ANALYSIS OF THE REALTIONSHIP OF GOODS FROM THE CONSUMERS' PERSPECTIVE

(The Goods being:

Toothbrush, Toothpaste; Limejuice,

Sugarcane Juice; Milk, Newspapers)

AN ECONOMICS PROJECT
UNDERTAKEN FOR CIA 2 SEMESTER 1 (FYBA 2016-17)
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Acknowledgements

The actuality of this paper would not have been possible without the thirty-six respondents, who took part in our survey. Even though their economic and social settings differed vastly, the patience with which each of them answered was at an inexplicably high level. The candour and perceptiveness, that was unexpectedly common was highly appreciated, and aided our premiere scientific endeavour.

This study would not have been possible without the unconditional support of Mumbai, and the life she sustains. Her perpetual ability to surprise us is reflected in our findings.

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September 2016

The opinions and conclusions expressed here are those of the authors, and do not necessarily represent the views of the institutions to which they are affiliated.

Abstract

The ethos of this exercise lies in expounding a plethora of patterns of consumption of three pairs of goods that reveal themselves when acutely examined. The pairs of goods chosen can be catalogued into three groups – complementary, competitive and unrelated. All the six goods chosen were both ubiquitous and widely used, adding an element of universality to the study. The culmination of the research carried out in this paper, which probes the effect of a multitude of seasons on the demand for the aforementioned pairs of goods, questions the various causes behind the consumer's decision to purchase the given goods and explains the other intra-economic and intra-disciplinary trends that exist.

Contents

1) Introduction

a. Outline of Goods

Osburne and Frey's seminal paper lists dentists amongst the lowest professions susceptible to computerisation. Oral pain triggers a dental enquiry which requires an immediate solution. Goods that prevent, to a limited extent, the onset of this pain are the evergreen toothbrush and toothpaste, which serve biological and cosmetic purposes. It is imperative to use both goods concurrently, hence affirming their complementarity.

 Both thirst-quenchers, limejuice and sugarcane juice are appetizing refreshers embedded into the routines of city-dwellers. They have similar functionality and are within analogous price ranges.

 Finally, milk and newspapers are incongruous in their functionality. Milk is used as a solvent in several beverages and for the preparation of food items. Newspapers are a potent medium of informational delivery.

b. Objectives

- To elucidate the relation between family size and the frequency of consumption,

- To examine the frequency of purchase of 'necessities',

- To establish motives that effectuate patterns of consumption, and

- To corroborate the following hypotheses –

1)   Variation in -

i)   Manmade seasons,

ii)   Cultural seasons,

iii)   Natural seasons ,

 has a positive effect on demand.

2) Demand for 'necessities' is does not vary with seasons.

c. Methodology

Primary data collection methods were extensively used. All 36 respondents were surveyed in person, through interviews that spanned the entire metropolis. The collected data was tabulated using Microsoft Excel, and graphically represented using the same. All formulae used can be found in .

d. General Overview

The succeeding sections of this paper document tendencies that surfaced during the analytical process. The qualitative aspects, explaining the consumer's intent will precede the quantitative segment, which is rife with perspicuous statistical concepts. Finally, the paper is recapitulative, with analytical fallacies and prospective exercises discussed.

2) ANALYSIS

a) Qualitative Analysis

This section attempts to establish the dominant motives of varying income groups in their consumption of the selected goods.

Low Income Groups(LIGs) are ostensibly motivated by price and longevity. They do not use any brand specific toothbrush or toothpaste, but are influenced by the popularity of the product. While High Income Groups(HIGs) buy toothbrushes based on their attractiveness, and their toothpastes for health reasons, LIGs prefer durable toothbrushes and family sized toothpastes. HIGs use organic or prescribed toothpastes, as they are able to afford them, on a larger scale than other income groups. Middle Income Groups(MIGs) consider durability as the basis of their purchase of the pair.

HIGs' prevailing motive for consuming Sugarcane Juice is the health factor, and the predominant reason for abstaining is diabetes. Conversely, LIGs are inclined to consume sugarcane juice because of their preferences. MIGs lie on the fence on most matters, but tend to consume homemade limejuice, as per their convenience. Only HIGs report to have consumed limejuice at restaurants/ clubs and sugarcane juice via delivery, testament to their exclusivity. LIGs largely consume limejuice from stalls.

HIGs are more health conscious than LIGs, as they typically purchase packaged milk that has low fat content. LIGs are the only set to identify affordability as a trigger for the consumption of milk. The types of newspapers consumed by HIGs are considered informative and reputed, while LIGs purchase newspapers based on their popularity. MIGs prefer vernacular newspapers.

b) Quantitative Analysis

i. Relation between Prices of Pairs

Before commencing with the analysis proper, it is imperative to examine the link between the prices of commodities comprising the pair.

All 3 pairs, complementary goods, competitive goods and unrelated goods, exhibit a modest correlation, implying that they vary in a broadly similar manner. An upward positive slope is observed, explaining a direct relation and a consistent ratio between the prices of the goods.

The above explanation testifies that consumers tend to purchase more expensive pairs of goods, or cheaper pairs of goods. This is mathematically shown here.

ii. Effect of Income on Price

Ascertaining the income elasticity is beyond the scope of this paper, simply due to the absence of a quantifiable *change* in an individual's income. The misconception that the income of all respondents can be interpreted as 'differing', thus enabling the calculation of income elasticity, must be avoided.

However, quantifying the effect of income on the price of the commodity being consumed is feasible. Colloquially, rich people buy more expensive goods, and poorer buy cheaper ones.

The above statements are epitomised by toothpaste and milk, both of which exhibit highly positive correlations with income. This occurs as both goods are traditionally shared amongst multiple individuals. In the case of milk, it is also due to its versatility. The correlation between income and the price of sugarcane juice, limejuice, toothbrushes and newspapers is almost negligible, as it is unlikely that richer people buy more expensive variants of commonplace items such as juice and newspapers.

The prices of all six goods are positive functions of income.

iii.   Determinants of Frequency of Purchase : Income versus Family Size

En masse, it is observed that both income and family size have a negligible effect on the frequency of purchase, but the effect income has is mathematically higher than family size does.

Two notable exceptions exist in the case of the effect of family size for toothpaste and milk. Both goods are shared by collectives, leading to increased consumption. The hasty rate of consumption leads to a hastened rate of replenishment.

A comparatively strong correlation exists between income and frequency of purchase of newspapers, solely as there exists a link between low-income and illiteracy, which would result in consumers abstaining from their purchase of newspapers. Similarly, a moderate relation between income and the frequency of purchase of toothbrushes can be attributed to consumers' tendency to replace toothbrushes at an accelerated pace with a higher income.

iv.   Varying Consumption During Seasons

An attempt has been made to corroborate the effect of variation among seasons on demand of the goods using the Co-efficient of Colligation.

Complete dissociation is observed in most cases. This implies that the two attributes being considered occur independently of each other.

There exists no relation between varying seasonal demand for complementary goods (toothbrush and toothpaste) and newspapers. This reflects reality, as the need for these goods is not seasonally altered.

A weak positive association is seen in the case of limejuice and milk between manmade and natural seasons It shows the consumer's tendency to buy more of a good in both aforementioned seasons. This can boiled down to both limejuice and milk's role as a thirst quencher. A spike in consumption was seen during the summer months, where high temperatures force regular hydration.

A significantly strong positive association can be seen in the case of the limejuice and sugarcane juice in manmade and cultural seasons. Both substitutes exhibit large fluctuations in demand when seasonal discounts are offered, and festivals are celebrated.

Similarly, an affirmative association is witnessed in the case of milk, which is due to a consumer's attraction to offers during synthesized seasons coupled with alternate uses of milk.

When independently analyzed, the most robust effect is that of varying natural seasons on the consumption of lime and sugarcane juice, which has been elucidated previously. Other puissant effects are that of manufactured seasons on the consumption of toothpaste and toothbrushes, as consumers would prefer stocking up for a long period of time at a cheaper price.

v.　Variation in Demand for Necessities

Both complementary goods under study are uni-purpose in nature, and are widely considered necessities. However, they experience minimal variation in demand with changing seasons, barring the effect of diminishing prices. Neither the use nor the utility of the pair transform with a change in natural or cultural seasons. It can be adjudicated that demand for both goods (necessities) is not a reactionary to varying seasons.

For substitute goods, both of which are deemed expendable, alterations in any season affect the consumption level. Consumption surges during summer, due to physical requirements, and during man-made seasons, when promotional offers are plentiful. A small portion of respondents consume more during cultural seasons, probably due to increased ceremonies and gatherings.

Finally, in the case of newspapers (highly adjudged as a necessity) there is nil effect on consumption with variation in cultural or natural seasons, and inconsequential variation during man-made seasons. Newspapers are usually part of subscription models, which are uniform all year-round. Milk, universally considered a necessity, exhibits higher demand during cultural seasons, and moderately higher demand during natural and man-made seasons. It is responsive to variation in seasons while being a necessity.

It is abundantly clear that 'necessities' are largely unaffected by variation in seasons.

3) Conclusive Comments

a) Overall Findings

It is evident that demand for goods is a positive function of fluctuating seasons. The increase in consumption outweighs the decrease with changing seasons. The hypothesis is epitomized in the case of substitute goods during summer, complementary goods during man-made seasons and milk during cultural seasons.

'Necessities' (with the exception of milk) are unresponsive to changing natural and cultural seasons, but respond positively to seasonal discounts.

b) Gaps in the Study

Variation in consumption pattern was not quantified, leaving qualitative analysis as the only option. Also, the number of respondents from each income group were dissimilar. Finally, neither a change in price nor income was recorded, thus eliminating the possibility of elasticity being calculated.

c) Prospects for the Future

A comparative between consumption patterns of e-papers and newspapers would be an impeccable measure of how profoundly technology has pervaded our daily lives. An assessment of triggers for purchasing toothpastes/toothbrushes would be useful to industrial giants, as it would allow them to shape their branding better.

4) Bibliography

Frey, C, Osburne, M (2013). *The Future of Employment*. Oxford University Press.

Distinction between High Income, Low Income and Middle Income:

http://www.incometaxindia.gov.in/charts%20%20tables/tax%20rates.htm

Calculation of Yule's Q and Y:

http://www.quantitativeskills.com/sisa/statistics/twoby2.htm

a)Bank

Attached as a separate file.

b) Sample Questionnaire

1) Age group :

   <20

   21 – 30

   31 – 40

   41 – 50

   51 – 60

   60<

2) Number of members in the family

3) Income (per annum)

   <2.5 lakh

   2.5 – 4 lakh

   4 – 6 lakh

   6 – 8 lakh

   8 – 10 lakh

   10 -15 lakh

   15 – 20 lakh

   20 - 25 lakh

4) Literate (Read and write in ANY language)

5) What price do you purchase the good for

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

6) How often do you purchase the good in a month

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

7) Features of the product

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

8) Triggers for buying the particular product

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

9) Do you consume more/ less of the good under question during certain natural seasons?

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

10) Do you buy more/less of the good during specific manmade seasons?

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

11) Do you buy more/less of the good during cultural seasons?

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

12) Do you consider the good to be a necessity?

Toothbrush	Toothpaste	Limejuice	Sugarcane Juice	Milk	Newspapers

c) Glossary:

Man-made season: Synthesised portions of the year where alterations in the price of commodities take place, usually independent of climatic or cultural ongoings.

Natural season: Uncontrollable, inevitable transitions in season, with temperature, humidity and precipitation wavering.

Cultural season: Pockets during the year where festivals, ceremonies and rituals are typically carried out.

Necessities: Commodities bereft of which an individual will be unable to survive.

Features: Differentials a product possesses, making it a more suitable option.

Triggers: Motives behind the purchase made by the consumer.

Family size: Number of people living in the same home as the respondent, including the respondent.

Dichotomous Data: This is data that has one of two possible outcomes, with the outcomes usually contradicting each other.

Low-income: Income less than Rs. 2.5 lakh per annum.

Middle Income: Income between Rs. 2.5 and 10 lakh per annum.

High Income: Income above 10 lakh per annum.

Note:

The above brackets are as defined by the Income Tax Department of India. Individual's whose income falls into the 'Low Income' bracket are exempted from paying taxes, those under the 'Middle Income' slab are expected to pay 10% and 20% depending on which side of 5 lakh they fall on, and finally those who come under the 'High Income' bracket are expected to pay 30% tax.

Co-efficient of Colligation: Yule's Y, also known as the coefficient of colligation, is a measure of association between two binary variables. Finding the coefficient of colligation is a very important way of quantifying the association between two disjoint classes known as dichotomous classes. While correlation and regression are quantitative measures, colligation is a very effective tool that helps in establishing association between qualitative attributes.

Alternate Uses of Milk: In households for ghee, sweets, delicacies etc. during cultural seasons.

d) Tables

Toothbrush

Table 1.1 - Manmade Seasons & Natural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	10	26	36
Total	10	26	36

Yule's Q= 0

Yule's Y= 0

Table 1.2 - Manmade Seasons & Cultural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	10	26	36
Total	10	26	36

Yule's Q=0

Yule's Y=0

Table 1.3 - Natural Seasons & Cultural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	0	36	36
Total	0	36	36

Yule's Q=0

Yule's Y=0

Toothpaste

Table 2.1 - Manmade Seasons & Natural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	9	27	36
Total	9	27	36

Yule's Q= 0

Yule's Y= 0

Table 2.2 - Manmade Seasons & Cultural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	9	27	36
Total	9	27	36

Yule's Q=0

Yule's Y=0

Table 2.3 - Natural Seasons & Cultural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	0	36	36
Total	0	36	36

Yule's Q=0

Yule's Y=0

<u>Limejuice</u>

Table 3.1 - Manmade Seasons & Natural Seasons

	More	No Effect	Total
More	6	20	26
No Effect	1	9	10
Total	7	29	36

Yule's Q: 0.459459

Yule's Y: 0.243332

Table 3.2 - Manmade Seasons & Cultural Seasons

	More	No Effect	Total
More	4	1	5
No Effect	3	28	31
Total	7	29	36

Yule's Q: 0.947826
Yule's Y: 0.71871

Table 3.3 – Natural Seasons & Cultural Seasons

	More	No Effect	Total
More	5	0	5
No Effect	22	9	31
Total	27	9	36

Yule's Q=0

Yule's Y=0

Sugarcane Juice

Table 4.1 - Manmade Seasons & Natural Seasons

	More	No Effect	Total
More	5	10	15
No Effect	0	21	21
Total	5	31	36

Yule's Q=0

Yule's Y=0

Table 4.2 - Manmade Seasons & Cultural Seasons

	More	No Effect	Total
MORE	2	1	3
No Effect	3	30	33
Total	5	31	36

Yule's Q: 0.904762

Yule's Y: 0.634512

Table 4.3 - Natural Seasons & Cultural Seasons

	More	No Effect	Total
More	3	0	3
No Effect	12	21	33
Total	15	21	36

Yule's Q=0

Yule's Y=0

<u>Milk</u>

Table 5.1 - Manmade Seasons & Natural Seasons

	More	No Effect	Total
More	1	2	3
No Effect	7	26	33
Total	8	28	36

Yule's Q: 0.3
Yule's Y: 0.153536

Table 5.2 - Manmade Seasons & Cultural Seasons

	More	No Effect	Total
More	7	14	21
No Effect	1	14	15
Total	8	28	36

Yule's Q: 0.75
Yule's Y: 0.451416

Table 5.3 - Natural Seasons & Cultural Seasons

	More	No Effect	Total
More	3	18	21
No Effect	0	15	15
Total	3	33	36

Yule's Q=0

Yule's Y=0

Table 6.1 - Manmade Seasons & Natural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	4	32	36
Total	4	32	36

Yule's Q=0

Yule's Y=0

Table 6.2 – Manmade Seasons & Cultural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	4	32	36
Total	4	32	36

Yule's Q=0

Yule's Y=0

Table 6.3 - Natural Seasons & Cultural Seasons

	More	No Effect	Total
More	0	0	0
No Effect	0	36	36
Total	0	36	36

Yule's Q=0

Yule's Y=0

e) Graphs

Figure 1

Combinations of Complementary Goods

Coefficient of correlation
= 0.4986

y = 0.716x + 31.361
R² = 0.2486

◆ Prices of Complementary Goods
— Linear (Prices of Complementary Goods)

X-axis: Price of Toothbrush
Y-axis: Price of Toothpaste

Figure 2

Effect of Income on Toothbrush Prices

Coefficient of correlation
= 0.504937

y = 0.0002x + 35.392
R² = 0.255

◆ Income and Toothbrushes
— Linear (Income and Toothbrushes)

X-axis: Income
Y-axis: Toothbrush Price

Figure 3

Figure 4

Figure 5

Effect of Income on Lime Juice Prices

Coefficient of correlation
= 0.4524

y = 0.0004x + 5.3718
R² = 0.2048

◆ Income and Lime Juice

—— Linear (Income and Lime Juice)

Figure 6

Effect of Income Sugarcane Juice Prices

Coefficient of correlation
= 0.28565

◆ Income and Price of Sugarcane Juice

—— Linear (Income and Price of Sugarcane Juice)

y = 6E-05x + 12.196
R² = 0.0816

Figure 7

Effect of Income on the Price of Milk

Coefficient of Correlation = 0.73912

◆ Income and the Price of Milk

— Linear (Income and the Price of Milk)

y = 0.0002x + 28.029
R² = 0.4028

Figure 8

Effect of Income on the Price of Newspapers

Coefficient of correlation = 0.526497

y = 6E-05x + 5.0232
R² = 0.2772

◆ Income and Price of...

Figure 9

Effect of Income on Frequency of Purchase of Toothbrushes

Coefficient of correlation = 0.5395

$y = -8E{-}06x + 1.3198$
$R^2 = 0.2911$

◆ Income and Toothbrushes

— Linear (Income and Toothbrushes)

Figure 10

Effect of Income on Frequency of Purchase of Toothpaste

Coefficient of correlation = 0.06633

◆ Income and Frequency of Purchase of Toothpaste

— Linear (Income and Frequency of Purchase of Toothpaste)

$y = -1E{-}06x + 1.1565$
$R^2 = 0.0044$

Figure 11

Figure 11: Effect of Income on Frequency of Purchase of Lime Juice

Figure 12

Figure 12: Effect of Income on Frequency of Purchase of Sugarcane Juice

Figure 13

Size of Family and Frequency of Purchase of Toothbrush

Coefficient of correlation
= 0.0529

◆ Size of Family and Frequency of Purchase of Toothbrushes

— Linear (Size of Family and Frequency of Purchase of Toothbrushes)

$y = 0.0263x + 0.7028$
$R^2 = 0.0028$

Figure 14

Effect of Income on Frequency of Purchase of Milk

Coefficient of Correlation
= 0.45672

◆ Income and Frequency of Purchase of Milk

— Linear (Income and Frequency of Purchase of Milk)

$y = 0.0001x + 19.529$
$R^2 = 0.2086$

Figure 15

Effect of Income on Frequency of Purchase of Newspapers

Coefficient of correlation = 0.397114

◆ Income and Frequency of Purchase of Newspapers

— Linear (Income and Frequency of Purchase of Newspapers)

$y = 8E\text{-}05x + 21.482$
$R^2 = 0.1577$

Frequency of Purchase of Newspapers

Income

Figure 17

Effect of Family Size on Frequency of Purchase of Toothpaste

Coefficient of Correlation = 0.4966

◆ Family Size and Purchase of Toothpaste

— Linear (Family Size and Purchase of Toothpaste)

$y = 0.2977x - 0.0041$
$R^2 = 0.2467$

Frequency of Purchase of Toothpaste

Size of Family

Figure 18

Figure 19

Figure 20

Effect of Family Size on the Frequency of Purchase of Milk

Coefficient of correlation = 0.4592

♦ Family Size and Milk Purchases

— Linear (Family Size and Milk Purchases)

$y = 4.9652x + 11.015$
$R^2 = 0.2109$

Figure 21

Effect of Family Size on Frequency of Consumption of Newspapers

Coefficient of correlation = 0.2249444

♦ Family Size and Newspaper Purchases

— Linear (Family Size and Newspaper Purchases)

$y = 1.5172x + 21.146$
$R^2 = 0.0506$

Figure 22

Effect of Income on Toothpaste Prices

Coefficient of Correlation
= 0.6580

$y = 0.0003x + 42.906$
$R^2 = 0.433$

◆ Income and Toothpaste Prices

——— Linear (Income and Toothpaste Prices)

f) Formulae

<u>1) Yule's Q (Coefficient of Colligation)</u>

For two possibly dichotomous events E1 and E2,

$$Q = ((ad - bc) / (ad + bc))$$

Where,

a = the number of times E1 happened and E2 happened

b = the number of times E1 did not happen and E2 happened

c = the number of times E1 happened and E2 did not happen

d = the number of times E1 did not happen and E2 did not happen.

<u>2) Yule's Y (Coefficient of Association)</u>

For two possibly dichotomous events E1 and E2,

$$Y = \frac{\sqrt{ad} - \sqrt{bc}}{\sqrt{ad} + \sqrt{bc}}$$

Where,

a = the number of times E1 happened and E2 happened

b = the number of times E1 did not happen and E2 happened

c = the number of times E1 happened and E2 did not happen

d = the number of times E1 did not happen and E2 did not happen.

<u>3) Coefficient of Correlation</u>

For two sets of data $\{x_1, x_2\ldots\ldots x_n\}$ and $\{y_1, y_2\ldots\ldots y_n\}$, the coefficient of correlation r can be given by the following formula:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

4) Income for Math

For annual income Y, the average monthly income M can be given by:

$M = Y/12$

5) Coefficient of Determination/Goodness of Fit

For two sets of data $\{x_1, x_2......x_n\}$ and $\{y_1, y_2......y_n\}$, the coefficient of correlation r can be given by the following formula:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

On finding r, it is then squared to find the coefficient of determination:

Goodness of Fit = r^2

6) Relation between prices of complementary goods

Mathematically, this can be expressed as –

$$p1 = f_+(p2)$$

Where p1 is the price of the first good of the pair,

P2 is the price of the second good of the pair, and

Ceteris parabus is employed.

g) Pie Charts

h) Tables – Necessities

Commodity	Consider Necessity (percentage)
Toothbrush	94.44
Toothpaste	100
Limejuice	61.11
Sugarcane Juice	52.78
Milk	100
Newspapers	86.11

i) Anecdotal Narratives

A respondent claimed that all the selected goods were not a necessity. He argued that none of them were required for sustenance, that he could brush his teeth with twigs, avoid the consumption of milk, lime, and sugarcane juice, and informed us that newspapers were becoming increasingly irrelevant. This led to an intense discussion on the fact that goods that are perceived as necessities have an inelastic demand, thus this was a matter of subjectivity. Finally, the respondent conceded that he consumed all the selected goods quite regularly, but still wouldn't want to classify them as a necessity.

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