

# A multi-criteria decision-making approach to finding relative weight of online & offline channels of retailing

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Abstract. In this article, we demonstrate how to use multi-decision-making tools such as fuzzy analytic hierarchy process and Thurstone's model of comparative judgement to find the relative valuation of online and offline channels of retailing. We list various factors customers consider while choosing between the two alternatives: shopping online vs. traditional brick and mortar store. Using the responses collected from a random sample of college students, we quantify the relative valuation of online and offline channels of retailing for that customer segment.

**Keywords:** Analytic Hierarchy Process, Multi-criteria Decision Making, Channel Competition.

#### 1 Introduction

The percentage of retail E-commerce sales as a percent of total retail sales has been steadily increasing in the last decade [1]. However, the preference towards online shopping over traditional brick-and-mortar shopping varies demographically [2]. There are a number of factors and criteria that affect an individual's decision to shop online vs. offline. It is important for companies to gauge the relative importance placed by target customer segments on these dual channels of retailing.

In this article, we demonstrate how to find the relative weight of online and offline channels of retailing in a sample customer segment. In particular, we collect various factors that undergraduate students (ages 18-22) in Indian Institute of Technology, Kharagpur look into while buying a product, find their relative importance and assign them weights. From a list of several criteria collected through literature survey [3-5], the more important ones are selected using Thurston's case V model [6] of comparative judgment and studied carefully. The fuzzy Analytic Hierarchy Process (AHP) [7] is used now to find the relative weights of the criteria as well as their importance with respect to each channel. This study would lead to the relative valuation of each of the channels with respect to the selected criteria. A survey was conducted to collect the preference order of each criterion over another and their relative importance while choosing between online and offline store. The fuzzy AHP was carried out using these responses and customer valuation of online purchasing with respect to offline purchasing was found.



## 2 Factors affecting a customer's choice of retail channel

First of all we collected various factors that may come into play when a customer decides to buy a product. These factors and their relative weightage decide which channel the customer would opt for. They are listed as below.

- Price
- Quality of product
- Discount, offers and rebates
- Delivery time
- Payment options available
- Brand selection and variety
- Ability to compare product
- Speed of selection
- Physical examination of product
- Warranty/Guarantee
- Serviceability and maintenance
- Refund policy
- Easiness to return
- Post purchase assistance and troubleshooting
- Shopping experience
- Charges for shipping and handling
- Physical exhaustion
- Product reviews available
- Stock availability
- Accessibility

Next a survey was conducted among the student community to rank these criteria according to their importance while buying a product. A total of 60 responses were collected.

#### 2.1 Thurston's case V model of comparative judgement

A pairwise matrix was created to find out how many people ranked a particular criterion over another. This matrix is listed in Table 1.



#### Table 1. Pairwise comparison matrix

|                                    | Price Qu | ality of I | Discol | Deliv | Payn | Bran | Abili | Spee | Phys N | Warr | Servil | Refu | Easin | Post | Sho | Charl | Phys | Prod S | Stock | Accesib | ility |
|------------------------------------|----------|------------|--------|-------|------|------|-------|------|--------|------|--------|------|-------|------|-----|-------|------|--------|-------|---------|-------|
| Price                              | 0        | 20         | 0      | 0     | 0    | 0    | 0     | 0    | 0      | 0    | 0      | 0    | 0     | 0    | 0   | 0     | 0    | 0      | 1     | 1       |       |
| Quality of product                 | 40       | 0          | 0      | 2     | 0    | 0    | 0     | 0    | 0      | 0    | 0      | 0    | 0     | 0    | 0   | 0     | 0    | 0      | 12    | 8       |       |
| Discount, offers and rebates       | 60       | 60         | 0      | 47    | 37   | 50   | 48    | 47   | 43     | 39   | 43     | 50   | 48    | 0    | 0   | 16    | 15   | 2      | 60    | 60      |       |
| Delivery time                      | 60       | 58         | 13     | 0     | 5    | 25   | 3     | 15   | 17     | 13   | 5      | 0    | 0     | 0    | 0   | 7     | 5    | 0      | 35    | 48      |       |
| Payment options available          | 60       | 60         | 23     | 55    | 0    | 48   | 49    | 44   | 46     | 37   | 59     | 48   | 49    | 53   | 5   | 17    | 37   | 5      | 60    | 60      |       |
| Brand selection and variety        | 60       | 60         | 10     | 35    | 12   | 0    | 15    | 16   | 3      | 4    | 2      | 0    | 4     | 0    | 0   | 0     | 0    | 0      | 48    | 49      |       |
| Ability to compare product         | 60       | 60         | 12     | 57    | 11   | 45   | 0     | 55   | 43     | 60   | 58     | 38   | 28    | 26   | 0   | 7     | 38   | 25     | 60    | 60      |       |
| Speed of selection                 | 60       | 60         | 13     | 45    | 16   | 44   | 5     | 0    | 48     | 60   | 60     | 48   | 52    | 56   | 0   | 6     | 37   | 28     | 60    | 60      |       |
| Physical examination of product    | 60       | 60         | 17     | 43    | 14   | 57   | 17    | 12   | 0      | 43   | 42     | 6    | 5     | 12   | 0   | 0     | 15   | 5      | 59    | 58      |       |
| Warranty/Guarantee                 | 60       | 60         | 21     | 47    | 23   | 56   | 0     | 0    | 17     | 0    | 32     | 28   | 25    | 20   | 0   | 0     | 12   | 0      | 58    | 60      |       |
| Serviceability and maintenance     | 60       | 60         | 17     | 55    | 1    | 58   | 2     | 0    | 18     | 32   | 0      | 16   | 15    | 12   | 0   | 0     | 0    | 0      | 52    | 56      |       |
| Refund policy                      | 60       | 60         | 10     | 60    | 12   | 60   | 22    | 12   | 54     | 32   | 44     | 0    | 20    | 15   | 0   | 0     | 2    | 0      | 60    | 60      |       |
| Easiness to return                 | 60       | 60         | 12     | 60    | 11   | 56   | 32    | 8    | 55     | 35   | 45     | 40   | 0     | 28   | 3   | 15    | 28   | 40     | 60    | 60      |       |
| Post purchase assistance and troub | 60       | 60         | 60     | 60    | 7    | 60   | 34    | 4    | 48     | 40   | 48     | 45   | 32    | 0    | 0   | 5     | 2    | 1      | 60    | 60      |       |
| Shopping experience                | 60       | 60         | 60     | 60    | 55   | 60   | 60    | 60   | 60     | 60   | 60     | 60   | 57    | 60   | 0   | 56    | 60   | 48     | 60    | 60      |       |
| Charges for shipping and handling  | 60       | 60         | 44     | 53    | 43   | 60   | 53    | 54   | 60     | 60   | 60     | 60   | 45    | 55   | 4   | 0     | 51   | 5      | 60    | 60      |       |
| Physical exhaustion                | 60       | 60         | 45     | 55    | 23   | 60   | 22    | 23   | 45     | 48   | 60     | 58   | 32    | 58   | 0   | 9     | 0    | 6      | 60    | 60      |       |
| Product reviews available          | 60       | 60         | 58     | 60    | 55   | 60   | 35    | 32   | 55     | 60   | 60     | 60   | 20    | 59   | 12  | 55    | 54   | 0      | 60    | 60      |       |
| Stock availability                 | 59       | 48         | 0      | 25    | 0    | 12   | 0     | 0    | 1      | 2    | 8      | 0    | 0     | 0    | 0   | 0     | 0    | 0      | 0     | 37      |       |
| Accesibility                       | 59       | 52         | 0      | 12    | 0    | 11   | 0     | 0    | 2      | 0    | 4      | 0    | 0     | 0    | 0   | 0     | 0    | 0      | 23    | 0       |       |

For example, in the cell corresponding to speed of selection and discount, offer and rebates the value is 13 which suggests that 13 people ranked speed of selection over discount offered and rebates. These values are converted to percentage (e.g.: score of 40 = 66.67%) and then the equivalent Z-Score has been found out. The mean Z score is calculated and re-scaled so that all values become positive (Table 2). These values corresponds to their relative importance (Fig. 1).

Table 2. Z score table of pairwise comparison matrix

|            | Price    | Quality of | Discount, | Delivery t | Payment  | Brand sel | Ability to | Speed of | Physical e | Warranty | Serviceab | Refund p | Easiness | Post purcl | Shopping | Charges f | Physical e | Product re | Stock ava | Accesibility |
|------------|----------|------------|-----------|------------|----------|-----------|------------|----------|------------|----------|-----------|----------|----------|------------|----------|-----------|------------|------------|-----------|--------------|
| Price      | 0        | -0.4307    | -3.719    | -3.719     | -3.719   | -3.719    | -3.719     | -3.719   | -3.719     | -3.719   | -3.719    | -3.719   | -3.719   | -3.719     | -3.719   | -3.719    |            | -3.719     | -2.1278   | -2.1278      |
| Quality of | 0.4307   | 0          | -3.719    | -1.8337    | -3.719   | -3.719    | -3.719     | -3.719   | -3.719     | -3.719   | -3.719    | -3.719   | -3.719   | -3.719     | -3.719   | -3.719    | -3.719     | -3.719     | -0.8415   | -1.1107      |
| Discount,  | 3.719    | 3.719      | 0         | 0.7834     | 0.2967   | 0.9673    | 0.8415     | 0.7834   | 0.5729     | 0.3853   | 0.5729    | 0.9673   | 0.8415   | -3.719     | -3.719   | -0.6229   | -3.719     | -1.8337    | 3.719     | 3.719        |
| Delivery t | 3.719    | 1.8337     | -0.7834   | 0          | -1.3829  | -0.2104   | -1.6447    | -0.6744  | -0.5729    | -0.7834  | -1.3829   | -3.719   | -3.719   | -3.719     | -3.719   | -1.1917   | -0.6744    | -3.719     | 0.2104    | 0.8415       |
| Payment    | 3.719    | 3.719      | -0.2967   | 1.3829     | 0        | 0.8415    | 0.9026     | 0.6229   | 0.7278     | 0.2967   | 2.1278    | 0.8415   | 0.9026   | 1.1917     | -1.3829  | -0.5729   | -1.3829    | -1.3829    | 3.719     | 3.719        |
| Brand sel  | 3.719    | 3.719      | -0.9673   | 0.2104     | -0.8415  | 0         | -0.6744    | -0.6229  | -1.6447    | -1.5009  | -1.8337   | -3.719   | -1.5009  | -3.719     | -3.719   | -3.719    | 0.2967     | -3.719     | 0.8415    | 0.9026       |
| Ability to | 3.719    | 3.719      | -0.8415   | 1.6447     | -0.9026  | 0.6744    | 0          | 1.3829   | 0.5729     | 3.719    | 1.8337    | 0.3407   | -0.0836  | -0.1679    | -3.719   | -1.1917   | -3.719     | -0.2104    | 3.719     | 3.719        |
| Speed of   | 3.719    | 3.719      | -0.7834   | 0.6744     | -0.6229  | 0.6229    | -1.3829    | 0        | 0.8415     | 3.719    | 3.719     | 0.8415   | 1.1107   | 1.5009     | -3.719   | -1.2814   | 0.3407     | -0.0836    | 3.719     | 3.719        |
| Physical e | 3.719    | 3.719      | -0.5729   | 0.5729     | -0.7278  | 1.6447    | -0.5729    | -0.8415  | 0          | 0.5729   | 0.5243    | -1.2814  | -1.3829  | -0.8415    | -3.719   | -3.719    | 0.2967     | -1.3829    | 2.1278    | 1.8337       |
| Warranty,  | 3.719    | 3.719      | -0.3853   | 0.7834     | -0.2967  | 1.5009    | -3.719     | -3.719   | -0.5729    | 0        | 0.0836    | -0.0836  | -0.2104  | -0.4307    | -3.719   | -3.719    | -0.6744    | -3.719     | 1.8337    | 3.719        |
| Serviceab  | 3.719    | 3.719      | -0.5729   | 1.3829     | -2.1278  | 1.8337    | -1.8337    | -3.719   | -0.5243    | 0.0836   | 0         | -0.6229  | -0.6744  | -0.8415    | -3.719   | -3.719    | -0.8415    | -3.719     | 1.1107    | 1.5009       |
| Refund p   | 3.719    | 3.719      | -0.9673   | 3.719      | -0.8415  | 3.719     | -0.3407    | -0.8415  | 1.2814     | 0.0836   | 0.6229    | 0        | -0.4307  | -0.6744    | -3.719   | -3.719    | -3.719     | -3.719     | 3.719     | 3.719        |
| Easiness   | 3.719    | 3.719      | -0.8415   | 3.719      | -0.9026  | 1.5009    | 0.0836     | -1.1107  | 1.3829     | 0.2104   | 0.6744    | 0.4307   | 0        | -0.0836    | -1.6447  | -0.6744   | -1.8337    | 0.4307     | 3.719     | 3.719        |
| Post purcl | 3.719    | 3.719      | 3.719     | 3.719      | -1.1917  | 3.719     | 0.1679     | -1.5009  | 0.8415     | 0.4307   | 0.8415    | 0.6744   | 0.0836   | 0          | -3.719   | -1.3829   | -0.0836    | -2.1278    | 3.719     | 3.719        |
| Shopping   | 3.719    | 3.719      | 3.719     | 3.719      | 1.3829   | 3.719     | 3.719      | 3.719    | 3.719      | 3.719    | 3.719     | 3.719    | 1.6447   | 3.719      | 0        | 1.5009    | -1.8337    | 0.8415     | 3.719     | 3.719        |
| Charges f  | 3.719    | 3.719      | 0.6229    | 1.1917     | 0.5729   | 3.719     | 1.1917     | 1.2814   | 3.719      | 3.719    | 3.719     | 3.719    | 0.6744   | 1.3829     | -1.5009  | 0         | 3.719      | -1.3829    | 3.719     | 3.719        |
| Physical e | 3.719    | 3.719      | 0.6744    | 1.3829     | -0.2967  | 3.719     | -0.3407    | -0.2967  | 0.6744     | 0.8415   | 3.719     | 1.8337   | 0.0836   | 1.8337     | -3.719   | -1.0363   | 0          | -1.2814    | 3.719     | 3.719        |
| Product re | 3.719    | 3.719      | 1.8337    | 3.719      | 1.3829   | 3.719     | 0.2104     | 0.0836   | 1.3829     | 3.719    | 3.719     | 3.719    | -0.4307  | 2.1278     | -0.8415  | 1.3829    | -3.719     | 0          | 3.719     | 3.719        |
| Stock ava  | 2.128    | 0.8415     | -3.719    | -0.2104    | -3.719   | -0.8415   | -3.719     | -3.719   | -2.1278    | -1.8337  | -1.1107   | -3.719   | -3.719   | -3.719     | -3.719   | -3.719    | 1.2814     | -3.719     | 0         | 0.2967       |
| Accesibil  | 2.128    | 1.1107     | -3.719    | -0.8415    | -3.719   | -0.9026   | -3.719     | -3.719   | -1.8337    | -3.719   | -1.5009   | -3.719   | -3.719   | -3.719     | -3.719   | -3.719    | -3.719     | -3.719     | -0.2967   | 0            |
| mean z so  | 3.209535 | 2.95701    | -0.56596  | 11         | -1.06877 | 1.12539   | -0.91342   | -1.01647 | 0.050095   | 0.311235 | 0.630495  | -0.36076 | -0.89838 | -0.86583   | -3.0578  | -1.92707  | -1.24756   | -2.09422   | 2.188355  | 2.338245     |

mean zs (3.20535 2.95701 0.56596 1.1 -1.06877 1.12539 -0.91342 -1.01647 0.050095 0.311235 0.650495 -0.36076 -0.88888 -0.86588 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.85688 -0.856888 -0.856888 -0.85688 -0.856888 -0.856888 -0.85688 -0.85688



Fig. 1. Weights of criteria

From this, we select top 9 criteria i.e., Price, quality, accessibility, stock availability, brand selection and variety, delivery time, serviceability, warranty & guarantee and physical examination of product for further analysis using fuzzy AHP.

#### 2.2 Fuzzy Analytic Hierarchy Process

The Fuzzy Analytic Hierarchy Process is used now to find the relative weights of the criteria as well as their importance with respect to each channel. This study would lead to the relative valuation of each of the channels with respect to the selected criteria. The membership functions are shown in Fig.2.



Fig. 2. Membership functions



Each criterion was asked to be compared with one another. Number in the bracket denotes the number of people that assigned that fuzzy value. We use the abbreviations as follows: Equally-E, Moderately-M, Strongly-S, Very Strongly-VS, Extremely-Ex.

| Table 3. Fuzzy value assigned to criteria pairs    |                        |                         |  |  |  |  |  |  |
|----------------------------------------------------|------------------------|-------------------------|--|--|--|--|--|--|
| Criteria pair                                      | Response               | Fuzzy value<br>assigned |  |  |  |  |  |  |
| Price, Quality                                     | E(40),M(20)            | 1                       |  |  |  |  |  |  |
| Price, Accessibility                               | M(42),E(13),S(5)       | 3                       |  |  |  |  |  |  |
| Price, Stock Availability                          | S(42),M(18)            | 5                       |  |  |  |  |  |  |
| Price, Brand selection and variety                 | VS(40),S(20)           | 7                       |  |  |  |  |  |  |
| price, Delivery time                               | M(47),E(5),S(8)        | 3                       |  |  |  |  |  |  |
| price, Serviceability and maintenance              | S(55),VS(5)            | 5                       |  |  |  |  |  |  |
| price, Warranty/Guarantee                          | VS(51),S(8),Ex(1)      | 7                       |  |  |  |  |  |  |
| price, Physical examination of product             | VS(47),S(13)           | 7                       |  |  |  |  |  |  |
|                                                    |                        |                         |  |  |  |  |  |  |
| quality, Accessibility                             | M(40),E(12),S(8)       | 3                       |  |  |  |  |  |  |
| quality, Stock availability                        | M(45),E(10),S(5)       | 3                       |  |  |  |  |  |  |
| quality, Brand selection and variety               | S(52),M(7),VS(1)       | 5                       |  |  |  |  |  |  |
| quality, Delivery time                             | M(40),VS(18),Ex(2)     | 3                       |  |  |  |  |  |  |
| quality, Serviceability and maintenance            | S(47),VS(13)           | 5                       |  |  |  |  |  |  |
| quality, Warranty/Guarantee                        | VS(49),S(11)           | 7                       |  |  |  |  |  |  |
| quality, Physical examination of product           | S(39),M(12),VS(9)      | 5                       |  |  |  |  |  |  |
|                                                    |                        |                         |  |  |  |  |  |  |
| Accessibility, Stock availability                  | E(52),M(8)             | 1                       |  |  |  |  |  |  |
| Accessibility, Brand selection and variety         | M(47),E(13)            | 3                       |  |  |  |  |  |  |
| Accessibility, Delivery time                       | M(32),E(20),S(8)       | 3                       |  |  |  |  |  |  |
| Accessibility, Serviceability and maintenance      | S(45),M(15)            | 5                       |  |  |  |  |  |  |
| Accessibility, Warranty/Guarantee                  | VS(47),S(12),E(1)      | 7                       |  |  |  |  |  |  |
| Accessibility, Physical examination of product     | S(58),E(1),VS(1)       | 5                       |  |  |  |  |  |  |
|                                                    |                        |                         |  |  |  |  |  |  |
| Stock availability, Brand selection and variety    | S(41),M(12),E(3),VS(4) | 5                       |  |  |  |  |  |  |
| Stock availability, Delivery time                  | E(47),M(13)            | 1                       |  |  |  |  |  |  |
| Stock availability, Serviceability and maintenance | S(44),M(16)            | 5                       |  |  |  |  |  |  |
| Stock availability, Warranty/Guarantee             | S(39),VS(21)           | 5                       |  |  |  |  |  |  |



| Stock availability, Physical examination of product             | S(41),M(11),VS(8)      | 5 |
|-----------------------------------------------------------------|------------------------|---|
| Brand selection and variety, Delivery time                      | M(35),E(15),S(5),VS(5) | 3 |
| Brand selection and variety, Serviceability and maintenance     | E(44),M(16)            | 1 |
| Brand selection and variety,<br>Warranty/Guarantee              | E(47),M(13)            | 1 |
| Brand selection and variety, Physical examination of product    | M(47),S(11),E(2)       | 3 |
|                                                                 |                        |   |
| Delivery time, Serviceability and maintenance                   | M(39),E(20),S(1)       | 3 |
| Delivery time, Warranty/Guarantee                               | M(44),S(13),E(3)       | 3 |
| Delivery time, Physical examination of product                  | E(42),M(8),S(10)       | 1 |
|                                                                 |                        |   |
| Serviceability and maintenance,<br>Warranty/Guarantee           | E(57),M(3)             | 1 |
| Serviceability and maintenance, Physical examination of product | M(40),E(18),S(2)       | 3 |
|                                                                 |                        |   |
| Warranty/Guarantee, Physical examination of the product         | E(50),M(10)            | 1 |
|                                                                 |                        |   |

Now each alternative is compared with each criterion (Table 4).

#### Table 4: Fuzzy value assigned to criteria with respect to alternatives

| Ranking of alternatives                                        | Response               | Fuzzy value<br>assigned |
|----------------------------------------------------------------|------------------------|-------------------------|
| Online,Offline with respect to Price                           | M(41),E(29)            | 3                       |
| Online,Offline with respect to Quality of product              | E(52), 1/M (8)         | 1                       |
| Online,Offline with respect to Accessibility                   | S(38),M(18),VS(4)      | 5                       |
| Online,Offline with respect to Stock availability              | M(40),E(18),S(2)       | 3                       |
| Online,Offline with respect to Brand selection and variety     | M(37),E(18),S(5)       | 3                       |
| Online,Offline with respect to Delivery time                   | 1/S(51),1/M(9)         | 1/5                     |
| Online,Offline with respect to Serviceability and maintenance  | 1/M(47),1/S(13)        | 1/3                     |
| Online,Offline with respect to Warranty/Guarantee              | 1/S(55),1/M(4),1/VS(1) | 1/5                     |
| Online,Offline with respect to Physical examination of product | 1/VS(41),1/S(19)       | 1/7                     |

Based on the responses, the fuzzy comparison matrices are shown in Table 5.



## Table 5: Fuzzy comparison matrices

|                    | Price | Quality | Accessibility | Stock availability | Brand selection | Delivery time | Serviceability | Warranty/guarantee | Physical examination |
|--------------------|-------|---------|---------------|--------------------|-----------------|---------------|----------------|--------------------|----------------------|
| Price              | 1     | 1       | 3             | 5                  | 7               | 3             | 5              | 7                  | 7                    |
| Quality            | 1     | 1       | 3             | 3                  | 5               | 3             | 5              | 7                  | 5                    |
| accessibility      | 1/3   | 1/3     | 1             | 1                  | 3               | 3             | 5              | 7                  | 5                    |
| Stock availability | 1/5   | 1/3     | 1             | 1                  | 5               | 1             | 5              | 5                  | 5                    |
| Brand selection    | 1/7   | 1/5     | 1/3           | 1/5                | 1               | 3             | 1              | 1                  | 3                    |
| Delivery time      | 1/3   | 1/3     | 1/3           | 1                  | 1/3             | 1             | 3              | 3                  | 1                    |
| Serviceability     | 1/5   | 1/5     | 1/5           | 1/5                | 1               | 1/3           | 1              | 1                  | 3                    |
| Warranty/guarantee | 1/7   | 1/7     | 1/7           | 1/5                | 1               | 1/3           | 1              | 1                  | 1                    |
| Physical           | 1/7   | 1/5     | 1/5           | 1/5                | 1/3             | 1             | 1/3            | 1                  | 1                    |
| examination        |       |         |               |                    |                 |               |                |                    |                      |

#### With respect to price

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 3       |
| offline | 1/3    | 1       |

#### With respect to quality

|         |  | online | offline |  |
|---------|--|--------|---------|--|
| online  |  | 1      | 1       |  |
| offline |  | 1      | 1       |  |
|         |  |        |         |  |

#### With respect to accessibility

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 5       |
| offline | 1/5    | 1       |

#### With respect to stock availability

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 3       |
| offline | 1/3    | 1       |

#### With respect to brand selection

|  | online | offline |  |  |  |  |  |
|--|--------|---------|--|--|--|--|--|



| online  | 1   | 3 |
|---------|-----|---|
| offline | 1/3 | 1 |

With respect to delivery time

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 1/5     |
| offline | 5      | 1       |

With respect to serviceability and maintenance

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 1/3     |
| offline | 3      | 1       |
|         |        |         |

With respect to warranty/guarantee

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 1/5     |
| offline | 5      | 1       |

With respect to physical examination of product

|         | online | offline |
|---------|--------|---------|
| online  | 1      | 1/7     |
| offline | 7      | 1       |

The next step is to find the eigenvector corresponding to the highest eigenvalues of the above matrices. They are then normalized so that the sum of weights equals 1.

| Table 6: Eigenvectors corresponding to hig | hest eigenvalue (criteria) [Normalized] |
|--------------------------------------------|-----------------------------------------|
|                                            |                                         |

| Price                           | 0.279026 |
|---------------------------------|----------|
| Quality                         | 0.238381 |
| Accessibility                   | 0.14245  |
| Stock availability              | 0.125128 |
| Brand selection and variety     | 0.064649 |
| Delivery time                   | 0.058606 |
| Serviceability                  | 0.038134 |
| Warranty/Guarantee              | 0.027111 |
| Physical examination of product | 0.026515 |

 Table 7. Normalized weights (Alternatives with respect to criteria)

| 8                                  |        |         |
|------------------------------------|--------|---------|
|                                    | Online | offline |
| with respect to Price              | .7388  | .2612   |
| with respect to Quality            | 0.5734 | 0.4266  |
| with respect to Accessibility      | 0.8304 | 0.1696  |
| with respect to Stock availability | 0.7388 | .2612   |
|                                    |        |         |



| with respect to brand selection and  | 0.7388 | .2612 |
|--------------------------------------|--------|-------|
| variety                              |        |       |
| with respect to delivery time        | .1696  | .8304 |
| with respect to serviceability and   | .2612  | .7388 |
| maintenance                          |        |       |
| with respect to warranty/guarantee   | .1696  | .8304 |
| with respect to physical examination | .1261  | .8739 |

#### 2.3 Relative valuation

|                         |                             | D '                             |          |                        |                        |
|-------------------------|-----------------------------|---------------------------------|----------|------------------------|------------------------|
| Focus: Buying a product | Price                       | 0.279026                        |          | Online7388 Offline2612 |                        |
|                         | Quality                     | 0.238381                        |          | Online5734 Offline4266 |                        |
|                         | Accessibility               | 0.14245                         |          | Online8304 Offline1696 |                        |
|                         | Stock availability          | 0.125128                        |          | Online7388 Offline2612 |                        |
|                         | Brand selection and variety | 0.064649                        |          | Online7388 Offline2612 |                        |
|                         |                             | Delivery time                   | 0.058606 |                        | Online1696 Offline8304 |
|                         | Serviceability              | 0.038134                        | -        | Online2612 Offline7388 |                        |
|                         | Warranty/Guarantee          | 0.027111                        |          | Online1696 Offline8304 |                        |
|                         |                             | Physical examination of product | 0.026515 |                        | Online1261 Offline8739 |

Calculating valuation of online:

.7388\*.279026 + .5734\*.238381 + .8304\*.14245 + ... 0.1261\*.026515 = .6292 Calculating valuation of offline:

 $.2612^{*}.279026 + .4266^{*}.238381 + .1696^{*}.14245 + \dots 0.8739^{*}.026515 = .3708$ 

Hence the relative valuation= .6292/.3708 = 1.69

In other words, the sample customers under consideration prefer online shopping 1.69 times over shopping offline.



### 3 Conclusions

In this paper, we identified several characteristics and traits that are relevant when a customer chooses between online and offline channels of retailing. Using a sample survey and using the popular MCDM techniques such as Fuzzy AHP and Thurston's case V model, we computed the relative weight of these competing retail channels. Similar method can be used to evaluate the relative importance any two (or more) alternatives and researchers may find the technique illustrated in this paper useful. In future work, we plan to increase the sample size and list of criteria/alternatives.

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