Aarhus (DK)	540	69	174
11.	Burgas (BG)	1470	69	232
12.	Hamburg (DE)	560	69	219
13.	Stockholm Arlanda (SE)	588	69	89
14.	Vaxjo (SE)	368	69	240
15.	Manchester (GB)	1360	73	616
16.	Santorini (GR)	2071	95	413
17.	Skelleftea (SE)	1149	99	246
18.	Paris Beauvais (FR)	1245	101	266

19.	Bergamo (IT)	1151	112	381
20.	Prague (CZ)	555	117	302
21.	Venice (IT)	1069	104	331
22.	Zadar (HR)	1164	121	396
23.	Newcastle (GB)	1293	132	284
24.	Belfast (GB)	1586	133	506
25.	Cork (IE)	1810	138	508
26.	Podgorica (SI)	1388	146	452
27.	Rome Ciampino (IT)	1464	163	557
28.	Chania (GR)	2141	164	492
29.	Malaga (ES)	2636	186	502
30.	Brindisi (IT)	1527	194	758
31.	Edinburgh (GB)	1392	202	393
32.	Bristol (GB)	1455	212	741
33.	Dublin (IE)	1616	225	1137
34.	Pisa (IT)	1325	238	510
35.	Alicante (ES)	2295	244	544

Source: *Rynair 2024.*

Table 3. *Airfare prices for direct Ryanair flights from Warsaw Airport in September 2024, in PLN*

No.	**Destination**	**Distance**	**The cheapest ticket**	**The most expensive ticket**
1.	Budapest (HU)	567	65	202
2.	Gothenburg (SE)	813	65	426
3.	Copenhagen (DK)	630	65	267
4.	Oslo Torp (NO)	989	65	70
5.	Brussels -Charleroi (BE)	1142	65	293
6.	Burgas (BG)	1213	69	249
7.	Bologna (IT)	1117	69	856
8.	Eindhoven(NL)	1051	69	293
9.	Helsinki (FI)	941	69	256
10.	Kaunas (LT)	360	69	69
11.	Bergamo (IT)	1096	69	304
12.	Paris Beauvais (FR)	1337	69	342
13.	Riga (LV)	342	69	216
14.	Stockholm Arlanda (SE)	819	69	165
15.	Vienna (AT)	563	69	160
16.	Liverpool (GB)	1573	81	594
17.	Rome Ciampino (IT)	1331	86	404
18.	Athens (GR)	1634	86	245
19.	Palma (ES)	1983	86	334
20.	Leeds/Bradford (GB)	1490	90	229
21.	Manchester (GB)	1535	92	185
22.	Catania (IT)	1722	95	284
23.	Venice Treviso (IT)	975	95	445
24.	Madrid (ES)	2265	134	522

25.	Paphos (CY)	2184	147	562
26.	Valencia (ES)	2184	164	533
27.	Barcelona (ES)	1870	168	723
28.	Thessaloniki (GR)	1339	180	656
29.	Chania (GR)	1902	181	338
30.	Edinburgh (GB)	1602	192	543
31.	Malaga (ES)	2631	236	706
32.	Lisbon (PT)	2741	336	1076
33.	Porto (PT)	2530	414	1261

Source: *Rynair 2024.*

Table 4. *Airfare prices for direct Ryanair flights from BerlinAirport in September 2024, in PLN*

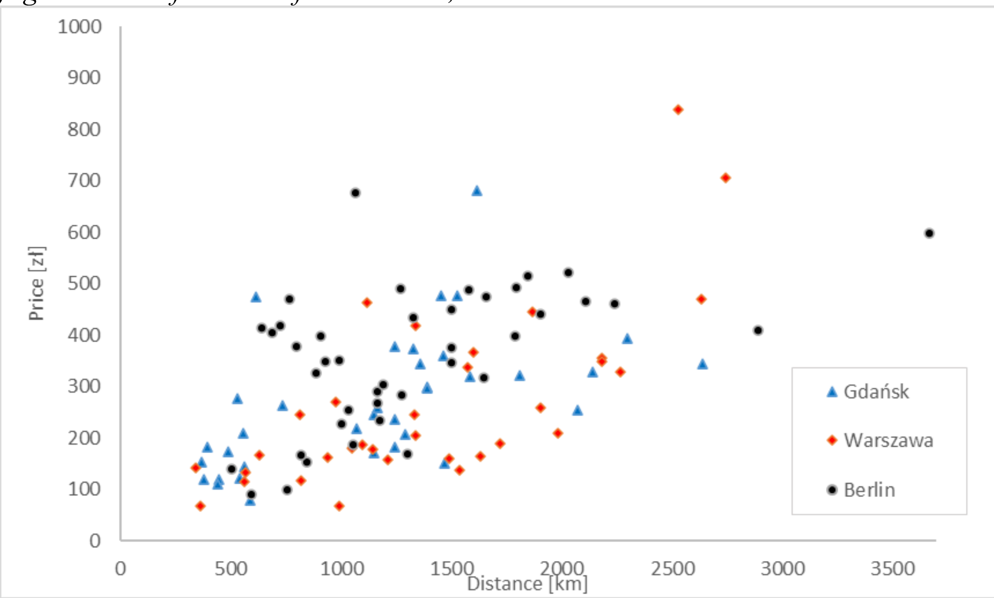
No.	Destination	Distance	The cheapest ticket	The most expensive ticket
1.	Birmingham (GB)	1033	65	443
2.	Brussels (BE)	642	65	761
3.	East Midlands (GB)	1001	65	391
4.	Kaunas (LT)	755	65	133
5.	Cracow (PL)	506	65	215
6.	Luxembourg (LU)	593	65	116
7.	Riga (LV)	843	65	241
8.	Tallinn (EE)	1054	65	310
9.	Trieste (IT)	726	65	770
10.	Vilnius (LT)	820	65	267
11.	Dublin (IE)	1328	82	787
12.	Edinburgh (GB)	1166	82	456
13.	Zadar (HR)	927	82	616
14.	Bologna (IT)	885	86	568
15.	Bucharest (RO)	1273	86	482
16.	Budapest (HU)	685	86	722
17.	London Stansted (GB)	906	86	710
18.	Manchester (GB)	1063	86	1269
19.	Bergamo (IT)	795	86	671
20.	Rome Fiumicino (IT)	1177	86	383
21.	Sofia (BG)	1303	91	249
22.	Palma (ES)	1645	147	486
23.	Venice (IT)	766	107	834
24.	Thessaloniki (GR)	1500	150	602
25.	Pisa (IT)	991	163	537
26.	Marseille (FR)	1166	168	413
27.	Valencia (ES)	1787	172	624
28.	Marrakesh (MA)	2890	189	632
29.	Madrid (ES)	1849	210	821
30.	Catania (IT)	1660	219	731
31.	Corfu (GR)	1501	219	473

32.	Kos (GR)	2031	224	821
33.	Podgorica (ME)	1192	232	374
34.	Malaga (ES)	2240	237	684
35.	Barcelona (ES)	1502	240	662
36.	Palermo (IT)	1577	245	731
37.	Bari (IT)	1271	253	727
38.	Alicante (ES)	1905	267	615
39.	Rhodes (GR)	2110	275	657
40.	Athens (GR)	1796	318	666
41.	Tenerife (ES)	3668	369	826

Source: *Rynair 2024.*

The research problem examined in this study is the relationship between airline ticket prices and route distance. A preliminary assessment presented in Figure 3, illustrating the relationship between these variables, already indicates a highly probable link. A clear positive association can be observed between route length and ticket price. To verify this observation, Pearson's linear correlation coefficients were computed and linear regression models were estimated.

Figure 3. *The relationship between the average airfare of low-cost airlines and the flight distance for routes from Gdańsk, Warsaw and Berlin*



Source: *Own work.*

The Pearson correlation coefficient between route distance and average ticket price was 0.547 for Gdańsk, 0.534 for Berlin, and as high as 0.927 for Warsaw. All correlation coefficients are statistically significant at any conventional significance level. The relationship is strong or very strong, although not strictly linear. This may be influenced by fixed airport charges, airline pricing policies, and other local airport-specific factors.

Subsequently, simple linear regression models were estimated with ticket price as the dependent variable and distance as the independent variable. The results are presented in Table 5. The models describing the relationship between route distance and ticket price for all three cities exhibit satisfactory properties. Only in the model for flights departing from Warsaw was the intercept parameter statistically insignificant; therefore, a model without this parameter was estimated.

Table 5. *Estimation results of linear models of the impact of flight distance on low-cost airline ticket prices, together with parameter significance tests, model linearity tests, and the adjusted coefficient of determination*

Departure city	**Parameter**		**Test *t***		**Test *F***		**Adjusted $\overline{R}^2$**
		Estymation value	**test statistics**	***p value***	**parameter**	**value**	
Gdańsk	intersection	133.179	3.289	*0.002*	F statistics	14.521	0.279
	slope	0.119	3.810	*0.001*	*p value*	*0.001*	
Warszawa	intersection	-	-	-	F statistics	203.460	0.860
	slope	0.191	14.264	*0.000*	*p value*	*0.000*	
Berlin	intersection	207.115	4.852	*0.000*	F statistics	15.571	0.267
	slope	0.115	3.946	*0.0003*	*p value*	*0.0003*	

Source: *Own work.*

The F-Wald test confirmed that the analysed relationship can be described using a linear model. The models for Gdańsk and Berlin show relatively low explanatory power, whereas the model for Warsaw explains price variation satisfactorily, accounting for 86% of the variance.

In all three models, the value of the slope parameter is low, ranging from 0.115 to 0.191. This means that for every additional 100 km of route distance, ticket prices increase on average by between 11.50 PLN and 19.10 PLN.

The second model parameter, in the case of Gdańsk and Berlin, suggests the presence of a fixed component of ticket price amounting to 133 PLN for Gdańsk and 207 PLN for Berlin, independent of flight distance.

Differences in ticket price levels become more noticeable when comparing short flights (up to 1000 km) and long flights (over 2000 km). In the first case, the average ticket price ranges from 70 PLN (Warsaw) to 82.21 PLN (Berlin), while in the second case it ranges from 172.25 PLN (Gdańsk) to 258.80 PLN (Berlin). It can therefore be concluded that the distance between airports does affect ticket prices in low-cost airlines, although this influence is moderate

5. Conclusions, Proposals, Recommendations

The study examined the relationship between airfare levels and flight distance in the low-cost airline sector using empirical data from Ryanair's direct connections from Gdańsk, Warsaw, and Berlin. The results confirmed that distance constitutes a statistically significant, yet moderate predictor of ticket prices across all three airports.

This finding aligns with previous research by Mathisen (2015) and Fageda and Flores-Fillol (2024), who emphasized the persistent link between distance and pricing mechanisms in passenger transport markets, although the strength of this relationship varies depending on market structure and operational conditions.

The study's contribution lies in demonstrating that, even within a highly dynamic and algorithm-driven pricing environment typical of low-cost carriers, a measurable distance–price gradient remains observable. At the same time, notable differences between airports indicate the importance of local cost structures, market conditions, and airport-specific factors, suggesting that distance alone cannot fully explain price formation in the LCC segment.

The research is subject to several limitations, including its reliance on a single carrier, one month of fare observations, and the use of the lowest and highest available fares rather than continuous pricing data.

Future studies could expand the temporal scope, incorporate additional airlines, or compare seasonal variations to produce a more comprehensive picture of distance-based pricing mechanisms. Incorporating nonlinear models or yield-management variables may also deepen the understanding of how low-cost carriers set fares across networks of varying geographical reach.

Overall, the study confirms that distance remains an important but not dominant element in shaping LCC airfare levels. These findings contribute to the ongoing discussion on determinants of airline pricing and offer a basis for further empirical investigations into the complexity of low-cost carrier revenue strategies.

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