CONSTRUCTING RANK PRICE INDEX NUMBER: AN APPLICATION TO RESIDENTIAL RENT

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ABSTRACT

Index numbers are often constructed for continuous variables such as price, weight, volume and quantity of goods, but rarely for nominal or ordinal categorical responses. Here, we constructed index number for ordinal categorical variables, called Jibasen-Gazali-Asanya rank price index (P^{JG}), the proposed index was applied to rent data of residential houses of different categories in Jimeta metropolis from 2000 - 2015.The method takes into cognizance expenditure and type of the property, as weights, the rent was considered as price. The results were compared with existing index methods such as Weighted Dutot Index method, Weighted Carli Index method and Weighted Jevons index method. The coefficient of variation (C.V.) for the distribution of price indices was also obtained with respect to each index method. The result shows that the proposed Index performed relatively well alongside existing index methods, since indices obtained from the proposed rank index is bounded by indices computed from weighted Dutot's price index, weighted Jevon's and the weighted Carli's price index.

Keywords: *Index number, rank index, categorical data, residential rent index*

INTRODUCTION

Index number refers to statistical techniques for indicating the relative movements of data where measurement of actual movement is difficult, it measures the change in the level of production, level of business activities and price of commodities that are exchanged for money in a given geographical area over a period of time (Jibasen, 2010 and Asanya, 2016). This technique has been widely used by statisticians and non-statisticians. The comparison can be across regions or time period. Index numbers are constructed for varying and different purposes such as, commodity price index, growth index, consumer price index and recently residential property price index was constructed for Nigeria by Olowofeso *et al.*, (2012). Index numbers are often constructed for continuous variables such as price, weight, volume and quantity of goods, but rarely for nominal categorical responses such as, political affiliations, religion affiliation, diagnoses, contraceptive methods used, choice of residence, nor for ordinal categorical variables, such as food preferences, consumer preferences among leading brands of product, social class, patient condition, etc.

According to Agresti (2002), the development of methods for categorical variables was stimulated by research in social and biomedical sciences but not restricted to those areas. Categorical data analysis frequently occur in behavioral sciences, epidemiology and public health, genetics, zoology, education, marketing, and even in highly quantitative fields such as engineering and industrial quality control.

Nominal variables are qualitative in nature, they vary only in quality not in quantity, and also ordinal variables are ordered categories, they are often treated as qualitative using methods for nominal variables. But in many respect, ordinal variables more closely resemble interval variables, they possess important features, hence analyst often utilize the quantitative nature of ordinal data by assigning numerical scores to categories or assuming an underlying continuous distribution (Agresti, 2002).

In this paper we proposed an index number formula for ordinal categorical variables, the constructed index was applied to rent data of residential houses of different categories in Jimeta metropolis.

REVIEW OF LITERATURE

Index numbers are divided into two major types; the un-weighted and the weighted indexes. The un-weighted index includes;

(1) Simple index number, otherwise known as relatives (price relatives, value relatives, etc.)

$$I_t = \frac{P_t}{P_o} x\ 100 \quad (1)$$

where, I_t – index at period t, P_t - price or value at period t, and P_o - price at the base period

(2) Dutot's price index (P^D) otherwise called, Simple aggregate index –the total of commodity prices (value) in the given year as a percentage of total prices (value) in the base year, this was developed by Dutot (1738) and is;

$$P^D = \frac{\Sigma p_t}{\Sigma p_o} x\ 100 \quad (2)$$

(3) Carli's price index (P^C), otherwise called, simple average of relatives index; where the averaging procedure may be the arithmetic mean, geometric mean, harmonic mean, median etc. The Carli price index falls in this category using the arithmetic mean, thus, the Carli (1764) index is given as,

$$P^C = \frac{\Sigma^{p_t}/_{p_o}}{N} x\ 100 \quad (3)$$

(4) Jevons' price index (P^J): This is the geometric mean of price ratios P_{it}/P_{io}, it was first suggested by Jevons [1863] and is given as:

$$P^J = \prod_{i=1}^{m} \sqrt{\frac{P_{it}}{P_{io}}}\ X\ 100 \quad (4)$$

(see, Jibasen(2010),Gupta (2011) and Asanya,(2016))

The weighted indexes includes:

(4) The Laspeyres' price index uses base-period prices to compare aggregate production levels in two periods. This was developed by Laspeyres (1871). The formula is given by:

$$L_I = \frac{\sum p_i(t)q_i(0)}{\sum p_i(0)q_i(0)} X\ 100 \quad (5)$$

(5) The Paasche'sprice index was proposed by Paasche (1874) uses the quantities of the current period as weight,the formula for Paasche's price index;

$$P_I = \frac{\sum p_i(t)q_i(t)}{\sum p_i(0)q_i(t)} X\ 100 \quad (6)$$

(6) The Fisher's ideal price index (proposed by Fisher (1922)) is the geometric mean of the Laspeyres' and the Paasche's indexes, is given as;

$$F_I = \sqrt{(L_I)(P_I)}$$

$$= \sqrt{\left(\frac{\sum p_i(t)q_i(0)}{\sum p_i(0)q_i(0)}\right)\left(\frac{\sum p_i(t)q_i(t)}{\sum p_i(0)q_i(t)}\right)} X$$

(7)

For further discussions on weighted indexes number methods see Fisher (1922), Eichhorn (1978) and Gupta (2011). It should be noted that all the index numbers listed make use of continuous quantitative variables. The proposed index makes use of ordinal categorical variables as weights.

MATERIALS AND METHODS

The Jibasen-Gazali-Asanya (P^{JG}) Ranked Rent Index Method:

The Jibasen-Gazali-Asanya (P^{JG}) rank price indexstemmed from the index number proposed by Gazali (2015), named Gazali-Jibasen rent rank index and is given as,

$$G-J = \frac{\sum_i^n P_i(t)W_i(R)}{\sum_i^n P_i(0)W_i(R)} X\ 100 \quad (8)$$

This method was found to be very inconsistent and biased. This method is now modified and called Jibasen-Gazali-Asanya (P^{JG}) rank price index. The modified method takes into cognizance expenditure on the property, because often times rent depends on the cost incurred on the property, aside other factors. The modified index is given as:

$$P^{JG} = \frac{\sum_{i=1}^{m} W_i P_{it} R_{it}}{\sum_{i=1}^{m} W_i P_{io} R_{io}} X\ 100 \quad (9)$$

where,

$$W_i = \frac{E_{io} + E_{it}}{\sum_{i=1}^{m}(E_{io} + E_{it})};\ (i = 1, 2, \ldots, m)$$

E_{io} and E_{it} = Mean Expenditure on the houses on rent (MEH) in base period and the period t respectively. For items other than house type, Q_{io} and Q_{it} is used as the quantity at the base period and the period t respectively.

R_{it} and R_{io} = Rank of mean house rent (MHR) in period t and the base period such that the house with the lowest MHR takes the first rank while the highest get rank m. These ranks are weights.

m = category of houses under study.

P_{it} and P_{io} = Mean House Rent (MHR) in period t and at the base period respectively.

When MEH is not available then equation (9) reduces to (10) respectively,

$$P^{JG(1)} = \frac{\sum_{i=1}^{m} P_{it}R_{it}}{\sum_{i=1}^{m} P_{io}R_{io}} \text{X } 100 \qquad (10)$$

Remark: when the ranks on MHR are not used equation (9) is approximately the weighted Dutot's price index as given below.

$$P^{JG(2)} = \frac{\sum_{i=1}^{m} W_i P_{it}}{\sum_{i=1}^{m} W_i P_{io}} \text{X } 100 \qquad (11)$$

Computational Procedures

Step 1: For house type (or item) i in period t, assign rank R_{it} to each of the i^{th} such that the lowest price takes the first rank and the highest get rank m. Where ties occur, the i^{th} items that have equal prices are assigned average of the ranks.

Step 2: For house type (or item) i (i = 1, 2,...,m) in base period and in period t, a common weight w_i (i.e the aggregate percent proportion of the criteria for weighting in both periods under consideration) is assigned to reflect the importance of each m items.

Step 3: For eachhouse type (i = 1, 2,...,m) obtain $W_i P_{it} R_{it}$ and $W_i P_{io} R_{io}$, and sum of the values obtained, that is, obtain,

$$\sum_{i=1}^{m} W_i P_{it} R_{it} \text{ and } \sum_{i=1}^{m} W_i P_{io} R_{io}$$

Step 4: Substitute the values obtained in step (3) in formula (9) or (10) as the case may be and compute for the required index number.

Test of Consistency of Jibasen-Gazali-Asanya Rank Index Formula

Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) was subjected to all the axiomatic test of adequacy of elementary indices using logical statement and mathematical proof (without any loss of generality the factor100 is removed from all proofs) as follows,

Positivity Test: Since price of goods and services can neither take negative value nor zero value then the proposed Index (P^{JG}) is strictly greater than zero. Hence, the proposed Index (P^{JG}) satisfies the positivity test.

Continuity Test: Provided the price (P_{io},P_{it}) for goods and services are always available, the proposed Index (P^{JG}) is a continuous function of its arguments. Hence, the proposed Index (P^{JG}) satisfied the continuity test.

Identity/Constant Prices Test: Jibasen-Gazali-Asanya Rank Price Index

(P^{JG}) satisfies identity/constant prices test, that is,

$$P^{JG}(P_{io}, P_{io}) = P^{JG}(P_{it}, P_{it}) = 1 \qquad (12)$$

Proof:

Let us consider prices of commodity at base period P_{io}, then $P^{JG}(P_{io}, P_{io})$ is given by:

$$P^{JG} = \frac{\sum_{i=1}^{m} W_i P_{io} R_{it}}{\sum_{i=1}^{m} W_i P_{io} R_{io}}$$

$$P^{JG} = \sqrt{1}$$

$$P^{JG} = 1 \text{ \{proved\}}$$

Proportionality in Current Prices Test: Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies proportionality in current prices test for $\lambda > 0$

$$P^{JG}(P_{io}, \lambda P_{it}) = \lambda P^{JG}(P_{io}, P_{it}) \qquad (13)$$

Proof:

$$P^{JG}(P_{io}, \lambda P_{it}) = \frac{\sum_{i=1}^{m} W_i \lambda P_{io} R_{it}}{\sum_{i=1}^{m} W_i P_{io} R_{io}}$$

$$= \frac{\lambda \sum_{i=1}^{m} w_i P_{io} R_{it}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= \lambda\ P^{JG}\ (P_{io}, P_{it})$$

{proved}

Inverse Proportionality in Base Prices Test: Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies inverse proportionality in base prices test for $\lambda > 0$

$$P^{JG}(\lambda P_{io}, P_{it}) = \lambda^{-1} P^{JG}(P_{io}, P_{it}) \quad (14)$$

Proof:

$$P^{JG}\ (\lambda P_{io}, P_{it}) = \frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\sum_{i=1}^{m} w_i \lambda P_{io} R_{io}}$$

$$= \frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\lambda \sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= \lambda^{-1} P^{JG}(P_{io}, P_{it})$$ {proved}

Monotonicity in Current Prices Test: Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies monotonicity in current prices testfor $P_{i1} < P_{i2}$

$$P^{JG}\ (P_{io}, P_{i1}) < P^{JG}(P_{i1}, P_{i2})$$

Invariance to Changes in Units/Commensurability Test: Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies invariance to changes in units/commensurability test for it $\lambda > 0$

$$P^{JG}(\lambda P_{io}, \lambda P_{it}) = P^{JG}(P_{io}, P_{it}) \quad (15)$$

Proof:

$$P^{JG}(\lambda P_{io}, \lambda P_{it}) = \frac{\sum_{i=1}^{m} w_i \lambda P_{it} R_{it}}{\sum_{i=1}^{m} w_i \lambda P_{io} R_{io}}$$

$$= \frac{\lambda \sum_{i=1}^{m} w_i P_{it} R_{it}}{\lambda \sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= \frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= P^{JG}\ (P_{io}, P_{it})$$

{Proved}

Time Reversal Test: Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies time reversal test

$$P^{JG}\ (P_{io}, P_{it}) = 1/P^{JG}\ (P_{io}, P_{it}) \quad (16)$$

Proof:

Considering the RHS,

$$1/_{P^{JG}}(P_{io}, P_{it}) = \frac{1}{\frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}}$$

$$= 1 \div \frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= 1 \times \frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= \frac{\sum_{i=1}^{m} w_i P_{it} R_{it}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= P^{JG}\ (P_{io}, P_{it})$$

LHS {proved}

Circularity Test: Considering P_{io} ,P_{i1} and P_{i2}; as prices of commodities at three successive periods, Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies circularity test;

$$P^{JG}\ (P_{io}, P_{i1})\ P^{JG}\ (P_{i1}, P_{i2}) = P^{JG}\ (P_{i0}, P_{i2}) \quad (17)$$

Proof:

$$P^{JG}(P_{i0}, P_{i1})\ P^{JG}\ (P_{i1}, P_{i2}) = \frac{\sum_{i=1}^{m} w_i P_{i1} R_{i1}}{\sum_{i=1}^{m} w_i P_{io} R_{io}} \times \frac{\sum_{i=1}^{m} w_i P_{i2} R_{i2}}{\sum_{i=1}^{m} w_i P_{i1} R_{i2}}$$

$$= \frac{\sum_{i=1}^{m} w_i P_{i2} R_{i2}}{\sum_{i=1}^{m} w_i P_{io} R_{io}}$$

$$= P^{JG}\ (P_{i0}, P_{i2})$$

{Proved}

Multiperiod Identity Test: Considering P_{io} ,P_{i1} and P_{i2}as prices of commodities at their successive periods, Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies multiperiod identity test:

$$P^{JG}(P_{io}, P_{i1})\ x P^{JG}\ (P_{i1}, P_{i2})\ x P^{JG}(P_{i2}, P_{i0}) = 1 \quad (18)$$

Proof:

$P^{JG}(P_{io},\ P_{i1})\ xP^{JG}(P_{i1},\ P_{i2})\ xP^{JG}(P_{i2},\ P_{i0}) = \frac{\sum_{i=1}^{m} W_i P_{i1} R_{i1}}{\sum_{i=1}^{m} W_i P_{io} R_{io}} \times \frac{\sum_{i=1}^{m} W_i P_{i2} R_{i2}}{\sum_{i=1}^{m} W_i P_{i1} R_{io}} \times \frac{\sum_{i=1}^{m} W_i P_{io} R_{io}}{\sum_{i=1}^{m} W_i P_{i2} R_{i2}}$

$= 1$ {proved}

It has also been shown that Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) satisfies the monotonicity in Base Prices Test, Mean Value Test, Price Bouncing test, Commodity Reversal Test/Symmetric treatment of outlets, see Asanya (2016).

DATA ANALYSIS AND RESULT

The proposed Jibasen-Gazali-Asanya Rank Price Index (P^{JG}) was used to compute residential rent index and the results were compared with existing index methods such as Weighted Dutot Index method (Dutot (1738)), Weighted Carli Index method (Carli (1764)) and Weighted Jevons index method (Jevons (1865)).

i. Weighted Dutot's Price Index: This is also referred to as the Weighted Aggregate Price index. The price index formula is given by:

$$P^{WD} = \frac{\sum_{i=1}^{m} W_i P_{it}}{\sum_{i=1}^{m} W_i P_{io}} \times 100 \qquad (19)$$

(i) Weighted Carli's Price Index: This is also referred to as the Weighted Arithmetic Mean of Price Relatives. This is given by:

$$P^{WD} = \frac{\sum_{i=1}^{m} W_i (\frac{P_{it}}{P_{io}})}{\sum_{i=1}^{m} W_i} = \frac{\sum_{i=1}^{m} W_i P}{\sum_{i=1}^{m} W_i} \qquad (20)$$

Where W_i is the weight attached to the price relatives, $P = \frac{P_{it}}{P_{io}} X\ 100$

(ii) Weighted Jevons Price index (P^{WJ}): This is also referred to as the Weighted Geometric Mean of Price Relatives. The weighted GM of price relatives is given by:

$$P^{WJ} = \left[\left(\frac{P_{it}}{P_{io}} X\ 100\right)^{W_i}\right]^{1/\sum_{i=1}^{m} W_i} \qquad (21)$$

Taking logarithm of both sides, we get

$$P^{WJ} = \frac{1}{\sum_{i=1}^{m} W} \left[\sum_{i=1}^{m} W_i \log(\frac{P_{it}}{P_{io}} \times 100)\right] = \frac{\sum_{i=1}^{m} W_i \log P}{\sum_{i=1}^{m} W_i} = \text{Antilog} \left[\frac{\sum_{i=1}^{m} W_i \log P}{\sum_{i=1}^{m} W_i}\right]$$

Comparison Criterion

The coefficient variation (C.V): The coefficient of variation (C.V) is given by:

$$C.V. = \frac{\sigma}{\bar{X}} X\ 100 \qquad (22)$$

Where σ is the standard deviation and $\bar{X}$ is the mean of the computed indices per index method.

Data Presentation

The data for this work were collected from an estate agent, Faruna and Co. Nigeria Ltd located along Abubakar Atiku Way, near Jimeta Shopping Complex, Jimeta,-Yola, Adamawa State. The data include the Mean House Rent per annum (MHR) and Mean Expenditure on the house (MEH) for each category for the period of 2000 - 2015. The data were originally obtained by Gazali (2015) and updated by Asanya (2016). The house types are categorized as follows: Single room (SR), Room and parlor (RP), One bedroom self-contain (OBS), Two bedroom flat (2BF) and Three bedroom flat (TBF). The data were collected from the following areas of Jimeta metropolis: Karewa, Army Barrack, Bekaji, Behind PZ, Jambutu and Shagari Housing Estate Phase I. The data are presented in Table 1.

Table 1: Mean house rents (MHR) per annum (in "000 Naira) and Mean Expenditure (MEH) (in "000 Naira) for different Category of houses within Karewa, Army Barracks (A/B), Bekaji, Behind PZ (PZ), Jambutu and ShagariHousing Estate Phase I (Shagari I) Residential Areas.

Year	2000		2005		2010		2015	
Karewa	MHR	MEH	MHR	MEH	MHR	MEH	MHR	MEH
SR	15	4500	30	900	40	1,200.00	80	2,400.00
RP	30	9000	60	1,800.00	80	2,400.00	100	3,000:00
OBS	50	1,5000	80	2,400.00	120	3,600.00	200	6,000.00
2BF	80	2,400.00	130	3,900.00	150	4,500.00	350	10,500.00
3BF	100	3,000.00	180	5,400.00	220	6,600.00	500	15,000.00
A/B								
SR	15	450	30	900	40	1,200.00	80	2,400.00
RP	30	900	60	1,800.00	80	2,400.00	100	3,000.00
OBS	50	1,500.00	80	2,400.00	120	3,600.00	200	6,000.00
2BF	80	2,400.00	130	3,900.00	150	4,500.00	350	10,500.00
3BF	100	3,000.00	180	5,400.00	220	6,600.00	500	15,000.00
Bekaji								
SR	30	900	30	900	50	1,500.00	100	3,000.00
RP	60	1,800.00	60	1,800.00	70	2,100.00	150	4,500.00
OBS	70	2,100.00	80	2,400.00	100	3,000.00	175	5,250,00
2BF	100	3,000.00	130	3,900.00	150	4,500.00	275	8,250.00
3BF	120	3,600.00	180	5,400.00	200	6,000.00	375	11,250.00
PZ								
SR	10	300	20	600	30	900	80	2,400.00
RP	20	600	40	1,200.00	70	2,100.00	120	3,600.00
OBS	40	1,200.00	50	1,500.00	100	3,000.00	150	4,500.00
2BF	60	1,800.00	110	3,300.00	100	3,900.00	225	6,750.00
3BF	100	3,000.00	150	4,500.00	200	6,000.00	300	9,000.00
Jambutu								
SR	10	300	15	450	25	750	50	1,500.00
RP	20	600	30	900	50	1,500.00	70	2,100.00
OBS	80	2,400.00	45	1,350.00	70	2,100.00	100	3,000.00
2BF	100	3,000.00	100	3,000.00	130	3,900.00	175	5,250.00
3BF	120	3,600.00	140	4,200.00	170	5,100.00	250	7,500.00
ShagariI								
SR	30	900	60	1,800.00	80	2,400.00	100	3,000.00
RP	50	1,500.00	80	2,400.00	90	2,700.00	110	3,300.00
OBS	70	2,100.00	100	3,000.00	105	3,150.00	125	3,750.00
2BF	100	3,000.00	150	4,500.00	180	5,400.00	200	6,000.00
3BF	150	4,500.00	200	6,000.00	235	7,050.00	275	8,250.00

Faruna and Co. Nigeria limited, Yola

RESULTS

The data were analyzed using proposed the Jibasen-Gazali-Asanya Rank Price Index (P^{JG}), without MEH ($P^{JG(1)}$) and without ranks ($P^{JG(2)}$). The results are presented alongside Weighted Dutot Index method, Weighted Carli Index method and Weighted Jevons index method, for comparison.

From Table 3, the proposed index performed relatively well compare to some existing index, because indexes computed from proposed method falls between figures computed from the other three methods.

From Table 4 indexes computed from the proposed index performed relatively well as those from existing method.

Table 2: Residential Rent Index of Jimeta Metropolis for the year 2015 using 2000 as the base year, computing P^{JG}

Area	P^{JG}	$P^{JG(1)}$	$P^{JG(2)}$	P^{WD}	P^{WC}	P^{WJ}
Kaewa	471.91	457.41	464.34	464.33	453.22	449.57
Army Barracks	451.17	423.45	433.62	438.95	422.03	414
Bekaji	292.91	286.77	288.34	288.11	285.15	283.6
Behind PZ	330.13	348.35	245.11	345.94	410.95	390.48
Jambutu	190.99	223.85	189.32	189.32	214.56	199.8
Shagari Phase I	189.29	192.61	194.34	194.34	207.65	203.75
C.V.	38.11	33.13	39.50	36.83	33.10	33.80

Table 3: Residential Rent Index for Jimeta Metropolis for the year 2015 using 2005 as the base year, computing P^{JG}

Area	P^{JG}	$P^{JG(1)}$	$P^{JG(2)}$	P^{WD}	P^{WC}	P^{WJ}
Kaewa	271.29	264.09	267.52	267.51	259.72	257.34
Army Barracks	258.38	2.44.48	250.00	251.79	239.35	414
Bekaji	211.89	215.47	215.69	215.69	226.95	283.6
Behind PZ	210.1	220.14	217.98	217.98	246.17	390.48
Jambutu	180.87	186.26	183.99	183.99	199.99	199.8
Shagari Phase I	135.68	135.38	136.37	136.37	137.78	203.75
C.V.	23.62	23.25	14.32	22.32	20.31	31.49

Table 4: Residential Rent Index for Jimeta Metropolis for the year 2015 using 2010 as the base year, computing P^{JG}

Area	P^{JG}	$P^{JG(1)}$	$P^{JG(2)}$	P^{WD}	P^{WC}	P^{WJ}
Kaewa	220.63	211.5	215.34	215.33	206.6	202.86
Army Barracks	210.14	195.8	201.03	202.72	191.04	185.91
Bekaji	186.26	186.6	187.05	187.05	189.05	188.71
Behind PZ	156.61	157.87	157.8	159.24	167.86	165.65
Jambutu	143.33	143.12	143.34	143.34	143.35	145.08
Shagari Phase I	115.85	116.19	116.42	116.42	117.49	117.41
C.V.	23.58	21.26	22.05	22.09	19.80	18.97

Table 2 shows that the proposed rank index performed relatively well alongside existing index with or without MEH or even without ranks.

Table 5 shows that the coefficient of variations and indices computed from the proposed methods falls within those of the other methods.

DISCUSSION

The results of the test of consistency of index number revealed that the proposed rank index number formula satisfies all the tests of consistency of elementary index formula as shown in section 3. The analyses in Table 2 to 5 show that the proposed rent index formula give indices that are bounded by the weighted Dutot's price index, weighted Jevon's and the weighted Carli's price index.

Table 5: Residential Rent Index for Jimeta Metropolis for the year 2010 using 2005 as the base year, computing P^{JG}

Area	P^{JG}	$P^{JG(1)}$	$P^{JG(2)}$	P^{WD}	P^{WC}	P^{WJ}
Kaewa	123.18	124.86	124.54	124.54	127.7	127.15
Army Barracks	123.18	124.86	124.54	124.54	124.7	127.15
Bekaji	113.74	115.77	115.22	115.22	119.55	118.82
Behind PZ	134.04	129.86	128.76	136.6	146.43	143.75
Jambutu	126.17	130.15	128.26	128.26	128.26	135.02
Shagari Phase I	117.12	116.51	117.12	117.12	117.12	116.98
C.V.	81.36	80.86	81.25	80.40	78.56	78.04

This work thus shows that the theory of index number can be extended to any situation; for discrete as well as continuous variates. Since the results obtained from the proposed rank index is bounded by indices computed from weighted Dutot's price index, weighted Jevon's and the weighted Carli's price index.Also, the proposed index number formula is the first of its kind since it uses of two weights, ranks and expenditure. The ranks and the expenditures were used as weight together when available, and either can be used singly. The proposed method can also be use to compute indexes that are not necessarily rent. Thus, we recommend the use of the proposed formula in computing index number.

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