Economic Research-Ekonomska Istraživanja

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Routledge
Taylor & Francis Group

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An important estate broker for retail in Europe has performed statistical research on retail business in cities in the Benelux area (Belgium, the Netherlands, Luxemburg). The broker choose five characteristics to rate 30 Benelux cities on their retail business. However, summing these ranks is not allowed as they do not represent cardinal numbers. Hence, calculating the medians and quartiles of this ordinal number series signifies a possible alternative. The disadvantages of this approach are: many ex aequos and to be operational at least six terms are needed, whereas only five characteristics are present here. Instead, an Ordinal Dominance Theory was developed that only needs at least three terms. Finally, a SWOT-analysis was made concerning retail business for the main Belgian cities, Brussels, Antwerp and Ghent.

Keywords: retail business; cardinal or ordinal numbers; medians and quartiles; Ordinal Dominance Theory; SWOT analysis

JEL classification: C02, C44, C61, D12, L81, R33

1. Introduction

Sometimes classifications are a result of summing ranks (ordinal numbers), following the Rank Correlation Method of Kendall (1948) and meaning that ordinal numbers can be treated like cardinal ones. Arrow pointed out that this is wrong (1974).

As a reaction to Arrow, different studies were set up in order to stress the cardinal approach in aggregating classifications, such as for forecasting the future of European countries (Brauers, Balezentis, & Balezentis, 2012), an alternative for the Standard & Poor's Ratings for Europe (Brauers & Zavadskas, 2013) and for the behaviour of the Construction Sector in 20 European countries during the recession years 2008–2009 (Brauers, Kildiene, Zavadskas, & Kaklauskas, 2013).

Cushman & Wakefield (2011b) were summing ranks from five characteristics for retail business in the main Benelux cities. We will try to correct this research by using the Median or by the Ordinal Dominance Method.

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2. The Benelux retail monitor

Statistical research on the retail business in the Benelux region was performed by Cushman & Wakefield (2011b), a very important estate broker for retail in Europe.[1] Therefore, five characteristics were chosen.

(1)   Potentiality

This characteristic reflects the strength of the considered major retail hub or city centre's catchment area. Its components are:

- Total population within a 20 min drive time,
- Socio-demographic and age structure,
- Purchasing power,
- Dominance of the considered hub within the catchment area towards surrounding hubs.

(2)   Diversity

This characteristic reflects the degree of diversification featured by the considered major retail hub or city centre. Its components are:

- Amount of anchor stores,
- Amount of large-scale shops,
- Hotels, Restaurants & Pubs.

(3)   Accessibility

This characteristic reflects the accessibility of the considered major retail hub or city centre. Its components are:

- Parking spaces,
- Public transportation.

(4)   Footfall

This characteristic reflects the level of footfall in the considered major retail hub or city centre. This factor only has one component.

(5)   Specialty.

This characteristic reflects the level of specialisation featured in the considered major retail hub or city centre.
   Its components are:

- Specialty retail areas,
- Supra-local international attraction.

Table 1 gives the ranking for the five characteristics for 30 Benelux (Belgium, the Netherlands and Luxemburg) cities.

Table 1. The five characteristics for retail business in 30 Benelux cities, after Cushman & Wakefield (2011b).

	Potentiality	Diversity	Accessibility	Footfall	Specialty
Brussels	1	2	2	2	2
Amsterdam	5	3	3	4	1
Antwerp	4	1	8	1	4
Rotterdam	2	4	4	5	5
The Hague	3	7	6	8	10
Ghent	8	6	1	7	6
Utrecht	7	8	9	3	9
Maastricht	-	12	12	6	3
Groningen	15	5	10	10	12
Eindhoven	9	9	11	11	13
Bruges	-	18	14	13	7
Luxemburg	19	15	5	21	8
Enschede	20	16	13	12	14
Arnhem	16	10	19	15	16
Den Bosch	18	11	20	16	17
Liège	12	24	7	9	11
Breda	-	13	21	17	18
Kortrijk	10	14	22	25	25
Tilburg	13	25	27	18	19
Nijmegen	17	29	17	14	15
Amersfoort	6	30	30	20	21
Leuven	-	19	15	22	22
Zwolle	-	26	28	19	20
Mons	-	17	23	26	26
Alkmaar	11	23	26	29	29
Charleroi	-	20	18	24	24
Haarlem	14	28	16	23	23
Namur	-	27	29	30	30
Almere	-	21	24	27	27
Hasselt	-	22	25	28	28

Note: This table is composed by the authors on the basis of the rankings by factor as given by Cushman and Wakefield (2011b).

3. Cardinal and ordinal scales

While we accept the research on 30 cities as carried out by C&W due to the experience of this company in the field of retailing, it can cause a problem when we have to aggregate the ranks of the five characteristics.

The use of ranks means an ordinal scale (i.e. first, second, third, etc.) has been used, which when adding up signifies a return to a cardinal operation $(1 + 2 + 3 + …)$. Is this allowed?

The answer is 'no' according to the Nobel Prize winner Arrow.

3.1. The impossibility theorem of Arrow

'Obviously, a cardinal utility implies an ordinal preference but not *vice versa*' (Arrow, 1974).

3.2. The rank correlation method

The method of correlation of ranks consists of summing ranks. Rank correlation was introduced first by psychologists such as Spearman (1904, 1906, 1910) and then taken

over in 1948 by the statistician Kendall. Kendall (1948, p. 1) argues: 'we shall often operate with these numbers as if they were the cardinals of ordinary arithmetic, adding them, subtracting them and even multiplying them,' but he never gives a proof of this statement. In his later work this statement is dropped (Kendall & Gibbons, 1990).

In ordinal ranking, 3 is farther away from 1 than 2 is from 1, but Kendal (1948, p. 1) goes too far (Table 2).

For Kendal B is far away from A as it has 7 ranks before and A only 4, whereas the distance is not important cardinally. In addition, a supplemental notion, the statistical term of *Correlation*, is introduced. Suppose the statistical universe is represented by just two experts, for us it could be two methods. If they both rank different items to reach a certain goal in the same order, it is said that correlation is perfect. However, perfect correlation is a rather exceptional situation. The problem is then posited: how in other situations is correlation measured? The following Spearman coefficient is therefore used (Kendall, 1948, p. 8):

$$\rho = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}, \tag{1}$$

where D stands for the difference between paired ranks, and N for the number of items ranked.

According to this formula, perfect correlation yields the coefficient of one. An acceptable correlation has the tendency to come nearby this coefficient one. No correlation at all yields a coefficient of zero. If the series are in reverse order, there will be a correlation of minus one, as shown in the example in Table 3.

This table shows that the sum of ranks in the case of an ordinal scale has no sense. Correlation leads to:

$$\rho = 1 - \frac{6 \times 112}{7(49 - 1)} = -1 \tag{2}$$

However, as the addition of ranks is not allowed, so also a subtraction, the difference D, is not permitted.

3.3. The ordinal scale

Many people will better understand the ordinal problem by the way of a qualitative scale, e.g.:

   1st very good;
   2nd moderate;

Table 2.   Ordinal versus cardinal: comparing the price of one commodity.

	Ordinal	Cardinal
	1	
	2	
	3	
	4	
A	5	6.03$
	6	6.02$
	7	6.01$
B	8	6$

Source: Author's calculations.

Table 3. Negative rank order correlations.

Items	Expert 1	Expert 2	D	D^2
1	1	7	−6	36
2	2	6	−4	16
3	3	5	−2	4
4	4	4	0	0
5	5	3	2	4
6	6	2	4	16
7	7	1	6	36
Σ				112

Source: Author's calculations.

    3rd very bad.
    But equally one could say:
    1st very good;
    2nd good;
    3rd more or less good;
    4th moderate;
    5th more or less low;
    6th low;
    7th very low.
How is the first '2nd' comparable with the second '2nd'? And so on.
    This could also be in a reversed order.
    An ordinal number is one that indicates order or position in a series, for example, first, second, and so on (Kendall & Gibbons, 1990, p. 1). After this definition consider exam figures 100, 90, 80, 70, 60, 50…, which are also ordinal, as the figure of 100 is not twice better than 50, and so on, as with qualitative scale, for instance:
    90: with the greatest honour
    80: with great honour
    70: with honour
    60: with satisfaction
    50: pass.

3.4. *The interval scale is also ordinal*

In the interval scale, not only is 100 not two times better than 50, but also the number 100 has an entirely different meaning than the number 50. A thermometer scale is the best example. Let us take the Celsius temperature scale as an example:

- 100°C by definition makes water boil, but only under certain external conditions, whereas for the Fahrenheit scale the definition is different;
- 30°C is very hot for some people depending of other conditions; in a humid climate 30°C is almost unbearable, and so on.
- 0°C and below 0°C mean freezing temperatures.
- Minus 4°C is bearable in Switzerland, but with cold winds as in the Benelux countries it gives the same feeling as –10°C.
- Zero degrees C equals 273.15 K, where K the Kelvin, the unit of thermodynamic temperature, basis of the International System.[2]

3.5. The qualitative cardinal scale

A qualitative cardinal scale may have the wrong outlook of an ordinal scale. Two variances are possible: on the one side, 'alternative measurement' and 'quality managment' on the other.

3.5.1. Alternative measurement

For instance, in residential construction, the attribute, price per square metre of the terrain in question, measures the 'district prestige'.

Pollution by a factory that causes cancer in the neighbouring inhabitants can be measured by the factory's pollution abatement costs in order to ameliorate the production process.

Pollution by an asbestos factory anticipated in the future to cause cancer for the employees is measured by the price obtained by selling the factory immediately.

3.5.2. Quality measurement

By definition, quality is not expressed as a quantity. However, to make our approach workable everything has to be expressed in quantities. For instance, aesthetics in residential construction remain a problem. Therefore, a series of cardinal numbers is introduced, where zero has no significance and, if the best aesthetics is two times better than the worst one, the numbers 1 and 2 are used, with eventually all decimals concerned in between, or the numbers 2 and 4 are used with all positions in between, e.g. 3, 2.5, 3.5 etc...

The point of view of the psychologists (Miller, 1965).

Consider cardinal scale: 1, 2, 3, 4, 5, 6, 7.

After 7, an individual would not know the cardinal significance compared with the previous 7 numbers.

3.6. Arbitrary methods to go from an ordinal scale to a cardinal scale

1) Arithmetical Progression: 1, 2, 3, 4, 5……
  The ordinal scale 1st gets 1 cardinal point
  The ordinal scale 2nd gets 2 cardinal points etc.

2) A Geometric Progression: 1, 2, 4, 8, 16……..
  The ordinal scale 1st gets 1 cardinal point
  The ordinal scale 2nd gets 2 cardinal points
  The ordinal scale 3rd gets 4 cardinal points etc.

3) The Fundamental Scale of Saaty (1987): 1, 3, 5, 7, 9

4) The Normal Scale of Lootsma (1987)
  $e^\circ = 1$
  $e^1 = 2.7$
  $e^2 = 7.4$
  $e^3 = 20.1………..$

5) The Stretched Scale of Lootsma (1987)
  $e^\circ = 1$
  $e^2 = 7.4$
  $e^4 = 54.6$
  $e^6 = 403.4………..$

Table 4. Ranking of scenarios for the Belgian regions by the full-multiplicative method in 1996.

1	Scenario IX	Optimal Economic Policy in Wallonia and Brussels	203,267
2	Scenario X	Optimal Economic Policy in Wallonia and Brussels even agreeing on the Partition of the National Public Debt	196,306
3	Scenario VII	Flanders asks for the Partition of the National Public Debt	164,515
4	Scenario VIII	No Solidarity at all	158,881
5	Scenario II	Unfavourable Growth Rate for Flanders	90
6	Scenario IV	an Unfavourable Growth Rate for Flanders and at that moment asks also for the Partition of the National Public Debt	87
7	Scenario III	Partition of the National Public Debt	54
8	Scenario I	the Average Belgian	51
9	Scenario V	Average Belgian but as compensation Flanders asks for the Partition of the National Public Debt	49
10	Scenario O	Status Quo	43
11	Scenario VI	Flanders asks for the Partition of the National Public Debt	42

Source: Brauers, Ginevičius 2010.

Here also, the point of view of psychologist Miller (1965) plays with the ordinal scales: 1, 2, 3, 4, 5, 6, 7.

In fact, infinite variations are possible, and all stress an acceleration or a deceleration process but are not aware of a possible trend break. The full multiplicative method with its huge numbers illustrates this trend break best and the nonsense cardinal value of ordinal numbers as shown in Table 4.

With the usual arithmetical progression: 1, 2, 3, 4, 5, … the distance from rank 4 to 5 would be the same as from 3 to 4, which is certainly not the case here. In addition, all the other progressions also fail to discover a trend break.

Not only it is not allowed to sum ordinal numbers but also combining weights or other coefficients of importance with ordinal numbers is not allowed.

Summarising all these statements, the following axioms are proposed.

3.7. *Axioms on ordinal and cardinal scales*

(1) A deduction of an ordinal scale, a ranking, from cardinal data is always possible.
(2) An ordinal scale can never produce a series of cardinal numbers.
(3) An ordinal scale of a certain kind, a ranking, can be translated in an ordinal scale of another kind.

In application of axiom 3 we shall translate the ordinal scales used in Table 1 to another ordinal scale based on two methods, namely the 'method of the median' and the 'method of the ordinal dominance theory'.

4. The method of the median as applied to the most attractive retail cities of the Benelux area

4.1. *The calculation of the medians for the Benelux cities*

Given a series of figures, the median is defined as the middle measurement after the measurements have been arranged in order of magnitude. In Table 5 the median is calculated for retail businesses in 30 Benelux cities.

Table 5.   Ranking for the retail business in the 30 main Benelux cities after the median method.

		Median
1.	Brussels	2
2.	Amsterdam	3
3.	Antwerp (ex aequo)	4
3.	Rotterdam (ex aequo)	4
5.	Ghent	6
6.	The Hague	7
7.	Utrecht	8
8.	Maastricht	9
9.	Groningen (ex aequo)	10
9.	Breda (ex aequo)	10
11.	Liège (ex aequo)	11
11.	Eindhoven (ex aequo)	11
13.	Bruges	13.5
14.	Enschede	14
15.	Luxembourg	15
16.	Arnhem (ex aequo)	16
16.	Den Bosch (ex aequo)	16
18.	Nijmegen	17
19.	Tilburg	19
20.	Leuven	20.5
21.	Amersfoort	21
22.	Kortrijk (ex aequo)	22
22.	Charleroi (ex aequo)	22
24.	Haarlem (ex aequo)	23
24.	Zwolle (ex aequo)	23
26.	Mons	24.5
27.	Almere	25.5
28.	Alkmaar	26
29.	Namur	26.5
30.	Hasselt	26.5

Source: Author's calculations.

4.2.   The shortcomings of the median method for retail businesses in the Benelux cities

A first remark is the huge number of ex aequo's (of the same importance), which certainly is a weak point. But there is even more.

It is clear that for five characteristics, as in the Benelux example, the median value alone is not representative of the composition of the whole series. Even in the case of only four characteristics, an average has to be made for the two characteristics situated in the middle. In order to better characterise the series of numbers the notion of skewness is introduced.

To measure skewness one could find two other values besides the median. The first quartile is the middle measurement between the origin and the median. The third quartile is the middle measurement between the median and the end of the scale. In fact, the median itself is the second quartile (for the theory on quartiles see Mills, 1924, p. 114). In this way one may speak of skewness to the left and skewness to the right. A task could be to find ways and means to decrease skewness by trying to bring the quartiles nearer to each other. It is preferable that the first and third quartile move as much as possible to the median. For instance, convergence of various opinions of a group of discussants is reached by ensuring the quartiles approach as much as possible to the

median. This forms the basis of the method that is called Delphi, where this convergence is reached after several rounds (for Delphi see Brauers, 2004, pp. 39–46).

In order to speak of a first quartile one has to have at least three numbers and another three for the third quartile. With the median itself, the median method needs to have at least six numbers to be operational. At that moment, the median is a point midway between the third and the fourth numbers (Mueller, Schuessler, & Costner, 1970, pp. 122–123). Consequently the median method is not valuable for application in the study of the retail businesses in the Benelux cities as we are counting only five characteristics each time.

5. The ordinal dominance theory as applied for the most attractive retail cities of the Benelux area

5.1. The origin of the Ordinal Dominance Theory

It is interesting to explain how the Ordinal Dominance Theory originated. Two methods with dimensionless measures for multi-optimisation, the ratio system and the reference point method, were brought together under the name of MOORA (Brauers, 2004; Brauers & Zavadskas, 2006), resulting in two different rankings. A summary of the ranking of the two MOORA methods was made on view.

Later on, these two methods extended to three methods of dimensionless measurements ((MULTIMOORA) Brauers & Zavadskas, 2010)), coupled with large decision matrices, asked for a more complicated summarising theory. At that moment the Ordinal Dominance Theory was developed (Brauers & Zavadskas, 2011). One may conclude that the ordinal dominance theory was operational from three series of numbers onwards, being the three methods of MULTIMOORA. Consequently, application for the Benelux example with even more characteristics, namely five, is allowed.

5.2. The ordinal dominance theory

Absolute dominance means that an object, alternative, solution or project is dominating in ranking all other objects, which are all being dominated. This absolute dominance shows as rankings in an illustrative example of three characteristics per object: (1-1-1).

General dominance in two of the three objects with a P b P c P d (P preferred to) is for instance of the form:

(d-a-a) is generally dominating (c-b-b).
(a-d-a) is generally dominating (b-c-b).
(a-a-d) is generally dominating (b-b-c).
and further on transitiveness occurs.

Transitiveness

If a dominates b and b dominates c than also a will dominate c.

Overall dominance of one object on another

For instance, (a-a-a) is overall dominating (b-b-b) which is overall being dominated by (a-a-a).

Equability

Absolute Equability has the form: for instance (e-e-e) for two objects.
Partial equability of 2 on 3 exists e.g. (5-e-7) and (6-e-3).

Circular reasoning

Despite all distinctions in classification some contradictions remain possible in a kind of circular reasoning.

We can cite the case of:

Object A (11-20-14) dominates generally object B (14-16-15).

Object B (14-16-15) dominates generally object C (15-19-12).

But Object C (15-19-12) dominates generally object A (11-20-14).

In such a case the same ranking is given to the three objects.

5.3. The ranking of the Benelux cities concerning retailing by the ordinal dominance theory

Table 6 shows the final ranking of the retail business in the main cities of Benelux.

A bold number means a domination of a number of a city on the corresponding number of the next ranked city.

Brussels is generally dominating Antwerp with domination over potentiality, accessibility and specialty but is dominated by Antwerp on diversity and footfall. As Antwerp is generally dominating Amsterdam by transitiveness Brussels is dominating Amsterdam, etc.

Den Bosch is overall dominating Breda, Mons compared with Almere, Almere to Hasselt and Alkmaar to Namur, etc.

Compared with the Cushman & Wakefield (2011b) study (Table 1) the ordinal dominance theory (Table 6) shows some changes. Brussels remains in the first place, but Antwerp overtakes Amsterdam, Ghent overtakes the Hague, etc.

6.   A SWOT-analysis for the main Belgian cities concerning retail business

In the first five rankings for retail business in Benelux, the three Belgian cities of Brussels, Antwerp and Ghent are present, but in the ten first rankings the same cities are represented. We shall make an attempt to give a SWOT-analysis for these cities concerning retail business. We had to limit our research mainly to these three cities as in-depth analysis for all the cities of Benelux concerning retail business would be too great an effort.

6.1.   Brussels

It is not very clear what Cushman & Wakefield (2011b) means by Brussels. Is it the previous capital of centralised Belgium or the Brussels Capital Region? Brussels capital is limited in area, whereas the Brussels Capital Region is larger and inhabited by approximately one million inhabitants, who live in Brussels Capital and in 18 other municipalities – a situation not easily understandable for foreigners. In this manner it is possible that the left side of a street belongs to one municipality and the right side to another municipality with different bylaws. Therefore, we define Brussels here as the Brussels Capital Region, a mini-region beside the Regions of Flanders and Wallonia in a Federal Belgium.

In the previous centralised Belgium the economic centre of Belgium was limited to the surroundings of Brussels Park. At the Northern side of the park was the national Parliament and the ministries, at the Southern side the King's Palace and at the Eastern side the embassies and also the scientific world, under the name of the Palace of the Academies. Finally, at the Western side was the main theatre of Belgium and the

Table 6. Most attractive retail destinations in Benelux using the ordinal dominance theory.

		Potentiality	Diversity	Accessibility	Footfall	Specialty
1.	Brussels	**1**	2	**2**	2	**2**
2.	Antwerp	**4**	**1**	8	**1**	4
3.	Amsterdam	5	**3**	**3**	**4**	**1**
4.	Rotterdam	**2**	**4**	4	**5**	5
5.	Ghent	8	**6**	**1**	**7**	**6**
6.	The Hague	**3**	7	**6**	8	10
7.	Utrecht	**7**	8	**9**	**3**	**9**
8.	Groningen	15	**5**	**10**	10	12
9.	Eindhoven	**9**	**9**	**11**	11	13
10.	Maastricht	-	**12**	12	**6**	**3**
11.	Luxembourg	19	**15**	**5**	21	**8**
12.	Liège	**12**	24	**7**	**9**	**11**
13.	Enschede	**20**	**16**	**13**	12	14
14.	Bruges	-	**18**	**14**	13	**7**
15.	Nijmegen	17	29	**17**	14	**15**
16.	Arnhem	**16**	**10**	**19**	15	16
17.	Den Bosch	18	**11**	**20**	16	17
18.	Breda	-	**13**	**21**	17	**18**
19.	Kortrijk	**10**	**14**	**22**	25	25
20.	Tilburg	13	**25**	27	**18**	**19**
21.	Amersfoort	**6**	30	30	**20**	**21**
22.	Leuven	-	**19**	15	22	22
23.	Zwolle	-	**26**	28	**19**	**20**
24.	Haarlem	14	28	**16**	23	23
25.	Charleroi	-	20	**18**	24	24
26.	Mons	-	**17**	23	26	26
27.	Almere	-	**21**	24	27	27
28.	Hasselt	-	**22**	25	28	28
29.	Alkmaar	**11**	**23**	26	29	29
30.	Namur	-	27	29	30	30

Source: Author's calculations.

Société Générale, a holding in possession of all the mines of Belgium, the monopoly of all electricity works of Belgium and the associated engineering works, the monopoly of the whole steel industry of Belgium, the whole industry of Belgian Congo and its main bank and the first and by far the largest bank of Belgium (General Bank). In a next circle around the park were located the Bank of Brussels, the second most important bank of Belgium, the seat of the National Railways, the national Post Office, the headquarters of the national police and the National Institute of Statistics. In the next surrounding circle were the National Bank of Belgium, the Royal Mint, the Cathedral of the archbishop and the Central Railway Station. In walking distance were the Palace of Justice, the Dexia Bank, the National Savings Bank and the National Stock Exchange, with other words the whole of Belgium was in walking distance.

What remained of all this glory? All Belgian mines were closed, Belgian economic activities have nearly disappeared in Congo, the Belgian steel works fell into Indian hands, the electricity works of Belgium and the associated engineering works were taken over by France and the Royal Mint will be closed soon. Brussels was an important centre for the financial sector, around 54% of the whole Belgian activity in that sector with its importance surpassing the borders of Belgium (Van Waterschoot, Brauers, & Van Elewyck, 1979, p. 8). Nowadays, the General Bank, the National Savings Bank

and a main part of Dexia Bank are in French hands and soon will moving in the direction of Paris. The Bank of Brussels came into Dutch hands. The National Bank plays a secondary role due to the creation of the European Central Bank and the Brussels Stock Exchange is incorporated in a minor position into NYSE-Euronext. The Kredietbank (KBC) is the only remaining important Belgian bank. But as the financial sector is vanishing in Brussels, that bank may move sooner or later to Antwerp, as the legal seat of KCB is in Antwerp. After the yearly questionnaire of the Z/Yen Group (2012), Brussels ranks only 47th in the classification of the main financial centres in the world, traditionally headed by London, New York, Hong Kong, Singapore and Tokyo.

Large sections of industrial activity have left Brussels, such as the tobacco industry, some machine construction, clothing and textile (BELGOSTAT). In addition, one may say that Brussels has no significant international trade.

The main importance of Brussels, beside the administration of the central state, the regions and the municipalities, is in the distribution sectors. these distribution sectors concern the percentage of the national value added (BELGOSTAT):

- Electricity distribution 32%
- Hotels and restaurants 23%
- Transport 13%
- Support of transport and travel agencies 19%
- Post office and telecommunications 46%
- Commerce and real estate 15%
- Computers and derivatives 30%
- Commercial services to enterprises 16%.

Brussels is located at the centre of Belgium between the Regions of Flanders and Wallonia. Visitors from Flanders and Wallonia are attracted by the variety of choice in the shopping streets of Brussels. Brussels' own population remains partly absent as retail customers due to the significant unemployment in the region; amounting to 25% of the active population (FOD, Economics, EUROSTAT).

Secondly we have to mention the expenses of the daily commuters to Brussels. As a large part of the Brussels population is unskilled, Flemish and Walloon workers come to Brussels. Instead of emigration these commuters prefer to come in daily. These movements are assisted by a huge network of railway lines. Indeed dating from the time of centralised Belgium, nearly all railway lines pass through Brussels.

Thirdly there are the expenses of tourists and the daily expenses of the personnel of the European Union and NATO with seats in Brussels and of the lobbyists and other visitors around these institutions. Contrary to what is said by Cushman & Wakefield (2011b), Brussels is not yet the Capital of Europe. The philosophy of the European States is rather decentralisation, with the European Commission and recently the Secretariat of the President of the European Union in Brussels, the European Parliament in Strasbourg, the Court of Justice and the statistical services EUROSTAT in Luxemburg, the Central European Bank in Frankfurt, etc.

What is the future of NATO? Pressures exist to move NATO headquarters, but owing to heavy investments of the Belgian Government NATO could remain in Brussels.

Concerning Brussels, Cushman & Wakefield remark: 'the city scores very high in terms of large-scale stores, which could easily attract international retailers' (2011b, p. 9)

Are there threats for the retail position of Brussels?

(1) The language problem

As the capital of a bilingual, French and Dutch, country, the inhabitants of Brussels have also to be bilingual. However, this is not the case in many Brussels shops, making them unattractive for Dutch speaking Flemish.

(2) The falsification of retail statistics

The Value Added Tax (VAT) is taxed on the seat of production and not at the head office, a principle not applicable for distribution sectors. Distribution firms mostly have centralised bookkeeping, with the exception of franchising. Suppose a travel agency, for prestige, preferred to have its head office in Brussels. Suppose the travel agency counts ten employees in Brussels and five in each of the ten provinces. The activity of the 60 employees will be designated to Brussels. The same will be true for perfume shops, department stores, and so on. The concentration of the electricity distribution sector and the post office and telecommunications is also unusual.

(3) The mega-shopping centre Uplace

A mega-shopping centre 'Uplace' of 190,000 m² is planned for the nearby town of Vilvoorde. Brussels protested at a Higher Court. In addition, the city of Leuven also protested against it. Leuven itself, although only classified as number 22, can also be considered as a competitor for Brussels.

(4) The rising star of Antwerp.

The retail rent in Brussels amounts to €1800 per square metre per year, but this figure is also true for Antwerp, which is amongst the most expensive places in Belgium for retail rent. However the percentage growth of retail rent amounts to 15.4% per year in Antwerp against only 10.8% in Brussels (Cushman & Wakefield, 2011a, p. 1).

6.2. Antwerp

The Antwerp sea port is second in size in Europe after Rotterdam and the concentration of the chemical industry is one of the largest in the world. Antwerp is also the commercial centre for the world's diamonds trade. Finally, its Academy-of-Arts fashion specialists are known the world over. These characteristics have effects on the retail trade of Antwerp.

As well as Antwerp's own population, Antwerp's shops are also committed to the neighbouring regions of the Scheldt-river left bank (Waasland) and in the north to the region of the Kempen and across the border into the Netherlands. Unlike earlier times, sailors are now less likely to visit Antwerp, as the new port is far out of the centre of the city and ships try to diminish their of boarding time owing to high costs. Some compensation is offered by the visits of cruise ship passengers. Finally, jewellery and diamond shops are a logical consequence of the presence of the world diamond trade. In addition, fashion shops are the logical result of the presence of the Academy.

It is certainly an exception in the Benelux-countries that the central station really is located in the centre of the city. From the central station, there starts a kilometres-long line of streets that have a high degree of attraction as retail destinations. This seems to be in contradiction with Cushman and Wakefield's (2011b, p. 11) remark about Antwerp: 'because Antwerp is caught in a strong competition with other Belgian tourist destinations, the city will have a hard time improving its performances in terms of specialty. A good solution there would be to keep on developing highly specialised retail areas'. Contrary to Cushman & Wakefield's suggestion, Antwerp had its specialised retail areas in the past but they were given up because of insufficient cost-effectiveness.[3]

Are there any further threats for the retail position of Antwerp? The amelioration and the modernisation of the neighbour town of Mortsel may have some possible influences in the future.

Finally, Antwerp has to give attention to the competing city in the ranking, which is Amsterdam.

6.3.   *Amsterdam and Rotterdam*

Cushman and Wakefield (2011b, p. 5) make the following remark about Dutch cities: 'Belgian cities have the largest amount of large-scale shops, a format which is clearly lacking in Dutch cities'.

Amsterdam has a very high international attractiveness and reputation as the official capital of the Netherlands and as an important centre of economic activity. Think, for instance, of its Stock Exchange, one of the most important of Europe. Amsterdam is also known for its seaport, although not so important as Rotterdam, also in the Netherlands, and which is ranked first in Europe.

On the tourist side we mention its famous canals and the historic buildings. This last characteristic also has its negative side, according to Cushman and Wakefield (2011b, p. 10): 'As far as mixity is concerned, it will obviously be a challenge to increase the amount of large-scale units. Amsterdam is indeed subject to strong regulations in terms of historical buildings, which prevents any significant changes in its retail structure'.

In another remark, Cushman & Wakefield say: 'the city faces the problem of its geographical position, close to uninhabited areas, and which naturally limits the extent of its catchment area' (2011b, p. 12).

Public transportation in the city centre can be considered as reasonably good but the neighbourhood around the main station is not very attractive for arriving visitors.

For Rotterdam, Cushman and Wakefield (2011b, p. 11) remark: 'Whilst scoring very high in terms of anchor tenants, Rotterdam only achieves a medium score in the category "Mixity". The amount of large-scale units is minimal, even though Rotterdam shows to be suitable for that type of format.'

6.4.   *Ghent*

The historical value of Gent makes it a competitor of Bruges, the Venice of the North. Its historic buildings present no handicap for its retail development. This positive point is in contrast with Amsterdam where strong regulations on historic buildings prevent any significant changes in its retail structure (see above, on Amsterdam).

Its seaport is important for Ghent, which is situated quite a way inland, as is its historic importance as a textile centre. The main railway station is outside of the city centre and urgently requires restoration.

Due to the distance involved, Ghent has no fear from the competition of Antwerp concerning retail shopping, although the mega-shopping centre 'Uplace' in the North of Brussels could be a threat for Ghent's retail position. Strangely enough, the Gent authorities see the city of Knokke, not even ranked in the classification of the main Benelux retail cities, as the main competitor for the retail business.[4]

Knokke is a sea resort some 50 km away from Ghent. People will do their shopping there when they take a holiday in this city and later will go there exclusively for shopping. The main shopping street is the Lippenslaan, a street of approximately 1 km long with popular but also luxury retail shops. Another shopping centre of Knokke is that of 'het Zoute', with very expensive shops.

Finally, we have to consider the next competing city for Ghent in the Benelux city ranking, namely the Hague (see Table 6).

6.5. *The Hague*

In the Netherlands, Amsterdam is the capital by name but the Hague is the seat of Parliament and of the national government. The royal residence is also in the Hague. In addition, the Hague offers hospitality to the UN International Court of Justice and to the Academy of International Law. All this increases the city's attractiveness for foreign tourists.

Cushman and Wakefield (2011b, p. 13) remark: 'The Hague will also have to create extra specialised retail areas, as its level of specialty remains currently insufficient to compete with other cities'.

7.   Conclusion

Statistical research on the retail business in Benelux was performed by Cushman & Wakefield (2011a, 2011b) a very important estate broker for retail in Europe. They considered five properties as characterising the retail business:

(1) Potentiality

This characteristic reflects the strength of the considered major retail hub or city centre's catchment area.

(2) Diversity

This characteristic reflects the degree of diversification of the offer featured by the considered major retail hub or city centre.

(3) Accessibility

This characteristic reflects the accessibility of the considered major retail hub or city centre.

(4) Footfall

This characteristic reflects the level of footfall in the considered major retail hub or city centre.

(5) Specialty

This characteristic reflects the level of specialisation of the offer featured in the considered major retail hub or city centre.

Is there not a problem when we have to sum ranks from five characteristics? Indeed, adding of ranks, meaning an ordinal scale, returns us to a cardinal operation, which is not allowed.

What is then allowed? Two possibilities exist: the median method and the ordinal dominance theory.

In order to be significant, the median method needs a series of at least six figures. The application for the retail business in the Benelux cities does not correspond to this condition. Indeed, only five characteristics are present. On the contrary, the ordinal dominance theory only needs a minimum of three characteristics.

In the first five rankings for retail business in the Benelux countries, three Belgian cities, Brussels, Antwerp and Ghent, are present, but in the ten first rankings only the same cities are represented. Additionally, we made a SWOT-analysis for these cities concerning retail business. Brussels' ranking is at risk from the planned huge shopping centre in the nearby Flemish city of Vilvoorde and is increasingly threatened by the rise of Antwerp. Ghent, from its side, fears competition in the retail business sector from the beach city of Knokke, a city not even mentioned in Cushman & Wakefield's research (2011a, 2011b).

Notes

1. Of course errors in observation are always possible in statistical work. However we have to have confidence in the statistical research on the retail business in Benelux by Cushman & Wakefield (2011a, 2011b) , an important estate broker for retail in Europe. Research on accuracy of statistical data would be a separate study, which is also necessary for official statistics such as for EUROSTAT. For that purpose we refer to Morgenstern (1963).
2. The ordinal interval scale must not to be confused with real interval arithmetic, where 'interval' means a part of the complete set of all real cardinal numbers (Maier, 1985, pp. 102–108).
3. These specialised retail areas in the past concerned shoe shops (Offerandestraat), furniture (Carnotstraat), and jewellery shops (Pelikaanstraat).
4. Interview with W. De Ruyter, collaborator of Mathias De Clercq, Alderman of Economy of the City of Ghent on March 9, 2012.

References

Arrow, K. J. (1974). General economic equilibrium: Purpose, analytic techniques, collective choice. *American Economic Review, 64*, 253–272.

BELGOSTAT. Retrieved from http://www.nbb.be/belgostat

Brauers, W. K. M. (2004). *Optimization methods for a stakeholder society, a revolution in economic thinking by multi-objective optimization*. Boston, MA: Kluwer Academic Publishers.

Brauers, W. K. M., Balezentis, A., & Balezentis, T. (2012). European union member states preparing for Europe 2020. An application of the MULTIMOORA method. *Technological and Economic Development of Economy, 18*, 567–587.

Brauers, W. K. M., & Ginevičius, R. (2010). The economy of the Belgian regions tested with MULTIMOORA. *Journal of Business Economics and Management, 11*, 173–209.

Brauers, W. K. M., Kildienė, S., Zavadskas, E. K., & Kaklauskas, A. (2013). The construction sector in twenty European countries during the recession 2008–2009, country ranking by MULTIMOORA. *International Journal of Strategic Property Management, 17*, 58–78.

Brauers, W. K. M., & Zavadskas, E. K. (2006). The MOORA method and its application to privatization in a transition economy. *Control and Cybernetics, 35*, 445–469.

Brauers, W. K. M., & Zavadskas, E. K. (2010). Project management by MULTIMOORA as an instrument for transition economies. *Technological and Economic Development of Economy, 16*, 5–24.

Brauers, W. K. M., & Zavadskas, E. K. (2011). MULTIMOORA optimization used to decide on a bank loan to buy property. *Technological and Economic Development of Economy, 17*, 174–188.

Brauers, W. K. M., & Zavadskas, E. K. (2013). Multi-objective economic evaluation of the European Union member states. As opposed to credit rating agencies opinions? *Transformations in Business & Economics, 12*, 102–124.

Cushman & Wakefield. (2011a, September). *Belgium retail snapshot*. Brussels: The Research Group of Cushman & Wakefield.

Cushman & Wakefield. (2011b, November). *Benelux Retail Monitor*. Brussels: The Research Group of Cushman & Wakefield.

FOD Economics. *General direction statistics and economic information*. Luxembourg: EUROSTAT.

Kendall, M. G. (1948). *Rank correlation methods*. London: Griffin.

Kendall, M. G., & Gibbons, J. D. (1990). *Rank correlation methods*. London: Edward Arnold.

Lootsma, F. A. (1987, July). Numerical scaling of human judgement in pairwise-comparison methods for fuzzy multi-criteria decision analysis. In *NATO Advanced Study Institute*, NATO conference report, July 26, Val d'Isere, France.

Maier, T. (1985). *Interval Input-Output Rechnung* [German for Interval Input-Output Arithmetic]. Königstein: Hain Verlag, Mathematical Systems in Economics.

Miller, G. A. (1965). The magical number seven plus or minus two: Some limits on our capacity for processing information. *Psychological Review, 63*, 81–97.

Mills, F. C. (1924). *Statistical methods applied to economics and business*, (2nd ed., 1938). New York, NY: Henry Holt.

Morgenstern, O. (1963). *On the accuracy of economic observations*. Princeton, NJ: Princeton University Press.

Mueller, J. H., Schuessler, K. F., & Costner, H. L. (1970). *Statistical reasoning in sociology* (2nd ed.). Boston, MA: Houghton Mifflin.

Saaty, T. L. (1987). What is the analytic hierarchy process? In *Nato Advanced Study Institute*, NATO conference report, July 26, Val d'Isere, France.

Spearman, C. (1904). The proof and measurement of association between two things. *American Journal of Psychology, 15*, 72–101.

Spearman, C. (1906). A footrule for measuring correlation. *British Journal of Psychology, 2*, 89–108.

Spearman, C. (1910). Correlation calculated from faulty data. *British Journal of Psychology, 3*, 271–295.

Van Waterschoot, J., Brauers, W. K., & Van Elewyck, P. (1979). *De sectoriële en regionale analyse van de Belgische economie* [Dutch for the sectoral and regional analysis of the Belgian economy]. Leuven, Belgium: KUL, Centrum voor Economische Studiën.

Z/Yen Group. (2012). Retrieved from http://www.tijd.be/nieuws/politiek_belgie/Brussel