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Efficiency in nigerian airports

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ABSTRACT

This paper analyzes efficiency levels in Nigerian airports using a stochastic frontier model that captures the impact of unobserved managerial ability during the period 2003–2014 based on the methodology presented in Alvarez et al. (2004) – the AAG model. Managerial ability in Nigerian airports is an important issue for sustaining efficiency levels because they are labor intensive rather than capital-intensive facilities. The AAG model was modified in this research to measure two exogenous contextual variables, namely regulation and hub. Under this modified version of the AAG model, inputs and outputs are disentangled in the frontier estimate while simultaneously allowing these contextual variables to control the impacts of managerial ability on efficiency. Results not only suggest that variations in efficiency scores are more sensitive to labor than to capital costs, but also indicate a negative impact of regulation and hub operations on efficiency levels possibly due to the small operational scale of Nigerian airports. Policy implications are derived.

1. Introduction

The study of efficiency in the airport industry can produce relevant insights in terms of competitiveness, unveiling inherent capabilities for performance improvement (Biesebroeck, 2007; Diana, 2010; Bezerra and Gomes, 2016). Previous studies on airport efficiency have either adopted the DEA (Data Envelopment Analysis) model and its variants (e.g. Sarkis, 2000; Sarkis and Talluri, 2004; Marques and Simões, 2010; Wanke, 2013; Tavassoli et al., 2014; Wanke and Barros, 2016) or the SFA (Stochastic Frontier Analysis) model (e.g. Barros, 2009; Pels et al., 2001, 2003). When looking at the details, while the slack analysis of DEA provides insight on resources to improve efficiency discrimination (Olesen et al., 2015), the SFA method focuses on the economic justification of a given production function. Besides, SFA has some advantages as well as disadvantages over DEA because of its parametric characteristics where some distributional assumptions are made regarding the error and the inefficiency terms (Sun et al., 2015). More precisely, DEA falls short with respect to the necessary statistical properties for a robust examination of the roots of inefficiency when using contextual variables (Bogetoft and Otto, 2010). This paper lends a contribution to the literature by analyzing a sample of Nigerian airports using a modified version of the Alvarez et al. (2004) model – AAG model, from here on – for unobserved managerial ability capable of handling the impact of exogenous contextual variables.

There are several motivations to better understand the role of managerial ability in Nigerian airports. First, although airport efficiency has been extensively researched in different countries, research on Nigerian airports is still restricted to a small number of studies (Daramola, 2014; Ismaila et al., 2014; Wanke et al., 2016), which justifies this present research. Second, the focus on African airports offers fertile ground for understanding the role of managerial ability in airport efficiency since they fall short in physical resources seeing that they are more labor intensive than capital intensive (Barros, 2011; Wanke et al., 2016). Third, benchmarking is a way of segmenting productive units in light of common patterns and, therefore, constitutes a relevant source for performance improvement (Hooper and Hensher, 1997; Diana, 2010). Fourth, given the relative importance of labor to the detriment of capital, managerial practices may heavily vary depending upon the airport, being strongly influenced by contextual variables. Finally, this eventual dispersion in efficiency scores, derived from distinct managerial practices and their cross effects upon contextual variables, may also produce what is called “unobserved heterogeneity”, which has been the focus of different researches such as that of Chesher (1984); Chesher and Silva (2002). Heterogeneity is an important source of model misspecification that leads to inconsistent parameter estimation.

The remainder of this study is organized as follows: Section 2 presents the contextual setting of Nigerian airports and the previous scant academic papers focused on them followed by a more general literature

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Table 1
Major Features of Nigerian Airports.
Source: FAAN (2014).

Airport Number	Airport Abbreviation	Airport Name (The name after the comma refers to the city in which the airport is located. When omitted, the airport and the city share the same name)	No. of Passengers ('000)	No. of Employees
1	ABJ DOM	Nnamdi Azikiwe Domestic Airport, Abuja	4865	712
2	ABJ INT'L	Nnamdi Azikiwe International Airport, Abuja	349,244	823
3	AKURE	Akure Airport, Akure	281,556	64
4	BENIN	Benin Airport, Benin	708	84
5	CAL DOM	Margaret Ekpo Airport	38,4921	135
6	CAL INT'L	Margaret Ekpo International Airport	25,039	103
7	ENUGU	Akanu Ibiam International Airport, Enugu	41,643	132
8	IBADAN	Ibadan Airport	1513	77
9	ILO DOM	Ilorin Domestic Airport, Ilorin	71,991	64
10	ILO INT'L	Ilorin International Airport, Ilorin	185,293	98
11	JOS	Yakubu Gowon Airport, Jos	146,842	107
12	KAD DOM	Kaduna Airport	234,796	95
13	KAD INT'L	Kaduna International Airport	146,842	135
14	KAN DOM	Mallam Aminu Kano Airport	1995	411
15	KAN INT'L	Mallam Aminu Kano International Airport	103,631	469
16	MKD	Makurdi Airport	1,5631	38
17	MAID DOM	Maiduguri Airport	3,864,858	148
18	MAID INT'L	Maiduguri International Airport	3,361,107	115
19	MMA DOM	Murtala Muhammed Airport, Lagos	1,198,668	1103
20	MMA INT'L	Murtala Muhammed International Airport	13,148	1224
21	PHC DOM	Port Harcourt Airport	62,429	317
22	PHC INT'L	Port Harcourt International Airport	40,980	264
23	SOK DOM	Saddik Abubakar III Airport, Sokoto	99,342	48
24	SOK INT'L	Saddik Abubakar III International Airport, Sokoto	10,600	69
25	YOLA DOM	Yola Airport	11,731	110
26	YOLA INT'L	Yola International Airport	9522	112
27	MINNA	Minna Airport	476,063	89
28	KAT	Katsina Airport	34,333	105
29	OWERRI	Sam Mbakwe Airport	3,529,162	116
30	OSUBI	Warri Airport	1,258,601	18
		Mean	532,235	246
		Median	85,666.5	111
		Std. Dev.	1,082,082	313.8

survey on airline efficiency in Section 3. Section 4 depicts the resource-based view framework, which encompasses both physical resources and managerial ability and shows how they interact to create a competitive advantage. Section 5 discusses the modified AAG model considering the contextual variables used in this research and Section 6 presents the hypothesis tested here. Section 7 analyzes and elaborates on the results, while Section 8 gives the conclusion.

2. Contextual setting

Airplanes are the main mode of transportation in Nigeria. There are 30 airports in the country, ten of which operate international flights, while the rest only focus on domestic aviation (cf. Table 1). The most important international airports that also serve as hub operators for other airports in Nigeria are the Murtala Muhammed airport in Lagos, the Aminu Kano airport in Kano city, the Kaduna airport in Port Harcourt, and the Abuja airport in Abuja city. Until 1991, Lagos was the capital of the country. At that time, the seat of government moved to Abuja. On the other hand, Kano and Port Harcourt cities have a high volume of commercial activities, mostly related to the oil industry. A map with the location of Nigerian airports is presented in Fig. 1.

Not only do airports in Nigeria tend to be old and poorly maintained (Wanke et al., 2016), but also capital intensity tends to be low and the workforce at the airports tends to be numerous in order to face an increasing demand for air transportation. A regulatory mark for Nigerian airports was established in 2006 by means of the Civil Aviation Act (CAC). The airports gradually started to be regulated and managed by the Federal Airports Authority of Nigeria (FAAN) on behalf of the Federal Government of Nigeria, the owner of these airports.

Nigeria's air transport industry was analyzed by Daramola (2014) with a focus on accidents and fatality rates for the period 1985–2008. The author used Chi-square and Fisher's test to discriminate between sample units. Ismaila et al. (2014) analyzed Nigeria's liberalization of its Air Service Agreements. Efficiency was analyzed by Wanke et al. (2016) with a fuzzy DEA model for 2003–2013. Therefore, this paper is innovative in this context since it focuses on heterogeneity and management issues employing a modified version of the AAG model.

3. Literature survey

Similar to what has been verified in other industries, efficiency in airports is typically analyzed under parametric and non-parametric methods. Over the course of time, different papers have presented a comprehensive literature review updating the list of airport efficiency studies using both methodologies (Bazargan and Vasigh, 2003; Diana, 2010; Bezerra and Gomes, 2016). In regards to the non-parametric DEA model, research on developed economies tends to prevail over underdeveloped ones with a focus on airport rankings, productive changes over the course of time, and slacks assessment (e.g. Gillen and Lall, 2001; Sarkis 2000; Sarkis and Talluri, 2004; Yoshida and Fujimoto, 2004; Fung et al., 2008; Barros and Dieke, 2007; Barros and Weber, 2009; Tsui et al., 2014a,b).

On the other hand, studies using the parametric SFA include those of Pels et al. (2001) who applied a traditional SFA model, and Barros (2008a,b,c) who applied variations of the SFA model to account for randomness and latent frontiers. Differently from the non-parametric approaches, stochastic frontier models allow different types of inferences to be drawn on the residuals of the regression (Kumbhakar et al., 2013). For example, one possible approach for inference on frontier residuals encompasses the Bayesian approach (Assaf, 2010a, 2010b). Putting it in a historical perspective to be more precise, SFA models started with homogenous assumptions for different observations