

REGIONAL AIRPORTS IN THE CZECH REPUBLIC: FOCUSED ON GEOGRAPHICAL EFFICIENCY

REGIONÁLNÍ LETIŠTĚ V ČESKÉ REPUBLICĚ: ZAOŠTŘENO NA GEOGRAFICKOU EFEKTIVITU

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Summary: Historically, transport belongs to the most important factors which influence territorial development. In several past decades, air transport experienced dynamic growth in many qualitative and quantitative indicators and airports have become an important location factor of economic activities. Also peripheral regional airports were redeveloped in this time especially due to boom of low-cost airlines. The theme of regional airports is relevant also in the Czech Republic. Therefore, the goal of this article is to assess geographical efficiency of regional airports in the Czech Republic, using the so called data envelopment analysis as the methodological rationale. In addition, geographical development potential of regional airports will be discussed, including the newly planned regional airport in Přerov-Bochoř. Our results point to inefficiency of Czech regional airports with respect to scale (number of passengers). Thus, the doubts on rationale of these airports are well founded. However, there is also clear development potential of Czech regional airports when a suitable strategy is chosen.

Key words: regional airports, air transport, geographic efficiency, Czech Republic

Anotace: Doprava patří mezi významné faktory, které ovlivňují rozvojový potenciál území. V několika posledních desetiletích zažila dynamický rozvoj svých kvantitativních i kvalitativních ukazatelů rovněž letecká doprava, která se stala významným lokalizačním faktorem ekonomických aktivit. Zejména boom nízko-nákladových leteckých přepravečů přitom umožnil rozvoj celé řady periferních regionálních letišť. Otázka regionálních letišť je aktuální i v případě České republiky, a proto cílem tohoto článku je zhodnotit geografickou efektivitu regionálních letišť v České republice a to na bázi DEA metody. Současně je diskutován rozvojový potenciál českých regionálních letišť včetně nově plánovaného letiště v Přerově. Výsledky analýzy poukazují na neefektivitu českých regionálních letišť z hlediska své velikosti (počtu cestujících). Na tomto základě jsou opodstatněné pochybnosti o racionálnosti stávající sítě veřejných mezinárodních letišť v České republice. Na druhé straně však výsledky naznačují existenci zřejmého rozvojového potenciálu regionálních letišť České republiky v případě volby vhodné rozvojové strategie.

Klíčová slova: regionální letiště, letecká doprava, geografická efektivita, Česká republika

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1. INTRODUCTION

There are a number of factors which influence territorial development. Historically, transport belongs to the most important ones. The absence of sufficient transport infrastructure and services may be a decisive barrier of territorial development (see Graham 1998, Cidell 2006). Not coincidentally, transport costs are an integral part of the classical von Weber's and Alonso's location models and although the importance of transport as location factor was questioned in the time-space compression concepts from the 1970s and 1980s interest in the transport-development nexus has re-emerged since the 1990s in the themes like intermodal transport, the hub and spoke versus point to point models discussion and others.

In several past decades, air transport experienced dynamic growth in many qualitative and quantitative indicators and airports have become an important location factor of economic activities. Viturka (2005) speaks about the positive links between international and regional airports and the quality of business environment, especially in commercial services. Note that just this type of services is the most dynamic growth sector of current information-based economy. Also Sarkis (2000) regards airports as an important part of transport infrastructure with potential to trigger territorial development. Feldhoff (2002) claims that airports should be understood in their broader spatial development relations as a cornerstone of transport and territorial planning.

Regional airports represent a specific type of airports importance of which has increased as a consequence of low-cost airlines boom in the past two decades. A number of peripheral regional airports were redeveloped because of the economic opportunities triggered by low-cost airlines. Note that regional airports offer several advantages in this regard. These include low fees, low-cost services, low pressure on flight-schedules, or flexibility to adapt the outdated airport infrastructure to airline needs (Tapiador, Mateos and Martí-Henneberg 2008, Barbot 2006). In addition, Tapiador, Mateos and Martí-Henneberg (2008) claim that a number of peripheral regions became an attractive tourism destination because of redevelopment of their airports. Note that positive economic synergies in the territories were created in this way and that local citizens gained a better air access to main economic areas of Europe.

And just regional airports in the Czech Republic are the main theme of this paper. Because of market potential there is a question whether the existing network of public international airports in the Czech Republic is efficient. This question is relevant also in the light of current development plan to initiate civilian flights from the regional airport in Přerov-Bochoř. This article tries to add a piece to this discussion through geographical efficiency assessment. Thus, our goal is to evaluate geographical efficiency of regional airports in the Czech Republic, using the so called data envelopment analysis (DEA hereafter) as the methodological rationale. In addition, geographical development potential of regional airports will be discussed, including the newly planned regional airport in Přerov-Bochoř. The article is structured as follows. The second chapter deals with the factors which influence the success of regional airports and summarizes the methodological approaches how to research these factors. The third chapter discusses the DEA results related to geographical efficiency and development potential of Czech regional airports. The fourth chapter concludes.

2. REGIONAL AIRPORTS - THEIR SUCCESS AND EFFICENCY

The success of regional airports is influenced by several factors which may be summarized as follows (Humpreys and Francis 2002):

- First, type of ownership may influence the success of regional airports. In this regard, public subjects as owners may decide to subsidy air transport because of other than economic reasons (e.g. image of region, job creation, or the position of airports in regional integrated security systems).
- Second, strategies of airlines determine the success of particular regional airports. It is rather intuitive that the efficiency of regional airports will increase when they become a main hub of airline flights. Thus, it is necessary to link airport planning with strategies of airlines. Technical characteristics of airports and their fee policy may be important tools and parameters in this regard. Moreover, intermodal strategies which try to link airports and high-speed railways may stimulate development of regional airports (compare with Tapiador, Mateos and Martí-Henneberg 2008 for Spain or Stubbs and Jegede 1998 for the United Kingdom).
- Third, territorial conditions influence the success of regional airports. These conditions are related especially to the size of potential market - population, and its socio-economic characteristics. Thus, the regions with a high air transport demand are generally preferred by airlines. However, there is also a potential for development of peripheral regional airports based on special market niches. These may include development models based on already mentioned low-cost airlines or charters.
- Fourth, competition among airports influences the success of regional airports. However, such a competition is not always of a zero sum game character. On the contrary, the relationship of two airports may be neutral when they are focused on different customer segments or even positive when a regional airport saturates transport from an overloaded airport in its proximity.

There are several methods which were applied to evaluate the factors which influence the success of (regional) airports. Ida (1993) explains territorial distribution of passengers in air transport according to their place of residence, using the Tokyo airport Haneda as a case study. First, Ida (1993), applying factor analysis, identified grouped socioeconomic characteristics (factors) of particular areas in the Haneda's surrounding. Subsequently, Ida (1993) applied multiple regression analysis, with the factors as independent variables and the number of passengers from particular areas as a dependent variable. Ida (1993) showed that a high share of passengers was generated in the close, densely populated, surrounding of the airport. Moreover, he pointed to the differences between passengers from close and more remote surrounding of the airport with respect to their travel motives. Thus, job and business were more frequent motives for passengers from close surrounding while tourism for passengers from more remote areas.

Min, Melachrinoudis and Wu (1997) suggested a model how to choose an optimal airport location based on a number of location factors which include total costs, noise pollution, economic development of territory and accessibility. Capacity and budget limits

were considered as well. Another strand of research deals with passengers' airport and airline choice in a multiple airport region. For this purpose, advanced statistical models of discrete choice were developed and tested. Note that multinomial logit models (MNL models hereafter) are the most common in this way (see e.g. Harvey 1987, Thompson and Caves 1993, Suzuki, Crum and Audino 2003). In these models, a passenger is required to choose an airport or airline for his flight based on several criteria such as flight costs, frequency of flights and others. Several extensions of the MNL models were applied as well in modelling the passengers' choice. Thus, Pels, Nijkamp and Rietveld (2001, 2003) or Suzuki (2007) used the nested version of MNL models, Basar and Bhat (2004) the probabilistic choice set multinomial logit model and Hess and Polak (2005) the mixed multinomial logit model. Furthermore, Loo, Ho and Wong (2005) applied the continuous equilibrium modelling approach. Finally, Blackstone, Buck and Hakim (2006) suggested univariate and multivariate probit models to model passengers' choice of four airports in USA. Passenger income, airport strategy, parking, the distance from place of residence, ticket price and proposal of international flights were the main determinants of passengers' choice in this study.

Tapiador, Mateos and Martí-Henneberg (2008) searched the success of regional airports in Spain on the basis of geographical efficiency, modelled using the territorial variables which characterize airport hinterland area in some distance from the airport. From the methodological viewpoint, a geographical version of DEA was used. Easy said, the essence of DEA rests on relative comparison between input territorial variables such as socioeconomic characteristics of population, intermodal transport accessibility, or industrial and tourism potential of airport hinterland areas and the output variable related to the number of passengers. Airports are then compared with respect to best performers. Based on this rationale, DEA enables to assess relative efficiency of regional airports and their potential for further development. The next chapter applies just the DEA method to evaluate efficiency of airports in the Czech Republic, with a special attention given to regional airports, including the newly planned regional airport in Přerov-Bochoř.

3. GEOGRAPHICAL EFFICIENCY OF CZECH REGIONAL AIRPORTS

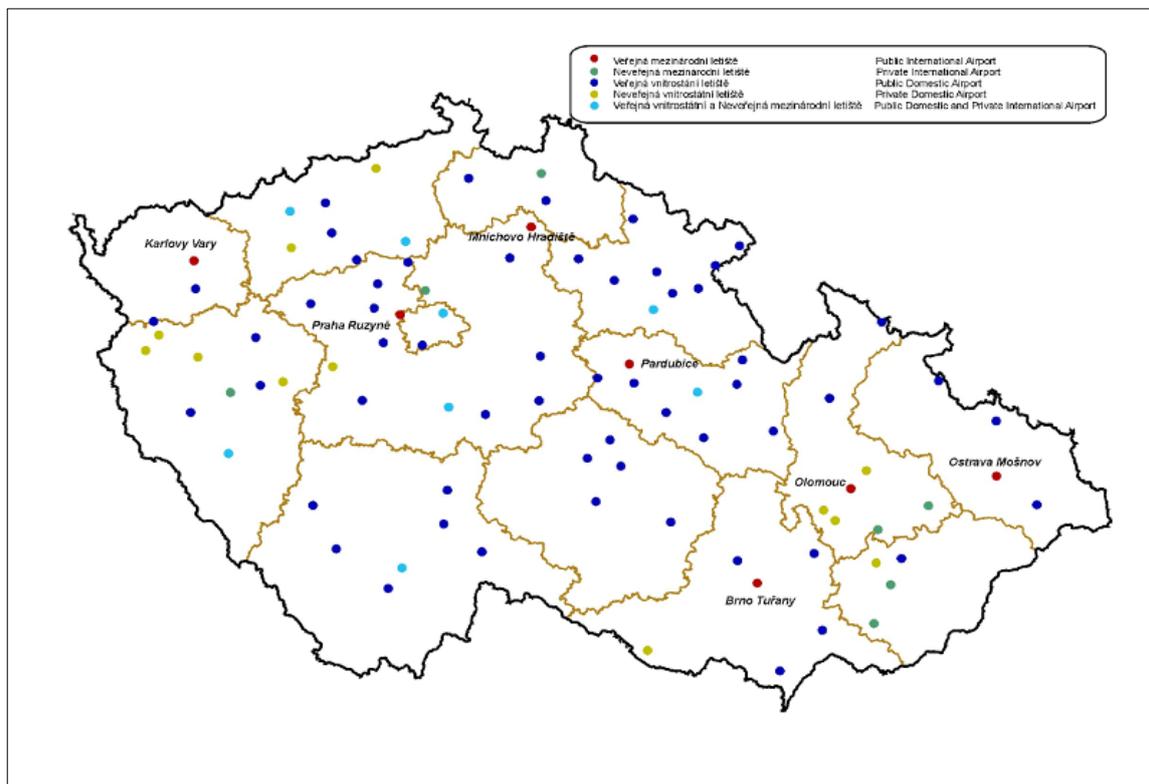
There were 88 airports in the Czech Republic in 2009 with few changes after 2000 in this way (see table 1). Only seven airports in the Czech Republic had public international status in 2009. These included the airports Prague-Ruzyně, Brno-Tuřany, Ostrava-Mošnov, Karlovy Vary, Pardubice, Mnichovo Hradiště and Olomouc. Figure 1 depicts spatial distribution of airports in the Czech Republic, including the seven airports with the public international status. Our subsequent analysis is focused on important regional airports, parameters of which enable regular flights. Thus, the airports in Brno, Ostrava, Karlovy Vary and Pardubice were included in the analysis and complemented by the most important airport in the Czech Republic Prague-Ruzyně. Moreover, the set of analyzed airports was extended by the planned regional airport in Přerov-Bochoř to assess its geographical development potential. Note that the former military airport in Přerov-Bochoř is being transformed to a mixed form of civilian and military airport now that public institutions (Olomoucký Region,

Zlínský Region, and the City of Přerov) are the main actors of this transformation, and that EU structural funds are the main source of financing of this development project.

Tab. 1 – Airports in the Czech Republic in selected years

| Year | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|------|------|------|------|------|------|
| Total number of airports | 86 | 88 | 89 | 91 | 91 | 88 |
| from which: | | | | | | |
| <i>Public international airports</i> | 12 | 9 | 9 | 8 | 7 | 7 |
| <i>Public domestic airports</i> | 57 | 57 | 58 | 58 | 58 | 57 |
| <i>Private international airports</i> | 6 | 5 | 5 | 6 | 8 | 7 |
| <i>Private domestic airports</i> | 11 | 13 | 12 | 13 | 12 | 11 |
| <i>Public domestic airports and non-public international airports</i> | 0 | 4 | 5 | 6 | 6 | 6 |

Source: own elaboration based on MD ČR (2010)

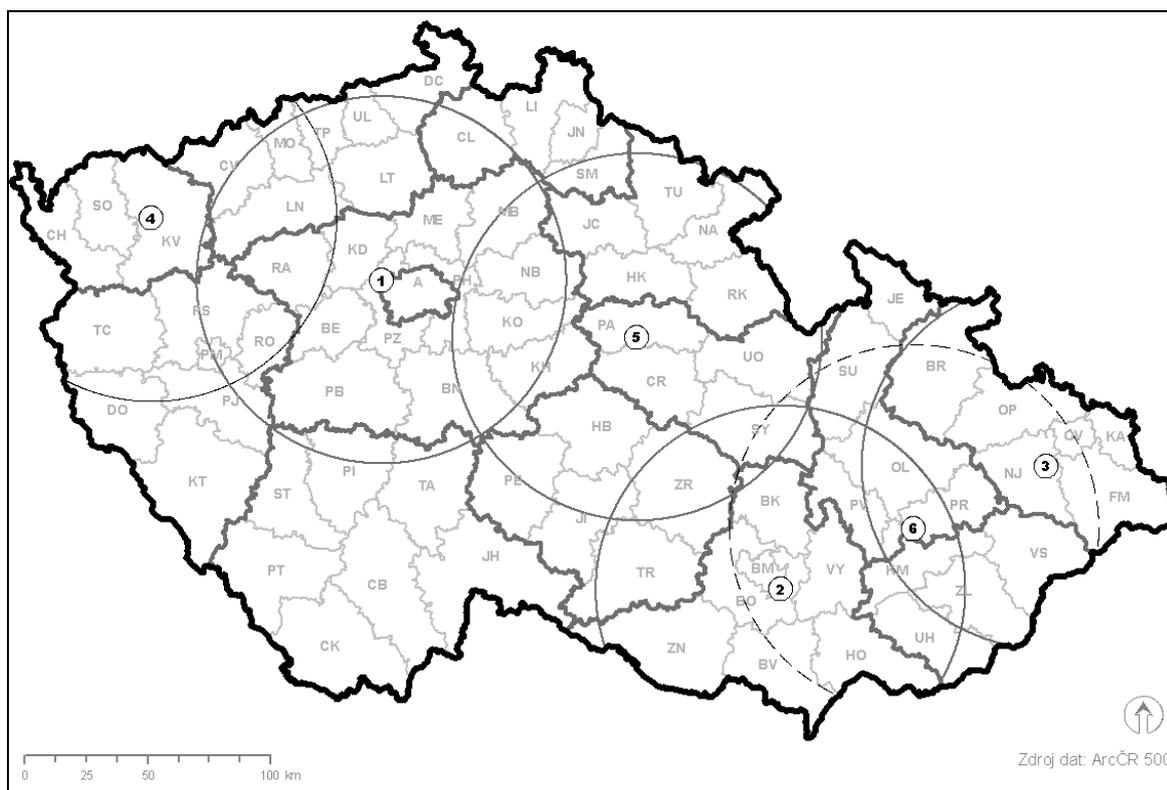


Source: own elaboration based on MD ČR (2010)

Fig. 1 – Spatial distribution of airports in the Czech Republic

As already mentioned, the DEA method was applied to assess the geographical efficiency of Czech regional airports. Note that geographical efficiency is understood as the ratio between the location assets of the airport (e.g. population, economic and tourism potential of a territory) and the traffic generated by DEA (Tapiador, Mateos and Martí-Henneberg 2008). Therefore, in accord with Tapiador, Mateos and Martí-Henneberg (2008), we defined eight input variables as location assets (see table 2) in the first step of our analysis. Subsequently, the most recent data for these variables were compiled from various statistical sources (Czech Statistical Bureau and Institute of Territorial Development) on the district

level. In the second step of analysis, a 75 km area of particular airports was defined as a hinterland area of each airport (see figure 2). The 75 km threshold was determined in accord with Tapiador, Mateos and Martí-Henneberg (2008). Thus, the districts falling into the 75 km area were assigned to each airport. Subsequently, two dimensional data matrix was created with input variables in columns and interest airports in rows. Data for each cell of the matrix were calculated as a sum of district values for a relevant airport and variable. Moreover, the number of passengers for each airport in 2009 as an output variable was added, using official web sites of the airports as the information sources. Table 3 shows the final database for further analysis. Note that the choice of the input variables is justified by the high level of correlation between the input variables and the output variable (see table 2).



Source: own elaboration based on ArcData

Fig. 2 - 75 km area of each interest airport

Tab. 2 – Input variables and their correlation with the output variable number of passengers

| Label | Variable | Correlation coefficient |
|--------|---|-------------------------|
| Var. 1 | Number of foreigners | 0,98 |
| Var. 2 | Number of inhabitants | 0,92 |
| Var. 3 | Number of registered subjects – industry and construction | 0,92 |
| Var. 4 | Number of registered subjects – wholesale and retailing | 0,96 |
| Var. 5 | Number of registered subjects – accommodation and restaurants | 0,97 |
| Var. 6 | Total number of registered subjects | 0,97 |
| Var. 7 | Number of overnights in accommodation facilities | 0,97 |
| Var. 8 | Inter-modality (aggregated length of highways and railways) | 0,81 |

Note: The airport Píerov-Bochoř was not included in the calculation.

Source: own elaboration based on data from Czech Statistical Bureau and Institute of Territorial Development

Tab. 3 – Data matrix of input and output variables for interest airports

| Airport | Number of passengers | Var. 1 | Var. 2 | Var. 3 | Var. 4 | Var. 5 | Var. 6 | Var. 7 | Var. 8 |
|----------------|----------------------|---------|-----------|---------|--------|--------|-----------|------------|--------|
| Prague-Ruzyně | 11 643 366 | 277 735 | 4 249 783 | 256 043 | 20 716 | 52 790 | 1 165 540 | 17 800 592 | 6 325 |
| Brno-Tuřany | 440 850 | 58 723 | 2 649 194 | 156 505 | 10 589 | 26 802 | 592 127 | 4 968 992 | 3 601 |
| Ostrava-Mošnov | 307 130 | 43 037 | 2 439 201 | 126 767 | 9 455 | 22 924 | 498 951 | 4 382 744 | 2 942 |
| Karlovy Vary | 68 369 | 81 312 | 1 667 273 | 91 953 | 8 200 | 22 124 | 379 766 | 5 975 044 | 3 455 |
| Pardubice | 49 032 | 75 656 | 2 511 274 | 149 623 | 12 092 | 29 022 | 551 228 | 7 556 462 | 5 058 |
| Přerov-Bochoř | 0 | 75 164 | 3 568 337 | 200 789 | 14 275 | 34 830 | 781 674 | 6 519 237 | 4 735 |

Source: own elaboration based on data from Czech Statistical Bureau and Institute of Territorial Development

In the third step of our analysis the data matrix was processed using the DEA method. The results are given in the table 4. Each column expresses the utilization level of particular location assets. The null value means that the location asset is used in an optimal (efficient) way, the values different from the null value are connected with inefficiency. Furthermore, the overall geographical efficiency was calculated (the column efficiency), and also the geographical efficiency adjusted to the total number of passengers was considered (the column scale efficiency). In this case, the airport is optimally efficient with the values of efficiency or scale efficiency equal to one. Other values are connected with inefficiency.

Tab. 4 – Utilization level of location assets and overall efficiency of airports

| Airport | Var. 1 | Var. 2 | Var. 3 | Var. 4 | Var. 5 | Var. 6 | Var. 7 | Var. 8 | Efficiency | Scale efficiency |
|----------------|--------|---------|--------|--------|--------|---------|-----------|--------|------------|------------------|
| Prague-Ruzyně | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Brno-Tuřany | 5 432 | 130 886 | 24 090 | 642 | 2 573 | 64 052 | 0 | 511 | 0,549 | 0,326 |
| Ostrava-Mošnov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0,170 |
| Karlovy Vary | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0,020 |
| Pardubice | 0 | 9 469 | 14 790 | 1 620 | 2 952 | 0 | 1 414 422 | 1 653 | 0,032 | 0,477 |
| Přerov-Bochoř | 0 | 881 292 | 56 326 | 3 279 | 7 818 | 191 476 | 299 771 | 1 330 | 0,000 | 0,590 |

Source: own elaboration based on data from Czech Statistical Bureau and Institute of Territorial Development

The results of the analysis show optimal efficiency of the airport Prague-Ruzyně. Note that just this airport has the highest values of all location assets and thus, the airport utilizes its strengths of large market and economic and tourism potential. The airports Ostrava-Mošnov and Karlovy Vary are efficient with respect to location assets, however, inefficient when the number of passengers is considered. Finally, there is a potential to increase efficiency of the remaining two airports – Brno-Tuřany and Pardubice – in both geographical efficiency and scale efficiency. Note that the airport Brno-Tuřany is inefficient especially in the utilization of its economic potential and the airport Pardubice of its tourism potential. The results for the last analyzed airport Přerov-Bochoř are naturally inefficient due to the lacking civilian flights in 2009. However, rather high values of input variables show that the potential of the airport may be relatively high compared with other regional airports in the Czech Republic. It is noteworthy that the high input values of the airport Přerov-Bochoř are caused by the presence of Brno and Ostrava in the 75 km area. Thus, competition between the regional airports Ostrava-Mošnov, Brno-Tuřany and Přerov-Bochoř must be considered.

4. CONCLUSION

The results of our DEA analysis confirm the dominant position of the airport Prague-Ruzyně in the network of Czech airports. Furthermore, all regional airports show geographical inefficiency related to the number of their passengers. This finding is ambivalent, formulating question on profitability of regional airports on one hand and on development potential on the other. In the latter case, the inefficiency of the airport Pardubice related to tourism assets may be given. In the abovementioned context we must perceive also the development project of the airport Přerov-Bochoř. Our analysis points at rather high potential of location assets for development of the airport compared with other regional airports in the Czech Republic. However, this potential must consider relations to other regional airports, especially in Ostrava and Brno, and also to other transport modes (e.g. railway Přerov-Prague and Přerov-Vienna). Altogether, the success of the airport Přerov-Bochoř will depend on the ability of its management to formulate a development strategy which would find a suitable market niche in the network of Czech regional airports.

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