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A STUDY ON IMPACT OF CLIMATE CHANGE ON INDIAN ECONOMY: A STATE-WISE ANALYSIS

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ABSTRACT

With regards to this, a brief analysis was done with the help of different variables such as precipitation and temperature that have radically constituted to climate changes and thereby estimate its effect on the Indian economy and its various sectors. To understand the major objectives of analysing the impact of this change, relevant charts and estimates have been calculated and arrived at using several analytical tools. Regression based modelling approach has been used to derive estimates of different variables and their significance have been observed. The major findings of the report show that climate changes play a significant role in the agricultural sector. And, as expected, it has a moderate impact on the secondary sector and a minimal impact on the services sector.

1 INTRODUCTION

In the words of Barack Obama, "There's one issue that defines the profile of this era more drastically than anything else, and that is the hazard of changing climate."

In the last hundred years, the earth's climate has changed drastically. The earth's temperature has become warmer than before. The ice sheets across the world have decreased in mass and glaciers are retreating almost everywhere around the world. Further, the global sea levels have risen by about 8 inches in the past century and the recent cold wave in USA triggered by polar vortex is an evidence of how climate change has resulted in extreme events across the world.

India, for one, should be concerned about climate change since this phenomenon might have substantial adverse impacts on it. Almost 70 percent of Indian population is engaged in agriculture, which is largely dependent on rainfall. Further, due to local weather change, 15% of India's groundwater sources are damaged, and the falling water desk is suspected to deal a extreme blow in agriculture progress. Also, rising CO2 stages due to the fact of international warming is suspected to decrease down the extent of protein in vegetation like rice and wheat, which are main meals supply for majority of the populace inside the country, leaving populations at threat of malnutrition, low immunity and elevating the danger of ailments affecting the populace severely. Further, rising sea-level and surges of storm would additionally affect agriculture, degrade groundwater quality, growing the chance of illness in water, and giving upward jab to diarrhoea and cholera. Kolkata and Mumbai, are suspected to be the most affected via sea degree rise. Apart from this, the temperatures have additionally risen substantially throughout the country. In 2018, India recorded its freshest day in the town of Phalodi, Rajasthan, when the temperature reached fifty one tiers Celsius. And in line with surveys, the frequency of heat waves will nonetheless upward shove as local weather situation degrades (e.g- in retaining with a search with the aid of MIT inside the US, heatwave that may also kill even healthful humans inside hours is suspected to come to India soon).

Further, the impact of climate change isn't evenly distributed across the Indian states, as noticed. The poor states are heavily affected by fluctuations in temperature than richer states as a poor state has a high proportion of the population engaged in agriculture where climate has an important contribution and there is very limited scope to develop and implement mitigation strategies. On the contrary, the rich states are expected to bear no significant impact of weather change on economic growth because of their ability to develop and adopt better technologies and strategies.

1.1 BACKGROUND SCENARIO

One of the most gripping change on the Indian Economy in today's era is observed due to climatic changes. Significant increase has been discerned in temperatures not only across India but also globally. Temperatures are soaring high and causing difficulties to various sectors of the economy. Similarly, changes have been observed in the rainfall patterns. This includes extremely heavy rainfall or no rainfall at all, or irregular rainfall in certain areas. Due to human interference with nature, such impact is been seen in the climate making it very vulnerable. As a result, studying the impact of these changes has been crucial and is the need of the hour and needs immediate attention. Various climate stress testing is being conducted to address the impact of these issues.

1.2 LITERATURE REVIEW

Besides the fact that economic analysis of climate change is a comparatively new issue, numerous studies have estimated changes in climate on economic growth in different regions of the world. Most of these studies are numerical in nature and are speculative but they provide a solid foundation for future research.

- With its huge and increasing population of around 1.2 billion and an increasing rate of urbanization, India is undergoing an enormous change; climate change poses as an overwhelming stressor that will magnify existing health dangers. In India, the scope is gigantic, supported by the potential for global climatic change along with variability to exacerbate endemic also as chronic diseases. Building on the data used at the 2009 Joint Indo-U.S. Workshop on global climate change and Health in Goa, the paper on "Impacts of Climate Change on Public Health in India"- Future Research Directions by Kathleen F. Bush et al discusses the observed relationship between climate variability and human health, for the Indian subcontinent. There is a growing literature on the impacts on human health as well. Studies of climate variability & human health indicate a great deal of heterogeneity in the reported associations therefore it will be important for India to leverage improvements in infrastructure that are innovative and that require unprecedented levels of interdisciplinary collaborations.
- Climate change in effect has a significant impact on the Indian agricultural sector due to its dependency om rainfall and temperature. Chandra Kiran B. Krishnamurthy investigates this using a panel data quantile-regression methodology and estimates the relationship between current weather & agricultural crops like rice and wheat. Results of the estimation, when projected onto moderate climate change scenarios for India, indicate a significant negative impact on wheat yields, of upto 11%, primarily in Southern and Central India, with more moderate losses in the Northern region. Further, these impacts were seen to be most negative for the most productive districts, indicating losses in production, which are likely to be significant. On the other hand, for rice, the rise in temperature (by about 2 degrees) was found to moderately and negatively effect, with reductions in yield concentrated at the upper quantiles i.e., the most productive areas, while impacts at the lower and intermediate quantiles are seen to be very mildly positive. This translates into moderate reductions in production of rice. Thus, it is seen that climate changes have led to a drastic decrease in the production of wheat but more moderate reductions in rice production. Finally, the paper concludes that in the absence of significant changes in agricultural practices and technology, climate change may lead to increases in food insecurity for India's poor, as a result of decreased yield at the national level.
- The paper on "Climate change and economic growth: Evidence from the last half century" by Melissa Dell et al estimates climate effects by examining the relevance between climate fluctuations and economic growth. They identify the different mechanisms one at a time and study the effects of temperature and precipitation, data of the countries from 1950 to 2003 and then compare it with historical growth data. Findings suggest substantial effects in poor countries. It is observed that one

point change in temperature leads to a more than one point change in economic growth. Higher temperatures reduce agricultural output in poor countries and also leads to reduction in industrial outputs and increased political instability.

- The paper on “Economic Impacts of Climate Change on Secondary Activities: A Literature Review” by Surender Kumar attempts to analyze the economic impacts of climate change on selected non-agriculture industries. Climate change affects the non-agricultural industries by its on the climate dependent primary economic activities. Though there can be a positive relationship through new taste for some goods, the paper instead focuses on the negative/counter aspects. There are four main ways through which climate change influences the non-agriculture industries: Direct (through variations in climate variables); supply of raw materials from primary sector, agriculture and natural resources; through changes in labor productivity; and indirectly through markets (through risk and insurance premium, new market opportunities, and new taste and demand, and labor markets). Additionally, preceding literature show that the impacts on the secondary and tertiary stage of economic activities are huge and complicated and sooner or later can be larger than on the effects on agriculture for those middle and affluent class countries.
- The paper by Jyoti and Kirit: ‘Climate Change: India’s Perceptions, Positions, Policies and Possibilities’ emphasizes on India's perceptions on the problem of weather exchange and sustainable development; the form of negotiating positions that observe from these perceptions; the guidelines India has undertaken up to now and finally India's opportunities for movement which could help contain the hazard of weather alternate. The primary end drawn by way of the paper became that India and other growing countries sense strongly that they're now not answerable for the hazard of climate change that is created and it's far alternatively the unsustainable intake patterns of developed industrialized international locations inside the international which are liable for it. India and different growing developed economies like U.S can be highly vulnerable to weather exchange, specifically to the probable growth within the prevalence of excessive events. An overall evaluation of India's emissions shows that with capita emission of carbon (one-fourth) of the worldwide average, it has made extensive progress in limiting GHG emissions through normal coverage developments including the ones aiming to improve energy and economic performance of the energy and industrial manufacturing capability. Also, in addition to energy improvement, for both traditional and renewable, which target incremental environmental quality and restrict human health hazards from air pollutants. The paper concludes by way of putting emphasis on confining the focus on an equitable climate regime, an equitable weather regime. This will create awareness in limiting the dangers from weather exchange effects on developing nations (or poorer countries) as opposed to prescribing the costs of mitigation. Alternatives that improve the financial performance of mitigation also need to address the distribution of economic changes owing to changes in climate. Such a system needs to be backed by a better comprehension of the potential

economic impacts and other risks to developing countries which emanate from the climate change problem.

1.3 OBJECTIVES

Main objectives of this research are listed below:

- To analyze the impact of climatic change on the Indian economy, across 14 indian states for the period 1990-2019:
  - Precipitation and temperature will be used as indicators for climate variability while per capita GDP Growth Rate is to be used as indicator of economic growth
- To analyze the impact of climate changes on the different sub-sectors of the three broad sectors (Primary, Secondary and Tertiary):
  - Within each sector we will further consider various sub sectors such as agriculture, allied agricultural activities, manufacturing, health, tourism, to name a few.
- To analyze if the climate change impact varies across different states (rich vs poor).

1.4 METHODOLOGY AND DATA SOURCE

Type of research: Analytical research

Statistical tool: Descriptive statistics (through percentages, charts and figures), Regression tools (Stata)

This study is a preliminary attempt to examine the state-wise impact of climate change measured by Rainfall and Temperature on different sectors of the Indian economy. The research is based on secondary data compiled from various sources such as- government websites and other official documents as listed below:

The data source for each of the variables is given as follows:

Data	Sources
Total State GDP	State Statistics, Niti Aayog
Sectoral GDP	State Statistics, Niti Aayog
Temperature	Meteorological Data, India Water Portal
Precipitation	Meteorological Data, India Water Portal
State Population	Census Data of India, State Statistics, Niti Aayog
Human Capital	State Statistics, Niti Aayog
Labor Shares in each sector	Census Data of India

The data has been compiled to carry out a state level analysis of the impact of climate change over time. The 14 states that are chosen for the analysis are Andhra Pradesh, Tamil Nadu, Karnataka , Arunachal Pradesh, Sikkim, Bihar, Himachal Pradesh, Uttar Pradesh, West Bengal, Haryana, Gujarat, Delhi, Assam and Jammu & Kashmir, that have been picked up to represent the whole north, south, west and east India. These states are analysed for 29 years i.e., from 1990-91 to 2019-20. Further, data on specific sectors like agriculture, allied agricultural activities, manufacturing, services (which has further been classified into banking & insurance, real estate & business services and transport, storage & communication), has been compiled to carry out an analysis of impact of climate change on specific sectors across the various states.

The state gross domestic product- SGDP is the target/dependent variable, which is further classified into various components, such as State Agricultural GDP, State Allied Agricultural activities GDP, State Manufacturing GDP, State Services GDP and other sector specific state level GDPs. Further, total precipitation and average temperature of each state across different years are used as indicators of climate variability.

2 DATA ANALYSIS AND DISCUSSION

2.1 DESCRIPTIVE STATISTICS

As observed from the graph below, in all the years from 1990-2019, Sikkim has reported the highest level of rainfall except for 1995 when Arunachal Pradesh recorded the highest level of rainfall. On the other hand, the states Andhra Pradesh and Himachal Pradesh have received lowest levels of rainfall with low variance throughout the period of study.

The within state variation is also quite visible. This is in accordance with the numerous recent floods that have occurred. The states of Arunachal Pradesh and Karnataka show smooth upward trend in rainfall while most other states have varying amounts over this span of 29 years.

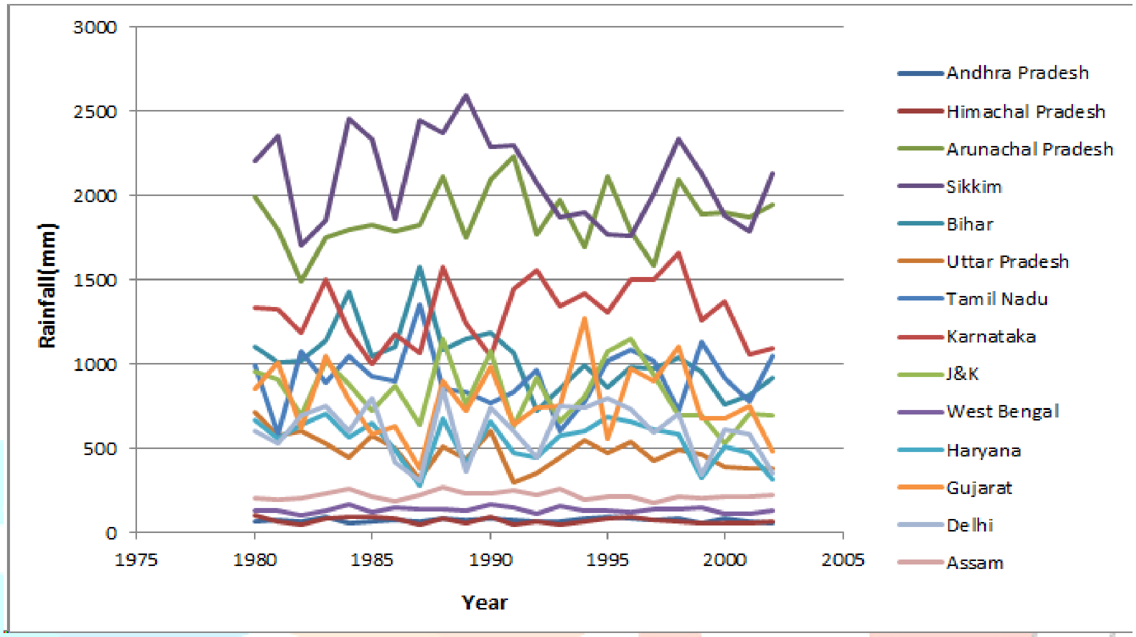

Figure 1: Average Rainfall Comparison

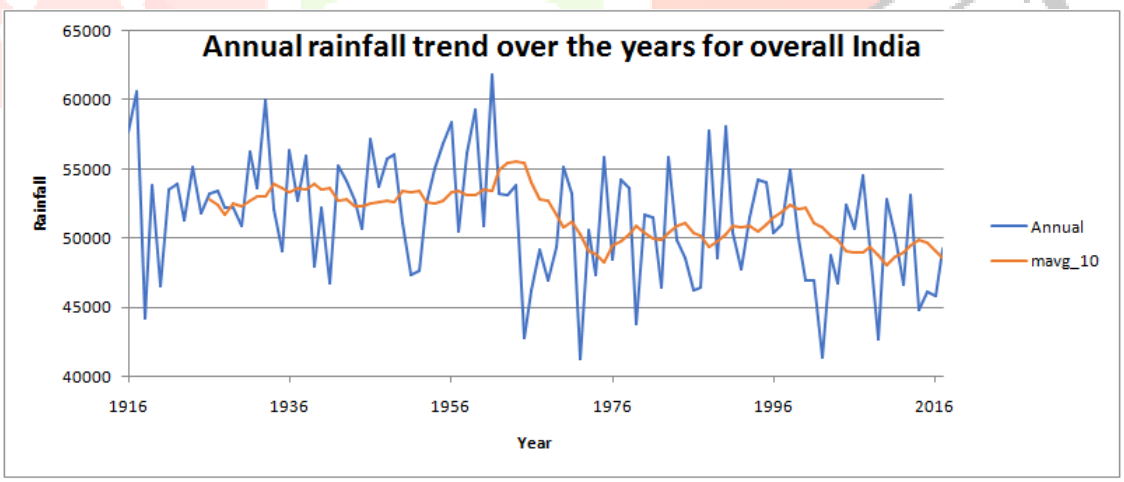

Figure 2: Annual rainfall Trend in India over the years

When it comes to temperature, the states Andhra Pradesh & Tamil Nadu have experienced the highest level of temperatures while Jammu and Kashmir is the lowest between 1970-2005. But nevertheless, it can be seen that there is a gradual rise in the temperatures of all the states and the within state variability in the temperatures is also more or less similar across the states which indicates that the effect of global warming

& other climatic conditions have had similar effects on mostly all the states that have been selected for our study.

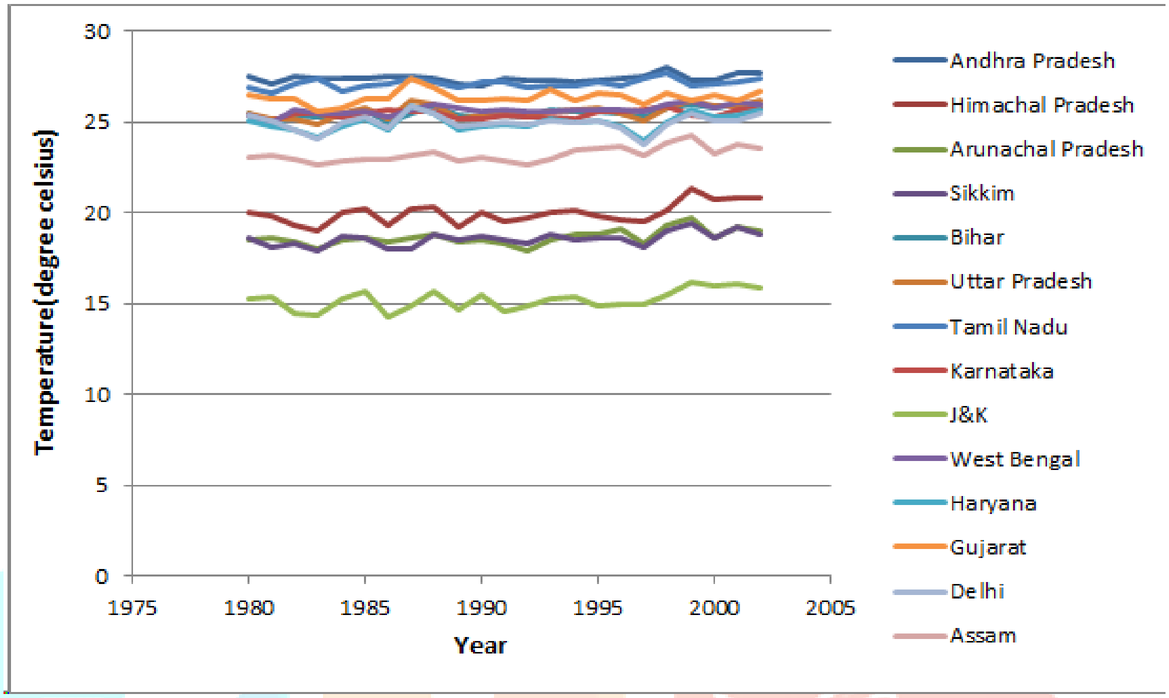

Figure 3: Average Temperature Comparison

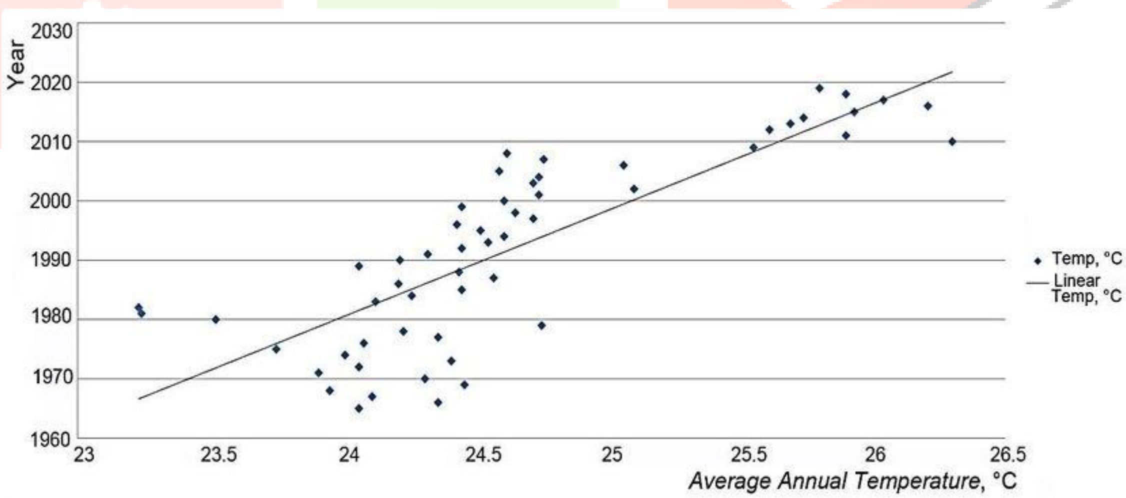

Figure 4: Average annual temperature in India over the years

2.2 METHODOLOGY

THEORETICAL MODEL:

Our study will be based on a model by Bond et.al. which incorporated climate change in the production function. The model is going to be used as baseline in the present study because it provides theoretical basis to incorporate the climate change into economic growth equations and elaborates on the decomposition of the impacts of changes in weather on economic growth.

Consider the production function

$$Y_{it} = e^{\beta T_{it}} A_{it} K_{it} L_{it} \quad (1)$$

Where Y is aggregate output (GDP), L is labor force, A is technology and canbe referred to as labor productivity, T is the impacts of climate and K is human capital.

$$\Delta A_{it}/A_{it} = g_i + \Upsilon T_{it} \quad (2)$$

Where g_i is the growth rate of GDP

Equation (1) captures the Level Effect of climate on production; e.g., the effect of current temperature or precipitation on features as crop yields.

Equation (2) captures the Growth Effect of climate; e.g., the effect of climate on features such as institutions that influence productivity growth.

Taking logs of the production function and differencing with respect to time, we get the dynamic growth equation as following:

$$g_{it} = g_i + (\beta + \Upsilon)T_{it} - \beta T_{it-1} \quad (3)$$

The above equation separately examines the level and growth effects of the impact of climate change on growth. Here, g_{it} is the growth rate of per-capita output and g_i reveals the state-specific fixed effects.

- The "level effects" of climate shocks on production, which come from equation (1), appear through β.
- The "growth effects" of climate shocks, which come from equation (2), appear through γ.

2.3 EMPIRICAL MODEL

In the light of the above theoretical model, we will estimate the following super redd form equation of economic growth. The equation is an empirical specification of equation (3) of the previous section

$$g_{it} = a_0 + a_1\, Tmp_{it} + a_2\, Pr_{it} + a_3\, Hc_{it} + E_{it} \qquad \text{(A)}$$

Where subscripts ‘i’ and ‘t’ are for states and years respectively and

g_{it} = growth rate of per-capita output

Tmp_{it} = deviations from mean temperature

Pr_{it} = annual rainfall

Hc_{it} = human capital

E_{it} = error term

In order to see the Differential Impacts of climate change on various sectors of the economy, the model is also tested on a number of sectors of the economy, such as agriculture, allied agricultural activities, manufacturing, transport and storage, banking & insurance, real estate & business services.

The model that is estimated is:

$$SGDP_{it} = a_0 + a_1\, Tmp_{it} + a_2\, Pr_{it} + a_3\, Hc_{it} + €_{it} \qquad \text{(B)}$$

SGDP = growth rate of sectoral per capita output

Note: Each sector’s per capita output has been calculated by dividing the total output of that sector by the labor force of that sector. Labor force for each sector is estimated by using labor shares in each sector from the census data.

In this analysis, the main focus will be on the Null Hypothesis that climate change does not affect growth:

H_0: a_1=0 and a_2=0

The random-effect model and fixed effect model technique were considered to estimate the models. The Hausman test of endogeneity was used to select the suitable technique.

H_0: Difference in coefficients is not systematic

H_A: Difference in coefficients is systematic

If the p value which is obtained is less than 0.05, then null hypothesis is rejected which means difference in coefficients is systematic or not random and hence a fixed effects model is preferred. Models A and B are estimated using Panel data of 14 states for 29 years.

2.4 GMM ESTIMATION

The DPD (Dynamic Panel Data) approach is usually considered the work of Arellano and Bond (Rev. Ec. Stud., 1991), but they in fact popularized the work of Holtz-Eakin, Newey and Rosen (Econometrica, 1988). It is based on the notion that the instrumental variables approach doesn't exploit all of the information available in the sample. Therefore, Generalized Method of Moments (GMM) constructs more efficient estimates of the dynamic panel data model. Arellano and Bond (1991) suggest using the following differenced equation:

$$\Delta\, yit = \Delta\, Xit\, B' + \Delta\, eit + \Delta\, yit\text{-}1 \qquad (4)$$

Arellano Bond Difference GMM estimators can be obtained from the following moment conditions:

$E(y\, i,t\text{-}s\, ,\Delta\, eit) = 0$, for $s \geqslant 2, t \geqslant 3$ and $E(Xi,t\text{-}s\ \Delta\, eit) = 0$, for $s \geqslant 2$, $t \geq 3$

where the second and the further lags of Dependent & Independent variables are instruments for the differenced transformations (given above).

Since the second and further lags are good instruments for Δ Xit (Xit- Xi, t-1) and Xi,t-2 is uncorrelated with Δ eit they become valid instruments for ΔXit and solve the problem of endogeneity.

We choose Arellano- Bond's D-GMM estimator because of its clear advantages over other estimators. Since, there is likely to be a two-way relationship between "growth rate of per capita output" and "human capital", it can also control for endogeneity introduced by human capital in our model by using lagged variables for independent and dependent variables as instruments. In this scenario, the instruments for the regression in differences are lagged levels as within the original estimator. We have hence used one period lagged growth rate per capita output as an independent variable and using (4) we formulate the model as:

$$\mathbf{SGDP_{it} = a_0 + a_1\, Tmp_{it} + a_2\, Pr_{it} + a_3\, Hc_{it} + a_4\, SGDP_{it-1} + E_{it}}$$

$SGDP_{it}$ = Growth Rate of Per-Capita Output

Tmp_{it} = deviations from mean temperature

Pr_{it} = annual rainfall

Hc_{it} = human capital

$SGDP_{it-1}$= one period lagged growth rate of per-capita output

E_{it} = error term

2.5 ESTIMATION AND RESULTS

We started with the "Fixed-Effects Model", the results for which are given below. The Hausman test was deployed to select the appropriate estimation methodology, which would be either a fixed effect model or a random effect model. The significant Chi-square test statistics suggest that the use of a fixed effects model would be appropriate instead of using the random effects model.

TABLE 1: FIXED EFFECTS ESTIMATION RESULTS FOR THE PRIMARY SECTOR

VARIABLE	AGRICULTURE	FORESTRY	FISHING	MINING AND QUARRYING
RAINFALL	6.79e-06***	1.16e-07	4.64e-07*	5.22e-07*
TEMP	0.0051615***	0.005563***	0.000257**	0.0002205
LITERACY RATE	0.0011958***	0.000072***	0.0000528***	0.0000648***
CONSTANT	-0.1647***	-0.01534***	-0.00826***	-0.0076844**

TABLE 2: FIXED EFFECTS ESTIMATION RESULTS FOR THE SECONDARY SECTOR

VARIABLE	REGISTERED	UNREGISTERED	CONSTRUCTION	ELECTRICITY AND GAS
RAINFALL	2.70e-06	1.51e-06	-2.03e-08	-1.02e-07
TEMP	0.0008684	0.0005012	0.0025461***	0.001174***
LITERACY RATE	0.0005713***	0.0003071***	0.0005375***	0.000179***
CONSTANT	-0.042798***	-0.02307***	-0.0789877***	-0.0342083***

TABLE 3: FIXED EFFECTS ESTIMATION RESULTS FOR THE SERVICE SECTOR

VARIABLE	TRANSPORT	TRADE AND HOTELS	BANKING AND INSURANCE	REAL ESTATE	PUBLIC ADMINISTRATION	OTHER SERVICES
RAINFALL	3.69e-07	2.03e-07*	-1.30e-06	-7.64e-07	-9.73e-07	-1.07e-06
TEMP	0.0013937*	0.0020214	0.000561	0.001241*	0.0033838***	0.00335***
LITERACY RATE	0.000381***	0.00069***	0.000378***	0.0003***	0.0004384***	0.000547***
CONSTANT	-0.046025***	-0.07033**	-0.0244	-0.0394**	-0.0941984***	-0.09664***

However, there is a problem of endogeneity in our model. The proxy for human capital, i.e., literacy rate shares a two -way relation with the dependent variable, i.e., sector specific GDP, which contributes to the total GDP. While a higher literacy rate will contribute positively to the GDP since more educated population usually has higher productivity too, it is seen that a higher GDP will also have a positive impact on literacy rate. This could be because a higher GDP allows the construction of more schools as well as better literacy programs. Thus, the results from the fixed-effects model may be biased.

In fact, we observe that contrary to our expectations, forestry turns out to be independent of rainfall. Further, both registered and unregistered manufacturing are independent of both climate change variables.

We therefore use the **GMM model** to deal with the issue of endogeneity. The results for the following are reported below.

TABLE 4: GMM ESTIMATION RESULTS FOR PRIMARY SECTOR

VARIABLE	AGRICULTURE	FORESTRY	FISHING	MINING AND QUARRYING
LAGGED VALUE OF SECTORAL GDP	0.9256764***	0.7755685***	1.03907***	1.092668***
RAINFALL	3.69e-06***	4.31e-07**	1.83e-08**	5.22e-07**
TEMP	.0006191**	0.0002366**	-0.000257**	-0.0002205**
LITERACY RATE	0.0001191***	0.0000255***	0.0000525***	0.0000648***
CONSTANT	-0.0158743***	-0.006729***	- 0.0080292***	-0.0074995***

TABLE 5: GMM ESTIMATION RESULTS FOR THE SECONDARY SECTOR

VARIABLE	REGISTERED	UNREGISTERED	CONSTRUCTION	ELECTRICITY AND GAS
LAGGED VALUE OF SECTORAL GDP	1.00346***	1.01375***	0.95888***	0.8234***
RAINFALL	1.51e-06**	2.70e-06**	-2.03e-08*	-8.40e-08
TEMP	-0.0001684**	-0.0005012**	0.0025461*	0.000246**
LITERACY RATE	0.0003071***	0.0000558***	0.005321***	0.0000495***
CONSTANT	-0.0037561***	-0.0118257***	-0.000926***	-0.0075602***

TABLE 6: GMM ESTIMATION RESULTS FOR THE SERVICES SECTOR

VARIABLE	TRANSPORT	TRADE AND HOTELS	BANKING AND INSURANCE	REAL ESTATE	PUBLIC ADMINISTRATION	OTHER SERVICES
LAGGED VALUE OF SECTORAL GDP	1.02698***	1.0680***	1.058273***	1.081779***	1.034361***	1.0488***
RAINFALL	3.86e-07	1.10e-0**	-1.44e-07	-3.00e-07**	2.51e-07	6.16e-07
TEMP	-0.0000778	-6.60e-08	-0.0001496	0.0001**	-0.0001217	5.80e-06
LITERACY RATE	0.00003***	0.000025*	0.000389***	0.0000**	0.0000291*	0.00002**
CONSTANT	-0.000497**	-0.001627	-0.0019446	-0.004**	-0.0016523	-0.0017242

We can see from the above tables that the highest impact of climate change has been on the primary sector, which is as expected. This is because sub sectors like agriculture in India, are still heavily dependent on rainfall as the sole source of water and temperature also plays a crucial role to maintain proper crop health. In fact, we see that a one-degree Celsius increase in temperature will lead to a 0.0006191 rise in agricultural GDP, on average. Similarly, a 100 mm rise in rainfall leads to a 0.91466 rise in agriculture GDP. We can also see that rainfall and temperature both have a "positive" and "significant" impact on the other sub sectors of primary sector.

Moving on to the secondary sector, we observe that while rainfall has a positive impact, temperature is seen to have a "negative" and "significant" impact on the manufacturing sector. This could be because higher temperature decreases the productivity of the workers which has a "negative" impact on the GDP and this effect is seen to be higher in case of unregistered manufacturing sector than registered manufacturing. Temperature is also seen to have a positive impact on electricity sector, perhaps because higher temperature tends to increase the electricity consumption. However, rainfall doesn't play a important role in this sector. Further, climate change seems to be "less significant" for the construction sector.

Finally, we see that climate change does not have a very significant impact on the services sector, except in case of real estate, where both the variables are significant, with rainfall having a negative impact while temperature having a positive one. This could be because climate plays an important role in selection of a particular location for housing. On the other hand, sectors like banking and insurance are unlikely to be affected by climate change since these activities are mainly carried out indoors.

3 CONCLUSION

The study has undertaken panel data research on the relationship between weather patterns (an indicator of climate change) and economic output for the Indian economy. The results show how temperature and precipitation significantly impact per capita GDP growth and productivity in the agriculture, manufacturing, and services sector. However, the severity of these effects is higher in the agricultural sector than the manufacturing and services sectors.

Although the poor states may contribute the least to causing climate change, they are the worst victim of climate change due to their main occupation being agriculture. They don't have the monetary and other resources required to adopt preventive or mitigation measures. Therefore, control of climate change is crucial for poverty alleviation and better development of the country.

- The results show how temperature and precipitation have significant impact on Per Capita GDP growth as well as with the productivity in agriculture, manufacturing and services sectors. The severity of these negative effects is highest in the Agriculture sector as compared to other sectors.
- The poor states contribute the least to Gross Domestic Product of the country and are the ones among the most adversely affected by climate change because of their dependency on agriculture and their limited ability to get hold of the resources necessary to adopt the preventive measures and adaptation strategies. The reduction in economic growth also results in increasing poverty.

3.1 MAJOR FINDINGS

- Climate change is an extremely important factor for the agricultural sector, particularly the primary sector. However, it has a moderate impact on the secondary sector and a not very significant impact on the services sector.
- Human capital has a "positive" & "significant" impact on almost all the subsectors. This is as expected since human development leads to an increase in economic growth.
- The lagged values of the sectoral GDP are also "significant" & positive across all sub sectors. A reason for this could be that higher GDP in one period enables the purchase of better equipment and inputs, which contributes to better output in the following period.

3.2 POLICY IMPLICATION

- Policies are required in regards to the adoption of mitigation strategies to control climate change for the development of poor states and Economic growth of India as a whole**.**

4 FUTURE SCOPE

The study reveals that the economic growth of Indian states will be adversely impacted if the climate conditions are not controlled or mitigated. Hence, what is required is a policy regarding adopting mitigation policies that help in preventing the effects of climate change. The estimates shared in this model are primarily based on short-term fluctuations in temperature. This cannot be in itself considered to be the estimated effect of climate change in the coming years. However, it provides a firm basis for policy implications and which group will face the brunt of climate change the most. So, government policies need to be targeted more towards the protection of those vulnerable groups.

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6 APPENDICES

APPENDIX 1- FIXED EFFECTS ESTIMATION TABLES

AGRICULTURE

Fixed-effects (within) regression — Number of obs = 322
Group variable: STATES — Number of groups = 14

R-sq: within = 0.6621 — Obs per group: min = 23
between = 0.0698 — avg = 23.0
overall = 0.0196 — max = 23

F(3,305) = 199.19
corr(u_i, Xb) = -0.8801 — Prob > F = 0.0000

agpercapita	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	6.79e-06	2.63e-06	2.58	0.010	1.62e-06	.000012
TEMPERATUREIntegerdegreecelsis	.0051665	.0012008	4.30	0.000	.0028035	.0075295
LITERACYRATE	.0011958	.0000568	21.06	0.000	.0010841	.0013076
_cons	-.1647082	.0277237	-5.94	0.000	-.2192621	-.1101542
sigma_u	.02855758					
sigma_e	.00764099					
rho	.93319224	(fraction of variance due to u_i)				

F test that all u_i=0: F(13, 305) = 65.52 Prob > F = 0.0000

FORESTRY

Fixed-effects (within) regression — Number of obs = 322
Group variable: STATES — Number of groups = 14

R-sq: within = 0.3803 — Obs per group: min = 23
between = 0.4446 — avg = 23.0
overall = 0.1990 — max = 23

F(3,305) = 62.38
corr(u_i, Xb) = -0.8905 — Prob > F = 0.0000

forestrypc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	1.16e-07	3.31e-07	0.35	0.727	-5.36e-07	7.67e-07
TEMPERATUREIntegerdegreecelsis	.0005563	.0001513	3.68	0.000	.0002585	.0008541
LITERACYRATE	.0000782	7.16e-06	10.92	0.000	.0000641	.0000923
_cons	-.0153412	.0034934	-4.39	0.000	-.0222155	-.0084669
sigma_u	.00408484					
sigma_e	.00096283					
rho	.94736565	(fraction of variance due to u_i)				

F test that all u_i=0: F(13, 305) = 62.28 Prob > F = 0.0000

FISHING

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.3077                         Obs per group: min =        23
       between = 0.0692                                        avg =      23.0
       overall = 0.1016                                        max =        23

                                                F(3,305)           =     45.19
corr(u_i, Xb)  = -0.7357                        Prob > F           =    0.0000

------------------------------------------------------------------------------------------------
                        fishingpc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------------------------+-------------------------------------------------------------
              RAINFALLIntegermm |   4.64e-07   2.46e-07     1.89   0.060    -1.94e-08    9.48e-07
TEMPERATUREIntegerdegreecelsis |    .000257   .0001123     2.29   0.023      .000036     .000478
                    LITERACYRATE |   .0000528   5.31e-06     9.95   0.000     .0000424    .0000633
                           _cons |  -.0082617   .0025931    -3.19   0.002    -.0133644   -.003159
----------------------------------+-------------------------------------------------------------
                         sigma_u |  .00122412
                         sigma_e |   .0007147
                             rho |  .74577993   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 305) =    28.26            Prob > F = 0.0000
```

MINING AND QUARRYING

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.2835                         Obs per group: min =        23
       between = 0.0005                                        avg =      23.0
       overall = 0.0265                                        max =        23

                                                F(3,305)           =     40.23
corr(u_i, Xb)  = -0.5668                        Prob > F           =    0.0000

------------------------------------------------------------------------------------------------
               miningquarryingpc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------------------------+-------------------------------------------------------------
              RAINFALLIntegermm |   5.22e-07   3.10e-07     1.68   0.093    -8.76e-08    1.13e-06
TEMPERATUREIntegerdegreecelsis |   .0002205   .0001415     1.56   0.120    -.0000579    .0004989
                    LITERACYRATE |   .0000648   6.69e-06     9.68   0.000     .0000516    .0000779
                           _cons |  -.0076844   .0032659    -2.35   0.019    -.0141109   -.001258
----------------------------------+-------------------------------------------------------------
                         sigma_u |  .00175992
                         sigma_e |  .00090011
                             rho |  .79265745   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 305) =    54.92            Prob > F = 0.0000
```

REGISTERED MANUFACTURING

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.3560                         Obs per group: min =        23
       between = 0.4390                                        avg =      23.0
       overall = 0.3686                                        max =        23

                                                F(3,305)           =     56.20
corr(u_i, Xb)  = -0.4054                        Prob > F           =    0.0000
```

regmanufacturingpc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	2.70e-06	2.23e-06	1.21	0.228	-1.70e-06	7.10e-06
TEMPERATUREIntegerdegreecelsis	.0008684	.0010211	0.85	0.396	-.0011409	.0028777
LITERACYRATE	.0005713	.0000483	11.83	0.000	.0004763	.0006664
_cons	-.0427981	.0235749	-1.82	0.070	-.0891882	.0035919
sigma_u	.00587652					
sigma_e	.00649752					
rho	.44994029	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(13, 305) =     15.24             Prob > F = 0.0000
```

UNREGISTERED MANUFACTURING

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.3747                         Obs per group: min =        23
       between = 0.6307                                        avg =      23.0
       overall = 0.4830                                        max =        23

                                                F(3,305)           =     60.92
corr(u_i, Xb)  = -0.3098                        Prob > F           =    0.0000
```

unregmanufacturingpc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	1.51e-06	1.16e-06	1.30	0.193	-7.67e-07	3.78e-06
TEMPERATUREIntegerdegreecelsis	.0005012	.000528	0.95	0.343	-.0005378	.0015402
LITERACYRATE	.0003071	.000025	12.30	0.000	.0002579	.0003562
_cons	-.02307	.0121903	-1.89	0.059	-.0470577	.0009177
sigma_u	.00255721					
sigma_e	.00335979					
rho	.36681102	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(13, 305) =     10.88             Prob > F = 0.0000
```

CONSTRUCTION

Fixed-effects (within) regression   Number of obs = 322
Group variable: STATES   Number of groups = 14

R-sq: within = 0.4898   Obs per group: min = 23
between = 0.0565   avg = 23.0
overall = 0.0101   max = 23

F(3,305) = 97.60
corr(u_i, Xb) = -0.8902   Prob > F = 0.0000

constructionpc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	-2.03e-08	1.73e-06	-0.01	0.991	-3.43e-06	3.39e-06
TEMPERATUREIntegerdegreecelsis	.0025461	.0007908	3.22	0.001	.0009899	.0041022
LITERACYRATE	.0005375	.0000374	14.37	0.000	.0004639	.0006111
_cons	-.0789877	.0182577	-4.33	0.000	-.1149147	-.0430607
sigma_u	.01444237					
sigma_e	.00503204					
rho	.89174414	(fraction of variance due to u_i)				

F test that all u_i=0: F(13, 305) = 9.15   Prob > F = 0.0000

ELECTRICITY AND GAS

Fixed-effects (within) regression   Number of obs = 322
Group variable: STATES   Number of groups = 14

R-sq: within = 0.5161   Obs per group: min = 23
between = 0.0092   avg = 23.0
overall = 0.0560   max = 23

F(3,305) = 108.44
corr(u_i, Xb) = -0.9287   Prob > F = 0.0000

elecgaspc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	-1.02e-07	5.71e-07	-0.18	0.859	-1.23e-06	1.02e-06
TEMPERATUREIntegerdegreecelsis	.001174	.0002611	4.50	0.000	.0006602	.0016877
LITERACYRATE	.000179	.0000123	14.49	0.000	.0001547	.0002033
_cons	-.0342083	.006028	-5.67	0.000	-.04607	-.0223465
sigma_u	.00543263					
sigma_e	.00166139					
rho	.91447462	(fraction of variance due to u_i)				

F test that all u_i=0: F(13, 305) = 18.75   Prob > F = 0.0000

TRANSPORT

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.3592                         Obs per group: min =        23
       between = 0.4275                                        avg =      23.0
       overall = 0.3275                                        max =        23

                                                F(3,305)           =     57.00
corr(u_i, Xb)  = -0.7040                        Prob > F           =    0.0000
```

transportpc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	3.69e-07	1.56e-06	0.24	0.814	-2.71e-06	3.45e-06
TEMPERATUREIntegerdegreecelsis	.0013937	.0007148	1.95	0.052	-.0000129	.0028003
LITERACYRATE	.0003817	.0000338	11.29	0.000	.0003152	.0004482
_cons	-.0460255	.0165029	-2.79	0.006	-.0784995	-.0135516
sigma_u	.00573743					
sigma_e	.00454839					
rho	.61407494	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(13, 305) =      9.80            Prob > F = 0.0000
```

TRADE AND HOTELS

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.3053                         Obs per group: min =        23
       between = 0.4470                                        avg =      23.0
       overall = 0.3318                                        max =        23

                                                F(3,305)           =     44.68
corr(u_i, Xb)  = -0.5737                        Prob > F           =    0.0000
```

tradeandhotelspc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RAINFALLIntegermm	2.03e-07	3.18e-06	0.06	0.949	-6.06e-06	6.47e-06
TEMPERATUREIntegerdegreecelsis	.0020214	.0014539	1.39	0.165	-.0008396	.0048824
LITERACYRATE	.0006967	.0000688	10.13	0.000	.0005614	.000832
_cons	-.0703371	.0335671	-2.10	0.037	-.1363894	-.0042847
sigma_u	.0092384					
sigma_e	.00925148					
rho	.49929263	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(13, 305) =      9.25            Prob > F = 0.0000
```

BANKING AND INSURANCE

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.0829                         Obs per group: min =        23
       between = 0.4809                                        avg =      23.0
       overall = 0.2495                                        max =        23

                                                F(3,305)           =      9.19
corr(u_i, Xb)  = 0.1576                         Prob > F           =    0.0000

------------------------------------------------------------------------------------------------
            bankinginsurancepc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------------------+----------------------------------------------------------------
           RAINFALLIntegermm   |  -1.30e-06   3.76e-06    -0.34   0.730    -8.70e-06    6.11e-06
TEMPERATUREIntegerdegreecelsis |   .0005612   .0017192     0.33   0.744    -.0028217    .0039442
                  LITERACYRATE |   .0003781   .0000813     4.65   0.000     .0002181    .0005381
                         _cons |  -.0244393   .0396911    -0.62   0.539    -.1025424    .0536637
-------------------------------+----------------------------------------------------------------
                       sigma_u |  .00724981
                       sigma_e |  .01093934
                           rho |  .30517352   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 305) =     8.14             Prob > F = 0.0000
```

REAL ESTATE

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.3400                         Obs per group: min =        23
       between = 0.2753                                        avg =      23.0
       overall = 0.2355                                        max =        23

                                                F(3,305)           =     52.38
corr(u_i, Xb)  = -0.7256                        Prob > F           =    0.0000

------------------------------------------------------------------------------------------------
                  realestatepc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------------------+----------------------------------------------------------------
           RAINFALLIntegermm   |  -7.64e-07   1.45e-06    -0.53   0.599    -3.62e-06    2.09e-06
TEMPERATUREIntegerdegreecelsis |   .0012409   .0006624     1.87   0.062    -.0000626    .0025444
                  LITERACYRATE |   .0003343   .0000313    10.67   0.000     .0002727     .000396
                         _cons |   -.039449   .0152939    -2.58   0.010    -.0695438   -.0093541
-------------------------------+----------------------------------------------------------------
                       sigma_u |     .00599
                       sigma_e |  .00421517
                           rho |  .66880907   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 305) =     8.01             Prob > F = 0.0000
```

PUBLIC ADMINISTRATION

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.5652                         Obs per group: min =        23
       between = 0.2798                                        avg =      23.0
       overall = 0.0086                                        max =        23

                                                F(3,305)           =    132.15
corr(u_i, Xb)  = -0.9460                        Prob > F           =    0.0000

------------------------------------------------------------------------------------------
                    publicadminpc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------------------------+-------------------------------------------------------
                  RAINFALLIntegermm |  -9.73e-07   1.31e-06    -0.74   0.459    -3.56e-06    1.61e-06
TEMPERATUREIntegerdegreecelsis |   .0033838   .0005995     5.64   0.000     .0022042    .0045635
                     LITERACYRATE |   .0004384   .0000284    15.46   0.000     .0003826    .0004941
                            _cons |  -.0941984   .0138407    -6.81   0.000    -.1214337   -.0669631
----------------------------------+-------------------------------------------------------
                          sigma_u |  .01748381
                          sigma_e |  .00381465
                              rho |  .95455974   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 305) =    15.27             Prob > F = 0.0000
```

OTHER SERVICES

```
Fixed-effects (within) regression               Number of obs      =       322
Group variable: STATES                          Number of groups   =        14

R-sq:  within  = 0.4942                         Obs per group: min =        23
       between = 0.0167                                        avg =      23.0
       overall = 0.0642                                        max =        23

                                                F(3,305)           =     99.35
corr(u_i, Xb)  = -0.9157                        Prob > F           =    0.0000

------------------------------------------------------------------------------------------
                 otherservicespc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------------------------+-------------------------------------------------------
                  RAINFALLIntegermm |  -1.07e-06   1.82e-06    -0.59   0.557    -4.64e-06    2.50e-06
TEMPERATUREIntegerdegreecelsis |    .003335   .0008296     4.02   0.000     .0017026    .0049675
                     LITERACYRATE |   .0005473   .0000392    13.95   0.000     .0004701    .0006245
                            _cons |  -.0966453   .0191527    -5.05   0.000    -.1343335    -.058957
----------------------------------+-------------------------------------------------------
                          sigma_u |  .01587386
                          sigma_e |  .00527872
                              rho |  .90042703   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 305) =     7.77             Prob > F = 0.0000
```

APPENDIX 2- GMM ESTIMATION TABLES

FORESTRY

```
Arellano-Bond dynamic panel-data estimation  Number of obs        =       294
Group variable: STATES                       Number of groups     =        14
Time variable: YEAR
                                             Obs per group:    min =        21
                                                               avg =        21
                                                               max =        21

Number of instruments =    207               Wald chi2(4)         =    959.81
                                             Prob > chi2          =    0.0000
One-step results
```

forestrypc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
forestrypc						
L1.	.7755685	.0383774	20.21	0.000	.7003503	.8507868
RAINFALLIntegermm	4.31e-07	2.09e-07	2.06	0.039	2.19e-08	8.41e-07
TEMPERATUREIntegerdegreecelsis	.0002366	.0000958	2.47	0.014	.0000487	.0004245
LITERACYRATE	.0000255	6.38e-06	3.99	0.000	.000013	.000038
_cons	-.006729	.0022264	-3.02	0.003	-.0110928	-.0023653

```
Instruments for differenced equation
        GMM-type: L(2/.).forestrypc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

FISHING

```
Arellano-Bond dynamic panel-data estimation  Number of obs        =       294
Group variable: STATES                       Number of groups     =        14
Time variable: YEAR
                                             Obs per group:    min =        21
                                                               avg =        21
                                                               max =        21

Number of instruments =    207               Wald chi2(4)         =   9384.96
                                             Prob > chi2          =    0.0000
One-step results
```

fishingpc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
fishingpc						
L1.	1.03907	.0138679	74.93	0.000	1.011889	1.06625
RAINFALLIntegermm	1.83e-08	5.51e-08	0.33	0.740	-8.98e-08	1.26e-07
TEMPERATUREIntegerdegreecelsis	-7.19e-06	.0000245	-0.29	0.769	-.0000553	.0000409
LITERACYRATE	2.77e-06	1.66e-06	1.67	0.096	-4.89e-07	6.03e-06
_cons	.0000674	.0005718	0.12	0.906	-.0010534	.0011881

```
Instruments for differenced equation
        GMM-type: L(2/.).fishingpc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

REGISTERED MANUFACTURING

```
Arellano-Bond dynamic panel-data estimation  Number of obs      =       294
Group variable: STATES                       Number of groups   =        14
Time variable: YEAR
                                             Obs per group:  min =       21
                                                             avg =       21
                                                             max =       21

Number of instruments =    199               Wald chi2(4)       =   6787.27
                                             Prob > chi2        =    0.0000
One-step results
```

regmanufacturingpc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
regmanufacturingpc						
L1.	1.00346	.0176348	56.90	0.000	.9688966	1.038024
RAINFALLIntegermm	9.04e-07	5.88e-07	1.54	0.124	-2.49e-07	2.06e-06
TEMPERATUREIntegerdegreecelsis	.0003839	.0002627	1.46	0.144	-.0001311	.0008989
LITERACYRATE	.0000558	.0000192	2.91	0.004	.0000182	.0000934
_cons	-.0118257	.0061412	-1.93	0.054	-.0238623	.0002108

```
Instruments for differenced equation
        GMM-type: L(2/.).regmanufacturingpc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

UNREGISTERED MANUFACTURING

```
Arellano-Bond dynamic panel-data estimation  Number of obs      =       294
Group variable: STATES                       Number of groups   =        14
Time variable: YEAR
                                             Obs per group:  min =       21
                                                             avg =       21
                                                             max =       21

Number of instruments =    207               Wald chi2(4)       =   5968.62
                                             Prob > chi2        =    0.0000
One-step results
```

unregmanufacturingpc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
unregmanufacturingpc						
L1.	1.013715	.0180103	56.29	0.000	.9784159	1.049015
RAINFALLIntegermm	2.42e-07	3.29e-07	0.74	0.462	-4.03e-07	8.87e-07
TEMPERATUREIntegerdegreecelsis	.0001551	.0001465	1.06	0.290	-.0001321	.0004422
LITERACYRATE	5.78e-06	.0000104	0.55	0.580	-.0000147	.0000263
_cons	-.0037651	.0034341	-1.10	0.273	-.0104957	.0029655

```
Instruments for differenced equation
        GMM-type: L(2/.).unregmanufacturingpc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

TRANSPORT

```
Arellano-Bond dynamic panel-data estimation  Number of obs       =       294
Group variable: STATES                       Number of groups    =        14
Time variable: YEAR
                                             Obs per group:  min =        21
                                                             avg =        21
                                                             max =        21

Number of instruments =    207               Wald chi2(4)        =  15032.84
                                             Prob > chi2         =    0.0000
One-step results

                    transportpc       Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

                    transportpc
                            L1.    1.026985   .0109153    94.09   0.000     1.005592    1.048379

              RAINFALLIntegermm    3.86e-07   2.87e-07     1.35   0.178    -1.76e-07    9.49e-07
TEMPERATUREIntegerdegreecelsis    -.0000778   .0001291    -0.60   0.547    -.0003309    .0001753
                  LITERACYRATE       .00003   7.84e-06     3.83   0.000     .0000146    .0000453
                         _cons     .0004917   .0030187     0.16   0.871    -.0054248    .0064082

Instruments for differenced equation
        GMM-type: L(2/.).transportpc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

TRADE AND HOTELS

```
. xtabond tradeandhotelspc RAINFALLIntegermm TEMPERATUREIntegerdegreecelsis LITERACYRATE

Arellano-Bond dynamic panel-data estimation  Number of obs       =       294
Group variable: STATES                       Number of groups    =        14
Time variable: YEAR
                                             Obs per group:  min =        21
                                                             avg =        21
                                                             max =        21

Number of instruments =    207               Wald chi2(4)        =  16965.22
                                             Prob > chi2         =    0.0000
One-step results

               tradeandhotelspc       Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

               tradeandhotelspc
                            L1.    1.068052   .0104506   102.20   0.000     1.047569    1.088534

              RAINFALLIntegermm    1.10e-06   5.36e-07     2.06   0.040     5.21e-08    2.15e-06
TEMPERATUREIntegerdegreecelsis    -6.68e-06   .0002369    -0.03   0.978    -.0004709    .0004576
                  LITERACYRATE     .0000255   .0000149     1.71   0.087    -3.73e-06    .0000547
                         _cons    -.0016271   .0055223    -0.29   0.768    -.0124507    .0091965
```

BANKING AND INSURANCE

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =       294
Group variable: STATES                       Number of groups      =        14
Time variable: YEAR
                                             Obs per group:    min =        21
                                                               avg =        21
                                                               max =        21

Number of instruments =     207              Wald chi2(4)          =  12930.07
                                             Prob > chi2           =    0.0000
One-step results
```

bankinginsurancepc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
bankinginsurancepc L1.	1.058273	.009942	106.44	0.000	1.038787	1.077759
RAINFALLIntegermm	1.44e-07	6.37e-07	0.23	0.822	-1.11e-06	1.39e-06
TEMPERATUREIntegerdegreecelsis	-.0001496	.0002832	-0.53	0.597	-.0007047	.0004055
LITERACYRATE	.0000389	.0000156	2.49	0.013	8.23e-06	.0000696
_cons	.0019446	.0065719	0.30	0.767	-.0109361	.0148252

```
Instruments for differenced equation
        GMM-type: L(2/.).bankinginsurancepc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

REAL ESTATE

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =       294
Group variable: STATES                       Number of groups      =        14
Time variable: YEAR
                                             Obs per group:    min =        21
                                                               avg =        21
                                                               max =        21

Number of instruments =     207              Wald chi2(4)          =  12761.44
                                             Prob > chi2           =    0.0000
One-step results
```

realestatepc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
realestatepc L1.	1.081779	.012201	88.66	0.000	1.057866	1.105693
RAINFALLIntegermm	-3.00e-07	2.76e-07	-1.09	0.276	-8.41e-07	2.40e-07
TEMPERATUREIntegerdegreecelsis	.0001877	.0001251	1.50	0.134	-.0000575	.0004328
LITERACYRATE	.0000107	7.38e-06	1.45	0.146	-3.73e-06	.0000252
_cons	-.0044947	.0028903	-1.56	0.120	-.0101597	.0011702

```
Instruments for differenced equation
        GMM-type: L(2/.).realestatepc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

PUBLIC ADMINISTRATION

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =        294
Group variable: STATES                       Number of groups      =         14
Time variable: YEAR
                                             Obs per group:    min =         21
                                                               avg =         21
                                                               max =         21

Number of instruments =    207               Wald chi2(4)          =   12791.28
                                             Prob > chi2           =     0.0000
One-step results
```

publicadminpc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
publicadminpc						
L1.	1.034361	.0154794	66.82	0.000	1.004022	1.0647
RAINFALLIntegermm	2.51e-07	3.16e-07	0.80	0.426	-3.67e-07	8.70e-07
TEMPERATUREIntegerdegreecelsis	-.0001217	.0001508	-0.81	0.420	-.0004173	.0001739
LITERACYRATE	.0000291	9.79e-06	2.97	0.003	9.92e-06	.0000483
_cons	.0016523	.0035586	0.46	0.642	-.0053225	.0086271

```
Instruments for differenced equation
        GMM-type: L(2/.).publicadminpc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```

OTHER SERVICES

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =        294
Group variable: STATES                       Number of groups      =         14
Time variable: YEAR
                                             Obs per group:    min =         21
                                                               avg =         21
                                                               max =         21

Number of instruments =    207               Wald chi2(4)          =   15156.12
                                             Prob > chi2           =     0.0000
One-step results
                                  (Std. Err. adjusted for clustering on STATES)
```

otherservicespc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
otherservicespc						
L1.	1.048802	.0289552	36.22	0.000	.9920507	1.105553
RAINFALLIntegermm	6.16e-07	4.64e-07	1.33	0.184	-2.94e-07	1.53e-06
TEMPERATUREIntegerdegreecelsis	5.80e-06	.0002843	0.02	0.984	-.0005513	.0005629
LITERACYRATE	.000032	.0000162	1.97	0.049	1.96e-07	.0000638
_cons	-.0017242	.0065229	-0.26	0.792	-.0145089	.0110604

```
Instruments for differenced equation
        GMM-type: L(2/.).otherservicespc
        Standard: D.RAINFALLIntegermm D.TEMPERATUREIntegerdegreecelsis D.LITERACYRATE
Instruments for level equation
        Standard: _cons
```