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Tobacco Consumption Pattern in Different Economies: A Comparison Among High, Middle and Low Income Group Countries

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Abstract

Consumption of tobacco (particularly smoking) is a very common thing in our society. It has reached to monstrous proportion as more than a billion people consume it on a regular basis. The tobacco consumption in developing world and transitional economies, are much grave than in the developed world (according to WHO). The study tries to find, if there is discernable pattern of tobacco consumers and does the state of economy in which the person resides, has an impact on the market value of tobacco industry. The study, also only focuses on youth (up to the age of 35), for the reason that it is highly unlikely for a non tobacco consumer to become one after 35. People take up to smoking etc. during their teens and once that phase is over, the danger is largely subsided.

This study is one of a kind in testing whether the overall economic condition of a country, is a fillip enough for the youth to take up tobacco. It analyses the high income group, middle income group and low income group of nations for the above mentioned purpose. The middle income group of countries (BRICSA) receives special attention because the problem is most deeply rooted there. Therefore, the middle income group is tested for similitude among themselves apart from being compared income group wise. This study aims to attract the attention of the policy makers of all the income group countries in general and middle income group countries in particular, to implement effective measures in place to mitigate the problem.

Keywords*:* Tobacco, BRICSA, GDP per capita, Hypothesis testing, Granger Causality

1. Introduction

Consumption of tobacco is an age old traditional practice. It is taken in different forms (chewing, smoking etc.), and a large proportion of the world population consumes it. This large proportion of tobacco consumers in turn generates huge money for the tobacco companies. The tobacco industry worldwide is arguably, the largest industry of the world. According to the fourth edition of the "Tobacco Atlas", in association with American Cancer Society and World Lung Foundation, the industry estimates a profit of 35 billion US Dollar. The tobacco industry is a behemoth. The data provided here speaks for itself. The size of the industry is such, that if it were a country, its GDP would be equal to the GDP of Poland, Saudi Arabia, Sweden and Venezuela combined together. According to the same source, tobacco is the cause of most preventable cancer disease, and is the cause for 6 million deaths annually. This is akin to an entire Denmark or Jordan dying annually.

The prudence behind this study, is to find out whether *inter alia*, GDP per capita (assumed as a proxy for the state of economy) has an impact on the market value of tobacco companies, in that economy and whether the proportion of youth (up to 35 years old) consuming tobacco, in these different economies, differ in their consumption pattern. Does the state of economy (High income group/ Middle income group/ Low income group), or the GDP per capita of a nation has an influence on the consumption of tobacco by the denizens

We closely inspect, developing countries (BRICSA), to find if there is any difference in the pattern of tobacco consumption among developing countries.

The study is an attempt to uncover, the nexus between the state of economy (Developed/ Developing/ Underdeveloped) in which citizens live and their tobacco consumption pattern. This study tries to find out, whether there exists one such relationship between these two variables and is it significant, if the answer to the former question is affirmative.

This study is being carried out, out of the sheer concern of the author for those who consume tobacco (in any form), and suffer as a result of it. They harm others too (passive smoking) in the process. This study could help provide some insight into the relationship among the state of economy, age group of consumers and market value dominated by the tobacco companies. This study is carried out by a scholar based in Hyderabad (India)

2. Body of the article

It is extremely unlikely to find previous literature on the same topic, but some earlier studies sharing some relevance to the topic at hand were reviewed. One of the papers to this effect is authored by Hana Ross and Frank J. Chaloupka, titled "The effect of cigarette prices on youth smoking". This paper uses a very large sample of 17287 high school students, to study the impact of cigarette prices on teenagers smoking habit. The study apart from the general measures of price, also takes into account the perceived price of cigarettes by the participants, to determine its effect on their smoking behaviour. The study concluded that price of cigarettes are a major driving force behind youth smoking habit, as they possess less disposable income that can be allotted towards cigarette. An increase in prices would deter, the youth from smoking more frequently.

J.L. Zagorsky, in his research article titled, "The wealth effects of smoking", delineates the case of heavy smokers suffering financially, than the light or non smokers. This is also very intuitive, and sounds logical as the smokers have to shell out the money, out of their income and/or savings to accommodate for the extra cost of tobacco. However this study has assumed other demographic variables, to be constant.

In their research article titled, "Smoking in Scottish youths: personal income, parental social class and the cost of smoking", Patrick West, Helen Sweeting, and Robert Young conducted a longitudinal study on over 2500 students of Scotland and concluded that personal income as well as the social class of parents are major contributors towards youth taking up the habit of smoking. The personal income factor was found to be more significant in the youth belonging to higher social class.

The analysis of the existing literature, pertinent to the topic leads us to conceptualize a vicious to and fro movement (let us denote it as the Class Run Concept), in which youth from lower social class, depends more on his personal income to resort to smoking[1]. As the personal income of the individual increases, he moves to the higher class and hence has more disposable income. Since, he has large income, prices would not deter his decision to consume more tobacco[2]. Higher smoking apart from causing health issues, will also impact his financial well being[3] pushing him back to the lower class. The pictorial representation of this to and fro movement is provided in the exhibit[4].

1. Questions addressed through this study:

1) Does consumption of tobacco gets influenced by the GDP per capita?
2) Does the market value of tobacco industry gets uniformly affected by GDP per capita in all income group? First Hypothesis: There is no difference in the mean market value of tobacco industry across different income group regions. Second hypothesis: There is no difference in the variation of market value of tobacco industry across different income group regions
3) Does GDP and market value influence the proportion of youth (upto 35 years old) tobacco consumers? (multiple regression model with proportion as dependent variable)
4) Does the proportion of tobacco consumers of tobacco industry gets uniformly affected by GDP in all income group? First Hypothesis: There is no difference in the proportion of consumers of tobacco

industry across different income group regions. Second hypothesis: There is no difference in the proportion of consumers of tobacco across different income group regions

5) Test the mean equality and variation equality of market value of BRICSA countries
6) Does the proportion of tobacco consumers remain same across BRICSA countries?

Table 1. Formulation of hypotheses corresponding to research questions:

Questions addressed through this study	**Corresponding hypothesis formed to answer the questions**
Is there any pattern between market value of tobacco industry and GDP per capita.	The correlation coefficient (rho) between market value of tobacco industry and GDP per capita is zero.
Does the market value of tobacco industry gets uniformly affected by GDP per capita in all income group	First Hypothesis: There is no difference in the mean market value of tobacco industry pairwise and across different income group regions. Second hypothesis: There is no difference in the variation of market value of tobacco industry pairwise and across different income group regions
Does the proportion of tobacco consumers of tobacco industry gets uniformly affected by GDP in all income group	First Hypothesis: There is no difference in the proportion of consumers of tobacco industry pairwise and across different income group regions. Second hypothesis: There is no difference in the proportion of consumers of tobacco across different income group regions
Does GDP and market value influence the proportion of youth (up to 35 years old) tobacco consumers	GDP and market value of tobacco industry have no impact on the proportion of youth smoking.
Test the mean equality and variation equality of market value of BRICSA countries	The mean of market value of tobacco industry is not significantly different across BRICSA countries. The variance of market value of tobacco industry is not significantly different across BRICSA countries.
Does the proportion of tobacco consumers remain same across BRICSA countries?	The proportion of tobacco consumers remain same across BRICSA countries?
Is GDP per capita, the reason behind the increase in market value of tobacco industry.	GDP per capita doe not Granger cause increase in Market value of tobacco industry

3. Results

For all the three income group economies:

1.1. For the significance of correlation:

In case of simple correlation coefficient: We use t-test and calculate the test statistic as under:

$$t = r_{yx}\sqrt{\frac{n-2}{1-r_{yx}^2}}$$

with (n – 2) degrees of freedom ryx being coefficient of simple correlation between x and y.

This calculated value of t which in this case is 6.47, then compared with its table value which is approximately 2.19 and it can be observed that the calculated value is more than the table value, we could not accept the null hypothesis at the given level of significance and may infer that there is significant relationship of statistical significance between the two variables.

For the equality of means

Null Hypotheses		Alternate Hypotheses
$\mu_1 = \mu_2$		μ_1 is not equal to μ_2
$\mu_1 = \mu_3$		μ_1 is not equal to μ_3
$\mu_2 = \mu_3$		μ_2 is not equal to μ_3

The table value of F at 5 per cent level for degree of freedom 1 = 12 and degree of freedom 2= 12 is 2.6866. Since the calculated value of F is greater than the table value for all the income group taken pairwise, the F ratio is significant at 5 per cent level. Accordingly we reject our Null hypothesis (The variances of the samples are equal) and conclude that the difference is significant. Hence, the bottomline is that, all the samples have significantly different variation, and has been drawn from different population.
Null hypothesis could not be accepted.

Null Hypothesis: $\mu_1 = \mu_2 = \mu_3$
Alternate Hypothesis: At least one of them is not equal
The cumulative F value comes out to be 45, and hence the mean market values across different income group nations are significantly different from each other.
Null hypothesis could not be accepted.

For the equality of variances

Null Hypothesis:		Alternate Hypothesis
$\sigma_1 = \sigma_2$		σ_1 is not equal to σ_2
$\sigma_2 = \sigma_3$		σ_2 is not equal to σ_3
$\sigma_1 = \sigma_3$		σ_1 is not equal to σ_3

The table value of F at 5 per cent level for degree of freedom 1 = 12 and degree of freedom 2= 12 is 2.6866. Since the calculated value of F is greater than the table value for all the income group taken pairwise[5], the F ratio is significant at 5 per cent level. Accordingly we reject our Null hypothesis (The variances of the samples are equal) and conclude that the difference is significant. Hence, the bottomline is that, all the samples have significantly different variation, and has been drawn from different population.
Null hypothesis could not be accepted.

For the equality of proportion

This hypotheses has been tested thrice on different combinations of income group countries. (like high middle, middle low, high low).

Null Hypothesis:		Alternate Hypotheses
$p_1 = p_2$		p_1 not equal to p_2
$P_2 = p_3$		P_2 not equal to p_3
$P_3 = p_1$		P_3 not equal to p_1

In order to test the significance of difference, we work out the test statistic as under:

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1 \cdot \hat{q}_1}{n_1} + \frac{\hat{p}_2 \cdot \hat{q}_2}{n_2}}}$$

The Z values for the tobacco consuming population proportion up to 35 years of age for the combinations are given below:
Z value between high and middle income economy is -1.08
Z value between middle and low income economy is -0.40
Z value between high and low income economy is -1.54
The critical value at 95% confidence level for a standard normal distribution is 1.96
As the test is two tailed i.e. it is two-sided, we shall determine the rejection regions applying two-tailed test at 5% level which comes as under using normal curve area table:
Since R : $|z| < 1.96$
The mod of observed value of Z is 1.08, 0.40 and 1.54, all of which is in the acceptance region and thus, the null hypothesis is accepted and as such we conclude that the difference between the tobacco consuming population proportion up to 35 years of age is insignificant across income group.
Thus null hypothesis is accepted.

For BRICSA (Brazil, Russia, India, China, South Africa)
For the equality of means

Null Hypothesis:		Alternate Hypotheses
$\mu_1 = \mu_2$		μ_1 is not equal to μ_2
$\mu_1 = \mu_3$		μ_1 is not equal to μ_3
$\mu_1 = \mu_4$		μ_1 is not equal to μ_4
$\mu_1 = \mu_5$		μ_1 is not equal to μ_5
$\mu_2 = \mu_3$		μ_2 is not equal to μ_3
$\mu_2 = \mu_4$		μ_2 is not equal to μ_4
$\mu_2 = \mu_5$		μ_2 is not equal to μ_5
$\mu_3 = \mu_4$		μ_3 is not equal to μ_4
$\mu_3 = \mu_5$		μ_3 is not equal to μ_5
$\mu_4 = \mu_5$		μ_4 is not equal to μ_5

Alternate Hypothesis: At least one of them is not equal
The table value of F at 5 per cent level for degree of freedom 1 = 12 and degree of freedom 2= 12 is 2.6866. Since the calculated value of F, is greater than the table value for all the income group taken pairwise, the F ratio is significant at 5 per cent level. Accordingly we reject our Null hypothesis (The variances of the samples are equal) and conclude that the difference is significant. Hence, the bottomline is that, all the samples have significantly different mean, and has been drawn from different population.
Null hypothesis could not be accepted.
The cumulative F value comes out to be 203.26, and hence the mean market values across different income group nations are significantly different from each other.
Null hypothesis could not be accepted.

For the equality of variances

Null Hypothesis		Alternate Hypothesis
$\sigma_1 = \sigma_2$		σ_1 is not equal to σ_2
$\sigma_1 = \sigma_3$		σ_1 is not equal to σ_3
$\sigma_1 = \sigma_4$		σ_1 is not equal to σ_4
$\sigma_1 = \sigma_5$		σ_1 is not equal to σ_5
$\sigma_2 = \sigma_3$		σ_2 is not equal to σ_3
$\sigma_2 = \sigma_4$		σ_2 is not equal to σ_4
$\sigma_2 = \sigma_5$		σ_2 is not equal to σ_5

$\sigma_3 = \sigma_4$		σ_3 is not equal to σ_4
$\sigma_3 = \sigma_5$		σ_3 is not equal to σ_5
$\sigma_4 = \sigma_5$		σ_4 is not equal to σ_5

The table value of F at 5 per cent level for degree of freedom 1 = 12 and degree of freedom 2= 12 is 2.6866. Since the calculated value of F, except for Brazil/Russia, is greater than the table value for all the income group taken pairwise, the F ratio is significant at 5 per cent level[6]. Accordingly we reject our Null hypothesis (The variances of the samples are equal) and conclude that the difference is significant but only in the case of Brazil/Russia is the null hypothesis getting accepted i.e. the variation of the market value of tobacco industry in these two countries are not significantly different from each other. Hence, the bottomline is that, all the samples have significantly different variation, and has been drawn from different population, except for Brazil/Russia.
Null hypothesis could not be accepted except in the case of Brazil and Russia.

For the equality of proportion

This hypotheses has been tested thrice on different combinations of income group countries. (like high middle, middle low, high low).

Null Hypothesis		**Alternate Hypothesis**
$p_1 = p_2$		p_1 not equal to p_2
$P_1 = p_3$		P_1 not equal to p_3
$P_1 = p_4$		P_1 not equal to p_4
$P_1 = p_5$		P_1 not equal to p_5
$P_2 = p_3$		P_2 not equal to p_3
$P_2 = p_4$		P_2 not equal to p_4
$P_2 = p_5$		P_2 not equal to p_5
$P_3 = p_4$		P_3 not equal to p_4
$P_3 = p_5$		P_3 not equal to p_5
$P_4 = p_5$		P_4 not equal to p_5

In order to test the significance of difference, we work out the test statistic as under:

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1 \cdot \hat{q}_1}{n_1} + \frac{\hat{p}_2 \cdot \hat{q}_2}{n_2}}}$$

The Z values for the tobacco consuming population proportion up to 35 years of age for the combinations are given in the exhibit[7] below:
The critical value at 95% confidence level for a standard normal distribution is 1.96
As the test is two tailed i.e. it is two-sided, we shall determine the rejection regions applying two-tailed test at 5% level which comes as under using normal curve area table:
Since R : | z | < 1.96
The mod of observed value of Z of all the hypothesis falls in the rejection region and thus, the null hypothesis is rejected in favour of the alternate hypothesis and as such we conclude that the difference between the tobacco consuming population proportion up to 35 years of age is insignificant across income group.
Thus null hypothesis is accepted.

For the regression model

The Estimated Regression equation is:

Market Value of tobacco industry = -459212 + 3.76 * GDP per capita + ε

Both the intercept and the slope are significant at 5% level of significance. Our model indicates that with every 1 billion US dollar, increase in the GDP per capita, the market value of the tobacco industry on an average grows by 3.75 billion US dollar.
The R^2 (coefficient if determination) value, for the model is .084, which connotes that more than 80% of the variation in the market value of the tobacco industry, can be explained by the GDP per capita. The model does a fairly decent job in accounting for a major portion of variation of the industry. Thus we can say that, consumption of tobacco does gets influenced by the GDP per capita.

4. Conclusion

This study leads us to important results. An analysis of which, suggests that GDP per capita has a significant bearing on the market value, that the tobacco industry commands. Although correlation between these variables does not establish causality, it gives a direction to our thought, that improving economy could lead to more tobacco consumption, because people have more disposable income with them.

For the mean value of the market value of tobacco industries in high, middle and low income group countries, a pair-wise test was done with all combination of income groups, which could not get accepted. i.e. the market value of tobacco industries is not the same in all income group regions. Even the variances of the market value are not similar for different income group regions.

The hypothesis of proportion of tobacco consumers being same in all income groups is accepted, prompting that the inclination towards consuming tobacco is very much same across income groups, and all are equally attracted towards it irrespective of their financial health.

For BRICSA, the results are very much similar to the earlier one, except for the variance of market value of tobacco industry in Brazil and Russia.

The study illustrates that GDP per capita has an influential bearing on the market value of tobacco industry. It would be utterly insane to curb GDP per capita (growth of economy) to check the growing number of tobacco consumers, but it is high time for policy makers to take the bull by its horns before it gets unmanageable. Tobacco is one of the major reason of decreased productivity, cancer and death.

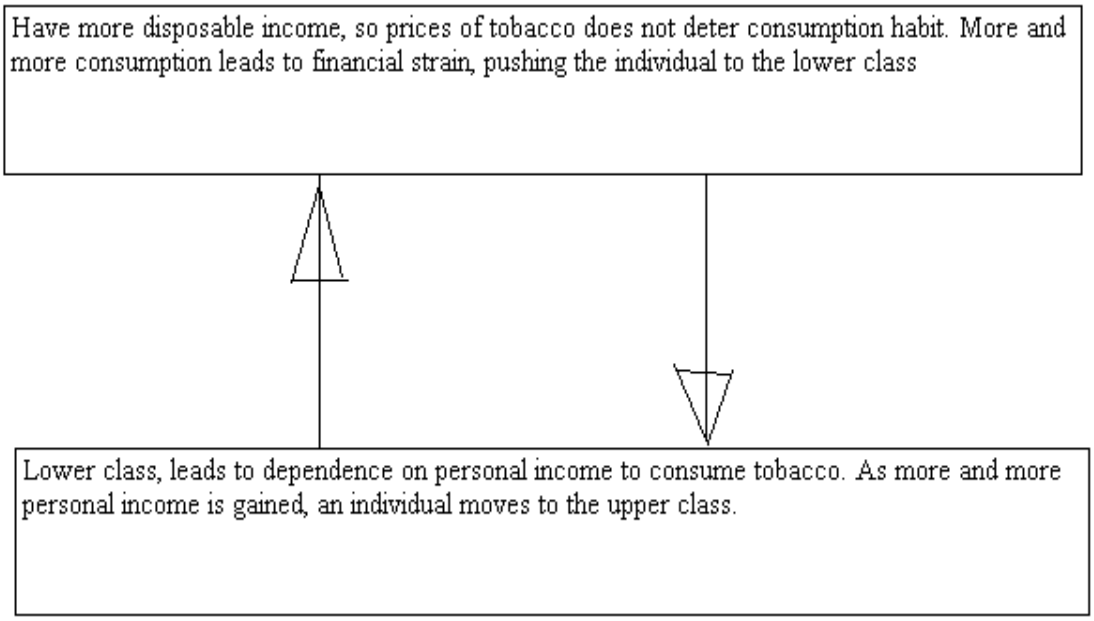
However, the Granger causality test refutes GDP per capita as the cause of market value of tobacco industries and vice versa for all lag periods ranging from 1 to 5.

"Of the more than 1 billion smokers alive today, around 500 million will be killed by tobacco," states the **WHO Report on the Global Tobacco Epidemic, 2008**. The **WHO** predicts that, without intervention, tobacco will kill more than 8 million people every year by 2030, and 80% of those deaths will occur in developing countries.

Exhibit

1. *Patrick West, Helen Sweeting, and Robert Young in Smoking in their research article titled "Scottish youths: personal income, parental social class and the cost of smoking"*
2. *Hana Ross and Frank J. Chaloupka, in their research article titled "The effect of cigarette prices on youth smoking"*
3. *J.L. Zagorsky, in his research article titled, "The wealth effects of smoking"*

4.



5. *The F value for high income/middle income group is 28.97, for middle income/ low income group is 8813.45 and for high income/low income group is 304.*
6. *The F value for Brazil/Russia is 1.71, for Brazil/India is 3.54, for Brazil/China is 648.5, for Brazil/South Africa is 140.2, for Russia/India is 6.09, for Russia/China is 1113, for Russia/South Africa is 81.66, for India/China is 182.8, for India/South Africa is 497.4 and for China/South Africa is 90934.*
7. *Z value between Brazil and Russia is -1.11*
   Z value between Brazil and India is -1.21
   Z value between Brazil and China is -0.68
   Z value between Brazil and South Africa is -0.41
   Z value between Russia and India is -0.09
   Z value between Russia and China is 0.40
   Z value between Russia and South Africa is 0.66
   Z value between India and China is 0.49
   Z value between India and South Africa is 0.76
   Z value between China and South Africa is 0.26

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5. Important tables and diagrams:

1. Correlation coefficient:

Correlations

		Market Value of total tobacco industry in US mn dollar	GDP per capita of the country/region
Market Value of total tobacco industry in US mn dollar	Pearson Correlation	1	.896(**)
	Sig. (2-tailed)		.000
	N	13	13
GDP per capita of the country/region	Pearson Correlation	.896(**)	1
	Sig. (2-tailed)	.000	
	N	13	13

** Correlation is significant even at the 0.01 level (2-tailed).

2. Regression Results for all the countries:

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.896(a)	.804	.786	28070.10239577917000

a Predictors: (Constant), GDP per capita of the country/region
b Dependent Variable: Market Value of total tobacco industry in US mn dollar

ANOVA(b)

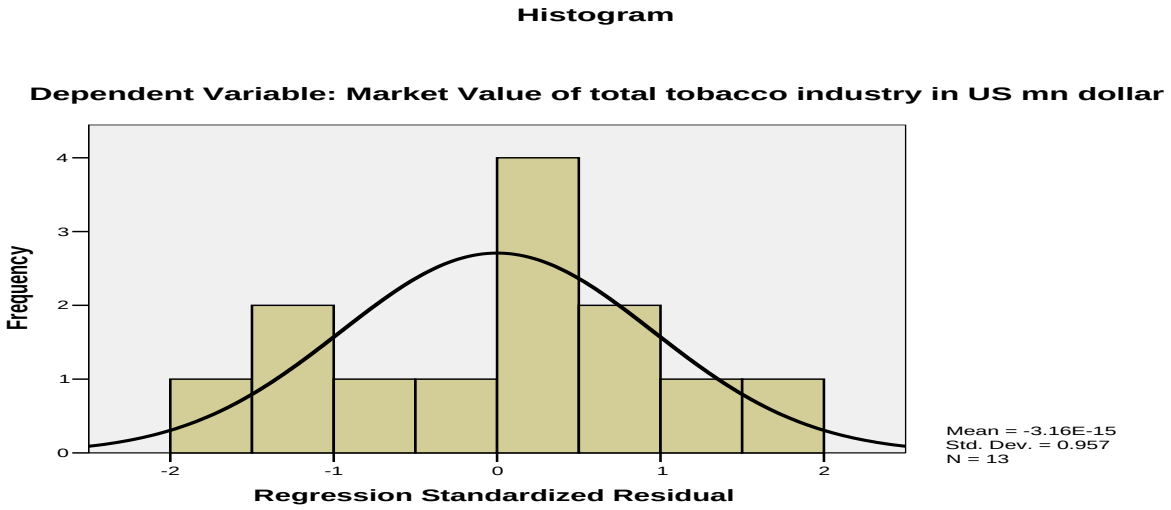
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35453659041.305	1	35453659041.305	44.996	.000(a)
	Residual	8667237133.605	11	787930648.510		
	Total	44120896174.910	12			

a Predictors: (Constant), GDP per capita of the country/region
b Dependent Variable: Market Value of total tobacco industry in US mn dollar

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients			
		B	Std. Error	Beta	t	Sig.	
1	(Constant)	-459212.805	131987.167		-3.479	.005	
	GDP per capita of the country/region	3.746	.558	.896	6.708	.000	

a Dependent Variable: Market Value of total tobacco industry in US mn dollar



3. Regression results for BRICSA:

Model Summary(b)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.974(a)	.949	.944	12043.49275 124867000

a Predictors: (Constant), BRICSA GDP
b Dependent Variable: BRICSA Market Value of tobacco

ANOVA(b)

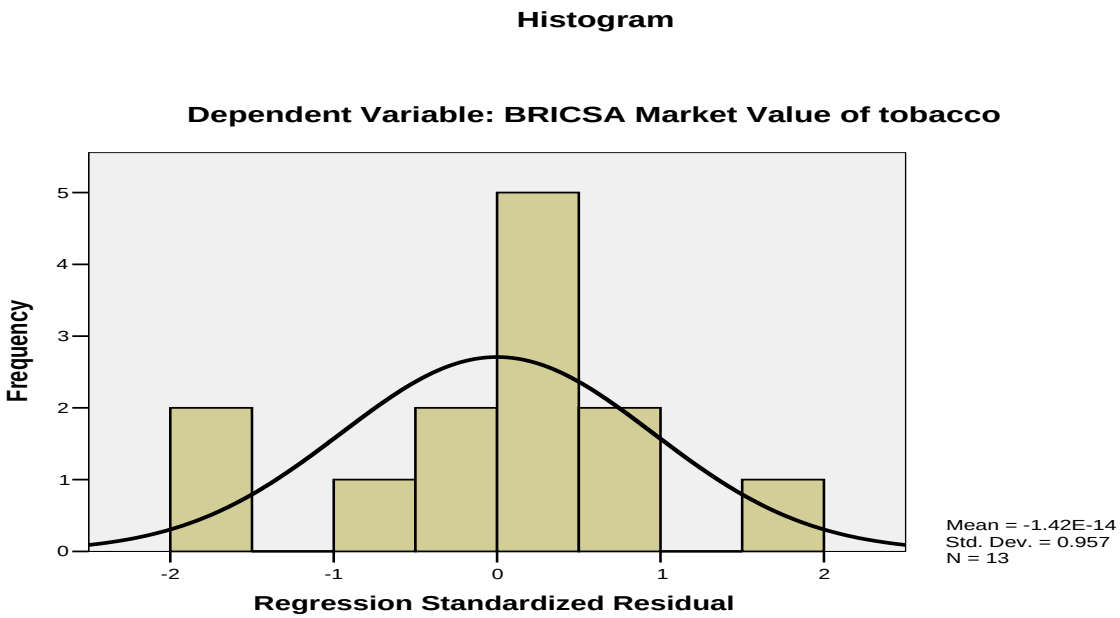
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29482029793.865	1	29482029793.865	203.260	.000(a)
	Residual	1595502894.143	11	145045717.649		
	Total	31077532688.008	12			

a Predictors: (Constant), BRICSA GDP
b Dependent Variable: BRICSA Market Value of tobacco

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients			
		B	Std. Error	Beta	t	Sig.	
1	(Constant)	-58674.450	22221.273		-2.640	.023	
	BRICSA GDP	16.579	1.163	.974	14.257	.000	

a Dependent Variable: BRICSA Market Value of tobacco



Granger Causality results with different lag periods:

Null Hypothesis: GDP per capita does not Granger cause Market value of tobacco industry:

Pairwise Granger Causality Tests
Date: 01/28/13 Time: 10:14
Sample: 1 117
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
MV_Y does not Granger Cause GDP_X	116	1.98499	0.1616
GDP_X does not Granger Cause MV_Y		0.60525	0.4382

Pairwise Granger Causality Tests
Date: 01/28/13 Time: 10:09
Sample: 1 117
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
MV_Y does not Granger Cause GDP_X	115	1.03496	0.3587
GDP_X does not Granger Cause MV_Y		0.33877	0.7134

Pairwise Granger Causality Tests
Date: 01/28/13 Time: 10:10
Sample: 1 117
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
MV_Y does not Granger Cause GDP_X	114	0.72240	0.5408
GDP_X does not Granger Cause MV_Y		0.25758	0.8558

Pairwise Granger Causality Tests
Date: 01/28/13 Time: 10:10
Sample: 1 117
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
MV_Y does not Granger Cause GDP_X	113	0.57909	0.6784
GDP_X does not Granger Cause MV_Y		0.22325	0.9249

Pairwise Granger Causality Tests
Date: 01/28/13 Time: 10:11
Sample: 1 117
Lags: 5

Null Hypothesis:	Obs	F-Statistic	Prob.
MV_Y does not Granger Cause GDP_X	112	0.51919	0.7612
GDP_X does not Granger Cause MV_Y		0.20601	0.9593

A Brief Author Biography

Naseem Ahamed – Mr. Naseem Ahamed is associated as full time Research Scholar with ICFAI (Institute of Chartered Financial Analysts of India). He has completed his MBA in the stream of Finance as his specialisation from the same institute and is currently pursuing his doctoral degree. He teaches Financial Management, Corporate Finance, Financial Accounting, Managerial Accounting, Statistics and allied subjects. Research area of interest includes Corporate finance, Corporate Governance etc.

