Determinants of retail revenue for today's airports[1]

Nadezda Volkova[2]

Abstract

This paper examines the importance of different factors affecting the retail revenue of selected airports from an EU country from 2001 to 2003. Unlike most prior studies, which usually only have a descriptive character, this paper uses econometric techniques of panel data analysis to estimate and explain retail revenue drivers of airports. The analysis shows that hubs and regional airports tend to have a different performance variables concerning non-aeronautical revenue. Once a certain level of retail area is reached, the retail revenue per square meter starts to grow, which could be explained by increased specialization, which allows wider use of brand names and national shops that have higher margins and are able to generate higher turnovers per square meter.

Key Words: Airports, Commercial revenues, Retail, Panel data analysis.

JEL classification: C23, D12

www.gap-projekt.de

Prof. Dr. Hans-Martin Niemeier
Hochschule Bremen
Werderstr. 73
28199 Bremen

Prof. Dr. Jürgen Müller
HWR Berlin
Badensche Str. 50-51
10825 Berlin

Prof. Dr. Hansjochen Ehmer
Internationale Fachhochschule Bad Honnef
Mühlheimer Str. 38
53604 Bad Honnef

1. Introduction

The last decades saw a period of huge transformations in the airport industry. Changes in the ownership structure, the understanding of an airport's mission, the influence of new market players like LCC companies etc. changed the focus of airport management and lead to an increased focus of non-aeronautical revenue. Some airports have successfully refocused and others are now only on the eve of that.

As the contemporary airport environment is highly competitive, an airport is no longer a monopoly for both airlines and passengers, as they can quite easily prefer one airport to another. Airports need to be attractive and effective to survive. Thus while management has to pay attention to all the activities of an airport, non-aviation activities have become extremely important for airports to remain profitable and competitive.

There are a lot of articles dealing with airport efficiency and the role of non-aeronautical revenue, but most of them only have a descriptive character. There has been very little modeling of the underlying relationships, mostly because of the limitations of the data. In this paper we want to focus on the empirical estimation of factors which influence retail revenue. We were fortunate to overcome the problem of data availability by having access to data from a sample of 13 airports from a large EU country.

We next review the literature on this topic, and then describe our data set and finally carry out an econometric analysis on the main drivers of retail revenue.

2. Review of the literature

Prior researches investigated the relation between nonaviation revenues and its determinants from different points of view. The main variables usually mentioned were the size of an airport, the influence of different types of passengers, and type of the contract used.

2.1 Structure of passenger flows

Tovar, B., Roberto Rendeiro Martırn-Cejas (2008) in a study based on data from Spanish airports found out that hubs and large tourist airports are expected to attract more international passengers than the small ones, and that commercial revenue increases in line with international passenger volume. Papatheodorou A. and Zheng Lei (2006) indicate that LCC passengers' contribution to non-aeronautical revenue is smaller for the large airports (with more than 3 mill. passengers) than for the small airports. The contribution of charter and full-service passengers are seen as comparable with LCC travelers in small airports. Torres E. et al (2005) who interviewed Asturias Airport travelers found out that business travelers on average spend less than vacation travelers. But if the boarding time is less than 45 min, business travelers tend to

consume more than vacation travelers. Thus the percentage of passengers who will make a purchase is also affected by the time the potential shopper has available.

Kasarda J. (2008) pointed out that not only air passengers determine non.-aviation business. With the growing airport-linked businesses, airport employees are also using some of the airports' services, including housing, recreation, food services, retail, health, and child day care.

2.2 Crowded environment shopping

Davies G. (1995) investigates how retailers can increase sales by managing customers in such a way that there are many people in a crowd. He found that the sales potential depends on the size of the crowd and the complementarity of retail offers, but the primary reason was their being a crowd. The percentage of the passengers in a crowd who will make a purchase is also affected by the time the potential shopper has available (and the degree of crowding). Sales are found independent of location, but dependent on the attractiveness of the merchandise and the size of the crowd, because of the increase in the potential number of customers, but will be decreased by the level of crowding.

2.3 Impulse purchasing behavior

It is well known that part of purchases in the airport are not planned, but made on impulse. Industry sources estimate that as much as 70 per cent of sales are impulse driven purchases as stated in as stated in Crawford G., Melewar T.C.(2003). This is also a category that has seen unprecedented annual growth in the travel retail sector, outperforming most other categories. Thus understanding and managing these impulses can increase retail revenue significantly.

Airports are unique retail environments, travelers experience feelings of anxiety, stress and excitement which make customers react in unusual ways. Cobb C.J., Hoyer W.D. (1986) define an impulse purchase as a situation when there is no intent to buy a specific brand, or even from the category, prior to entering the store.

Omar O. (2002) stated that it is not certain that receiving an impulse necessarily results in an action, because of the various factors, which may intervene between the impelling force and the action. Time pressure, consumer's economic position, social visibility and even the shopping impulse itself can trigger the need to evaluate a prospective impulsive purchase quickly according to Hoch S. Loewenstein G. (1991). Crawford G., Melewar T.C.(2003) also pointed out that the impulse effects will differ significantly between customer segments due to both the psychological effects of the travel experience and the existence of normative traits. As airports have become larger and the distance between check in and boarding has grown further, this has

raised the level of anxiety for travelers, whose objective is to get straight to the departure gate, according to Crawford G., Melewar T.C.(2003).

Retailers must create an environment that minimizes inherent stress and accentuates or at least maintains natural levels of excitement, while also virtuously motivating impulse purchasing by reducing or eliminating barriers to purchase. Development of an impulse strategy, which should permeate all elements of airport retail activities, is essential for maximizing performance and profitability according to Crawford G., Melewar T.C.(2003)?.

Thomas D. (1997) examined impulse purchase behavior in the airport environment in more detail and pointed out two emotional shifts affect the buying habit. One is an increase in stress levels because consumers are out of their daily routine. The other is an increase in levels of anticipation and excitement. She further shows that after passenger receive their boarding pass, stress levels are lower but excitement remains high. She referred to this period of high excitement as the 'happy hour', suggesting that shopping at the airport is all about manipulating this happy hour.

Developing the idea of the "travel stress curve" Scholvinck J. (2000) presented changes in the stress levels during time spending in the airport as shown in Figure 1. He identifies the period between 'immigration' and 'pre-flight security' as the 'captive customer segment' because stress level decrease significantly in these stages. In order to increase potential revenues during this time, retailers should reduce transaction time (the potential for exploitation of the 'happy hour' will be increased in this way) and maximize impulse purchasing opportunities within the 'happy hour'.

Figure 1. Travel stress curve[3].

---
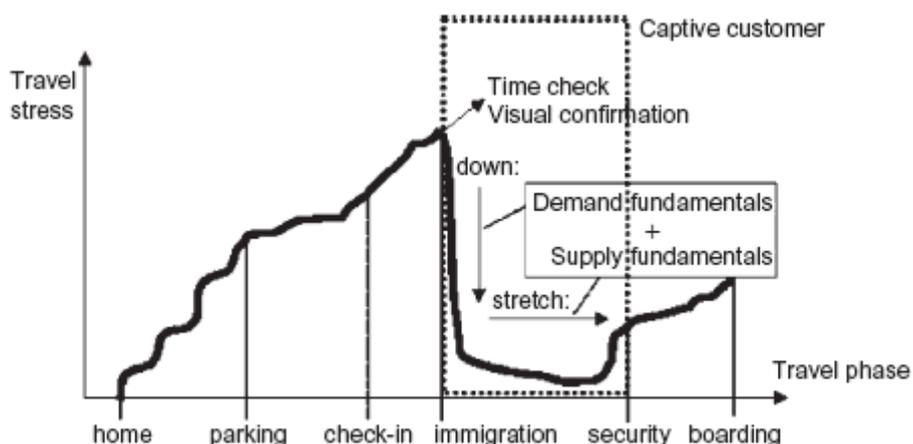
[3] Based on Scholvinck J. (2000)

Passengers indicated they were more likely to purchase after passing through airport control than before.

2.4 Airport size

Non aviation revenue should increase more than proportional with size, because of the increased specialization that is possible with a larger retail area that can be supported at large airports. This also allows more specialty shops to reach a critical volume, who usually have higher margins than the simple traveler value stores. Using airport data for the UK, Italy and Germany Graham A.'s (2006) study showed that for airports with less than 4 million passengers commercial revenues represented 44%, 33% and 31% of the total revenues, whereas airports larger than 10 million passengers showed revenues between 57%, 46% and 39%. Graham A.(2008) concluded that large airports offer a much wider range of facilities, including specialty shops and food and beverage (F&B) outlets, which a smaller airport that do not reach the critical mass would find hard to sustain. Large airports also tend to have more international (and especially intercontinental) passengers who are willing spend more.

Thompson B. (2007) gives us an idea of the amount of retail space available in major European airports (for every thousand of passengers). It will be interesting to compare these figures with our own data later on.

Figure 2. Retail space in sq meters per '000 passengers[4].
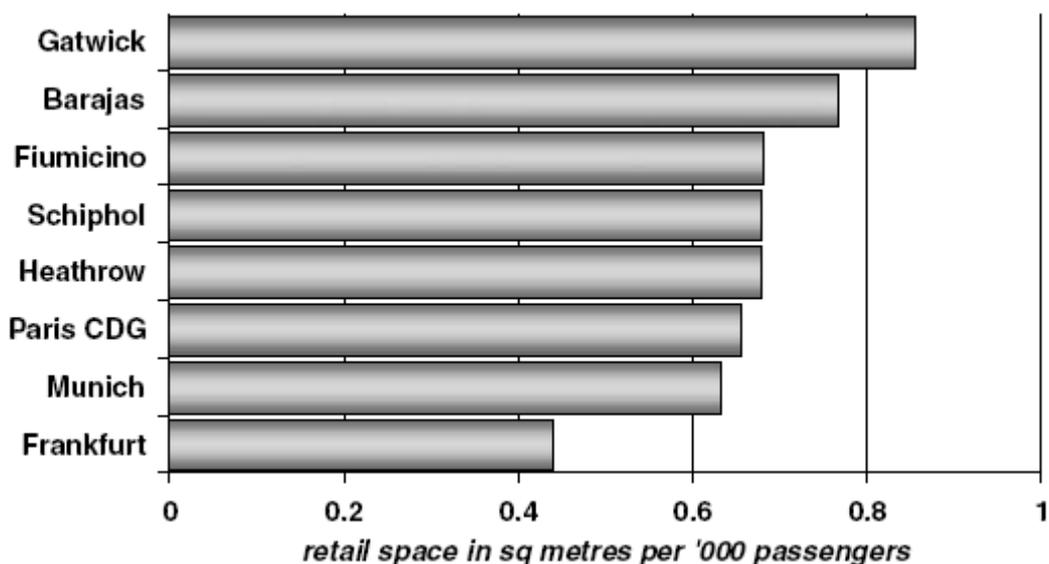
2.5 Types of contracts

---

[4] Based on Thompson B. (2007)

By type of contracts we mean the way in which retail and restaurant concessions are managed and what effect it has on performance. Hong-bumm Kim, Jee-Hye Shin (2001) revealed that mix contracts of MGR (Minimum guaranteed rate) and percentage of annual sales (paying either MGR or percentage of sales depending on which is greater) are effective for duty-free, retail and convenience shops, whereas the percentage of sales method might be more appropriate for F&B catering services. Tovar, B., Roberto Rendeiro Martırn-Cejas (2008) illustrated that among Spanish airports the ones that show an above average technical efficiency also have a higher level of outsourcing of such activities and also have higher commercial revenue. Consequently, they argue that airports who outsource are able to pay more attention to their core services and thus improve their competence, while outsourcing non aviation activities to specialists that are active at more than one location.

2.6 Demand vs. Supply side of Retail Space

International airports are facing a highly competitive environment and are increasingly required to be self-financing. If the operators of airports aims at maximizing commercial concession, then they may lower public facility service level in response to increased passenger volume due to the limitation of the original space. However, the level of space allocated for public facilities in terminal buildings must be maintained at a certain level-of-service in order to be competitive. This could result in a shortage of commercial space so ideally, space for commercial and public facilities should be adjusted according to passenger volumes.

Chaug-Ing Hsu, Ching-Cheng Chao (2005) examined the relationships among concession revenue, passenger service level and space allocation for public facilities and commercial activities at international passenger terminals. The results of their study showed that to maintain the same public facility service level, the space required for commercial activities increases proportionally with passenger volume, while the concession revenue does not increase by the same proportion, and instead depends on the allocated locations. They showed that total commercial revenues can be maximized by allocating the stores with more concession revenue per square meter in the more accessible positions in the terminal building.

To maximize concession revenue, even given constant passenger volume, the required commercial space is not the same and its ratio to public facility space also differs for different public facility service levels. The ratio of commercial space to public facility space increases with reducing public facility service level. The airports that incorporate a high public facility service in their original design may reduce public facility space while increasing commercial space, thus increasing commercial concession revenue.

Thus, it is not just enough to look at the demand for retail services, but one must also see how many shopping opportunities are being offered. This is not the small question, because in the past airports have been laid out to provide a fast throughput of passengers, rather than to maximize the amount of time available for shopping between arrival and take off. Thus we must pay special attention to how much retail space can be made available at different airports.

Benjamin J.D. (1998) analysis revealed inelastic price demand and supply elasticities for retail space. Because demand and supply are price inelastic, shifts in demand (supply) were found to result in relatively large changes in rent and relatively small changes in quantity demanded (supplied). Rental prices were largely explained by the previous year's rental price and the current year's vacancy rate, with higher vacancy rates resulting in lower rental prices. Demand for space was strongly influenced by the real level of retail spending; in particular, space demand seemed to rise slightly less than in proportion to increases in real retail sales. On the supply side, the supply of space was negatively affected by more stringent land-use regulation and less land availability, while capital costs, as measured by interest rates, did not appear to have a significant impact on supply.

.

2.7 Retail location planning

Shop location itself plays an important role in the process of the retail revenue generation.

Hernandez T. et al. (1998) stated that location has come to be appreciated much more as a potential source of competitive advantage. The intensity of competition in a number of markets, including the onset of saturation in some sectors, has led retailers to place far greater emphasis on the effective management of their store portfolios, and to plan these much more systematically in order to maximize the aggregate returns to their business.

Brueckner J.K. (1993) showed that the design of a shopping center can be viewed as a two-stage problem. First, the developer decides on the number and types of stores that the center will contain. Then, he or she decides on the amount of space that will be allocated to each of the chosen stores. Analytically, the first stage involves a discrete choice problem, while the second stage has continuous choice variables. The given stores' own sales rise as other stores grow in size because the shopping center is then more attractive to customers.

Hernandez T. et al. (1998) grouped the location planning techniques into three broad groups: *comparative* (where the essence is simple benchmarking against already established stores); *predictive*, which are the multivariate statistical techniques, using cumulative data on past store performances to ascertain future ones; and *knowledge based*, where statistical data is combined with programmed intelligence.

2.8 Hypothesis from the review of the literature

This review has allowed us to identify some principal relationships that we now want to analyze empirically. But we were not able to test all of the hypothesis, because of the lack of data.

Table 1. Effect of different factors on the commercial revenue of the airport

Independent variable	Sign	Interpretation of the coefficient/relation
International passengers	+	International passengers tend to spend more than domestic passengers; consequently coefficient in front of international pax should be grater than in front of domestic pax volume.
Domestic passengers	+	
LCC passengers	+	LCC passengers contribution for small airports is higher than for hubs.
Business passengers	+	Business passengers spend less on average.
Leisure passengers	+	
Airport employees	+	Coefficient in front of number of employees should be statistically significant.
Level of crowding	–	Increase in the level of crowding decrease sales.
Stress level	–	Passengers state that they are more likely to purchase after passing through airport sequrity control than before, consequently airside retail sales per square meter should be higher than landside retail sales per sqm.
Airport size	+	At hubs retail revenue is higher (as a percentage of total revenue) than at regional airports.
Specialization	+	Increase in number of specialty shops increase retail revenue per pax or per sqm.
Outsourcing	+	Outsourcing of retail activities to retail professionals increase commercial revenue.
Public facility service levels	+	High public facility service levels helps to increase retail revenue by affording an airport to reduce public facility space while increasing commercial space, thus increasing commercial revenue.
Location		Allocating the stores with higher retail revenue per square meter in the more accessible positions in the terminal increase retail revenue.

3. Data

Our sample consists of 13 airports during the years 2001 and 2003. Six of them had more than 3 mill. passengers in 2003. The data includes retail and F&B turnover before and behind customs; terminal, retail and F&B space and the number of passengers (both arrivals and departures, divided into intra and extra EU). Data concerning rental charges, the number of transit passengers, the number of parking places and the number of employees is only available for 2003.

3.1 Descriptive statistics

a) revenue components

The data allows us an overview of the most important revenue sources. Car rental services and retail account for the largest part of non-aviation revenue per passenger at the airports in our sample (Fig 3).

Fig 3. Mean turnover per passenger from different activities (2001)

Fig 4. Mean turnover per passenger in different types of airports (2001)

Fig 5. Landside and airside mean turnover per passenger (2001)

Fig 6. Landside and airside mean turnover per square meter (2001)
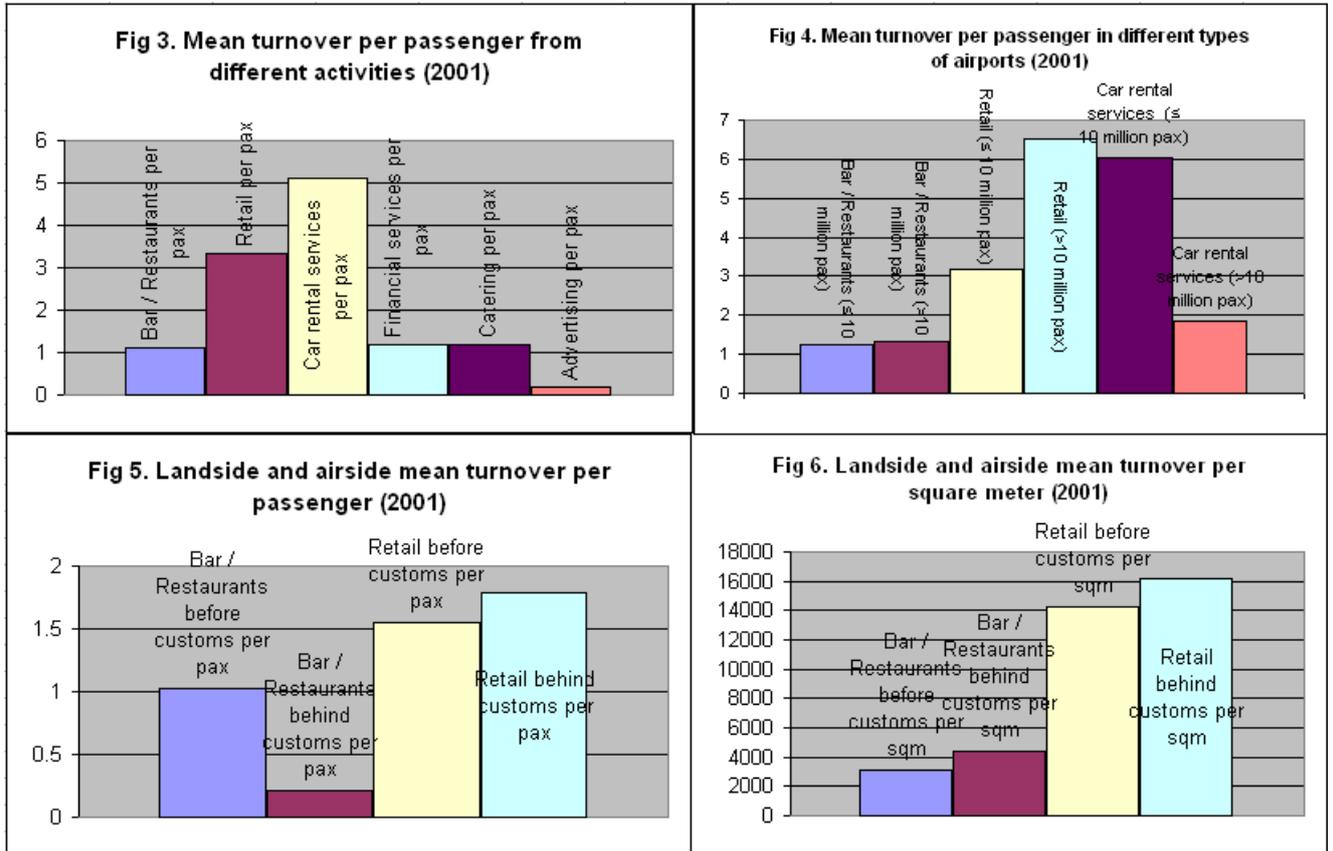
It is interesting, to compare our sample of airports from one country with the data of the Airport Council International. Graham A. (2008) shows that the most significant single revenue item is retail (including F&B) in most regions worldwide, except in North America where car parking (31%) and car rental (14%) are more important than retail (10%). Our data shows that 9 of the 13 airports have higher car rental revenue than revenues generated by retail and bars/restaurants. But the hubs in our sample show a different division of non aviation revenue because it covers small and large airport (Fig 4). If we differentiate by airport size, i.e. above and below 10 mill. passengers per year, retail revenue is several times higher in these hubs than revenues from car rental. On the other hand, we find larger car rentals at smaller airports This can be explained by the fact that there are a lot of transit passengers in hubs who do not need car rentals and in addition there is a well-developed infrastructure of the retail sector (diversification: national and brand name shops) at these airports. It is clearly differnt for small airports

There is nothing surprising when looking at the retail revenue before and behind customs (Fig 5, Fig 6). Retail revenue behind customs is greater both per passenger and per square meter units, due to the presence of more shops behind the customs area. But the differences are not so large.

When looking at the revenues from F&B it can be seen that the revenues before customs per pax are much higher, probably because it may also include meters and greeters. The productivity , i.e. the turnover of her square meter is higher after the security, especially for restaurants and bars (Fig 5, Fig 6). Conclusions about the efficiency of space allocation for bars/restaurants before and behind customs could be hasty here as in 9 out of 13 airports less than 20% of the total space behind customs is occupied by F&B facilities.

b) retail space

Our database gives us the chance to look in detail at retail productivity per square meter.

Fig 7. Turnover per sqm of retail surface area (2001)

Fig 8. Share of retail surface in terminal surface (2001)
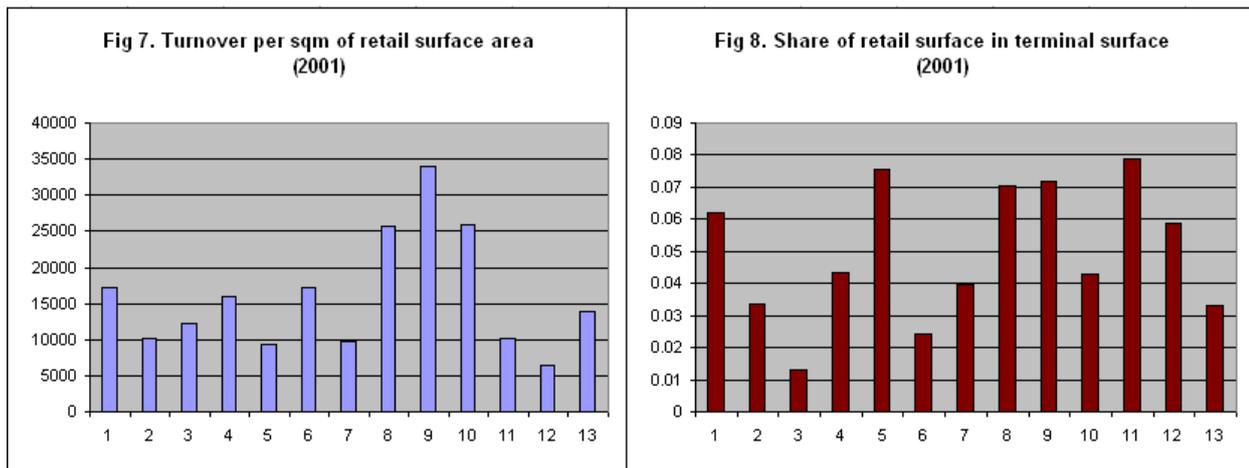
Airport 2, Airport 3 and Airport 6 have the lowest turnover per sqm and at the same time they have the lowest ratio of retail to terminal surface (Fig 7, Fig 8). Their results in turnover per passenger are also the worst ones. Airport 3 is the smallest in this sample and has fewer than 1 million passengers per year.

Airport 1 and Airport 2 have a similar number of passengers, terminal and retail surface, but the performance of Airport 1 is better. This may be because 64% of retail space in Airport 1 is behind customs, where duty free shops are situated. Moreover, the majority of passengers prefers purchasing after the security controls. At Airport 2 airport only 20% of the retail space is situated behind customs.

From 2001 to 2003 due to the increase of retail space,the turnover per square meter at 7 of our 13 airports decreased.

c) routes data

Fig 9. Routes data (2001)

Fig 10. Routes data (2001)
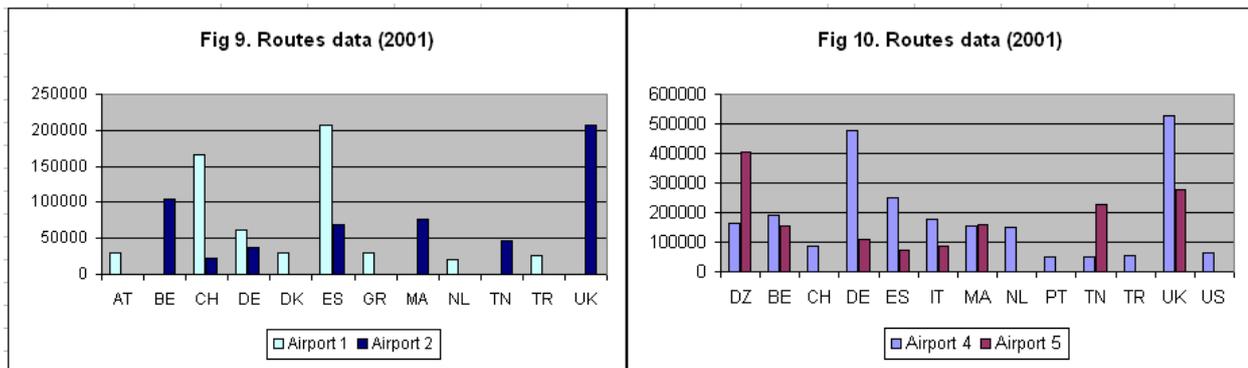
The number of domestic passengers carried at Airport 1 is fewer than at Airport 2. Airport 4 and Airport 5 also have a similar level of passenger volume, but the share of retail space in the terminal is much higher in Airport 5 even though the two airports have an equal level of retail revenue. Consequently, the additional retail space in Airport 5 does not generate additional revenue. The number of domestic passengers carried at Airport 4 airport is fewer than in Airport 5. The hypothesis resulting could be that domestic passengers spend less than other kinds of passengers, which corresponds with the results found in the literature.

At Airport 2 and Airport 5 airport a lot of international passengers travel between Europe and Africa . In terms of retail revenue per square meter Airport 2 and Airport 5 airports have a worse performance than Airport 1 and Airport 4. This should be taken into account when estimating and interpreting the spending patterns of international passengers at some of these airports.

Fig 11. Scatter plot between turnover from retail per square meter and retail surface
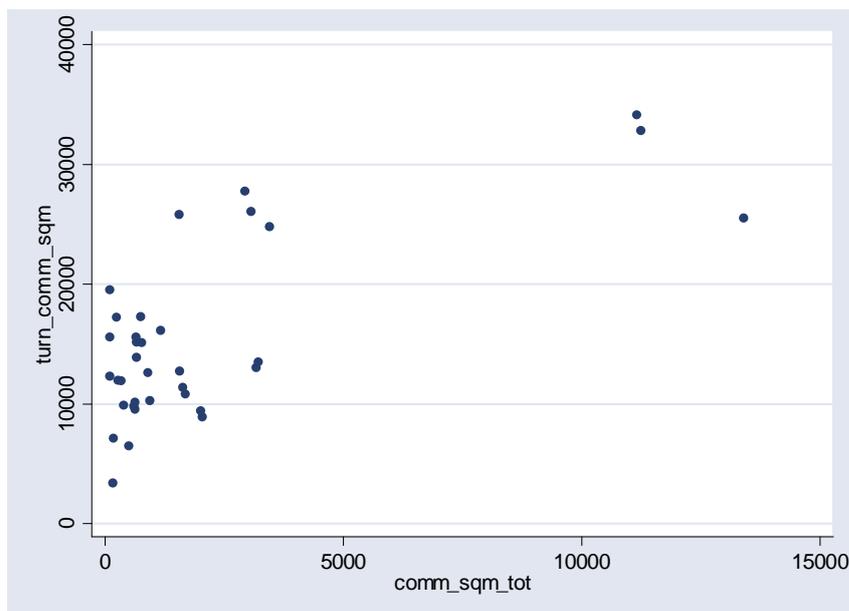
The dependence of revenue per square meter and retail space in Fig.11 is not linear. So the saturation effect exists and we should estimate this dependence by log linear relationship, but not linear model.

The analyses of descriptive statistics show that airports which have a higher share of retail space that is especially concentrated behind customs have a better performance concerning retail revenue. The division of the turnover generated by different components of non-aeronautical revenue is different in hubs and regional airports. Normally, the growth of an airport's terminal size and number of passengers is linked to an increase of non-aeronautical revenues (in absolute values), but all of these components grow at different speed.

These general remarks give us only a first overview of our data said. Clearly, we need a more detailed examination, but also a deeper analysis with the help of econometric techniques, which will be provided in the next section.

4. Empirical results

We start our analysis with a simple model and refine this afterwards in order to estimate more specific effects.

Our main restriction is the number of observations given the small sample, in other words to have enough degrees of freedom to estimate the model. Sometimes we have to look separately at each independent variable instead of putting them together in one model.

Table 2. Random-effects GLS regression				
	Model 1		**Model 2**	
Retail revenue per sqm (in 1000 €)	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Ln (total number of passengers)	12.78	(2.15)***	8.21	(2.49)***
Ln (retail surface)	-6.48	(1.79)***	-4.89	(1.77)**
dummy_hub_3 (takes the value 1 if an airport has more than 3 000 000 passengers)	-2.59	(2.25)	No	No
dummy_hub_10 (takes the value 1 if an airport has more than 10 000 000 passengers)	No	No	7.34	(3.57)*
Const	-134.83	(22.65)***	-78.54	(27.46)***

"***" Significant at the 0.1% level. "**" Significant at the 1% level. "*" Significant at the 5% level.

Firstly we want to identify the passenger volume which differentiates regional airports from hubs. Following previous researches mentioned in the literature review we use a 3 and 10 mill passenger level as a cutting benchmark. In our sample the 3 mill level was insignificant as statistically significant differences in the performance can only be noticed at airport with more than 10,000,000 passengers (Table 2).

When looking at the relation between surface of retail area and retail revenue per square meter we estimate Model 3 (Table 3). By adding the regression independent variable in the first and the second power we can model diminishing or increasing return of the scope. Empirical results show that after certain level of retail area is reached, retail revenue per square meter starts to grow. Consequently, the question arises whether only the size of the retail area is important or the different approaches taken towards retail strategies in hubs.

On the one hand hubs have more specialty shops which have higher margins but on the other hand they have a different structure of passenger flows than have regional airports.

In order to catch the effect of differences in the passenger flow structure we add the number of intra and extra EU departures to the model(Model 4, Table 3).

Bars/restaurants also influence the retail revenue of an airport in different ways, as there is clearly a substitution effect. After a passenger spends money and time in a bar/restaurant he or she could become restricted in time and money in order to make purchases in an airport's shop. But if shops and bars/restaurants are situated close to one another, a different , complementary effect could be noticed. While a passenger eats he or she is able to have a look at the shop windows and can decide to buy something.

To test this effect, we have added the natural logarithm of revenue from F&B per departure to the model. The passenger regressors concerning the surface area now becomes insignificant (Model 5, Table 3). If we look at the retail and bar/restaurant revenue, it seems that in order to maximize non-aeronautical revenues as a whole, the location effect could have a more significant effect than the surface area. If F&B outlets are situated before the shopping area the probability that retail revenue will be lower is more likely. Unfortunately it is hard to estimate all effects of the location with the help of econometrics techniques, given the small sample size.

In Model 6 (Table 3) the revenue variable from F&B is added to model 4. The natural logarithm of revenue from F&B (in 1000 €) has a positive sign and all variables are significant in the model. By adding the revenue from F&B we are able to estimate the overall performance of an airport (if the terminal is well planned, the airport has a good quality of management etc., all components will have a positive direction on growth).

Table 3. Random-effects GLS regression

Retail revenue per sqm (in 1000 €)	Model 3 Coef.	Model 3 Std. Err.	Model 4 Coef.	Model 4 Std. Err.	Model 5 Coef.	Model 5 Std. Err.	Model 6 Coef.	Model 6 Std. Err.
Ln(retail surface area in sqm)	-19.03	(9.41)*	-17.14	(6.70)**	-11.32	(9.00)	-20.27	(4.38)***
Ln(retail surface area in sqm)^2	1.56	(0.67)*	0.83	(0.50)^	0.32	(0.68)	0.87	(0.33)**
Ln(departure passengers Intra-EU)	No	No	5.64	(1.24)***	5.69	(1.35)***	3.10	(1.22)**
Ln(departure passengers Extra-EU)	No	No	3.40	(0.89)***	4.07	(0.96)***	1.40	(0.80)^
Ln(revenue from F&B per departure passenger)	No	No	No	No	-6.21	(2.57)*	No	No
Ln(revenue from F&B (in 1000 €))	No	No	No	No	No	No	8.09	(2.19)***
Const	69.84	(32.52)*	-31.51	(30.93)	-93.18	(40.80)*	-20.52	(20.36)

"***" Significant at the 0.1% level. "**" Significant at the 1% level. "*" Significant at the 5% level. "^" Significant at the 10% level.

Model 4 shows that if the number of intra-EU departure passengers increases by 1% the retail revenue per square meter will increase by 5 640€ and if the number of extra-EU departure passengers increases by 1% the retail revenue per square meter will increase only by 3 400€. It looks surprising on the first glance, because extra-EU passengers tend to spend more in duty free shops.

Table 4. Random-effects GLS regression

Ln (Retail revenue per sqm (in 1000 €))	Model 7 (< 10 000 000 passengers) Coef.	Model 7 (< 10 000 000 passengers) Std. Err.	Model 8 (≥ 10 000 000 passengers) Coef.	Model 8 (≥ 10 000 000 passengers) Std. Err.
Departure passengers Intra-EU	1.10E-07	(5.82E-08)*	-1.07E-07	(4.79E-08)*
Departure passengers Extra-EU	1.30E-07	(1.62E-07)	6.39E-08	(2.11E-08)**
Const	2.25	(0.13)***	4.02	(0.37)***

"***" Significant at the 0.1% level. "**" Significant at the 1% level. "*" Significant at the 5% level.

The largest group of the airports in our sample are small regional airports. After looking separately at the airports with less and more than 10 mill passengers the results differ. For regional airports extra-EU passengers were statistically insignificant (but their share of

passengers is also very low) and for hubs extra-EU passengers are significant and have positive sign (Table 4).

The number of employees, check-in facilities and short stay parking places have a statistically significant positive relation with the retail revenues per square meter, medium and long stay parking places have no significant effect (Table 5).

Table 5. Random-effects GLS regression

Retail revenue per sqm (in 1000 €)	Model 9		Model 10		Model 11		Model 12	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Number of employees	0.003	(0.0006)**	No	No	No	No	No	No
Parking short stay places	No	No	0.001	(0.0003)*	No	No	No	No
Parking medium and long stay places	No	No	No	No	0.0003	(0.0009)	No	No
Number of check-in facilities	No	No	No	No	No	No	0.036	(0.010)**
Const	12.71	(1.07)***	12.06	(1.97)***	15.05	(3.86)**	11.51	(1.69)***

"***" Significant at the 0.1% level. "**" Significant at the 1% level.   "*" Significant at the 5% level. "^" Significant at the 10% level.

Contrary to the literature the models show that international transit passengers add fewer revenue per square meter than ordinary passengers (Model 13, Model 15, Table 6). On the one hand transit passengers spend more time in the airport and they have more time for shopping, they also spend this time at the airside area of an airport where most the shops are located. In addition they are unstressed, because check-in and security controls are already behind. But on the other hand all the spending of the transit passengers are summed up. These expenditures could be higher than the spending of passengers form direct routes if all spending of transit passengers are taken but not only a transit passenger's expenditures at one airport. Domestic transit passengers are insignificant in the sample.

We have so far estimated the fixed effect and the random effect models during the analysis. The random-effect model is preferred because of the results of the Hausman test.

If the random effect model is: $y_{it}=\mu+x'_{it}\beta+\upsilon_{it}$, where $i=1,...,N;\ t=1,...,T$.

$\upsilon_{it}=\alpha_i+\varepsilon_{it}$, where α_i are $iid(0,\sigma^2_\alpha)$ and independent of ε_{it} $iid(0,\sigma^2_\varepsilon)$ and x_{it} for all $i,\ t$.

Rewriting in matrix notation: $y=W\delta+\upsilon$.

Null hypotheses: $H_0 : E(\alpha_i|W_{it}) = 0$

Table 6. Random-effects GLS regression						
	Model 13		**Model 14**		**Model 15**	
Retail revenue per sqm (in 1000 €)	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Ln(International direct transit passengers)	3.36	(1.39)**	No	No	No	No
Ln(Domestic direct transit passengers)	No	No	0.21	(0.80)*	No	No
Ln(Departure passengers without transit)	No	No	No	No	5.37	(0.92)***
Const	-14.72	(13.93)	12.80	(7.67)^	-63.28	(13.41)***

"***" Significant at the 0.1% level. "**" Significant at the 1% level. "*" Significant at the 5% level. "^" Significant at the 10% level.

Under the null hypotheses both Random effect GLS and FE estimator are consistent, whereas under the alternative only the fixed effect estimator is consistent. This means that if the null hypothesis is true there should not be a significant differences between the parameters. So, the Hausman test statistic is:

$$H = (\beta^{est}_{RE} - \beta^{est}_{FE})'(Var_{FE} - Var_{RE})^{-1}(\beta^{est}_{RE} - \beta^{est}_{FE})$$

Under the null hypothesis the Hausman test statistic will have X^2 (chi-squared) distribution asymptotically.

For Model 13, for example, the Hausman test statictic was equal to 0,85 with $P > X^2 = 0,36$. We accept the null hypothesis and choose random-effect model.

5. Conclusion

The purpose of this study was to understand the main drivers of retail revenue at a sample off for airports from one EU country. It was found that regional airports and hubs have a different performance, which becomes statistically significant at the 10 mill. pax level. Extra-EU passengers increase retail revenue per square meter in hubs, but they have no significant effect on retail revenue at regional airports.

The number of short stay parking places, check-in facilities and the number of employees also contribute to the retail revenue. This suggest that the infrastructure of an airport is extremely important for the retail revenue, because the coefficients for such variables as retail surface, parking places, check-in facilities are greater than the coefficients of such regressors as different

types of passengers or number employees. On the other hand an airport's management has more possibilities to improve the infrastructure than the passenger flows.

Concerning the retail surface, it was found that once a certain level of retail area is reached, retail revenue per square meter starts to grow, which could be explained by the benefits of specialization, the wider use of brand name shops which have higher margins and are able to generate a higher turnover per square meter. Bars/restaurants also influence the retail revenue and generate externalities. This is similar to the externalities, which are created by anchor stores in shopping malls (Gould at al, 2005).

There are also several aspects which should be taken into account before making final conclusions. The location of shops close to bars/restaurants, financial and car rental services seems to have a very important effect on non-aeronautical revenues. Habits and mentality of different nationalities influence the retail revenue as well. We cannot estimate the relations concerning the location with the help of econometrics techniques on the basis of this sample which we are currently using; observations of additional years would be needed in order to add additional regressors on the role of nationalities to the model.

The estimation of this model on a set of US data will be the next step of this line of research, which helps to understand whether our results are true in general or whether they have a country and regional specific character.

References

1) Benjamin J.D. (1998), A Simultaneous Model and Empirical Test of the Demand and Supply of Retail Space. Journal of real estate Research volume 16, Number 1.

2) Brueckner J.K. (1993), Inter-Stoore Externalities and Space Allocation in Shopping Centers. Journal of Real Estate Finance and Economics, 7: 5-16.

3) Chaug-Ing Hsu, Ching-Cheng Chao (2005), Space allocation for commercial activities at international passenger terminals. Transportation Research Part E 41, 29–51.

4) Cobb, C. J., Hoyer, W. D. (1986), Planned versus impulse purchase behaviour, Journal of Retailing, 62(4), 384–409.

5) Crawford G., Melewar T.C. (2003), The importance of impulse purchasing behaviour in the international airport environment. Journal of Consumer Behaviour Vol. 3, 1, 85–98.

6) Davies G., (1995), Bringing stores to shoppers – not shoppers to stores. International Journal of Retail & Distribution Management Volume 23 · Number 1,· pp. 18–23.

7) Forsyth P. (2004), Locational and monopoly rents at airports:creating them and shifting them, Journal of Air Transport Management 10, 51–60.

8) Freathy P., O'Connell F. (1998), Supply chain relationships within airport retailing. International Journal of Physical Distribution & Logistics Management, Vol. 28 No. 6.

9) Gillen D., William G. Morrison (2005), The economics of franchise contracts and airport policy, Journal of Air Transport Management 11,43–48.

10) Gould Eric D, B. Peter Pashigian, and Canice J. Prendergast (2005), Contracts, externalities, and incentives in shopping malls. The Review of Economics and Statistics, 87(3): 411–422.

11) Graham, A., (2006), Assessing the economic challenges facing regional airports in today's environment: turning these challenges into opportunities. In: Presentation given at the Global Airport Development Conference, Rome.

12) Graham A. (2008), How important are commercial revenues to today's airports? Journal of Air Transport Management, doi:10.1016/j.jairtraman.2008.11.004.

13) Graham Francis, Alessandro Fidato, Ian Humphreys (2003), Airport–airline interaction: the impact of low-cost carriers on two European airports, Journal of Air Transport Management 9, 267–273.

14) Graham Francis, Ian Humphreys, Stephen Ison (2004), Airports' perspectives on the growth of low-cost airlines and the remodeling of the airport–airline relationship, Tourism Management 25, 507–514.

15) Hernandez T., Bennison D., Cornelius S. (1998), The organisational context of retail locational planning, GeoJournal 45: 299–308.

16) Hoch S., Loewenstein G. (1991), Time inconsistent preferences and consumer self-control, Journal of Consumer Research, 17 (March), pp. 497-507.

17) Hong-bumm Kim, Jee-Hye Shin (2001), A contextual investigation of the operation and management of airport concessions, Tourism Management 22,149-155.

18) Kasarda J.D. (2008), Shopping In the Airport City and Aerotropolis, RESEARCH REVIEW, VOL. 15, NO. 2.

19) Lyon D., Graham Francis (2006), Managing New Zealand's airports in the face of commercial challenges, Journal of Air Transport Management 12, 220–226.

20) Omar O. (2002), Airport Retailing: Examining Airline Passengers' Impulsive Shopping Behaviour, Journal of Euromarketing,11:1,87-105.

21) Papatheodorou A., Zheng Lei (2006), Leisure travel in Europe and airline business models: A study of regional airports in Great Britain. Journal of Air Transport Management 12, 47–52.

22) Scholvinck, J. (2000), The Travel Stress Curve, Market Square Consulting, Amsterdam.

23) Thomas D. (1997), Retail and Leisure developments at London Heathrow, Commercial Airport, British Airport Authority, (August), 38-41.

24) Thompson B. (2007), Airport retailing in the UK. Journal of Retail and Leisure Property 6, 203 – 211.doi: 10.1057/palgrave.rlp.5100067

25) Thorsten Teichert, Edlira Shehu, Iwan von Wartburg (2008) Customer segmentation revisited: The case of the airline industry, Transportation Research Part A 42,227–242.

26) Torres E. , J.S. Dominguez, L. Valdes, R. Aza (2005), Passenger waiting time in an airport and expenditure carried out in the commercial area, Journal of Air Transport Management 11, 363–367.

27) Tovar B., Roberto Rendeiro Martin-Cejas (2008), Are outsourcing and non-aeronautical revenues important drivers in the efficiency of Spanish airports? Journal of Air Transport Management, doi:10.1016/j.jairtraman.2008.09.009.