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Estimating the determinants of the passenger air transport recovery after the crisis caused by the Covid-19 pandemic based on quantitative methods

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Abstract

For the past several decades, air transport has been developing smoothly, and forecasts were very optimistic. The Covid-19 pandemic set this development back a minimum of two dec-ades. According to the black swan theory, this is not bad news but a stimulus for a change. Every crisis causes improvements in economic processes. The pandemic has forced every busi-ness entity present in the market to learn lessons and implement new solutions to help over-come future crises, the occurrence of which seems inevitable. This article attempts to estimate economic parameters, which are best correlated with the structure of the airline industry opera-tion in Poland, and thus answers questions about the scope of macroeconomic decisions nec-essary to be taken to rebuild the volume of checked-in passengers in Polish air transport.

Keywords: airline crisis, black swan, econometrics, economics, logistics, safety

1. Introduction

The crisis has become an integral part of the surrounding reality in economic, political and social terms. Its occurrence evokes a sense of danger in the first place, but it should be emphasized that such a situation can also be treated as an opportunity and the beginning of success for the organization in the changed business conditions (Romanowska & Dziurski, 2016). The following typology of crises has been distinguished: by the source of origin – internal and external, and by the probability of occurrence – normal and abnormal (Snyder, 2006, pp. 371-383). Diagnosis of the sources of the crisis seems to be a basic element of efficient management of the enterprise in a crisis situation, making the application of corrective programs dependent on the causes of its occurrence (Grądzki et al., 2009). Given the intense nature of the effects of the crisis caused by the Covid-19 pandemic, it could be assumed that restoring the efficiency of business entities to pre-pandemic levels would be lengthy and require the involvement of public funds. Due to the characteristics of the various industries in the economy and the specifics of the market in which companies operate

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– the scope and intensity of the impact of the crisis varied. Throughout the Covid-19 pandemic, national governments launched two-pronged measures, focused on countering the spread of the virus and creating an economic shield for companies operating in the market and their employees. The measures taken against passenger air transport were radical in nature; the possibility of air travel was not only restricted, but temporarily shut down. The difficulty in implementing the process of reviving passenger air transport was the lack of consistent rules for travel between countries, especially in view of the international nature of the airline industry. Business entities, including those operating in the air services market, are not able to predict future crises or economic fluctuations, hence the importance of taking measures to optimize their operations, with a particular focus on optimizing fixed costs, which should be implemented while they have the means to change, i.e., in times of prosperity (Naruć, 2012). This assumption justifies the creation of scenarios for the return to the 2019 air transport conditions and estimating the probability of the reality of their occurrence, with particular attention drawn to the key factors determining the return in question.

2. Crisis as an impetus for change in a crisisogenic reality

The complexity, uncertainty and unpredictability of the surrounding reality, determine its perception as characterized by global crisisogenicity. The ongoing period in the history of the world is characterized as a crisis multiplication, in which crises of diverse nature and scope of impact coexist with each other, and new collapses overlap with those still ongoing (Mączyńska, 2021). The prevalence of the use of the term 'crisis' in social, economic and political dimensions is recognized, indicating its progressive renaissance as a conceptual category (Stachewicz, 2010).

Using the Google Trends tool, the search trend of the phrase 'crisis in the period from 2004 to 2022' was presented in relation to the total number of searches on Google (Figure. 1). The search trend for the key phrase reached a value of 100 in October 2008, which is directly related to the global economic crisis in the financial and economic markets in 2007-2009. The search trend during the period of the crisis caused by the Covid-19 pandemic was not so spectacular, which may indicate the scale of the effects of the two collapses in question.

Figure 1. The trend of search interest for the search term 'crisis by time period from 2004 to 2020' according to Google Trends

Naturally, the term 'crisis' evokes mostly pejorative connotations. At the same time, its Greek etymology does not clearly indicate a negative overtone, the verb "krinein" means to settle, decide, judge, separate, or sift, and the noun derived from it "krisis" is interpreted as a choice, resolution (Wysłocka, 2011). It should be noted that crisis, for example, in the course of an illness, means a state of resolution, the most serious, crucial moment (Internetowy słownik wyrazów obcych, 2023). Moreover, the more general way of defining the term proposed by W. Kopalinski contradicts only the negative meaning of the term, emphasizing that it is a period of solstice, a decisive turn (Kopaliński, 1968). Based on the conclusions from the analysis of the presented definitions of the term crisis in the literature, it should be emphasized that it is a time of decisions and actions, on the scope and nature of which the final outcome of a given situation depends. Therefore, it can be assumed that the most pertinent way to interpret the term will be as a breakthrough between two qualitatively different phases of the process, and despite the variation due to the severity of the consequences, the extent of the impact, the duration, it ends the status quo (Otwinowski, 2010), and the nature of its end, depending on the effectiveness of the implemented actions and measures, can have a positive effect.

In the case of the crisis caused by the Covid-19 pandemic, the airline industry and its players have confirmed three important and special characteristics of their functioning in the market under the imposed restrictions and difficulties, i.e.:

- the need to exist,
- flexibility,
- prospectiveness (Mikosz, 2020).

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The means of air transport were used to transport the materials necessary to undertake the fight against the cause of the crisis – the Covid-19 pandemic – and for the so-called repatriation transports. For the duration of the introduction of the most severe restrictions on air travel, the industry hibernated and successively adapted to the changed conditions of service provision. Despite the collapse in demand for air services, the prospects for recovery still remain optimistic and multivariate.

3. Analysis of global airline industry crises based on the assumptions of black swan theory – causes and effects

By the end of 2019, demand for air transportation services was steadily increasing. Aviation industry players have not been affected by global crises. The main problems in the operation of the air transport market concerned depleting infrastructure capacity and shortages of personnel and equipment to handle the projected growth in air traffic. In view of, the future of air transport thus outlined, the Covid-19 pandemic has been interpreted as an example of a "black swan" type event, i.e., one that is characterized by three attributes, being:

- unexpected,
- unusual,
- unpredictable and highly unlikely,

by causing spectacular consequences for the quality of world functioning in social and economic contexts (Szczepański, 2020). The actions of national governments aimed at combating the Covid-19 pandemic, including closing borders, imposing quarantine obligations and social distance rules, have led to a drastic decrease in air operations. The Covid-19 pandemic is not the first "black swan" phenomenon that has been so severely affected by the quality of the airline industry's operations (Fig. 2). As another example of an event of this type for the aviation industry, the author of the Black Swan Theory – Nassim N. Taleb points to the terrorist attack on the World Trade Centre on September 11, 2001. At the same time, he stresses that in the situation of this event, not all observers were surprised by it; while for the victims, the event was unforeseeable, the terrorists responsible for the attack were aware of its occurrence (Taleb, 2020).

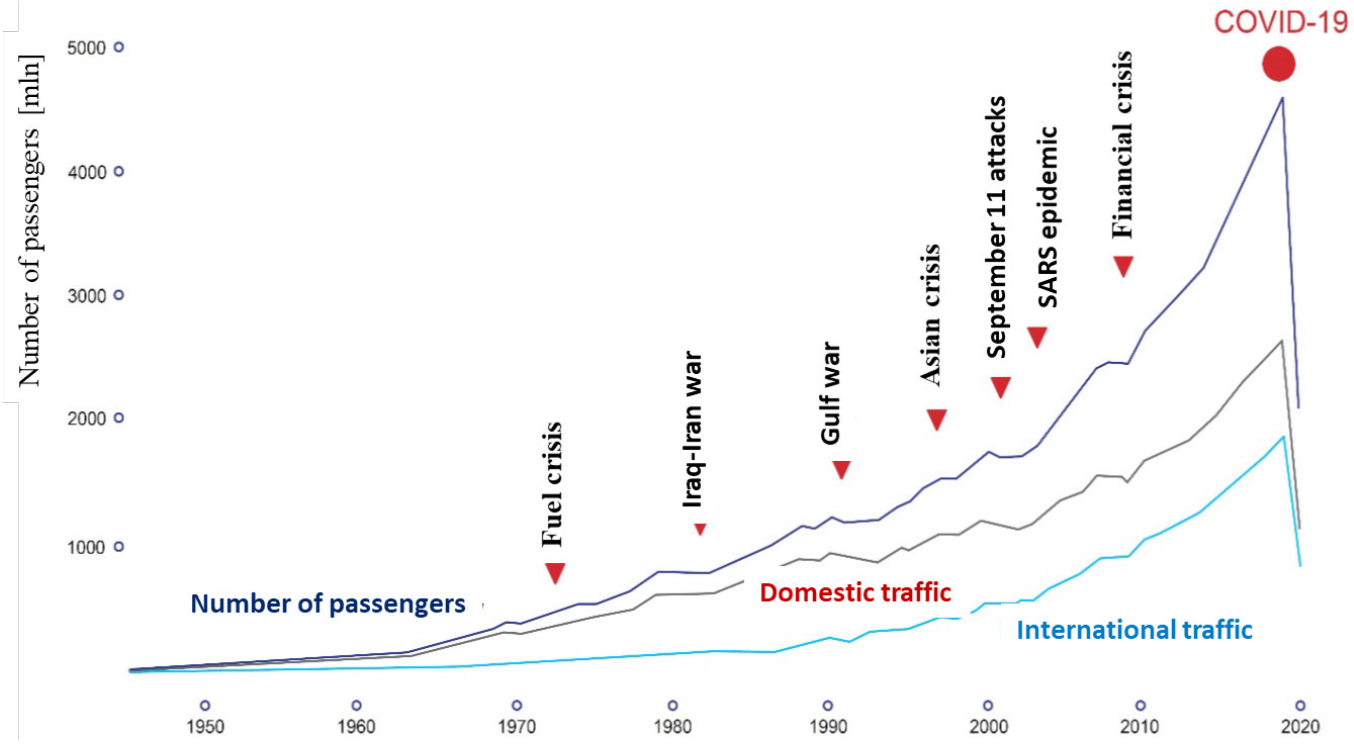

Figure. 2. Global economic crises and changes in air traffic

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In the past, the rhythm of crises was mainly determined by factors external to the economy, i.e., natural phenomena such as natural disasters, epidemics or political causes such as war. With the development of the economy, the course of the boom was less and less influenced by natural phenomena, while the importance of economic factors increased (Morawski, 2003). The operation of players in the aviation services market remains highly sensitive to the consequences of global economic crises. It is possible to demonstrate the main features and characteristics of the aviation industry, acting as peculiar catalysts of the negative effects of global economic crises, i.e.:

- the derivative nature of demand for air transport services,
- the international nature of the operation of the aviation industry,
- the strong and interdependent nature of market players in the aviation industry,
- low resistance to the time and cost factor.

In the case of the aviation industry, the peculiarities of the aviation services market hinder the possibility of preparing a black swan impact scenario for the entities operating in it. At the same time, the conditions of aviation service provision limit the possibility of rapid adaptation to the surrounding, strongly changed reality as a result of their occurrence (Wilczyńska-Strawa, 2022).

As a consequence of the Covid-19 pandemic, the activities of the aviation industry were severely limited, and periodically also completely prevented. Aviation industry players were forced to operate under conditions of uncertainty and risk. The uncertainty of the public, which was linked to the lack of a clear, transparent and coordinated policy of opening borders, can be considered a key factor slowing down the recovery of air transport.

Eurocontrol has assumed three variants of the 2019 air transport recovery scenario after the Covid-19 pandemic (*European Flight Movements,* 2021):

- optimistic,
- baseline,
- pessimistic.

According to the assumptions of the optimistic and baseline variants, the restoration of former air traffic is expected to take place by the end of 2023, while in the pessimistic variant, the return has been delayed until 2027. The forecast was updated in October 2021 based on airline industry results from the summer season.

The reality of the occurrence of each scenario variant depended on a group of risk factors not directly related to the operation of the aviation industry, i.e.,

- the level of effectiveness of the vaccination program, including the effectiveness of vaccine prophylaxis against new variants of the virus,
- the level of coordination between regions,
- the economic situation, including the level of energy prices,
- the rate at which the public's inclination to fly is recovering.

Given the scale of the crisis, a sharp return to air transport's V-shaped condition was not forecast. A "U"-shaped return seemed more realistic, readily indicating that domestic air travel would return much more quickly than the international travel market (*Linie lotnicze,* 2022). When analyzing the return of travel by destination, tourist traffic was expected to return the fastest, and whether business travel would return to its former level was most questionable.

4. Research assumptions

Estimating the structural parameters that are best conducive to the recovery of passenger air transport in Poland, especially after the pandemic period, is a complex and multifaceted process. Air transport has been one of the most rapidly growing modes of transportation in our country. The dynamics of traffic growth necessitated the need for pragmatism in the expansion of point infrastructure elements and the evaluation of buyers' expectations for the purpose of meeting transport needs. Unfortunately, none of the forecasts and analyses took into account the random component (randomness) of the process. The outbreak of the pandemic and the significant reduction in air transportation capacity forced a revision of earlier forecasting models.

The beginning of the research process was an analysis of the literature on the subject, reports of specialized institutions involved in air transport and discussions with industry experts because without a proper interpretation of the results, a precise distinction of variables, there can be no consistency in the monitoring system and methodology for assessing the performance of the aviation market.

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The study aimed to identify the factors that best influence the formation of the air passenger transport market in Poland. For the purposes of the study, the airports in Poland whose data were used in the analyses were identified, in particular:

- Chopin Airport in Warsaw,
- Warsaw-Modlin Airport,
- Gdańsk-Rębiechowo Airport,
- Kraków-Balice Airport,
- Katowice-Pyrzowice Airport,
- Wrocław-Strachowice Airport,
- Poznań-Ławica Airport,
- Rzeszów-Jasionka Airport,
- Szczecin-Goleniów Airport.

The empirical data used in the study comes from the period from 2007 to 2021, including the use of residual data for 2022. Their sources were publications of institutions involved in air transport monitoring, both in Poland and Europe. Sources and databases include:

- Macroeconomic Data Bank of the Central Statistical Office,
- Local Data Bank of the Central Statistical Office,
- National Bank of Poland,
- Statistics of the Air Transport Market Department of the Civil Aviation Authority,
- Airport Statistics,
- European Organization for the Safety of Air Navigation Eurocontrol,
- Polish Air Navigation Services Agency,
- World Economic Outlook Database.

When estimating the parameters that determine the reconstruction of passenger air transport in Poland, it is worth noting that they can provide a wide range of snapshots that can be used in research work. Studies can be comparisons in time and space with a European dimension, between unions of EU countries, between regions, and finally between individual airports. To carry out an attempt to analyze the interdependence of socio-economic phenomena, decisions were made on qualitative and quantitative approaches that also include quasi-quantitative characteristics. The use of a mixed approach seems to be the most justified, with a particular emphasis on quantitative characteristics, since the results obtained in this way should most accurately reflect the empirical economic reality.

The basis in the research procedure seems to be regression analysis based, in turn, on the analysis of relationships between variables that characterize specific research objects or categories, and examining the impact of variables on each other in a specific way. An economic facility, as understood by many authors, means a complex arrangement of organizations, which can be defined as (Czerwieński, 2002):

- an airport, providing services with other market participants,
- enterprises in the market,
- national economy,
- a family business, earning and spending the money earned on transportation services.

Taking into account the approach to an economic facility, it is necessary to determine the economic purpose of its operation and precisely define the market for air transport services where there is interaction between the supply and demand sides.

There is no doubt that each of the economic facilities mentioned is located in a specific, characteristic environment, which includes different spheres and elements.

According to the authors, the correlation of an object with its environment means that the values of the variables that characterize an object can be determined by the independent variables included in that environment. The description of an object can be determined at an interval or point in time, so when estimating the parameters, it is necessary to take into account both their static and dynamic aspects since the results of both of these analyses provide answers to various very important questions (Cywiński, 2013).

A prerequisite for resource management, understood as a conscious human activity, is knowledge of the regularities occurring in economic relations, considered from the point of view of the economy as a whole but also in the cross-section of individual enterprises (such as airports). These are regularities of mass processes occurring in a large number of events, relevant from the point of view of a randomly selected research sample. We are not able to isolate any regularities on the basis of individual phenomena. Thus, due to the massiveness of the phenomenon, we are able to make hypotheses and conclusions and then skillfully verify

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them. We use econometric and statistical methods to describe relationships and regularities. In order for a study to be considered statistically significant, it must concern a specific statistical community, adequately determine the regularities that characterize the studied community, and these regularities must concern the variables in this specific community. Any statistical study requires the establishment of an appropriate method. The choice of method depends on the purpose of the study, the type of statistical community, the topic of the study, its detail, the means at our disposal, etc. Difficulties in accessing data force us to define the collectivity as a whole of enterprises, while it is worth noting that the analysis carried out is mainly about indicative results that give a basis for defining the objectives of subsequent studies already of a dynamic nature.

When conducting econometric analysis and building models, statistical methods are used. One of the methods of econometric analysis is econometric analysis of progress, rather understood as positive quantitative development over time.

For the purpose of econometric modelling, a mixed model for estimating structural parameters was used using the Hellwig method and the classical least squares method (Cywiński, 2013). The analytical form is adopted on the basis of the collected empirical material, which takes into account theoretical knowledge of the phenomenon under study as an economic process. The above approach results in the observation of multiple characteristics and their effects on the explanatory variable. In the case of the study of air transport recovery, we are dealing with many factors that affect it in some way. Therefore, the best way of analysis seems to be econometric modelling using multiple regression, which mainly relies on the possibility of including more than one factor in the model in explaining the dependent variables.

Assuming that we are dealing with n-observations of variables x_1, x_2,..., x in which we see an effect on the dependent variable y, it seems appropriate to construct a linear form of the function. Unfortunately, we know from econometrics theory that the parameters [α] are theoretical quantities, the determination of which would require measuring an infinite number of observations. It was decided at this point, moreover, in accordance with economic practice, to estimate the aforementioned coefficients on the basis of an n-element survey sample. Given the aforementioned assumption, the linear form takes the following form (Cywiński, 2013):

$$y_i = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + \ldots + a_nx_n \quad (1)$$

In order to obtain estimators that have the properties we are looking for, they must meet certain conditions (Hozer, 2003):

- the model must be linear with respect to the parameters,
- the independent variables are non-random,
- the number of observations must be greater than the number of estimated parameters [n > k-1],
- none of the independent variables is a linear combination of the other independent variables,
- the random component has an expected value equal to zero,
- the variance of the random component is the same for all observations.

At the beginning of the construction of the econometric model, a function was determined so that we could make a presentation of the initial model.

An extremely important stage in the construction of an econometric model, often determining its diagnostic-predictive properties and the final outcome of the study, is the selection and choice of explanatory variables (X). The variables in question are valuable due to the amount of information they carry if they correspond to relatively high variability (both temporal and spatial) and are strongly correlated with the explanatory variable (Y) and weakly correlated with the other variables (X). Moderation was attempted in the selection of variables, as too many could lead to phenomena of collinearity, coincidence and catalysis (Cywiński, 2013). Increases in the variance of the estimators of the model parameters were also avoided, which could result in large estimation errors and lead to a lack of statistical significance of the model.

Based on the above assumptions, empirical variables were selected, which can be represented as follows:
1: (Y); the explanatory variable (dependent variable) – the number of air passengers (in million people),
2: (X); explanatory variables (independent variables);

- X1 – population in Poland (million pers.),
- X2 – GDP (%),
- X3 – GDP per capita (% and million, depending on the analysis),
- X4 – public holidays (pcs.),
- X5 – ticket prices (quasi-quantitative per km),
- X6 – inflation rate (%),
- X7 – median earnings in Poland (PLN),
- X8 – airport investments in ground and IT (IoT) infrastructure (PLN million),
- X9 – business investments (PLN million),
- X10 – fuel costs (PLN).

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With the detailed variables in mind, the collection of statistical material began and variable specifications were made to select the best combination of independent variables in the model. Keep in mind the criteria adopted:

- variables should be characterized by sufficiently high temporal or spatial variability; those variables for which the coefficient of variation Vs ≤ έ, where έ, is a predetermined critical value, should be eliminated; for the purposes of econometric modelling, the critical value of the coefficient was estimated at [0.3], which means that the standard deviation of the explanatory variable is no more than 30% of its mean value,
- the variables should be maximally correlated with the explanatory variable,
- the econometric model should, as much as possible, describe the formation of the phenomenon under study.

5. Results of the study

Of the selected variables, we qualify for further estimation of model parameters for those variables whose limiting coefficient of variation is equal to or less than 30%. There are many ways and statistical tools to preserve the above principles in determining variables, although the process's pragmatics suggests that the most accurate was Hellwig's method of integral information capacities. Using it, it was possible to determine a matrix of correlation coefficients (R) between variables (Xn) and a vector of correlation coefficients (R0) between variables (Yi and Xn), using the following formulas (Hozer, 2003):

$$R_0 = \begin{bmatrix} r_1 \\ r_2 \\ \vdots \\ r_n \end{bmatrix} \quad R = \begin{bmatrix} 1 & r_{12} & .... & r_{1K} \\ r_{21} & 1 & .... & r_{2K} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ r_{K1} & r_{K2} & .... & 1 \end{bmatrix} \tag{2}$$

$$R_0 = \begin{bmatrix} 0.736508 \\ 0.78317163 \\ 0.754990675 \\ 0.806966547 \end{bmatrix} \quad R = \begin{bmatrix} 1 & 0.694561874 & 0.839878361 & 0.807817706 \\ 0.694561874 & 1 & 0.707672689 & 0.747868847 \\ 0.839878361 & 0.707672689 & 1 & 0.837389474 \\ 0.807817706 & 0.747868847 & 0.837389474 & 1 \end{bmatrix} \tag{3}$$

Based on the vector and matrix analysis, it was determined that there are four variables in the further modeling (X1, X5, X7, X9). Using the assumptions of Hellwig's method, the total number of combinations of variables (15) was determined, from which the combination that would best match the research hypothesis (highest integral information carrier) was sought, using the formulas of individual information carrier (h_{mj}) and integral information carrier (H_m) (Cywiński, 2013):

$$h_{mj} = \frac{r_j^2}{1 + \sum_{\substack{i=1 \\ i \neq j}}^{kn} |r_{ij}|} \qquad H_m = \sum_{j=1}^{k_m} h_{mj} \tag{4}$$

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Table 1. Summary statement of individual information capacity indicators

h_{11}	0.542444	h_{71}	0.300055	$h_{11/1}$	0.157213	$h_{13/4}$	0.190361
h_{22}	0.613358	h_{74}	0.360211	$h_{11/2}$	0.108185	$h_{14/1}$	0.167893
h_{33}	0.570011	h_{82}	0.349178	$h_{11/3}$	0.167515	$h_{14/2}$	0.178711
h_{44}	0.651195	h_{83}	0.343774	$h_{12/1}$	0.165647	$h_{14/4}$	0.210532
h_{51}	0.320109	h_{92}	0.360918	$h_{12/3}$	0.163556	$h_{15/1}$	0.086261
h_{52}	0.361957	h_{94}	0.365657	$h_{12/4}$	0.191852	$h_{15/2}$	0.118834
h_{61}	0.294826	$h_{10/3}$	0.322902	$h_{13/2}$	0.186265	$h_{15/3}$	0.098427
h_{63}	0.309809	$h_{10/4}$	0.344513	$h_{13/3}$	0.163106	$h_{15/4}$	0.125659

Table 2. Summary statement of integral information (information) capacity indicators

H_1	0.544324	H_9	0.703484
H_2	0.605833	H_{10}	0.664442
H_3	0.560022	H_{11}	0.521123
H_4	0.561100	H_{12}	0.516056
H_5	0.696527	H_{13}	0.639622
H_6	0.614356	H_{14}	0.555759
H_7	0.660356	H_{15}	0.430191
H_8	0.699272		

On the basis of the information carriers, the optimal combination of variables in the model was obtained, which will best enable us to determine the factors shaping the construction (reconstruction) of passenger air transport in Poland. We can include two variables X7- median earnings in Poland (in thousands of zlotys) and X9 – business investment (in millions of zlotys). The model takes the following form, where ut is the random component (randomness occurs in every model).

$$y_t = \alpha_0 + \alpha_0 X_7 + \alpha_0 X_9 + u_t \tag{5}$$

Based on the model obtained, it can be seen that three potential scenarios for the development of the aviation industry in Poland are taking shape. The first one is optimistic, where the volume of business investment in Poland grows (million PLN), with stagnation of median earnings. The second one is baseline, where the volume of median earnings in Poland increases by a unit (thousand PLN) with a stagnation in business investment. Meanwhile, the third one is pessimistic, where the volumes of both indicators remain stagnant.

For verification purposes, additional parameter estimation was carried out using the calculation modules of the Statistica and Gretl packages, where the mathematical reliability of the model was confirmed (92% agreement) based on the following formulas (Hozer, 2003):

$$R^2 = 1 - \varphi^2 = 0,9222007 \qquad \varphi^2 = \frac{\sum(y_t - \hat{y}_t)^2}{\sum(y_t - \overline{y})^2} = 0,0077993 \tag{6}$$

6. Conclusions

In view of the prevalence of crises in the surrounding reality, it may become natural to perceive them also as an opportunity for business entities – a time to mobilize, take on new challenges, and redefine the directions of activities, including diversification of the activities undertaken. Depending on the nature of the cause of the crisis, the various sectors of the economy and the organizations within them may respond in different ways. In the case of air transport, the nature of the industry's operation

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determines greater vulnerability to crises. The key fact seems to be the complexity of the air transport system and the multiplicity and reciprocity of relationships that exist between its elements. In the past, entities operating in the air services market have repeatedly faced crises, with the one related to the Covid-19 pandemic proving unprecedented, due to the duration and intensity of the effects. In the course of undertaking the fight against the effects of the crisis, restoring passengers' confidence in aviation and eliminating their sense of insecurity in air transport was taken as a priority. The source of the crisis in question and the factors determining the feasibility of the various variants of the scenario for a return to the former condition of air transport are unrelated to the aviation industry. The recovery process from the crisis requires the readiness of the forces and resources of players in the aviation services market since a lack of adequate preparation may prove to be a catalyst for further crises. The findings suggest that some of the most important tasks to focus on in rebuilding passenger air transport in Poland are macroeconomic decisions affecting the country's median earnings and the level of business investment.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

References

1. Cywiński, M. (2013). Próba identyfikacji spójnego systemu oceny działalności innowacyjnej przedsiębiorstw. *Zarządzanie i finanse, 11*(1), 19–40.
2. Czerwieński, Z. (2002). *Moje zmagania z ekonomią.* Wydawnictwo Akademii Ekonomicznej w Poznaniu.
3. EUROCONTROL. (2021). *EUROCONTROL Forecast Update 2021-2027. European Flight Movements and Service Units: Three scenarios for recovery from COVID-19*. https://www.eurocontrol.int/publication/eurocontrol-forecast-update-2021-2027
4. Grądzki, R., & Zakrzewska-Bielawska, A. (2009). Przyczyny i objawy kryzysu w polskich przedsiębiorstwach. *Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego, 3*(2), 11–21.
5. Hozer, J. (2003). *Ekonometria stosowana z zadaniami*. Wydawnictwo Pomoc i Rozwój w Szczecinie.
6. Internetowy słownik wyrazów obcych. (2023). https://sjp.pwn.pl/slowniki/s%C5%82ownik-wyraz%C3%B3w-obcych.html
7. Kopaliński, W. (1968). *Słownik wyrazów obcych i zwrotów obcojęzycznych* (4th ed.). Wiedza Powszechna.
8. Mączyńska, E. (2021). Kryzysy jako impulsy zmian systemów społeczno-gospodarczych. *MAZOWSZE Studia Regionalne, 37*, 11–32. http://doi.org/10.21858/msr.37.01
9. Morawski, W. (2003). *Kronika kryzysów gospodarczych*. Wydawnictwo Trio.
10. Naruć, W. (2012). Zarządzanie przedsiębiorstwem w warunkach kryzysu gospodarczego. *Zeszyty Naukowe Uniwersytetu Szczecińskiego: Finanse, rynki finansowe, ubezpieczenia, 52*(708), 13–25.
11. Otwinowski, W. (2010). Kryzys i sytuacja kryzysowa. *Przegląd Naukowo-Metodyczny. Edukacja dla bezpieczeństwa, 2*, 83–89.
12. Romanowska, M. & Dziurski, P. (2016). *Anatomia kryzysu w przedsiębiorstwie*. Oficyna Wydawnicza SGH.
13. Snyder, P., Hall, M., Robertson, J., Jasinski, T., & Miller, J. S. (2006). Ethical Rationality: A Strategic Approach to Organizational Crisis. *Journal of Business Ethics, 4*, 371–383.
14. Stachewicz, K. (2010). Kryzys jako kategoria filozoficzna. *Teologia i moralność, 7*, 7–16.
15. Szczepański, M. (2020). Epidemia koronawirusa jako wydarzenie typu „czarny łabędź". *Przegląd Ekonomiczny, 20*, 8–13.
16. Taleb, N. N. (2020). *Czarny łabędź: Jak nieprzewidywalne zdarzenia rządzą naszym życiem.* Wydawnictwo Zysk i S-ka.
17. Wilczyńska-Strawa, A. (2022). Zależność w układzie: zmiany w otoczeniu ogólnym a determinanty wyboru strategii działań dla wyodrębnionej grupy podmiotów na rynku usług lotniczych w dobie pandemii COVID-19. *Modern Management Systems, 17*(2), 29–45. http://doi.org/10.37055/nsz/150302
18. Wysłocka, E. (2011). Kryzys – nieodłączny element funkcjonowania współczesnych organizacji. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu, 199*, 138–147.