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A comparative study of relation between the national housing & building material cost and economic gap in India

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Abstract

Housing in India has extensively become a money mending business. Several private sector companies have made housing affordability in India elusive for a common man. The elevated housing costs, however, are not in proportion with the growth of per capita income. This relation is well articulated in this paper. A scrupulous relation between housing and building material costs (H&BMC) and gross per capita income has been established, thus coming to a conclusion of polarization of economies and widening of gap between rich and poor; making it imperative to scrutinize the issue.

Selection and/or peer-review under responsibility of Symbiosis Institute of Management Studies.

Keywords: Housing; polarization; gap

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1. Introduction

The 2011 Consensus of India reveals that the urban population of the country stood at 377 million or 31.2 percent of the total population. It is projected that the urban population will grow about 470 million in 2021 and 700 million in 2041[1]. The level of urbanization is expected to reach 50 percent mark in the next 2-3 decades. Urbanization and economy growth are closely inter-linked, as more than 60% of the Gross Domestic Product (GDP) is contributed by urban India. Thus it becomes clear that government takes lucrative measures to develop Urban India.

In spite of the quantum leap in the housing stocks in the country, the housing shortage has also increased. According to the estimation of the Working group on the Urban Housing for the 11th Plan period, the total housing shortage in the country in 2007 was 24.71 million[2] dwelling units and 99percent of this shortage pertains to the economically weaker sections of the lower income group of the society.

Housing has been one of the priorities of the Government of India right from the first Five year plan. Government has provided fiscal incentives to promote housing from both the demand and supply sides. Since independence, a large number of schemes were launched under different names, though the focus remaining on the housing of the poor; especially the urban poor. These schemes have concentrated on improving housing conditions of the urban poor

Several questions have been raised on why this shortage persists. The prima facie evidences state that the cost of housing materials have increased. The stint of economic resources to these groups have not increased as compared to the progression in the high income groups. Statistical evidences suggest that the imbalance between the housing costs and per capita income has been inter-linked with several variations. Further archives of Govt. of India say that even though the urban population is increasing, the standard and cost of living is substantially stagnated [3]. Similarly, the basics necessities are becoming day by day difficult to bear for the common man.In this paper we will try to prove the close co-relation between cost of building material and the standard of living of a common man in society. Eventually we will further prove the said relation as a major cause of polarization of wealth and economic imbalance which has stretched the hiatus between the rich and the poor.

2. LITERATURE SURVEY

Governments are increasingly using analytics to consume, unlock and apply new insights from information, despite challenges with data [4]. Executives told us the “data paradox” – the dilemma presented by too much data, too little insight – is the biggest barrier to analytics adoption and use. They also expressed concerns about data reliability [5]. The more qualitative the information, the less confident they are in the dependability of their data.

Research done by IBM [6] for public sector companies and Government shows most public sector organizations are just starting to explore ways to leverage analytics to manage for results. A select number of organizations are “going pro” and developing analytics leadership. These leaders are looking for analytics capabilities that help them optimize choices and inform decisions with new and predictive insights.

Over the next three years, these “pros” expect their analytics talent to become more anticipatory and open to the

expertise of others. They anticipate talent will become more efficient in exploiting data and more attuned to performance.

2.1. ANALYTICS AND SOCIAL SECTOR: RESEARCH IN A NASCENT STAGE

Analytics has been widely used all over the world for business purposes and other verticals like the retail segments, marketing, telecom, pharmaceuticals, finance etc. However much of its techniques and theorems can be used in social sector the same way as used in other industry domains. The results using analytics are far much accurate than using the regular traditional techniques of graphs and Venn diagrams. Computational statistics has been a neophyte as far as social sector is concerned [7]. Up till now, the social sector, being in the hands of government and public authorities, there has not been any research due to lack of funds. Literature survey suggests that

According to IBM[2]:

To capitalize on its potential power in the public sector, analytics must become a core management competency. Building competency will require organizations to focus on four strategic imperatives:

1. Focus on outcomes to move beyond issues 2. Orient the management of information around its use 3. Use analytics-enabled insights to meet specific objectives 4. Model and embed analytics discipline in management practices.

Their research also shows that organizations fall within four categories of analytics competence, depending upon the extent of their analytics vision and practice: Starters, Foundation Builders, Practitioners and Virtuosos. Most organizations are Foundation Builders. This means they have a good information base and related practices, but more work is required to predict future outcomes with confidence.

Today, however, most organizations spend more time collecting and organizing data than analyzing it. Analytics talent also tends to be more concentrated within organizations, rather than pervasive across them. This can make it more difficult to discover useful insights that can only be obtained by looking at information across multiple agencies and databases.

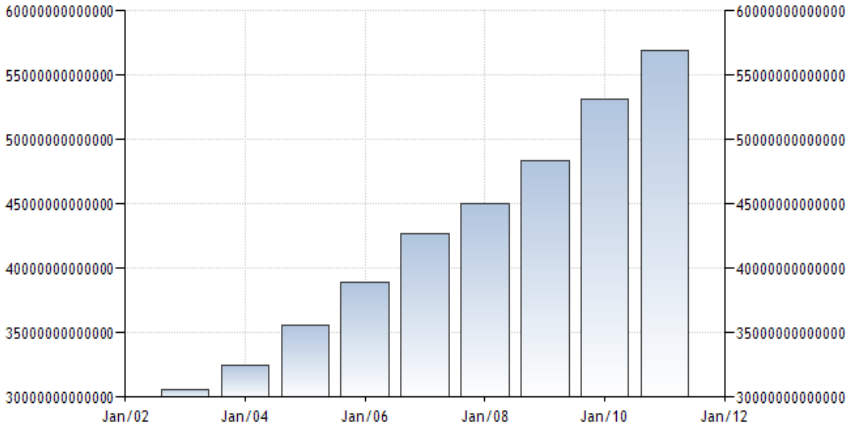
Any government for that sense, cannot handle such large amount of data using mathematical and statistical methods without computational techniques. To determine the co-relation, regression, and other terms the Government will require immense data segregation and consolidation into single tables.

Similarly, to extricate the government from this data explosion and thus, to find out meaningful conclusions and results, analytics will play a vital role.

2.2. BUILDING MATERIAL PRICES AND AFFORDABILITY INDEX

There is no much data and work done on comparing and co-relating the building material with the standard of living (SOL). However some attempts have been made to prove the leveraging the issues of society because of a

plethora of building material costs.



Source: World Bank Data: GROSS DOMESTIC INCOME (CONSTANT LCU) IN INDIA

The last report published by the World Bank was in 2012 for domestic income till 2011[8]. It was recorded to be 55,000 billion. However within 10 years the income has rose from 30,000 billion to 55,000 billion. So the total percent rise can be aggregated to merely 67%. However the steady rise of the building materials prices have increased with an exorbitant rate of 300%. This haphazard rise has caused an economic imbalance in the society which has led to the decrease in the housing affordability index.

In this paper we have found a nexus between the rise in cost of building material, affordability index and finally the standard of living (SOL).

3. COMPUTATIONAL STATISTICS FOR DETERMINING INSIGHTS: USING SAS

Using the traditional and mundane practices for deducing the results are debarred as far as our main issue is concerned. The data is acquired from Gov. of India, Delhi and will be used as a dataset. The data used is of 50 major cities including the 5 metropolitan areas [9]. The data isconsolidated into a single dataset with parameter essential for construction material. Following SAS commands and procedures are used:

a. PROC TABULATE
b. PROC TRANSPOSE
c. PROC ANOVA
d. PROC TTEST

Primarily a co-relation is calculated between the construction cost and the Gross Domestic Income. If co-relation exists, the data is pivoted and specific details are extracted.

4. METHODOLOGY ADOPTED

Primarily we will use statistical tools viz. Analysis of Variance, co-relation and t-test. The analysis initiated by applying ANOVA [10] on the datasets of H&BMC. The dataset being inchoate and intricate, we will do inter-quarter and intra-quarter analysis. A cognitive computational method as mention below will be implemented using SAS EG 4.3. An in depth study will lead us to understand at macro level the variance of prices between two quarters. Continuing with the analysis, we will analyze the f-value's significance compared to degree of freedom. After studying the variance, a systematic analysis of price hike will lead us to analysis between gross per capita income and the housing prices. This step will also include ANOVA on GPCI which will prove the variance between the GPCI, thus giving us a head start to study co-relation between the annual cost hike and annual per capita income. Using the co-relation efficient, the comparison will lead us to astounding conclusion of polarization of wealth and economic gap.

Steps:

Following is the segregated dataset for the housing and building material costs (H&BMC)

The compendium provided ahead presents tables for selected centers across the country on prices of basic building materials namely bricks, sand, stone ballast, teak, Sal wood, cement and steel for the quarters ending March, June, September and December for the years from 2007 to 2010. It also brings out the price variations in basic building materials during the years 2008, 2009 and 2010 for the selected centers in the country. An analysis of average price and percentage variations with respect to selected items i.e. Bricks (First Class), Sand (Coarse), Stone Ballast (20mm/gauge), C.P. Teak, Sal wood ,Cement (High Strength) and Steel ((M.S. Round Bars) for 2007 to 2010 has been made available for selected centers viz. Hyderabad, Kolkata, Chennai, Delhi, Lucknow, Guwahati, Bangalore, Bhopal and Mumbai. Preliminary analysis is done using consolidated data of material costs of the said cities. Seven main tables will be used for preliminary analysis of variance from 2009 to 2012:

Bricks(First Class)

(In Rs. Per 1000 Unit)							
Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
Hyderabad	3600	3588	3638	3600	-0.35	1.39	-1.03
Kolkata	3581	5113	5613	5850	42.76	9.78	4.23
Chennai	3613	4013	3625	5050	11.07	-9.66	39.31
Delhi	2075	2300	2900	3063	10.84	26.09	5.60
Mumbai	3000	4000	5000	5500	33.33	25.00	10.00
Bangalore	3750	4075	4300	4363	8.67	5.52	1.45
Lucknow	2400	2800	3100	3925	16.67	10.71	26.61
Guwahati	3000	4400	4875	5400	46.67	10.80	10.77
Bhopal	2900	2900	3150	4550	**0.00**	8.62	44.44

Sand (Coarse)

(In Rs. Per Cubic Meter)							
Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
Hyderabad	538	550	550	550	2.33	**0.00**	**0.00**
Kolkata	531	692	689	855	30.32	-0.43	24.02
Chennai	826	1078	1078	1104	30.53	**0.00**	2.46
Delhi	291	562	714	688	92.96	27.05	-3.71
Mumbai	777	890	941	950	14.51	5.70	0.98
Bangalore	500	601	672	681	20.25	11.75	1.40
Lucknow	410	313	250	300	-23.78	-20.00	20.00
Guwahati	450	538	588	643	19.44	9.30	9.36
Bhopal	1106	1106	1075	1294	**0.00**	-2.82	20.35

STONE BALLAST (20mm /gauge):

Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
Hyderabad	713	750	750	750	5.26	**0.00**	**0.00**
Kolkata	893	1153	1193	1349	29.02	3.47	13.08
Chennai	924	909	909	813	-1.65	0.03	-10.64
Delhi	724	922	1070	1234	27.28	16.12	15.33
Mumbai	436	508	542	545	16.33	6.75	0.60
Bangalore	910	970	1044	1063	6.59	7.60	1.80
Lucknow	587	628	625	650	6.96	-0.50	4.00
Guwahati	749	855	950	1225	14.23	**11.11**	28.95
Bhopal	1088	1088	1194	1269	**0.00**	9.77	6.28

C. P. TEAK

(In Rs. Per Cubic Meter)							
Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
Hyderabad	NA	NA	NA	NA	-	-	-
Kolkata	69937	74205	81273	82156	6.10	9.52	1.09
Chennai	NA	NA	NA	NA	-	-	-
Delhi	62322	71025	71924	80320	13.96	1.27	11.67
Mumbai	54868	60381	65066	65066	10.05	7.76	**0.00**
Bangalore	80000	87500	98344	91988	9.38	12.39	-6.46
Lucknow	39778	48125	54375	58750	20.99	12.99.	8.05
Guwahati	24880	27192	30370	30370	9.29	11.69	**0.00**
Bhopal	47923	47923	101528	105942	**0.00**	111.86	4.35

SALWOOD

(In Rs. Per Cubic Meter)							
Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
Hyderabad	31779	31779	34779	31779	**0.00**	9.44	-8.63
Kolkata	32332	38251	47924	48586	18.31	25.29	1.38
Chennai	NA	NA	NA	NA	-	-	-
Delhi	31354	36068	34516	36171	15.03	-4.30	4.79
Mumbai	NA	NA	NA	NA	-	-	-
	35000	35750	40350	40513	2.14	12.87	0.40
Lucknow	26500	23500	22000	25000	-11.32	-6.38	13.64
Guwahati	21411	28869	31783	33548	34.83	10.09	5.55
Bhopal	19329	19329	35314	35314	**0.00**	82.70	**0.00**

Cement (High Strength)

(In Rs. Per Metric Ton)							
Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
Hyderabad	4275	4475	4550	4600	4.68	1.68	1.10
Kolkata	4743	4959	5520	5830	4.54	11.32	5.63
Chennai	4863	5425	5175	5200	11.57	-4.61	0.48
Delhi	4610	4725	4925	4925	2.49	4.23	**0.00**
Mumbai	5000	5000	5500	5500	**0.00**	10.00	**0.00**
Bangalore	4300	4550	5825	5963	5.81	28.02	2.36
Lucknow	4725	5500	5625	6000	16.40	2.27	6.67
Guwahati	5250	5650	6000	6600	7.62	6.19	10.00
Bhopal	4450	4450	5500	6075	**0.00**	23.60	10.45

STEEL (M.S. Round Bars)

(In Rs. Per Metric Ton)							
Centre	Average Price				Percentage Variation During		
Name	2009	2010	2011	2012	2010	2011	2012
1	2	3	4	5	6	7	8
	30882	40833	31833	32667	32.22	-22.04	2.62
Kolkata	28125	39625	30917	34896	40.89	-21.98	12.87
Chennai	33375	42625	32575	37750	27.72	-23.58	15.89
|Delhi	29283	41050	31800	34833	40.18	-22.53	9.54
Mumbai	30700	44950	35250	35813	46.42	-21.58	1.60
Bangalore	28550	29500	37375	38000	3.33	26.69	1.67
Lucknow	29564	30220	30370	31650	2.22	0.50	4.21
Guwahati	28325	40449	33668	36013	42.80	-16.77	6.97
Bhopal	36500	44500	33184	34000	21.92	-25.43	2.46

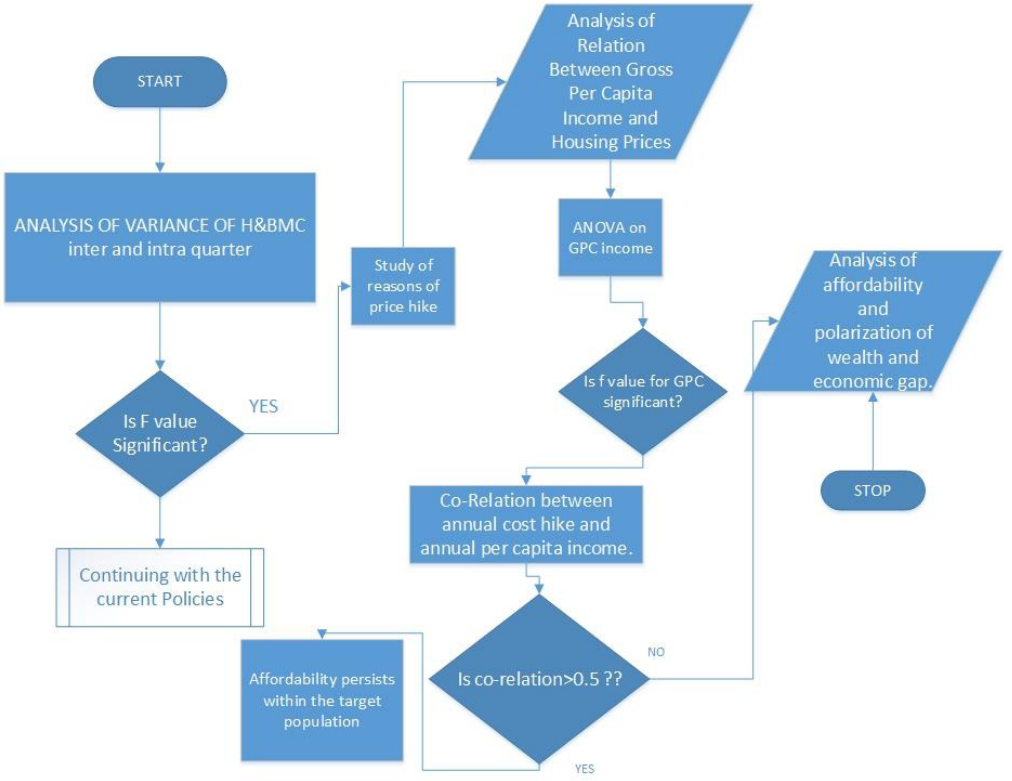
The above tables were illustration of the major housing and building material required for construction. However to analyze further more profoundly, we have consolidated the data of inter & intra quarter of 50 cities including metropolitan areas to extrapolate our results to the whole of Urban India. Following are the sample table out of 80 tables/datasets considered for analysis:

CENTRE	BANGALORE																			
STATE	KARNATAKA																			
		(In Rs.)																		
S. No.	Material	Price Per	2009				2010				2011				2012			
			Quarter Ending				Quarter Ending				Quarter Ending				Quarter Ending			
			Mar	June	Sept	Dec	Mar	June	Sept	Dec	Mar	June	Sept	Dec	Mar	June	Sept	Dec
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Bricks (First Class)	1000 Unit	3750	3750	3750	3750	4000	4050	4100	4150	4300	4300	4300	4300	4350	4350	4375	4375
2	Sand (Coarse)	Cu.mt	500	500	500	500	580	600	600	625	675	675	675	663	675	675	688	688
3	Stone (20mm/gauge)	Cu.mt	910	910	910	910	950	970	980	980	1050	1050	1050	1025	1050	1050	1075	1075
4	Timber: C.P. Teak	Cu.mt	80000	80000	80000	80000	85000	85000	90000	90000	100500	100500	100500	91875	91975	91975	92000	92000
5	Timber: Sal wood	Cu.mt	35000	35000	35000	35000	35500	35000	36000	36500	40500	40500	40500	39900	40500	40500	40525	40525
6	Cement (High	Metric Ton	4300	4300	4300	4300	4400	4500	4600	4700	5850	5850	5850	5750	5850	5850	6075	6075
7	Steel (M.S. Round	Metric Ton	28600	28533	28533	28533	29000	29500	29500	30000	37500	37500	37500	37000	38000	38Q00	38000	38000

CENTRE	SRINAGAR																			
STATE	JAMMU & KASHMIR																			
		(In Rs.)																		
S. No.	Material	Price Per	2009				2010				2011				2012			
			Quarter Ending				Quarter Ending				Quarter Ending				Quarter Ending			
			Mar	June	Sept	Dec	Mar	June	Sept	Dec	Mar	June	Sept	Dec	Mar	June	Sept	Dec
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Bricks (First Class)	1000 Unit	3500	3500	3500	3500	4000	4000	4200	4200	5000	5000	5000	5000	5000	5000	5000	5000
2	Sand (Coarse)	Cu.mt	550	550	550	550	450	530	530	530	550	550	550	550	750	750	750	750
3	Stone (20mm/gauge)	Cu.mt	800	800	800	800	600	600	600	600	800	800	800	NA	750	750	750	750
4	Timber : C.P. Teak	Cu.mt	74000	74000	74000	74000	77000	77000	77000	77000	81000	81000	81000	81000	NA	NA	NA	NA
5	Timber: Sal wood	Cu.mt	30000	30000	30000	30000	33000	33000	33000	33000	35000	35000	35000	35000	35000	35000	35000	35000
6	Cement (High	Metric Ton	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6720	6720	6720	6720
7	Steel (M.S. Round	Metric Ton	35000	35000	35000	35000	43000	55000	55000	55000	57000	57000	57000	57000	45000	45000	45000	45000

CENTRE	KURNOOL																		
STATE	ANDHRA PRADESH																		
		(In Rs.)																	
S. No.	Material	Price Per	2009				2010				2011				2012				
			Quarter Ending				Quarter Ending				Quarter Ending				Quarter Ending				
			Mar	June	Sept	Dec	Mar	June	Sept	Dec	Mar	June	Sept	Dec	Mar	June	Sept	Dec	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Bricks (First Class)	1000	2200	2250	2275	3000	3000	3037	3065	3100	3100	3100	3150	3200	3150	3200	3300	3500	
2	Sand (Coarse)	Cu. mt	210	210	210	200	200	200	200	200	200	200	210	210	210	320	320	350	
3	Stone (20mm/gauge)	Cu. mt	400	400	420	350	350	350	350	450	500	550	550	733	733	900	900	900	
4	Timber: C.P. Teak	Cu. mt	70600	70600	70600	70600	70600	70600	70600	70600	70600	70600	70600	70600	70600	70600	82000	82000	
5	Timber: Sal wood	Cu. mt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6	Cement (High	Metric Ton	4200	4200	4600	4600	4600	4800	4800	4700	4700	4700	4300	3600	4300	3300	4800	4800	
7	Steel (M.S. Round	Metric Ton	30250	30250	32400	34100	47600	49600	38060	32240	32520	27800	27800	37800	37800	33300	35900	37800	

FLOW CHART OF ALGORITHM



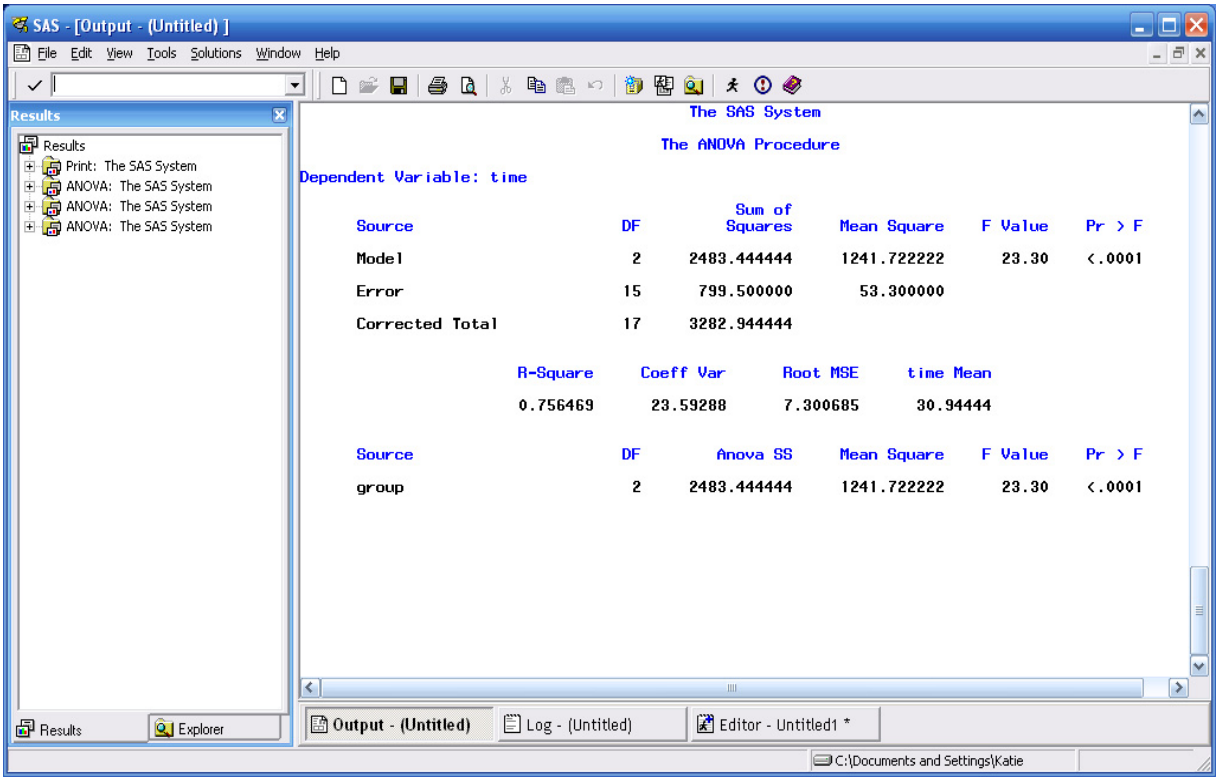
ALGORITHM:

1. Start
2. An ANOVA tests $\mathbf{H_0}$: all group means are equal vs. $\mathbf{H_a}$: at least one group's mean is different.
   The ANOVA results do not tell you which group is different, only whether a difference exists.
3. For testing our hypothesis we will be using SAS code as follows;

```
PROC ANOVA DATA = relief;
        class group;
        model time = group;
RUN;
QUIT;
```

- "class" tells SAS the classification variable. In general, this is going to be the effect that you are studying. In this case, the effect is "group."
- "model" tells SAS the dependent variable. The general format is "model Y = X" where Y is the dependent variable, and X is the independent variable. In this case, time to relief is dependent on treatment group.
- Often a "quit" statement is necessary, because SAS may continue to run a procedure until either another one has been run, or SAS has been told to quit.

Following is a sample output of the ANOVA procedure when applied on the said datasets of building materials:



- The "Between SS" is under "Model" and has a value of 2483.44.
- The "Within SS" is under "Error" and has a value of 799.50.
- The F*= MSB/MSW = 1241.72/53.30 = 23.30. The p-value of this F* is found under "Pr>F" and p < 0.0001.
- Because the p-value for the test statistic (F*) is less than alpha (0.05), we reject the null hypothesis and conclude that at least two of the groups' means differ on the annual prices of material hence we will continue with the study of price hike.

4. 2nd ANOVA procedure will be applied on Gross Per Capita Income.
5. The same results as above with changes in numerical values occur which imply that there is definitely a co-relation between annual cost hike and per capita income.
6. Correlation is a measure of the strength of relationship between random variables. The population correlation between two variables X and Y is defined as:

$$\rho\,(X, Y) = \text{Covariance}\,(X, Y) \,/\, \{\text{Variance}\,(X) \;*\; \text{Variance}\,(Y)\}^{\frac{1}{2}}$$

ρ is called the Product Moment Correlation Coefficient or simply the Correlation Coefficient. It is a number that summarizes the direction and closeness of linear relations between two variables. The sample value is called r, and the population value is called ρ (rho). The correlation coefficient can take values between -1 through 0 to +1. The sign (+ or -) of the correlation defines the direction of the relationship.

When the correlation is positive (r > 0), it means that as the value of one variable increases, so does the other.

7. SAS codes (v8.2) for correlation coefficient, hypothesis test and confidence interval are:

```
proccorr data=a outp=corr;                    *output with Pearson correlation coefficient;
var x y;
run;
data corr_ci;
set corr (rename=(x=corr) drop=y _name_);
retain n;
if _type_='N' then n=corr;
if _type_='CORR'and corr ^= 1;
fishersz=0.5*(log(1+corr)-log(1-corr));      *Fisher Z transformation;
Sigmaz=1/sqrt(n-3);                          *variance;
l95=fishersz-1.96*sigmaz;                    *α=0.05, i.e. at 95% level;   u95=fishersz+1.96*sigmaz;
l95=(exp(2*l95)-1)/(exp(2*l95)+1);           *inverse of Fisher Z ;
u95=(exp(2*u95)-1)/(exp(2*u95)+1);           *transformation to get CI; run;
proc print data=corr_ci;
run;
```

8. The correlation value (r^2) is less than 0.5; which has been deduced based on scientific social indicators, will lead us finally to the analysis of affordability and polarization of wealth and economic gap.
9. Stop.

5. IMPLICATIONS OF THE SIGNIFICANCE OF VARIANCE

As proved using ANOVA, it has become a predominant fact that the exorbitant rise of the housing and building material cost has led to denigration of standard of living. The superfluous loan interest rates have divested a common man from his basic needs. The increase in the base prices clearly indicate the inflation; thus making it imperative to apply for loans.

Although the last decade has shown a growth in the gross per capita income and affordability index, the inflation in all other daily necessities hasn't been eradicated. This has led to a more depravity of middle/lower middle class to afford quality housing. However, this inflation doesn't affect the rich as their affordability is not hindered. This imbroglio has led to an increase in retail banking, increasing financial load on these families. For example, if we consider family income of 100 units, 40-60% of income goes to bank in terms of EMI's. Major part of his income is spent on housing thus making his and a poor man's income same. This gives rise to HIDDEN POVERTY. What just differs is the dwelling type.

Still the questions prevail about the further consequences of housing. The rise in material costs along with the rise in taxation have simultaneously over-burdened the common man to satisfy his basic needs. This directly implies the denigration of the purchasing power.

Thus a person earning 100 units and affording to buy/rent an apartment actually has an income of 50 units; which is equal to the income of a lower/lower middle class person.

6. CONCLUSION

Poverty has been rampant in Indian society for few decades. Indicators like the economic gap between rich and poor has been increasing at a rapid pace to deteriorate the condition further. Though the respective governing authorities are taking preliminary steps to reduce this gaps, certain antithesis situations are arising. We have submitted this research to the authorities which are now curbing the rising housing and building material prices to ensure that there is no further rise in the gap.

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