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Retail Macro-location Factors: Empirical Evidence from the Portuguese Shopping Centres

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Abstract

Shopping centres appeared in Portugal in the beginning of the 1970's and have expanded their presence from the eighties onwards. However, few efforts have been made to identify the macro level factors that influenced the location of Portuguese shopping centres. This study attempts to fill this gap by focusing on the region-specific endowments that motivate promoters of shopping centres to invest in a particular location.

Using OLS Regression, we tested five hypotheses as pointed out by the theory, namely the population (measured by the population/area), the economy (measured by the purchasing power index), the competition (measured by the number of retailers per head), the accessibility to the shopping centre (measured by the difference between the maximum and minimum altitude) and costs (measured by the average time distance).

The results support all our hypotheses, except accessibility. The population hypothesis (H1) was supported, promoters tended to invest in regions where population density is higher. The economy hypothesis was supported (H2), promoters tended to invest in high income regions. The competition hypothesis was supported (H3), promoters tended to choose regions where there is a lack of retailers per head. Finally, the cost hypothesis was also supported (H5), promoters tended to choose regions where they perceived low levels of cost. We found no support for the accessibility measure (H4), although the variable was correctly signed.

Introduction

The introduction and growth of shopping centres has become an essential element of retail structures in the most developed countries in the space of the last decades, reflect also the progressive involvement of several subjects (developers, construction companies, financial institutions, retailers, public authorities, etc.) that, even though on the basis of different motivations, have deeply affected the formula's characteristics (HORVATH, 1997).

The Portuguese retail industry has undergone significant structural transformations over the last two decades. A number of factors have combined to promote retail change at local, regional and national level. Firstly, corporate concentration has occurred across most retail sectors. This has resulted in a small number of major retailers controlling a large proportion of total retail sales. Widespread development of shopping centres has taken place in the Portuguese retail sector and is still expanding if one considers the intention of the two most important investors. Indeed, *Sonae* intend to invest € 169,5 millions until 2003 while *Mundicenter* are planning to invest € 189,5 millions until 2004 (ANTUNES, 2000).

The primitive forms of shopping centres were groups of shops that between them supplied a complete range of goods for daily consumption and had little or no spatial impact in Portugal. The most recent formula (planned shopping centre), tries to emulate a typical city centre, by linking a strictly commercial offer with other services (restaurants, leisure facilities, etc.). Also, this new formula creates centrality, changes shopping habits, attracts people to suburban areas and helps the revival of urban districts or the rehabilitation of property areas of historical value that have been neglected or have decayed.

A brief analysis of the evolution of shopping centres over the last 30 years in Portugal provided the basis for understanding the metamorphoses which have occurred in the location patterns of such retail outlets. At the same time, it highlights the growing importance of this phenomenon, not only in its social aspects, but also in what concerns the modernisation of the Portuguese retailing sector.

This study is based on the assumptions that number of shopping centres in each county and, in fact, the entire gross selling area, is the result of the attraction that each county has made upon the promoters of those shopping centres. Therefore, when a certain county is endowed with adequate retail macro-location factors, the developers of this kind

of projects are more interested in that area. Thus, the unit used in the analysis is the county (concelho), which is an intermediate level of administrative division in Portugal, between parish (freguesia) and district (distrito).

In this paper, the focus is on shopping centre location decision-making activities, as they are widely recognised as the most decisive factor in determining retail success or failure. Once made, poor location decisions are difficult to remedy (HERNANDEZ and BIASIOTTO, 2001). The aim is to identify the macro level factors that favour or deter the location of shopping centres in certain Portuguese geographical areas (municipalities).

After a brief history of the development of shopping centre formulas in Portugal (section 1), we review the literature on retail macro-location factors and put forward the hypotheses (section 2). Then, we present the methodology used in the study (section 3), report and discuss the results (section 4) and draw some conclusions.

1. Shopping Centres in Portugal: brief history

The very first shopping centre in Portugal was opened in 1971, in Lisbon (capital city of the country). Two earlier attempts had been made in the mid-1960's but had failed failed (SALGUEIRO, 1996, p. 209). Although the central trading areas of Lisbon and Oporto (2nd largest city, located in the north of Portugal) absorbed most of these outlets, innovation also reached some urban coastal parts of the country in the late 1970's. By that time, shopping centres had been growning very slowly (5 new outlets per year). They were relatively small in size, the tenant mix was hybrid and they did not have any sort of centralised management unit. They appear to have been associated with real estate speculation, which sought to turn profitable areas unoccupied, underused or linked to storage or parking functions (SALGUEIRO, 1996; OC, 2000; CACHINHO, 2002).

The expansion of a new sort of shopping centres began in the 1980’s. It disseminated more intensely throughout the coastal cities and suburban areas, in a first wave, and expanded to less developed towns afterwards. From then on, the size of those outlets has grown considerably, their formula has become more diversified, and the major foreign groups of distribution have joined national ones, thus entering the Portuguese market. The maturity of the market fosters a more accurate conception of the projects that contemplates the implementation of anchor stores, a better harmony between common spaces and commercial areas, wide open corridors with various alternative circuits, air conditioning and lightening, among other concerns related to their functional organisation.

The location patterns have also become more diversified. Some of them are located in the new town centres, practically denuded of retailing, or in edge-of-town areas which have awaken for this phenomenon. Most of the times these areas have become centres, not only in terms of trade but also in terms of social life and leisure. Others are located in out-of-town or former second rate commercial zones, thereby increasing the attraction of those trading areas. There are others that seem to follow the dynamics of the city centre and are often integrated into projects of urban renovation and revitalisation. Finally, a small number, including hypermarkets such as *Continente* and *Pão de Açucar (Jumbo)*, are located in the main out-of-town highway axes (SALGUEIRO, 1996; OC, 2000; CACHINHO, 2002).

The third wave of the shopping centre evolution begins in the 1990's, and this seems to be an ongoing process that is still occurring today (OC, 2000). During the nineties we see a diffusion of shopping centres anchored in hypermarkets/large supermarkets, specialised stores, leisure facilities (cinema, etc.) and an increase in the size of the outlets, with improvements in the construction, aesthetics, architecture and urban planning of the shopping centres (BALSAS, 1999; OC, 2000; CACHINHO, 2002).

Regarding the large shopping centres, they are promoted by the major domestic groups of food retailing alone or in closer association with foreign partners. These shopping centres are no longer confined to the out-of-town areas of Lisbon and Oporto but have expanded to urban agglomerates of less consumption potential, either on the coast or inland regions. Rather, promoters seem to look for areas that offer a large population size or a high purchasing power index. This may explain the reason why their implementation has confined itself to the main centres of Lisbon and Oporto in a first phase, and, afterwards, to have spread to other urban coastal areas (Coimbra, Guimarães, Portimão, Albufeira, Braga, Aveiro, Viseu and Leiria). Nowadays, shopping centres are associated, in small and medium towns, mainly coastal, and in the heart of Lisbon and Oporto, with new urban areas in peripheral zones or integrated in projects of urban renovation and reconstruction (OC, 2000; CACHINHO, 2002).

In the near future, it is expected that new centres will be developed by the main operators in the industry. *Sonae* has invested in the construction of new shopping centres in Madeira Island, Albufeira and retail parks in Sintra and Setúbal. *Mundicenter* intends to develop a new shopping centre in Odivelas, another in Lisbon, and a retail park in Cascais. *The Multi Development Corporation* (MDC) has itself planned to build new shopping centres in Madeira Island, Faro, Almada and Lisbon (associated with the new Sporting

Football Club Stadium). Other private promoters are also planning to launch shopping centres with large selling areas in Vila Real and Figueira da Foz (ANTUNES, 2000; FRANCHISING, 2001; HEALEY & BAKER, 2001).

2. Theory and Hypotheses

The promoter of a retail outlet has to face two rather distinct decisions in the process of location (CASARES, 1987, p. 265; RIPOL and ARÉVALO, 1996, p. 148; MCGOLDRICK, 1990, p. 158; GARCÍA, 1999, p. 106). The first one, which should be designated by macro level location, deals with the evaluation of the trade area density of the different geographic areas under analysis. The second one, which has to do with the micro level location, tackles the detailed analysis of the characteristics of alternative sites for the purpose of implementing the outlet (BROWN, 1994; BALSAS, 1999; FREITAS SANTOS, VIEIRA and ANTUNES, 2000; JIMENEZ, 2002). In what concerns the shopping centres, the first step corresponds to the selection of the best geographical areas that seem to offer trade potential, thereby favouring the implementation of the outlet. The second step refers to the selection of the site, inside the trading area.

In this light, it is expected that, within the macro level framework, the location factors to be taken into account should be general. Some of these factors are: population (size, age profile, household size); income levels (purchasing power, consumption index); competition (existing retail activity, saturation index, competitive potential) of other retailing activities; costs (purchase price, leasing terms, building costs); and accessibility (car ownership levels, road network, parking) [PETTIGREW, 1989; MCGOLDRICK, 1990; RIPOL and ARÉVALO, 1996; GARCÍA, 1999]. As for the micro level location framework, there are more specific factors that seem to interfere with the whole process. Some of these factors are: the possibility of access by public transport; the distance from the shop to residential centres; the physical barriers to circulation; the distance from the shops to the parking areas; the proximity of public or private transportation stops; parking facilities; store centrality; the existence of pedestrian zones and pedestrian flows; street liveliness; the existence of entertainment areas in the neighbourhood; available commercial area; the neighbourhood of public or private services (BALSAS, 1999; FREITAS SANTOS, VIEIRA and ANTUNES, 2000; JIMENEZ, 2002).

Retailers have a wide array of analytical techniques at their disposal to support their locational decision-making activities. Researchers identified seven broad groups:

experience; checklists, analogues and ratios; multiple regression and discriminant analysis; cluster and factor analysis; gravity modelling; expert systems/neural networks; financial analysis (MCGOLDRICK, 1990; CLARKSON, HILL and ROBINSON, 1996; HERNANDEZ and BENNISON, 2000).

The experience is based on intuition, “rules of thumb” or “common sense”. The checklists/analogues/ratios consist of a simple list of relevant factors, considered to have an influence on store performance; analogues, which enable potential new stores or sites to be compared with existing ones; and ratios, which provide basic indicators of performance, such as customer transactions per store.

The techniques of multiple regression and discriminant analysis have been developed around determinants (such as catchment area characteristics, or competition) to estimate potential turnover of a store. Cluster and factor analysis are aimed at grouping data cases and variables together in order to segment a portfolio of stores into similar groups (clusters) or group together a range of variables that can be used to predict profitability (factors). Gravity modelling techniques attempt to quantify the relationship between the movement of consumers and the attractiveness of surrounding retail centres. Geographical Information Systems (GIS)/neural networks provide different levels of support for location research, which are largely dependent on the techniques to be used. Financial analysis simply studies the financial aspects of the development and operation of a store, comparing the development costs in terms of site acquisition, building and operational costs against estimated turnover.

Thus, for the purposes of this study, we will consider two of the above techniques. In the first step we review different kinds of checklists and empirical evidence in order to obtain the most relevant macro location factors. In the second step, we use regression modelling to test empirically the variables proposed by various hypotheses.

A general factor that affects the potential of a shopping centre location is the size of population within the selected area. Total population of the county and population characteristics such as age profiles, average education level, nature and type of employment and household composition are important when dealing with retailing that needs to have a considerable trading area in order to be profitable. Population and road distance are important variables in Reilly’s law of retail gravitation. Other recognized refinements and modifications to the gravity model, such as Converse and Huff, still include population as a critical factor (PELLEGRINI, 1990; CLARKSON, HILL and ROBINSON, 1996). Also different types of checklists consider a detailed review of the

population characteristics to be fundamental to any evaluation (MEYER, HARRIS, KOHNS, STONE III, 1988; BERMAN and EVANS, 1989; JALLAIS, ORSONI and FADY, 1993). Empirical evidence of the critical role of this factor in the location of shopping centres can be found in several analyses (MCT, 1995; DELTORO and DESCALS, 1997; JIMENEZ, 1997; OC, 2000; CACHINHO, 2002). Thus, the following hypothesis is put forward:

Hypothesis H1: Promoters of shopping centres are more likely to invest in areas with high population density than in areas with low population density.

Another major concern in planning the location of a shopping centre is the economic strength of the area. Therefore, the future of the area in terms of the stability of its economic base and indicators such as purchasing power index or family disposable income should be studied. These data help us to trace the consumer profile within an area in order to better tailor the tenant-mix of the shopping centre and estimate the potential turnover of the outlet. Although some authors (BERMAN and EVANS, 1989; MCGOLDRICK, 1990) include the disposal income of residents as a characteristic of the population, the purposes of the present study advised a separation of the two variables. However, problems of multicollinearity may arise, due to a high correlation between population and income. Several checklists (MEYER, HARRIS, KOHNS, STONE III, 1988; JALLAIS, ORSONI and FADY, 1993) reinforce the interest of studying the two variables autonomously. Empirical evidence from Portugal (OC, 2000; CACHINHO, 2002), Leicester (NAGY, 1997), Madrid (JIMENEZ, 1997) and Spain (MCT, 1995; DELTORO and DESCALS, 1997) sustains the importance of including this variable in the analysis. Thus, the following hypothesis is advanced:

Hypothesis 2: Promoters of shopping centres are more likely to invest in high income areas than in low income ones.

The third general factor affecting the choice of a shopping centre location involves the number and type of competitors or potential competitors. A shopping centre may have to consider not only intra-type competition (competitors of the same type), but also a very large number of inter-type competition (indirect competitors). The presence of speciality centres, district centres, retail parks or regional centres is important, because an area can only support a limited number of competing shopping centres. If too many shopping centres of the same type are located in the same area, they may all have limited sales and

several may not survive. The presence of chain stores, franchises and superstores that provide similar kinds of goods and services should be noted, because they reduce the potential of the area (MEYER, HARRIS, KOHNS, STONE III, 1988; JIMENEZ, 1997). The index of retail saturation shows the level of retail competition (PETTIGREW, 1989; MCGOLDRICK, 1990; GARCÍA, 1999). As competition becomes more intense, the potential area of location becomes less attractive. This leads to the following hypothesis:

Hypothesis 3: Promoters of shopping centres are more likely to invest in areas where competition is less intense than in areas where competition is more intense.

The accessibility to and from the shopping centre could be seen as synonymous with car ownership, parking provision or road infrastructures. In the last decade, most new retail developments pay increasing attention to their accessibility to car-borne shoppers, due to the ever growing overall level of car ownership (MCGOLDRICK, 1990). Although this is a key variable in most retail location decisions, many other facilitating or deterring factors may have to be taken into account, namely the entry routes to the potential site, the availability of public transport and their costs or physical barriers (access constraints) [ARENAS, 1993; JIMENEZ, 1997; LEO and PHILIPPE, 2002]. Thus, the following hypothesis is advanced:

Hypothesis 4: Promoters of shopping centres are more likely to invest in areas of high accessibility (low access barriers) than in areas of low accessibility (high access barriers).

The variable cost includes rents and land purchase prices, which are obtained following negotiations with lease owners or developers. However, in some cases, the cost of site preparation may be greater than the purchase price, especially if extensive demolition is needed or unsuitable land has to be converted. Building restrictions relating to height, architectural requirements or landscaping can also greatly influence building costs (PETTIGREW, 1989; MCGOLDRICK, 1990).

High order retailing functions are prepared to bid the highest prices, though the amount they are willing to pay falls off rapidly with distance. Promoters of shopping centres are often willing to trade off the accessibility of primary shopping streets for the lower prices available in secondary or peripheral areas (BROWN, 1994; CLARKSON, HILL and ROBINSON, 1996). Therefore, as distance from the city centre increases, the cost of land decreases. Based on this reasoning, the following hypothesis is stated:

Hypothesis H5: Promoters of shopping centres are more likely to invest in low cost areas than in high cost ones.

3. Methodology

3.1 – Model and variables

The data were analyzed using OLS (ordinary least squares) multiple regression analysis (methods enter and stepwise). Since the dependent variable is continuous and the data are cross-sectional, such a model seems appropriate. Similar studies are reported by MCGOLDRICK (1990, p. 172), JALLAIS, ORSONI and FADY (1993, p. 65), CLARKSON, HILL and ROBINSON (1996), HERNANDEZ and BENNISON (2000), BENITO (2001) to estimate the impact of each macro-location factor in the increase of the gross selling area or sales of the shopping centres. The equation used is:

$ATTRA = b_0 + b_1\,DEM + b_2\,ECON + b_3\,COMP + b_4\,ACCES + b_5 COST + e$

Where:

ATTRA is the dependent variable and it represents the attraction capacity of a given county regarding promoters of shopping centres;

The regression coefficients are b_1 , b_2 , b_3 , b_4 , b_5 ;

The dependent variables DEM, ECON, COMP, ACCES and COST represent, respectively, demography, economy, competition, access barriers and cost factors;

The constant is b_0. The residuals of the regression are represented by ***e***.

Data on the dependent variable (ATTRA) were obtained entirely from the database from *Retailing Observatory* (*Observatório do Comércio* - OC, 2000). These data were derived from a survey that recorded the total gross selling area in square metres of each shopping centre, among other information. Thus, to get information by county we need to sum up the gross selling area of all shopping centres located in that area. This measure of attraction stems from the utility model developed by Huff and the multiplicative competitive interaction model (MCI), formulated by Nakanishi and Cooper (CLARKSON, HILL and ROBINSON, 1996; BENITO, 2001; CADIMA RIBEIRO and FREITAS SANTOS, 2001).

The location factors displayed in the hypotheses (H1 to H5) constitute the independent variables. Demography (DEM) was measured by the population density (population/area) using data from *Portuguese Statistical Institute* (*Instituto Nacional de Estatística* - INE, 2002). The concentration of population denotes market potential for the shopping centre.

The economy (ECON) variable was measured using INE (2000) data on regional purchasing power index per capita. This measure reflects differences in distribution of income from one county to another and helps to approximate consumption capacity.

Competition (COMP) was measured through the number of retailers of one county weighed by the population (MARKTEST, 2000). This measure tries to capture the threats of inter-type competition (competition between shopping centres and other retailers).

The variable we first used to measure accessibility is car ownership. However, this variable was highly correlated with purchasing power, which originates problems of collinearity. To overcome this problem, we measured accessibility (ACCES) through the level of access barriers. So, the measure used was the difference between maximum and minimum altitude in each county (altimetric amplitude) [DGAA, 2002], multiplied by the area of the county. This variable tries to approximate the difficulties of circulation (by walk or by car), since barriers to mobility (high altitude asymmetries) decrease accessibility inside the region.

Costs (COST), are approximated by the logarithm (log) of average time distance between the peripheral areas and the city centre (DGAA, 2002). This variable seems appropriate to measure cost, since the cost of land decreases with the distance from the city centre.

Table I - Variables, measures and expected signals

Variable	Measure	Expected Signal
Commercial Attraction (ATTRA)	Total gross selling area of each shopping centre (squared metres) located in the county.	Dependent Variable
Demography (DEM)	Population density (total population in the county, weighted by the existing area of the same county)	+ (H_1)
Economy (ECON)	Regional purchasing power index *per capita*, as calculated by the Portuguese Institute of Statistics.	+ (H_2)
Competition (COMP)	Number of retailers operating in the county, weighted by the total population of the same county)	- (H_3)
Access Barriers (ACCES)	Difference between the maximum and minimum altitude in metres, multiplied by the area of the county	- (H_4)
Cost (COST)	Logarithm average time distance between the county and the city centre.	- (H_5)

Table I summarises the variables used in the model and the way in which their measurement has been taken. It systematises the hypothesis previously formulated, anticipating the expectations in what concerns regression coefficients signals.

3.2 - Data

The database that serves as the primary source of information was made available by *Observatório do Comércio* (OC, 2000). This database records all the shopping centres that operate in Portugal, from the beginning of the 70's until 1999. The survey took place between April and August of 1999. The outlets with less than 500 m^2 of gross selling area and with less than 12 shops were disregarded.

Table II - Portuguese Shopping Centres' Profile

Shopping centres	
Total number	789
Medium size (number of shops)	38
Total number of shops	30.099
Total number of empty shops	7124 (23,7%)
Gross Selling Area (GSA) (a)	2.433.097 m^2
Medium size (GSA m^2)	3.084 m^2
Composition of shopping centres	
Management unit	562 (71,2%)
Planned tenant-mix	156 (20,2%)
Anchor shops	161 (20,8%)
Franchising regime shops	160 (20,8%)
Parking areas	150 (20,0%)
Location of shopping centres	
Centre of the city	401 (53,0%)
Expansion axes in the centre of the city	176 (23,3%)
Residential areas	94 (12,4%)
Periphery (flat field)	33 (4,4%)
Peripheric new urbanisations	52 (6,9%)
Starting year of shopping centres	
1970/79	48 (6,1%)
1980/89	369 (46,8%)
1990/99	372 (47,1%)

Source: *Observatório do Comércio*, 2000.
Notes: (a) The calculation of this indicator is an estimation. Due to the lack of available information on some of the enterprises, the gross selling area (GSA) for the missing units is determined on the basis of the medium value of the remaining ones, pondered by the number of shops built in each shopping, the presence or absence on the tenant mix of supermarkets and hypermarkets, or other big department stores, and the opening time-period.

A brief analysis of the available data (Table II) allows us to observe that the amount of shopping centres may be considered very significant if one looks at the Portuguese reality.

The average size (concerning the number of shops) of shopping centres is small, but in terms of gross selling area (GSA) is rather important. The number of vacant shops in the outlets is considerable. Indeed, it can be said that in each four shops at least one is empty.

On the other hand, the high number of shopping centres which have a centralised management unit should be noted (71,2%). However, only a small number (20% each) of the centres offers planned tenant mix, anchor stores, franchising regimes shops or parking areas. This strategy attempts to create an attractive and appealing overall atmosphere, supported by a planned tenant mix, pooled advertising, promotion programs and ample parking. Many centres sponsor promotional events, such as new car shows, to attract potential customers.

As for the location of shopping centres, more than 75% have been placed either in the city centre or in their axes of expansion. Nonetheless, a small number of them have chosen peripheral urban areas (a little more than 10%). In what concerns the age of the outlets, as we mentioned earlier, this type of formula has registered a considerable growth from the 80's onwards. This phenomenon continued to develop steadily throughout the 90's.

Table III - Shopping centres and regional development

Regions	Shopping Centres (Number)	GSA (m^2) per head (x)	Retailers (n.º) per head (y)	RPPI (z)	Correlation (x,z)	Correlation (y,z)
Aveiro	47	0,1426	0,0159	127,20	0,749**	0,549**
Beja	4	0,0099	0,0304	102,91	0,965**	0,014
Braga	64	0,1327	0,012	103,57	0,91**	0,336
Bragança	15	0,1429	0,01	86,70	0,594*	0,511*
C. Branco	13	0,0052	0,02	87,43	0,518	0,573*
Coimbra	28	0,0061	0,017	136,99	0,873**	0,337
Évora	3	0,0008	0,022	105,00	0,68**	0,308
Faro	55	0,172	0,02	139,37	0,528*	0,585**
Guarda	7	0,0033	0,018	93,99	0,529*	0,389
Leiria	30	0,0088	0,016	103,83	0,824**	0,476*
Lisboa	165	0,2063	0,017	305,19	0,838**	0,153
Portalegre	3	0,0026	0,022	95,31	0,228	0,347
Porto	165	0,3598	0,011	238,77	0,426*	0,704**
Santarém	29	0,0088	0,016	94,52	0,604**	0,537**
Setúbal	65	0,1117	0,023	114,46	0,669*	-0,024
V. Castelo	50	0,642	0,019	80,10	0,307	0,581*
Vila Real	19	0,0096	0,013	84,22	0,509*	0,625**
Viseu	27	0,0073	0,018	95,39	0,587**	0,406*

Source: *Observatório do Comércio*, 2000 and calculations of the authors. GSA – Gross Selling Area; RPPI – Regional Purchasing Power Index. Statistical significance: **p<0,01, *p<0,05 (one tail test).

Table III provides the regional (district) distribution of number of shopping centres; total Gross Selling Area (GSA); number of retailers, per head; and Regional Purchasing Power Index (RPPI). The more developed regions of the country (Oporto and Lisbon), have the same number of outlets, although in terms of gross selling area (GSA) per head, Oporto accounts for a considerably higher figure (0,3598).

The region of Lisbon is only the third in GSA per head, well below Viana do Castelo, which is the first, despite the weak purchasing power of the region. The region that hosts the smallest GSA per head is Évora, but other regions, such as Portalegre or Guarda, have also a small supply.

The correlations included in Table III postulate two positive relationships: one, between regional development as measured by the Regional Purchasing Power Index (RPPI) and the GSA per head; the other, between GSA per head and the number of retailers per head. The value of the correlations is expected to be strong, if higher income attracts more retailing activity, and weak or even negative, if retailing is independent of region's purchasing power. Just as important in assessing the significance of the relationship is an examination of those regions which are below or above 0,5. At one extreme is Oporto, Bragança, Faro, Guarda, Vila Real and Viseu, where the supply of GSA is poor when correlated with the purchasing power and appears to have a relatively high supply of GSA, if we only attend to the purchasing power index. On the other extreme we find Beja, Braga, Coimbra, Leiria and Lisbon, where the correlations are strong (above 0,8) and the supply of shopping centres is more closely related with the income of population. The second postulated relationship (number of retailers per head *versus* regional purchasing power index) provides weaker levels of correlation by region. However, regions like Oporto and Vila Real are exceptions and appear to complement, in terms of retailing, the supply of shopping centres.

4. Results and discussion

Table IV shows the descriptive statistics and correlation matrix for all the variables. The correlation matrix suggests that a moderate level of collinearity exists among the measures of demography and economy ($r = 0,72$). But such moderate level should not be damaging to the assumptions of the ordinary least squares regression (GUJARATI, 1988). This relatively high correlation is acknowledged by MCGOLDRICK (1990) and BERMAN and EVANS (1989), who include income levels in population characteristics.

Several of the other independent variables have statistically significant relationships, but none of the correlations appear to be large enough to warrant concern for multicollinearity (HAIR *et al*., 1995).

Table IV - Descriptive Statistics and Pearson Correlation Matrix

	Mean	S.D.	2	3	4	5	6
1. ATTRA	8847,63	29746,8	0,711**	0,736**	-0,007	-0,379**	-0,023
2. DEM	282,45	838,35	1	0,72**	-0,299**	-0,029	0,119*
3. ECON	66,48	28,91		1	-0,386**	0,202**	-0,079
4. COMP	0,0179	0,286			1	-0,03	0,218**
5. COST	-0,1951	0,006				1	0,071
6. ACCES	2,931	3,645					1

Notes: **p<0,01; *p<0,05 (Two Tail Test)

To determine the validity of hipotheses H1 to H5, a first regression (Initial Model) was run on all of the hipothesized independent variables, using the enter method. The only insignificant variable was ACCES, although it showed the expected sign. The other four variables (DEM, ECON, COMP, COST) were significant at the 0,001 level and all had the expected signs. To determine the order in which the variables were entered in the model a stepwise regression was performed on the data. A first model (General Model) includes all the counties. Then, the data were tested by breaking down the database into two samples, for possible detection of differences in the variables (entry order and statistical significance). The second model (Inland Regions Model) only includes the counties that are located in the internal part of the country (first sample) and could be also associated with less developed regions. The third model (Coastal Regions Model) only includes the counties that are located in the coastal areas of the country (second sample) and could be also associated with more developed regions.

One problem that may occur with this type of data is multicollinearity, which is a high degree of correlation among two or more of the independent variables. One of the effects of multicollinearity is that the estimates of the coefficients of the independent variables become very sensitive to the data used. The variable-inflation factor (VIF) is one measure of the effect the other independent variables have on the variance of a regression coefficient (MADDALA, 1988). These factors, for all the models in Table 5, are less than 5,3, a threshold value that indicates the presence of multicollinearity (HAIR *et al*, 1995). Furthermore, the coefficients also appear to be relatively stable in all the equations.

All the models are statistically significant and explain more than 40% of the variance (F >26,8, p<0,001), except the inner regions models (F = 9,09, p< 0,001; adjusted R^2 = 0,129).

Table V - Results of the Regression Analysis (Enter and Stepwise Methods)

Variables	Step	Regression Coefficient	t-Statistic	VIF	R^2	R^2 Change
Initial Model (Enter Method)						
Constant		-4003,31	-1,075			
Demography		0,318***	5,019	1,815		
Economy		0,306***	4,746	1,88		
Competition		-0,188***	-3,8	1,112		
Cost		-0,167**	-3,255	1,19		
Accessibility		-0,069	-1,392	1,097		
Adjusted R Square = 0,434						
n = 275; F = 40,33 ***						
General Model (n=275)						
Demography	1	0,57	11,076***	1,00	0,325	0,325
Economy	2	0,317	5,09***	1,611	0,387	0,062
Competition	3	-0,177	-3,538***	1,087	0,416	0,029
Cost	4	-0,172	-3,361**	1,183	0,441	0,025
Adjusted R Square = 0,432						
F = 49,74 ***						
Inland Regions Model (n=135)						
Economy	1	0,289	3,134**	1,00	0,083	0,083
Competition	2	-0,266	-2,786**	1,138	0,145	0,062
Adjusted R Square = 0,129						
F = 9,09 ***						
Coastal Regions Model (n=140)						
Demography	1	0,54	7,732***	1,00	0,292	0,292
Cost	2	-0,273	-3,9***	1,1	0,36	0,068
Economy	3	0,25	2,938**	1,715	0,396	0,036
Competition	4	-0,21	-2,925**	1,283	0,43	0,034
Adjusted R Square = 0,414						
F = 26,81 ***						

Notes: *p<0,05; **p<0,01; ***p<0,001.

Regarding hypothesis 1 (H_1), the population density is important to the promoter of shopping centres, as the variable (DEM) displays a positive and expected sign in all the

models, except in the inland regions model, where the variable did not enter after step 2. The failure of population density to be found as a significant variable is probably due to the fact that population density is not enough to attract retailing to the inner regions, unless the residents have purchasing power. Hence, and in accordance with the existing literature, population density positively affects the location of shopping centres. This supports Hypothesis 1.

The second hypothesis (H_2) states that purchasing capacity of a county positively attracts shopping centres. This hypothesis is supported by the data, since the variable economy is positive and statistically significant in all the models. Thus, consistent with the empirical evidence, regional purchasing power *per capita* exert a positive effect on the promoters' decisions to choose a county to locate the shopping centre.

The third hypothesis (H_3) states that promoters of shopping centres are more likely to invest in areas (counties) where competition is less intense. This hypothesis is supported by the data. In all the models the variable competition is negative and statistically significant. As expected, the presence of other type of retailers negatively affects the location of shopping centres.

The variable access barriers (Hypothesis 4), as measured by the difference between the maximum and minimum altitude multiplied by the area, exhibits the expected sign (negative) in the initial model, but lacks statistical significance. In the other three models this variable did not enter. Accessibility in the coastal and inner regions appears to be not so important on the macro level, as it was at micro level location (FREITAS SANTOS, VIEIRA and ANTUNES, 2000). Therefore, hypothesis 4 was not supported by the data and the variable was rejected.

The last hypothesis (H_5) states that promoters of shopping centres are more likely to invest in low cost areas. The variable cost, as measured by the average time distance, displays a negative and expected sign in all the models, except the inner regions model, where the variable did not enter after step 2. Interestingly, cost seems to be a factor promoters take into account for the coastal regions, but not for the inland regions, where costs (especially land) are relatively low. Thus, the hypothesis is supported by the data.

An analysis of the residuals provides some interesting insights into the nature of some regions. The residuals include the unexplained portion of the regression. Either there is another variable missing, or each case is *sui generis*. Table VI lists those regions that attract more gross selling area of shopping centres than predicted by the model. The first column includes regions located in the periphery of Lisbon (Cascais) and Oporto

(Matosinhos and V. N. Gaia). In this cases, the cost and availability of land associated with the proximity of Lisbon or Oporto (two main cities of the country) probably dictated the decision. The last town (Valença) is located on the border of Spain and the surplus of gross selling area could be justified by the traditionally strong cross-border trade with Spanish consumers. The third column, which includes the first three regions only reinforces the explanation.

Table VI

Residuals: regions more attractive than predicted

General Model Regions more attractive than predicted	**Inner Regions Model** Regions more attractive than predicted	**Coastal Regions Model** Regions more attractive than predicted
Cascais, Matosinhos, V.N. Gaia, Valença	Bragança, Macedo de Cavaleiros, Mirandela, Fundão, Viseu, Chaves, Vila Real	Matosinhos, V.N. Gaia, Valença

The second column includes regional capital towns (Bragança, Viseu, Chaves, Vila Real) that have important political and administrative roles. Although geographically located in the internal part of the country, they are relatively well developed and similar to some of the less developed coastal counties. Other counties are located in the vicinity of capital towns (Fundão – Castelo Branco; Macedo de Cavaleiros - Bragança) or are strategically located (Mirandela is between Bragança and Vila Real). These reasons could explain why these counties are better positioned to attract shopping centres than others.

To conclude, the proposed hypothesis were generally supported in this study, except access barriers. The results of the analyses are summarized as follows. Firstly, our study suggested that promoters of shopping centres were significantly influenced by the population density (DEM), regional purchasing power index per capita (ECON), number of retailers/population (COMP) and log average time distance (COST). Secondly, promoters' main motivations to invest in a particular inland county are purchasing power and lack of competitors. Thirdly, promoters tend to invest in coastal counties if population density and purchasing power are high and cost and competition are low. Thus, the idea that shopping centres location differs according to region-specific factors was supported.

Conclusion

Shopping centres have increased their presence in Portugal from the 80's onwards. They went on growing steadily in the 90's and some expansion is expected at least until 2004. From small size shopping centres located in the central areas of Lisbon and Oporto at the outset, the formulas have diversified, their size has increased and the location patterns have changed. These outlets have played an important role in the metamorphosis of the Portuguese urban landscape and have also tailor the consumption habits of the population.

This study tested, using OLS regression, the retail macro-location factors that are put forward by the theory, namely population (measured by the population/area), economy (measured by the purchasing power index), competition (measured by the number of retailers per head), accessibility to the shopping centre (measured by the difference between the maximum and minimum altitude) and costs (measured by the log of average time distance).

The results support all our hypotheses, except access barriers. The population hypothesis (H1) was supported, as promoters tend to invest in regions where population density is higher. The economy hypothesis was supported (H2), as promoters tend to invest in high income regions. The competition hypothesis was supported (H3), as promoters tend to choose regions where there is fewer retailers per head. Finally, the cost hypothesis was also supported (H5), as promoters tend to choose regions where they perceive low levels of cost. We found no support for the accessibility measure (H4), although the variable was correctly signed.

One limitation of the present work is the absence of secondary data with the required level of disaggregation (county). The inclusion of more pertinent variables to measure cost and accessibility factors should be further examined.

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