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Aviral Kumar Tiwari (Research scholar and Faculty of Applied Economics, Faculty of Management, ICFAI University, Tripura, Kamalghat, Sadar, West Tripura)
Sankharaj Roy (Research scholar and Faculty of Applied Economics, Faculty of Management, ICFAI University, Tripura, Kamalghat, Sadar, West Tripura)

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Testing the influence of different sector's contribution to the State Domestic Product of North Eastern States of India

Author (s)

Aviral Kumar Tiwari
Research scholar and Faculty of Applied Economics, Faculty of Management, ICFAI University, Tripura, Kamalghat, Sadar, West Tripura, Pin-799210,
Email-Id: aviral.eco@gmail.com & aviral.kr.tiwari@gmail.com

Sankharaj Roy
Faculty, Department of Management Studies, ICFAI University, Tripura, Kamalghat, Sadar, West Tripura, Pin-799210.
Email-Id: sankharajroy@rediffmail.com & sankharajroy@gmail.com

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Abstract

Northeastern region of India is basically a developing region contributing 2.54% of the country's GDP. The factors that comprises of the state gross domestic product (SGDP) are agricultural, allied activities, manufacturing, industry and services. The basic objective of the paper is to find out the sector that had been significantly contributing to the state domestic products of the eight northeastern states for the period 1999-2007. For analyzing panel data, regression method was chosen. We found that impact of agriculture, industry, service and transport is positive and significant whereas impact of manufacturing is mildly significant.

Introduction

Agriculture is the mainstay of the Indian economy as it gives highest share in the employment and livelihood creation to the people in spite of reduced contribution to the nation's gross domestic product (GDP). The share of agriculture to GDP is in a declining mode from 55.4% in 1950-51 to 20.6% in 2006-07. During this time, the contribution of the service sector to the economy increased from 28.5% in 1950-51 to 55.1% in 2006-07.

The northeastern region comprises of states like Arunachal Pradesh, Assam, Sikkim, Manipur, Mizoram, Tripura, Nagaland, and Meghalaya. These state's accounts for 8% of country's geographical area and 4% of population. Out of this 70% is hilly region and mountains covers most of Arunachal Pradesh, Mizoram, Nagaland, Meghalaya, Sikkim and about half of Tripura, one-fifth of Assam and nine-tenth of Manipur. Out of the total land reported for use, only 18% of the land is arable and fit for agriculture. Only in Assam and Tripura, 30-35 percent of land is used for cultivation.[1]

Due to the special constitutional arrangements for, and the historical background as well as the geographical location of the region, the central government has long been trying to integrate the Northeast with the national economy. The policy framework for the region has so far been guided by a combination of approaches affecting its political economy and culture. The northeast region remains isolated from the rest of the country. It has not been able to attract investors or to produce skilled labour and entrepreneurial resources, and has failed to transform the primitive agricultural practices of the region into modern commercial agriculture.

The eight states in the northeastern region are different with respect to their resource endowments, level of industrialization as well as infrastructural facilities. The industrial sector has mainly seen a growth around tea, petroleum (crude oil), natural gas etc. In Assam, mining, sawmills, and steel fabrication units in other parts of the region. The economy of the region is still primarily agrarian but its full potential is yet to be exploited. Since agriculture and industry has not really taken off in spite of the potential in the form of vast unexploited resource base available in the region. Overall, all these economies are underdeveloped agrarian societies with very weak industrial sectors and inflated service sectors creating a pressure for employment in this service sector. The northeastern region (NER) continues to be a net

1 http://databank.nedfi.com/content/general-information

importer of food grains even for its own consumption. The NE region produces only 1.5% of the country's total food grain production provides livelihood support to 70% of the population.

The economy of the region is still underdeveloped as compared to the mainstream economies because of the unbalanced development strategies followed by the centre and the state government. Small-scale industries have also not been viable and there is widespread industrial sickness in this sector. The economy of the region remains primarily agricultural, and the full potential of this sector has not been tapped. Primitive farm practices like shifting (*jhum*) cultivation in many of the hill areas, and mainly single crop traditional farming in the plains, continue to damage the agricultural production. Adoption of agricultural technology is poor and is indicated by the fact of low use of fertilizer. The average fertilizer consumption in the region is 41kg/hectors. The contribution of the agricultural and allied activities, constitute nearly 25% of the region's GDP, which has been declining in this region.[2] The compounded annual growth rate (CAGR) of the five sectors comprising of agriculture, manufacturing, industry, transport, storage & communication, and service sector is given below in Table 2 for a period of nine years from 1999 to 2007.

The CAGR chart of the eight states shows that the agriculture and allied activities of growth rate is highest in Nagaland and lowest in Mizoram. Nagaland's agricultural and allied activities has shown a constant growth during the last eight years. Among the NE states, the average size of land holding is highest in Nagaland that is 6.92ha which is much more the average size of land holding (1.60ha) in the region. Tripura with a CAGR of 43.01% in industries is highest in the region. The industrial sector has mainly grown around tea, timber, mining, saw mills and plywood factories. Mining in case of Meghalaya and forestry and logging in case of Arunachal Pradesh and Nagaland is the important contributor to the net state domestic product. The manufacturing sector has seen the highest CAGR of 46.19% in Meghalaya during the last eight years period. Transport, storage and communication have registered a highest CAGR of 41.09% in Tripura and lowest of 34.68% in Nagaland. Service sector in the NE region gives the highest number of employment because the industrial and manufacturing sector has not grown to its full potential. The growth of service sector is the highest in Nagaland with a CAGR of 36.69% and others states have a marginal growth rate in the range of 31% to 35%.

Literature Review

Using Social Accounting Matrices for 27 countries, Vogel (1994) examined the strength of the linkages between agriculture and rest of the economy at different stages of development. Classical theorists led by Arthur Lewis in the 1950's believe that agriculture is a passive contributor to economic development. They believe that economic development is a process of relocating factors of production from agricultural sector to a high productive industrial sector. Lewis's model of growth is a theory of development emphasizing rapid industrial growth, which is fueled by the agricultural sector. Thus, industrial expansion is possible by means of cheap food and surplus labor Lewis (1954).

Although passive, agricultural growth was necessary for two reasons (1) to ensure free and fair supply of food items in order to prevent inflation (2) to utilize land as a major natural resource that would not compete with resources for industrial growth Lewis (1954). Much has been written on the linkage between agriculture and industry in India including Varshney's (1994) study, Krishnan and Sen (1995) examines the degree to which fluctuations in industrial output are permanent by analyzing its univariate time series properties. Tiwari and KG (2011) analyzed the causality and cointegration relationship between sectoral GDP's of agriculture, industry, service and the GDP as a whole over the period 1951-2009 which has shown a long term relationship among the variables. Katircioglu (2006) investigated possible cointegration and causal relationship between economic growth and sectoral growth in North Cyprus mainly including agriculture, industry, and services sector. Due to the political isolation of Turkish Republic of Northern Cyprus (TRNC), everything went worse in the country since 1974. This caused huge economic and social cliffs between Turkish Cypriots and Greek Cypriots on the island. Results reveal that agriculture is still the backbone of the North Cyprus economy. It is in a long run equilibrium relationship with growth and gives direction to industry as it provides raw materials to that sector. However, it does not give any direction to the economic growth as measured by real Gross Domestic Product (GDP) growth rate. A cointegration is also obtained between real GDP and industrial output and services sector. Additionally, a

2 http://www.satp.org/satporgtp/publication/faultlines/volume6/Fault6-GSach-F.htm#_ftn3

Table-1: CAGR for a Period 1999-2007

	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
Agriculture and Allied	33.55	31.63	33.84	34.68	31.50	40.92	35.67	33.94
Manufacturing	34.58	37.57	34.41	46.19	36.04	37.38	35.01	41.17
Industry	42.91	36.52	37.01	37.86	37.64	40.66	41.96	43.01
Transport, Storage & Communication	40.01	36.57	39.04	38.99	40.34	34.68	38.89	41.09
Services	35.57	35.75	31.95	35.39	36.08	36.69	35.46	36.42
Source: Data obtained from Central Statistical Organization.								

unidirectional causation exists from real GDP to industrial output and to services sector.

Data and methodology

The present study is intended to examine the effects of different sectors of the north eastern states on their State Gross Domestic Product (*SGDP*). For the analysis, we have taken 8 north-eastern states and the period of our study is 1999-2007. Further to measure the relative performance of different sectors, we have taken 5 sectors for analysis which are agriculture, manufacturing, industry, service and transportation in the study. Actual SGDP and contribution of these five sectors to the GSDP at current price is taken for analysis. For the estimation, we used panel data techniques. There are three forms of the static panel data models: one is a pooled Ordinary Least Square (OLS) regression; second is panel model with random effects, and third is panel model with fixed effects. Considering the different sectors the evaluation of a pooled OLS regression can be specified as follows:

$$SGDP_{it} = \beta_0 + \beta_1(Agri_{it}) + \beta_2(Manu_{it}) + \beta_3(Indus_{it}) + \beta_4(Serv_{it}) + \beta(Trans_{it}) + \varepsilon_{it} \quad (1)$$

where *i* denotes the states, *t* denotes the time and remainder ε_{it} is the error term which is assumed to be white noised and varies over both states and time. However, while using a pooled OLS regression, states unobservable individual effects are therefore not controlled. According to Bevan and Danbolt (2004), heterogeneity of the countries under consideration for analysis can influence measurements of the estimated parameters.

Further, using a panel-data model with incorporation of individual effects, has a number of benefits, for example, among others, it allows us to account for individual heterogeneity. Indeed, Serrasqueiro and Nunes (2008) mentioned that developing countries differ in terms of their colonial history, their political regimes, their ideologies and religious affiliations, their geographical locations and climatic conditions, not to mention a wide range of other country-specific variables. In addition, if this heterogeneity is not taken into account, it will inevitably bias the results, no matter how large the sample is.

Therefore, by incorporating countries' unobservable individual effects in equation (3) the model to be estimated is as follows:

$$SGDP_{it} = \beta_0 + \beta_1(Agri_{it}) + \beta_2(Manu_{it}) + \beta_3(Indus_{it}) + \beta_4(Serv_{it}) + \beta(Trans_{it}) + w_{it} \quad (4)$$

where $w_{it} = \mu_i + \varepsilon_{it}$, with μ_i being countries' unobservable individual effects. The difference between a polled OLS regression and a model considering unobservable individual effects, lies precisely in μ_i. When we consider the random-effect model, equation (4) will be same. However, in that case, μ_i is presumed have the property of zero mean, independent of individual observation error term ε_{it}, has constant variances σ_ε^2, and is independent of the explanatory variables.

However, there may be a correlation between states' unobservable individual effects and growth determinants. If there is no correlation between states' unobservable individual effects and growth determinants, the most appropriate way of carrying out the analysis is using a panel model of random effects. On the contrary, if there is a correlation between states' individual effects and growth determinants, the most appropriate way of carrying

out the analysis is to use a panel model of fixed effects.

To test for the possible existence of a correlation we use the Hausman test. This test tests the null hypothesis of non-existence of a correlation between unobservable individual effects and the growth determinants, against the alternative hypothesis of an existence of a correlation. If the null hypothesis is not rejected we can conclude that correlation is not relevant and therefore a panel model of random effects is the most correct way of carrying out the analysis of the relationship between economic growth and its determinants. On the contrary, if the null hypothesis is rejected, we can conclude that correlation is relevant and therefore a panel model of fixed effects is the most appropriate way to carry out the analysis of the relationship between economic growth and its determinants.

Further, unlike previous studies which have analyzed the impact of FDI and exports on economic growth by using only the one-way error component model (i.e., either fixed effect or random effect is present in the model), we have analyzed the model in which two-way error components are present. Therefore, by expanding equation (4) to incorporate the two-way error component model, the equation becomes as follows:

$$SGDP_{it} = \beta_0 + \beta_1(Agri_{it}) + \beta_2(Manu_{it}) + \beta_3(Indus_{it}) + \beta_4(Serv_{it}) + \beta(Trans_{it}) + u_{it} \quad (5)$$

where $u_{it} = w_{it} + \lambda_t = \mu_i + \lambda_t + \varepsilon_{it}$, μ_i denotes the unobservable individual effect, λ_t denotes the unobservable time effect, and ε_{it} is the remainder stochastic disturbance term. Note that λ_t is individual-invariant and it accounts for any time-specific effect that is not included in the regression. For example, it could account for strike-year effects that disrupt production; oil-embargo effects that disrupt the supply of oil and affect its price; Surgeon General reports on the ill-effects of smoking; or government laws restricting smoking in public places, all of which could affect consumption behaviour. If μ_i and λ_t are assumed to be fixed parameters to be estimated, and the reminder disturbance is stochastic with $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$, then equation (4) represents a two-way fixed effect error component model.

Estimation and empirical results

It is evident from the model 1 (which is based on simple OLS estimate) of Table 2 that impact of agriculture, industry, and services is positive and highly significant whereas impact of manufacturing is negative and significant. The impact of transport is also negative but not significant. Result of model 2, which is based on the states' fixed effects show in two instances different results than OLS model. In first instance, impact of manufacturing is turned to insignificant and second instance show that now not only the sign of the coefficient of the transport is changed but also it becomes significant. Further, F-test of fixed effect is also highly significant indicating that state specific effects are playing important role. Model 3, which treats states specific effects as random show the similar results as reported in the model 2. However, in this case we find two differences: first, level of significance of the coefficients associated with transport sector has been affected and second, coefficient associated with manufacturing has become significant though the level of significance is relatively low. However, Hausman test in this case is significant which suggests us that random effect model is not correct way of the analysis and fixed effect model can be preferred. Therefore, in the next step we analyzed another model which treats both states and time effect as fixed and report results in model 4. We find the same results as reported in the model 3 in terms of significance of the coefficient. F-test of fixed effects is also significant showing that both states and time effects are playing their role. Preference towards model 4 is also indicated by the Hausman test of model 5, which treats both states and time effect as random. In the final step, we analyzed two another model wherein we treated first, time effects as random and cross-section effects ad fixed and in the second model we treated time effects as fixed and cross-section effects as random and reported results of these cases in the model 6 and model 7 respectively. However, both these models reported same results in terms of sign and significance of the coefficients. But, Hausman test is not significant in model 6 whereas it is significant in model 7 and fixed effect is significant in both cases. This show that time effect can be treated as random but not the cross-section effect. Importantly, in our all evaluations of different specifications J-B test of normality is not significant showing that all models are correctly specified. Our overall observation show that impact of agriculture, industry, service and transport is positive and significant whereas impact of manufacturing is mildly significant.

Conclusion

In the study, we examine the effects of different sectors of the north eastern states on their GDP. For the analysis, we have taken all the eight states of

north-eastern India and period of our study is 1999-2007. Our overall observation shows that impact of agriculture, industry, service and transport is positive and significant whereas impact of manufacturing is mildly significant. The analysis showed that all three sectors namely agriculture, industry and service has been growing sector in the north east.

Table-2: Regressions Results of Panel Data Models

Panel data Models: Dependent variable SGDP							
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	OLS	FE	RE	Two way FE	Two way RE	TE-RE & CS-FE	TE-FE & CS-RE
Constant	1.0243*** (28.3154)	1.1440 *** (12.2025)	1.1036*** (16.3235)	1.0392*** (3.2249)	1.1058*** (15.4678)	1.2207*** (11.3062)	1.1237*** (14.4811)
AGRI	0.2679*** (29.8965)	0.2614*** (23.2462)	0.2448*** (23.4372)	0.2653*** (18.5558)	0.2448*** (22.3563)	0.2576*** (19.4960)	0.2533*** (22.5405)
MANU	-0.0128*** (-3.1582)	-0.0045 (-1.0563)	-0.0074* (-1.6773)	-0.0095* (-1.7869)	-0.0074* (-1.5890)	-0.0081* (-1.5710)	-0.0087* (-1.9324)
INDUS	0.2324*** (37.8624)	0.2392*** (29.5908)	0.2474*** (40.7506)	0.2525*** (25.5496)	0.2475*** (38.8509)	0.2493*** (31.1067)	0.2434*** (29.6172)
TRANSPORT	-0.0001 (-0.0266)	0.0604*** (4.0851)	0.0160* (1.8566)	0.0681*** (2.9443)	0.0164* (1.7915)	0.0591*** (3.1167)	0.0141* (1.5996)
SERVICES	0.5122*** (75.7079)	0.4470*** (24.0508)	0.4964*** (32.4064)	0.4372*** (15.4835)	0.4957*** (30.6003)	0.4389*** (16.4855)	0.4931*** (32.1209)
Model summary							
R^2	0.9998	0.9999	0.9993	0.9999	0.9993	0.9999	0.9994
F-test	85962.62***	98812.53***	18210.26***	64006.85***	17934.24***	96433.82***	7742.923***
Hausman test	---	---	10.3344*	--	13.0930**	7.8786	10.1993*
Fixed effect (F-test)	---	$F_{(7, 51)}$ = 22.0718***	---	$F_{(7, 51)}$ = 8.5779***	---	$F_{(7, 51)}$ = 15.0202***	$F_{(7, 51)}$ = 1.29889***
J-B test		0.1278 [0.9380]	3.2140 [0.2004]	0.2666 [0.8751]	3.4746 [0.1759]	1.8677 [0.3930]	3.4657 [0.1767]
States included							
Total panel observations							

Notes: 1. The Hausman test has $\chi 2$ distribution and tests the null hypothesis that unobservable individual effects are not correlated with the explanatory variables, against the null hypothesis of correlation between unobservable individual effects and the explanatory variables.
2. The Wald test has $\chi 2$ distribution and tests the null hypothesis of insignificance as a whole of the parameters of the explanatory variables, against the alternative hypothesis of significance as a whole of the parameters of the explanatory variables.
3. The F-test has normal distribution N(0,1) and tests the null hypothesis of insignificance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters.
4. ***, **, and *denote significance at 1, 5 and 10 % level of significance, respectively.
5. EF, CS, SD denotes fixed-effect, cross-section and standard deviation, respectively.
6. [----] denotes results are not computed.
7. @ denotes that model is estimated with Panel EGLS (Cross-section SUR) method.

Source: Author's calculation

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