ISSN (online): 2320-9836
ISSN (Print): 2320-9828

Macro Economic overview of growth and inequality in Assam using time series analysis

Farah Hussain*[1], Priyanka Bharali[2]

[1]*Assistant Professor, Department of Economics, Assam Women's University, Jorhat, Assam, India, Zip code: 785 004*
[2]*Research scholar, Department of Economics, Dibrugarh University, Dibrugarh, Assam, India, Zip code: 786 004*
farahhussain05@gmail.com[1], priyankasm13@gmail.com[2]

Abstract

Background/Objective: Concentrating on Assam, this study makes an attempt to investigate the growth-inequality dynamics of the state taking account of factors like government expenditure on health and education.
Methods/Statistical Analysis: The study adopts time series analysis to test the relationship among income inequality, economic growth and social sector variables like education and health in Assam. The data over the period 1981-82 to 2011-12 is used in an ARDL framework to look into co integration and error correction mechanism.
Findings: The results derived are suggestive of the presence of a long term relationship between income inequality and economic growth, given the government expenditure on education and health. The findings show that government expenditure on education in Assam have the desired redistributive effect in narrowing the inequalities with time, but the results for government expenditure on health are alarming. Further, the results support the validity of Kuznet's 'Inverted U hypothesis' in case of Assam.
Application/Improvement: Government commitment towards provision of social services like government expenditure on education and health should be further streamlined to ensure that the expenditure is redistributive in dealing with income inequalities in the state.

Key Words: Economic Growth, Income Inequality, Kuznet's hypothesis, Time series analysis, ARDL Co integration

1. Introduction

India has come to be known as the 'bright spot' among the emerging markets in the world economy, successfully emerging out as a strong economic power not susceptible to the downfall in the advanced world economies in recent times. The emerging markets captured attention among the world economies for their budding growth rate becoming a beacon of hope, which have however given away to gloom in later times. While China's economy has slowed down and Brazil got mired in stagflation, Russia is in recession, battered by Western sanctions and the slump in the oil price. Further, South Africa is plagued by inefficiency and corruption. Amid the disappointment, India stands out as one big emerging market. The Indian economy has been growing at about 7.5 per cent per year for the last twelve years, with minor deviations up or down in specific years. The Indian economy has made considerable progress as far as growth is concerned amid economic woes faced by the other emerging economies. The stock market has boomed, in part because foreign investors remain keen buyers of Indian assets, even as they pull money from other emerging economies. The rupee is firm. The central bank has even expanded its foreign-exchange reserves to a record $330 billion—thus keeping the rupee from rising by more. The economy is likely to pick up further. The recent falls in commodity prices, which have hurt raw-material exporters such as Brazil, Russia and South Africa, are a boon for India, which imports 80% of the oil it consumes. Rich economies may fret about the dangers of falling prices around the world; Indians, on the other hand, are pleased they no longer have double-digit inflation at home [1].

The International Monetary Fund is predicting India that it will grow faster than each of its BRIC counterparts for the first time since 1999. The larger picture of the Indian economy, therefore, seems very satisfying. However, rising economic growth does not also indicate economic development taking place at same rates in the country. In India, the pace of economic development lags behind because of the existence of social evils like poverty, inequality,

ISSN (online): 2320-9836
ISSN (Print): 2320-9828

unemployment and so on. Inequality among them poses to be a serious threat which seems to go on increasing in spite of all the growth taking place in the country. As the World Income Inequality Database (WIID) confirms that although World Gross Domestic Product (WGDP) has increased in recent times, the level of income inequality has also widened [2]. Inequalities are widely visible in India, among different income sections of the society and across the different regions and states of the country. It is well known that, among the different regions, the North Eastern region of the country is backward and poor and Assam which stands out to be the most industrialized among the other seven states of the region is again lagging behind in the socio economic growth parameters.Further the situation in this region is such that income inequality has been on a rise. According to National Human Development Report, 2001,five states in the North Eastern Region recorded an increase in both rural and urban inequality over the period 1993-94 to 1999-2000. These states were Assam, Manipur, Mizoram, Nagaland and Sikkim. The inequality situation has not undergone any radical changes in these states over the following decade. The increased inequalities or the widening gap between the rich and the poor leads to a situation of growing poverty which has an effect on slowing down the growth process. Concentrating on the case of Assam, this study makes an attempt to investigate the inequality dynamics of the state taking account of factors like health and education in addition to income. The relevance of the Kuznets 'Inverted U hypothesis' concerning income-inequality relationship, is also explored to arrive at the underlying concerns in this matter.

2. Inequality and Growth: Theoretical framework

There are two approaches of looking at the growth and inequality dynamics. The first approach explains the effect of economic growth on income inequality which is explained by the famous Kuznet's 'Inverted U hypothesis'. It postulates a nonlinear relationship between a measure of income distribution and the level of economic development [3]. The hypothesis signifies that economic development may tend to deteriorate income inequality in the early stages of development but income distribution is improved at the later stages as the economy progresses over time. Kuznets documented this argument using both cross-country and time series data. This inverted U-shaped pattern of income inequality (often measured by the Gini coefficient, a scale on which zero is perfect equality and one is perfect inequality) is known as the Kuznets curve, becoming one of the major stylized facts about long-run processes of economic development [4].

Kuznets (1955) ascertained that economic development process should lead to an initial period of income concentration as people and resources migrate from agriculture to urban and industrialized areas, but this trend should be reversed as the migration process is attenuated. Switching the population from one sector to another, from a traditional agricultural population to a modern industrialized sector, income inequality would increase, given that this more dynamic sector is also wealthier and more unequal [5]. However, long term growth causes income inequality to decline, as spillover effects trickle down to more individuals.

Kuznets's hypothesis is based on empirical research and the initial observation of the growth and distribution of income inequality was based for the economies of United States, Germany, and England. Kuznets in his hypothesis also documents that income distribution is more equal in industrialized countries than in developing or agrarian economies.

There is a second approach to the growth and inequality dynamics that which focuses on the inverse relationship: impact of income equality on economic growth [6]. This approach holds that income inequality is inversely correlated with economic growth, but that the relationship is only significant in democracies [7].

3. Data and Methodology

To test the relationship among income inequality, economic growth and social sector variables like education and health in Assam, the data over the period 1981-82 to 2011-12 is used in the following model considered in logarithmic form;

$$lgini = f(lnsdppc, lnsdppc^2, lss) \quad (1)$$

ISSN (online): 2320-9836
ISSN (Print): 2320-9828

Here, gini stands for Gini-coefficient which is a standard measure of income inequality. Higher Gini represent higher level of inequality. Per-capita NSDP (nsdppc) variable is included in the model as representing level of economic development. To incorporate the non-linearity as explained by Kuznet's inverted U hypothesis, per-capita NSDP variable is squared. SS represents provision of social service. Government commitment for the provision of social service is captured here by the government expenditure on education and health. If this expenditure is redistributive, thenlss will be negative and significant or vice versa.

To test the relationship among the variables included in equation (1) following equation will be estimated using time series techniques;

$$lnGini_t = \infty_0 + \beta_1 lnspdpc_t + \beta_2 lnsdppc_t^2 + \beta_3 lnedu_t + \beta_4 lnhealth_t + \epsilon_t \quad (2)$$

If the Kuznets' inverted U-curve hypothesis is valid, then,$\beta_1 > 0 \; and \; \beta_2 < 0$. If this hypothesis is invalid and the income inequity decreases as national income rises as the economy grows, then, $\beta_1 < 0$ and $\beta_2 = 0$[4].The study adopts the Autoregressive Distributed Lag (ARDL) technique to estimate the above model. The ARDL representation of the above equation is:

$$lngini_t = \infty_1 + \sum_{i=1}^{n} \beta_i \, gini_{t-i} + \sum_{i=1}^{n} \delta_i \, \Delta lnsdppc_{t-i} + \sum_{i=1}^{n} \gamma_i \, lnsdppc_{t-i}^2 + \sum_{i=1}^{n} \theta_i \, lnedu_{t-i}\gamma_1 + \sum_{i=1}^{n} \vartheta_i \, lnhealth_{t-i} + \gamma_1 lngini_{t-1} + \gamma_2 lnsdppc_{t-1} + \gamma_3 lnsdppc_{t-1}^2 + + \gamma_4 lnedu_{t-1} + \gamma_5 lnhealth_{t-1} + \epsilon_{1t} \quad (3)$$

The hypothesis of the ARDL model is given as-

H_0: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$ implies that there is no long term relationship,

H_1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$

First, a bounds test for the null hypothesis of no co-integration is conducted. The calculated F-statistic is compared with the critical value tabulated [8] [9]. If the test statistic exceeds the upper critical value, the null hypothesis of a no long-run relationship can be rejected regardless of whether the underlying order of integration of the variables is 0 or 1. After looking for cointegration, the long run estimates of the model (3) are obtained. The orders of lags in the ARDL model are selected by Schwartz Bayesian Criterion (SBC). The next step involves estimation of short run parameters in error correction model (ECM), which also indicates the speed of adjustment back to long-run equilibrium after a short-term disturbance. The standard ECM involves estimating the following equation.

$$\Delta lngini_t = \infty_1 + \vartheta_1 (ECM)_{t-1} + \sum_{i=1}^{n} \beta_i \, gini_{t-i} + \sum_{i=1}^{n} \delta_i \, \Delta lnsdppc_{t-i} + \sum_{i=1}^{n} \gamma_i \, lnsdppc_{t-i}^2 + \sum_{i=1}^{n} \theta_i \, lnedu_{t-i}\gamma_1 + \sum_{i=1}^{n} \vartheta_i \, lnhealth_{t-i} + \gamma_1 lngini_{t-1} + \epsilon_{1t} \quad (4)$$

Where, ϑ is the speed of adjustment parameter and ECM is the residuals that are obtained from the estimated co-integration model of the ARDL equation. The sign of the error correction (EC) coefficient must be negative and significant to ensure convergence of the dynamics to the long-term equilibrium.

The data for the variables are obtained from various publications of the Directorate of Economics and Statistics of Assam. For the data on Gini coefficient particularly, Gini Inequality in Monthly Per-Capita consumption expenditure is used which is obtained from various NSSO reports.

4. Results and Discussion

In estimating the relationship between income inequality and economic growth, the Autoregressive Distributed Lag (ARDL) technique is used in this study. The ARDL bounds testing approach is applied to determine the short run and long run components of a model simultaneously. The best feature of ARDL methodology of is that it can be applied to time series that are not integrated of the same order. However testing for stationarity for each individual data series is the first practiceprior to use of any cointegration test. The study proceeds in this line and carries out the

ISSN (online): 2320-9836
ISSN (Print): 2320-9828

Augmented Dickey Fuller (ADF) unit root test to see if the variables are stationary. On carrying out the test for each individual data series, it was found that all variables undertaken in the study are non stationary at levels. In order to convert them into stationary variables, they were transformed to their first differences. Apparently, on first differenced series when the ADF test was run again, each series was found stationary this time.

Table 1. ADF Unit Root Test Results

$lnGini$	-3.2937 **(2)	Stationary	I (1)
$lnspdpc$	-5.0944*** (0)	Stationary	I (1)
$lnspdpc^2$	-4.9493***(0)	Stationary	I (1)
$lnedu$	-5.6537***(1)	Stationary	I (1)
$lnhealth$	-4.4866***(1)	Stationary	I (1)

Notes:

a) The critical values are those of Davidson and MacKinnon (1993)
1 % ADF-Critical value = -3.43; 5% ADF-critical value = -2.86, 10% ADF-critical value= -2.57.
*b) *** indicates significance at 1% level and ** indicates significance at 5% level. It represents rejection of null hypothesis of unit root at 1% and 5% of the critical values, respectively.*
c) The figures within parenthesis are lag lengths. The lag selections are in compliance with the Akaike Information criteria.

The results in Table 1 present the values of the ADF test statistic for each individual time series which are found statistically significant at their first differences. As a result the first differenced series are confirmed to be stationary. At the same time, even though individual variables are non-stationary, it is possible for their linear combinations to be stationary. If such linear combinations are found stationary, they would be called co integrated indicating the existence of a long-run equilibrium relationship among the set of variables. The same phenomenon could occur here and therefore, ARDL Bound test approach is adopted to see if the variables are co integrated. That would indicate if a long term relationship pattern is exhibited by income inequalities, economic growth and government spending on health and education in Assam over the years. The bound testing procedure is based on the F-test. The calculated F-statistics for model is 8.2834 and this is found to be significant at 99 per cent upper bound. Hence, the null hypothesis of no co-integration can be rejected which suggests the existence of co-integration among the undertaken variables in the study. In other words, the results provide support for the existence of long-run relationship among Gini, per capita NSDP and social sector spending in Assam. After establishing the existence of cointegration, the long-run coefficients of the model is estimated and the results are presented in Table 2.

Table 2. Long Run Coefficient of ARDL Models

Dependent Variable	Constant	$lnspdpc$	$lnspdpc^2$	$lnedu$	$lnhealth$
$lnGini$	-147.6888 (-1.8285)*	31.0757 (1.8656)*	-1.6026 (-1.8708)*	-.17780 (-2.6514)**	.22584 (3.0550) ***

Notes: 1.*** indicates significance at 1% level and * indicates significance at 10% level

From Table 2, it is observed that the variables in the model are statistically significant and the coeffiecient for all but health variable bears the expected sign. For the per capita NSDP variable, the coefficient of the level term is positive and it is negative on the squared term. This provides evidence for an inverted U shaped curve between inequality and income, validating Kuznet's hypothesis in case of Assam. The government spending on health though significant is positive indicating that increase in the government spending for the provision of this social service will increase the income inequality further within the state in the long run. This is alarming for it indicates that government redistributive policies are not helpful in reducing the income inequality in the state and rather they are widening the inequalities already present. On the other hand, government spending on education has act as a corrective measure in lessening income inequality in the state as suggested by the results.

ISSN (online): 2320-9836
ISSN (Print): 2320-9828

The study then looks into the short run estimates of the model by drawing the error correction model.

Table 3. Error Correction Representations of ARDL Model

Dependent Variable: $\Delta lngini$		
Regressors	**Co-efficient**	**T-ratio**
Constant	-103.4104	-1.7252*
$\Delta lngini(1)$	.29338	1.9140*
$\Delta lngini(2)$	.30024	1.9552*
$\Delta lnspdpc$	21.7590	1.7567*
$\Delta lnspdpc^2$	-1.1221	-1.7629*
$\Delta lnedu$	-.12450	-2.7052**
$\Delta lnhealth$	.15813	3.1335*
ECM(-1)	-.70019	-4.1980***

Notes:*** indicates significance at 1% level; ** indicates significance at 5% level and * indicates significance at 10% level

The findings of the error correction model as presented in Table 3further supports the deductions made on the long run estimates of the relationship. The results indicate that economic growth, government spending on education and health are significant in explaining income inequality in the short run as well. The coefficient of the per capita NSDP term bearing the expected sign further supports the inverted U shaped curve between inequality and income in the short run. The coefficient of the estimated error correction term (ECM) of the selected ARDL has the correct negative sign, which is significant at 1 per cent. This further confirms the existence of long-run relationship already established from the findings in Table 2. In addition, the coefficient of the ECM is
- 0.70019, suggesting that a deviation from the long-run equilibrium following a short-run shock is corrected by about 70 per cent in less than a year.

5. Conclusion

The study tried looking into the inequality dynamics in Assam taking account of factors like government spending on health and education in addition to income. In trying to explore such relations, the use of time series data helps in drawing a true or a clearer picture. The adoption of time series analysis, however, necessitates the datasets to be checked for some properties like their stationarity which indicates about the presence or absence of a trend in the data over the time period under consideration. This becomes indispensable prior to running a regression analysis, for regression on non stationary data might generate spurious regression estimates. The study, therefore, addressed those issues and went on to estimate the long run and short run estimates of the inequality and growth proposition for Assam. The results derived are suggestive of the presence of a long term relationship between income inequality and economic growth, given the government expenditure on education and health. Further, the estimates of the non-linearity term in the model support the validity of Kuznet's 'Inverted U hypothesis' in Assam. Assam has been primarily agrarian which yields lower income to the people engaged in this sector. In the early years of initiation of growth process, this fact remained but gradually over time, a shift of both human and physical capital to the industrial sector and largely to the service sector can be seen in Assam. Though the manufacturing and service sector generates higher average income than the agricultural sector, at the same time, income dispersion is also found to be higher in these sectors and particularly in the industrial sector. Hence, income inequalities are unavoidable at this stage but later on inequalities tends to diminish with growth. In the following phases, once a certain income threshold has been met, inequalities begin to shrink due to a combination of several factors, such as legislation (e.g.

ISSN (online): 2320-9836
ISSN (Print): 2320-9828

the introduction of capital, inheritance or capital revenue taxes) or the dynamic characteristic of a growing economy, which favors the career of young entrepreneurs [3].

The study also incorporated social sector parameters to look for government commitment for the provision of social service and if the same has been redistributive so as to bridge the gap between the rich and the poor. This is captured here by the government expenditure on education and health. The findings show that government expenditures on health and education in Assam bear an impact on income inequality measured by the gini coefficient. While the results attained for government education seems lucrative by proving that it has the desired redistributive effect in narrowing the inequalities with time, the results for government expenditure on health are alarming. Government spending for the provision of health facilities has increased the income inequality in the state in the long run. This might be because of the quality of health services that are being provided over the decades have not improved much and thereby failing to create the desired impact.

Thus the findings of the study validate the famous inverted U hypothesis of Kuznets in Assam in the context of the relationship between income inequality and economic growth. This hypothesis claims that inequalities tend to lower with growth. If Assam exhibits the U shaped pattern for inequality and growth relationship, possibilities remain for further lessening of the gap between the rich and the poor backed by the redistributive impact of government expenditure on education. Further initiatives to improvise the scenario in provision of health care facilities to the extent it also contributes towards minimizing the inequalities would ameliorate the inequality situation in the state. This has to be equally backed by the people in the society by actively playing their individual roles in uplifting their economic well being and that of the society as a whole. Inequalities reduced would deal with poverty and pave the path for prosperity. Though the end does not seem very near but gradual and well thought out moves would bestow more equal benefits and opportunities upon different sections of people in Assam.

6. References

1. GDP growth in India and China: Catching the dragon. *The Economist.* 2015, February. http://www.economist.com/news/business-and-finance/21642656-indias-economy-grew-faster-chinas-end-2014-catching-dragon. Date accessed: 25/03/2016.
2. UNU-WIDER, World Income Inequality Database, 2008. http://www.wider.unu.edu/research/Database/en_GB/wii d/. Date accessed: Dec. 12, 2014.
3. Simon Kuznets. Economic Growth and Income Inequality. *American Economic Review.1955;* 45, 1-28.
4. Hae-Young Lee, Jongsung Kim and Beom Cheol Cin. Empirical Analysis on the Determinants of Income Inequality in Korea. *International Journal of Advanced Science and Technology*. 2013; 53,95-110.
5. Jair Andrade Araujo and Janaina Cabral. The relationship between Income Inequality and Economic Growth in Brazil: 1995-2012. *Problemas Del Desarrollo. Revista Latinoamericana De Economía. 2014;* 47(184).
6. KeithGehring and Kishore G. Kulkarni. Economic Growth and Income Inequality in India. 2006, 4-18.
7. Torsten Persson andGuido Tabellini.Is Inequality Harmful for Growth. *The American EconomicReview.* 1994; 84, 600-621.
8. M.H Pesaran and B. Pesaran. Working with Microfit 4.0: Interactive Econometric AnalysiS. Oxford: Oxford University Press. 1997.
9. M Hashem Pesaran, Yongcheol Shin, and Richard J. Smith. Bounds Testing Approaches to the Analysis of level relationships. *Journal of Applied Econometrics*. 2001; 16, 289-326.

The Publication fee is defrayed by Indian Society for Education and Environment (www.iseeadyar.org)

Cite this article as:

Farah Hussain, Priyanka Bharali. Macro Economic overview of growth and inequality in Assam using time series analysis. *Indian Journal of Economics and Development*. Vol 4 (3), March 2016.