INTERNATIONAL JOURNAL OF RESEARCH IN COMMERCE, ECONOMICS & MANAGEMENT

IJRCM

A Monthly Double-Blind Peer Reviewed (Refereed/Juried) Open Access International e-Journal - Included in the International Serial Directories

Indexed & Listed at:

Ulrich's Periodicals Directory ©, ProQuest, U.S.A., EBSCO Publishing, U.S.A., Cabell's Directories of Publishing Opportunities, U.S.A.,
Open J-Gage, India [link of the same is duly available at Inflibnet of University Grants Commission (U.G.C.)],
Index Copernicus Publishers Panel, Poland with IC Value of 5.09 & number of libraries all around the world.

Circulated all over the world & Google has verified that scholars of more than 2980 Cities in 165 countries/territories are visiting our journal on regular basis.

Ground Floor, Building No. 1041-C-1, Devi Bhawan Bazar, JAGADHRI – 135 003, Yamunanagar, Haryana, INDIA

http://ijrcm.org.in/

CONTENTS

CALL FOR MANUSCRIPTS

We invite unpublished novel, original, empirical and high quality research work pertaining to recent developments & practices in the areas of Computer Science & Applications; Commerce; Business; Finance; Marketing; Human Resource Management; General Management; Banking; Economics; Tourism Administration & Management; Education; Law; Library & Information Science; Defence & Strategic Studies; Electronic Science; Corporate Governance; Industrial Relations; and emerging paradigms in allied subjects like Accounting; Accounting Information Systems; Accounting Theory & Practice; Auditing; Behavioral Accounting; Behavioral Economics; Corporate Finance; Cost Accounting; Econometrics; Economic Development; Economic History; Financial Institutions & Markets; Financial Services; Fiscal Policy; Government & Non Profit Accounting; Industrial Organization; International Economics & Trade; International Finance; Macro Economics; Micro Economics; Rural Economics; Co-operation; Demography: Development Planning; Development Studies; Applied Economics; Development Economics; Business Economics; Monetary Policy; Public Policy Economics; Real Estate; Regional Economics; Political Science; Continuing Education; Labour Welfare; Philosophy; Psychology; Sociology; Tax Accounting; Advertising & Promotion Management; Management Information Systems (MIS); Business Law; Public Responsibility & Ethics; Communication; Direct Marketing; E-Commerce; Global Business; Health Care Administration; Labour Relations & Human Resource Management; Marketing Research; Marketing Theory & Applications; Non-Profit Organizations; Office Administration/Management; Operations Research/Statistics; Organizational Behavior & Theory; Organizational Development; Production/Operations; International Relations; Human Rights & Duties; Public Administration; Population Studies; Purchasing/Materials Management; Retailing; Sales/Selling; Services; Small Business Entrepreneurship; Strategic Management Policy; Technology/Innovation; Tourism & Hospitality; Transportation Distribution; Algorithms; Artificial Intelligence; Compilers & Translation; Computer Aided Design (CAD); Computer Aided Manufacturing; Computer Graphics; Computer Organization & Architecture; Database Structures & Systems; Discrete Structures; Internet; Management Information Systems; Modeling & Simulation; Neural Systems/Neural Networks; Numerical Analysis/Scientific Computing; Object Oriented Programming; Operating Systems; Programming Languages; Robotics; Symbolic & Formal Logic; Web Design and emerging paradigms in allied subjects.

Anybody can submit the **soft copy** of unpublished novel; original; empirical and high quality **research work/manuscript** ***anytime*** in ***M.S. Word format*** after preparing the same as per our **GUIDELINES FOR SUBMISSION**; at our email address i.e. infoijrcm@gmail.com or online by clicking the link **online submission** as given on our website (***FOR ONLINE SUBMISSION, CLICK HERE***).

GUIDELINES FOR SUBMISSION OF MANUSCRIPT

1. **COVERING LETTER FOR SUBMISSION:**

DATED: _____________

THE EDITOR
IJRCM

Subject: **SUBMISSION OF MANUSCRIPT IN THE AREA OF.**

(e.g. Finance/Marketing/HRM/General Management/Economics/Psychology/Law/Computer/IT/Engineering/Mathematics/other, please specify)

DEAR SIR/MADAM

Please find my submission of manuscript entitled '____' for possible publication in your journals.

I hereby affirm that the contents of this manuscript are original. Furthermore, it has neither been published elsewhere in any language fully or partly, nor is it under review for publication elsewhere.

I affirm that all the author (s) have seen and agreed to the submitted version of the manuscript and their inclusion of name (s) as co-author (s).

Also, if my/our manuscript is accepted, I/We agree to comply with the formalities as given on the website of the journal & you are free to publish our contribution in any of your journals.

NAME OF CORRESPONDING AUTHOR:
Designation:
Affiliation with full address, contact numbers & Pin Code:
Residential address with Pin Code:
Mobile Number (s):
Landline Number (s):
E-mail Address:
Alternate E-mail Address:

NOTES:
a) The whole manuscript is required to be in ***ONE MS WORD FILE*** only (pdf. version is liable to be rejected without any consideration), which will start from the covering letter, inside the manuscript.
b) The sender is required to mentionthe following in the **SUBJECT COLUMN** of the mail:
New Manuscript for Review in the area of (Finance/Marketing/HRM/General Management/Economics/Psychology/Law/Computer/IT/Engineering/Mathematics/other, please specify)
c) There is no need to give any text in the body of mail, except the cases where the author wishes to give any specific message w.r.t. to the manuscript.
d) The total size of the file containing the manuscript is required to be below **500 KB**.
e) Abstract alone will not be considered for review, and the author is required to submit the complete manuscript in the first instance.
f) The journal gives acknowledgement w.r.t. the receipt of every email and in case of non-receipt of acknowledgment from the journal, w.r.t. the submission of manuscript, within two days of submission, the corresponding author is required to demand for the same by sending separate mail to the journal.

2. **MANUSCRIPT TITLE**: The title of the paper should be in a 12 point Calibri Font. It should be bold typed, centered and fully capitalised.

3. **AUTHOR NAME (S) & AFFILIATIONS**: The author (s) **full name**, **designation**, **affiliation** (s), **address**, **mobile/landline numbers**, and **email/alternate email address** should be in italic & 11-point Calibri Font. It must be centered underneath the title.

4. **ABSTRACT**: Abstract should be in fully italicized text, not exceeding 250 words. The abstract must be informative and explain the background, aims, methods, results & conclusion in a single para. Abbreviations must be mentioned in full.

5. **KEYWORDS**: Abstract must be followed by a list of keywords, subject to the maximum of five. These should be arranged in alphabetic order separated by commas and full stops at the end.

6. **MANUSCRIPT**: Manuscript must be in ***BRITISH ENGLISH*** prepared on a standard A4 size ***PORTRAIT SETTING PAPER***. It must be prepared on a single space and single column with 1" margin set for top, bottom, left and right. It should be typed in 8 point Calibri Font with page numbers at the bottom and centre of every page. It should be free from grammatical, spelling and punctuation errors and must be thoroughly edited.

7. **HEADINGS**: All the headings should be in a 10 point Calibri Font. These must be bold-faced, aligned left and fully capitalised. Leave a blank line before each heading.

8. **SUB-HEADINGS**: All the sub-headings should be in a 8 point Calibri Font. These must be bold-faced, aligned left and fully capitalised.

9. **MAIN TEXT**: The main text should follow the following sequence:

   INTRODUCTION

   REVIEW OF LITERATURE

   NEED/IMPORTANCE OF THE STUDY

   STATEMENT OF THE PROBLEM

   OBJECTIVES

   HYPOTHESES

   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

   RECOMMENDATIONS/SUGGESTIONS

   CONCLUSIONS

   SCOPE FOR FURTHER RESEARCH

   ACKNOWLEDGMENTS

   REFERENCES

   APPENDIX/ANNEXURE

   It should be in a 8 point Calibri Font, single spaced and justified. The manuscript should preferably not exceed ***5000 WORDS***.

10. **FIGURES &TABLES**: These should be simple, crystal clear, centered, separately numbered & self explained, and **titles must be above the table/figure**. **Sources of data should be mentioned below the table/figure**. It should be ensured that the tables/figures are referred to from the main text.

11. **EQUATIONS**:These should be consecutively numbered in parentheses, horizontally centered with equation number placed at the right.

12. **REFERENCES**: The list of all references should be alphabetically arranged. The author (s) should mention only the actually utilised references in the preparation of manuscript and they are supposed to follow **Harvard Style of Referencing**. The author (s) are supposed to follow the references as per the following:

- All works cited in the text (including sources for tables and figures) should be listed alphabetically.
- Use (**ed.**) for one editor, and (**ed.s)** for multiple editors.
- When listing two or more works by one author, use --- (20xx), such as after Kohl (1997), use --- (2001), etc, in chronologically ascending order.
- Indicate (opening and closing) page numbers for articles in journals and for chapters in books.
- The title of books and journals should be in italics. Double quotation marks are used for titles of journal articles, book chapters, dissertations, reports, working papers, unpublished material, etc.
- For titles in a language other than English, provide an English translation in parentheses.
- The location of endnotes within the text should be indicated by superscript numbers.

PLEASE USE THE FOLLOWING FOR STYLE AND PUNCTUATION IN REFERENCES:

BOOKS

- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

UNPUBLISHED DISSERTATIONS AND THESES

- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

ONLINE RESOURCES

- Always indicate the date that the source was accessed, as online resources are frequently updated or removed.

WEBSITES

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

THE EFFECT OF CLIMATIC SHOCKS ON AGRICULTURAL PRODUCTION AND FOOD SECURITY IN TIGRAY (NORTHERN ETHIOPIA): THE CASE OF RAYA AZEBO WOREDA

GIRMA BERHE
LECTURER
DEPARTMENT OF ECONOMICS
COLLEGE OF BUSINESS AND ECONOMICS
MEKELLE UNIVERSITY
MEKELLE

ABSTRACT

This study set out to explore the effect of climatic shocks on agricultural production and food security in the Raya Azebo woreda of Tigray region in Northern Ethiopia. In this study, an econometric method is employed to estimate the effect of climatic shocks using rainfall variability as a proxy on the level of per hectare farm output and food security status of the households. The result obtained shows that climatic shocks have a significant adverse effect on the level of agricultural production and food security status of the households. Based on this it is recommended that there should be encouragement of the various indigenous ways of coping with the effect of climate change. There should also be introduction of various new coping mechanisms from which expansion of irrigation is an important one.

JEL CODE
Q12

KEYWORDS
agricultural output, food insecurity, rain variability, Ricardian Approach.

1. INTRODUCTION

The sharp increase in food price in 2008 has led to a come back to the issues of concern on food security at the global level (Wiggins, 2008) and its impact on prospects for achieving the first Millennium Development Goal (MDG), namely, to end poverty and hunger. In relation to this, there will be a need to look in to not only the short term causes that lead to volatile food prices but also the longer-term negative impacts of climate change.

The United Nations Development Programme (UNDP) warns that the progress in human development achieved over the last decade may be slowed down or even reversed by climate change, as new threats emerge to water and food security, agricultural production and access, and nutrition and public health. In fact this report claims that the impacts of climate change such as sea level rise, droughts, heat waves, floods and rainfall variation could, by 2080, push another 600 million people into malnutrition and increase the number of people facing water scarcity by 1.8 billion (UNDP 2008).

Agriculture constitutes the backbone of most African economies. It is the largest contributor to GDP, the biggest source of foreign exchange, accounting for about 40% of the continent's foreign currency earnings; and the main generator of savings and tax revenues. In addition, about two-thirds of manufacturing value-added is based on agricultural raw materials. Agriculture remains crucial for pro-poor economic growth in most African countries, as rural areas support 70-80% of the total population. More than in any other sector, improvements in agricultural performance have the potential to increase rural incomes and purchasing power for large numbers of people to lift them out of poverty (NEPAD, 2002; Wiggins, 2006).

Climate change, however, is considered as posing the greatest threat to agriculture and food security in the 21st century, particularly in many of the poor, agriculture-based countries of sub-Saharan Africa (SSA) with their low capacity to effectively cope (Shah et al., 2008;). African agriculture is already under stress as a result of population increase, industrialization and urbanization, competition over resource use, degradation of resources, and insufficient public spending for rural infrastructure and services. The impact of climate change is likely to exacerbate these stresses even further.

Rural households tend to rely heavily on climate-sensitive resources such as local water supplies and agricultural land; climate-sensitive activities such as arable farming and livestock husbandry; and natural resources such as fuel wood and wild herbs. Climate change can reduce the availability of these local natural resources, limiting the options for rural households that depend on natural resources for consumption or trade. Land may become less fertile; there may be less local fuel wood for cooking. Of course, shifts in climate will bring different changes to different regions. Some areas may see greater natural resources because of increased rainfall, for example. But on balance, the poorest regions are most likely to suffer because they are least able to adjust to new conditions.

2. LITERATURE REVIEW

2.1 ISSUES IN CLIMATE CHANGE

The issue of climate change and its different impacts has been quite a significant concern throughout various fields of science since the 20th century. The concern has been more of whether it is happening and to what extent its impact can be ascertained. The debate is still continuing as to whether indeed climate change is happening and whether the causes are factors which are frequently associated with carbon emission. But the intergovernmental panel on climate change (IPCC) reported that the global temperature has increased by 0.6^{0}C during the 20th century and since 1950 there appears to be a decline in the frequency of low temperatures while there looks to be a modest rise in the frequency of high temperatures. The IPCC also estimates that precipitation increased during the 20th century by 0.5% to 1% every ten years in most of the high and middle latitudes of the continents in the northern hemisphere and from 0.2% to 0.3% in the tropical land areas (10° north to 10° south). Concerning rains however there has been a decrease in the subtropical land areas of the northern hemisphere (10° North to 30°North) during the 20th century by about 0.3% every ten years.

Regarding the impact of climate change, various authors (Mandelson et al, 2000; Sultz et al, 1993; Kurukulasuriya&Rosenthal 2003,) have argued that climate change has had a visible effect on the physical and biological systems of the globe. The biological effect does not simply mean it affects human beings but also – agriculture, forestry, fishing and so on – will be affected as well. One of the economic activities that are severely exposed to the effects of climatic changes is agriculture (Kabubo-Mariara and J.Karanja, 2007). So the climate change that has been taking place over the years is argued to have a significant effect on agricultural production. Agriculture is expected to suffer the most because climatic conditions set the limits for agricultural methods. Therefore, any change will obviously affect the agricultural ecosystems and the average outputs (in time and space) (Kabubo-Mariara and J.Karanja, 2007)

2.2 APPROACHES TO ANALYSE EFFECT OF CLIMATE CHANGE ON AGRICULUTRE AND FINDINDGS

According to (Kurukulasuriya & Rosenthal 2003) climate affects agriculture fundamentally in four ways. Firstly, changes in temperature and precipitation directly affect crop production and can even go as far as the pattern of the distribution of agro-ecological zones. Secondly, the expected rise in carbon dioxide which is associated with climate change is believed to have a positive effect on agricultural production due to greater water use efficiency and higher rates of plant photosynthesis. Thirdly, availability of water and runoff which are critical for crop production are expected to be influenced by climate change. Lastly, climate variability is expected to affect agricultural losses since it can lead to increased frequency of droughts and floods.

A large body of literature has developed to analyze the various effects of climate change on agriculture taking developed and developing countries particularly as of the early 1990s. In all these body of literature, two methods of analysis are clearly observed. One is what is known as the Ricardian approach which tries to measure the impact of climate change by trying to quantify the effect of it on net revenue from land which of course is supposed to represent value of land. The other is what is known us the production function approach which tries to measure the effect of climate change on agriculture by taking climate variables as additional determinants of agricultural output besides the usual factors of production. In what follows then a review of such studies is made initially on those that use the Ricardian approach and next those that used the production function approach.

To begin with a study of the effect of climate change on agriculture in Burkina Faso using the Ricardian approach by Ouedraogo et al (2010) has shown that temperature and precipitation have a significant effect on agricultural output.

Mendelsohn et al. (2003) used the same approach as the above study to analyze the relationship between climate and rural income based on country data for two US states and municipos from Brazil. Their findings show that agricultural net revenue increases when there are favorable climate increases agriculture net revenues and thus per capita incomes. They conclude that climate is an important determinant of household welfare and therefore that providing new technology and capital may be an ineffective strategy for increasing rural incomes in hostile climate regions.

Mendelsohn et al. (2000) explore climate change impacts on African agriculture using the

IPCC (Intergovernmental Panel on Climate Change) forecast of future CO2 levels in the atmosphere by 2100. Because of the lack of African studies that calibrate climate sensitivity, the authors rely on studies of climate sensitivity for the US. Their results show that the most pessimistic forecast implies that African countries may lose 47% of their agricultural revenue because of global warming, while a cross-sectional forecast suggests losses of only 6% of agricultural GDP. With the expected fall in the contribution of agriculture to GDP over time, the authors conclude that the damage from climate change to African agriculture may be expected to range from 0.13% to 2% of GDP by 2100. They further argue that every region in Africa will experience some negative climate change impacts. They caution that their findings may be quite optimistic given that they are based on US climate response functions, and they call for African countries to estimate the climate effects and to understand adaptation options for Africa.

Seo et al. (2005) employ the Ricardian approach to measure the impact of climate change on Sri Lankan agriculture, focusing on four major crops. The authors find that global warming is expected to be harmful to Sri Lanka but increases in rainfall will be beneficial. They also find that with warming the already dry regions are expected to lose large proportions of their current agriculture, but the cooler regions are predicted to remain the same or increase their output. They conclude that climate change damages could be extensive in tropical developing countries but will depend on actual climate scenarios. Tol (2002) assesses the impacts of climate change on agriculture, forestry and other aspects of human welfare using GCM (Global Circulation Model) based scenarios of climate change. This study is based on a number of countries. The results show that a 1°C increase in the global mean surface air temperature would have a positive impact on the OECD, China and Middle East countries but a negative effect on others. The author further argues that the distributional aspects of climate change and the uncertainty about the impacts can be extremely large.

Kumar et al. (1998) use farm level data to examine and the agricultural impacts and adaptation options of climate change in India. They find that adverse climate change would lead to huge losses in agricultural revenues, even if farmers were to adapt their farming practices to climate change. Molua (2002), in an analysis of the impact of climate on agriculture in Cameroon, finds that increased precipitation is beneficial for crop production and that farm level adaptations are associated with increased farm returns. Etsia et al. (2002) find that a combination of increasing CO2, temperature and rainfall is likely to have adverse effects on agricultural production in Tunisia. These results support findings by Rosenzweig and Parry (1994) who find that increased CO2 and temperatures reduce rice production in India.

Turpie et al. (2002) analyze the economic impact of climate change in South Africa. Their study addresses impacts on natural, agricultural, man-made and human capital. They use the production function approach to measure the natural capital lost from global warming. They predict the impact of climate change on rangelands will be positive, with the fertilization impact of CO2 outweighing the negative effects of reduced precipitation. However, they find the impact of climate change on maize production will be negative both 'with' and 'without' CO2 fertilization. They found estimates of impact of climate change for other crops were not reliable.

Other studies that use the production function approach argue that climate change may have beneficial effects on agriculture, especially in more arable lands, but adverse effects on more arid zones (for example Downing 1992). The positive impact of CO2 fertilization effects and rising temperatures may however be determined by the adaptation measures adopted by farmers. Studies that support this argument include Inglesis and Minguez (1997), Mohamed et al. (2002) and Schulze et al. (1993). Inglesis and Minguez (1997) report that with a combination of different adaptation strategies in Spain, farmers not only derived higher crop yields with increased temperatures but also used water and land more efficiently. Mohamed et al. (2002) argue that climate change factors are significant determinants of millet productivity in Niger and predict a huge fall in crop productivity by 2025 as a result of global warming. Downing (1992) argues that potential food production in Kenya will increased if increased temperatures are accompanied by high rainfall, while marginal zones will be adversely affected by decreased rainfall. Fischer and Velthuizen (1996) (as cited by Kurukulasuriya & Rosenthal 2003) note that food productivity in Kenya may well increase with higher levels of atmospheric CO2 and climate change induced increases in temperatures accompanied by some increases in precipitation, as predicted by several GCMs. These arguments are also supported by Makadho (1996), who argues that maize production in Zimbabwe is expected to fall as a result of increased temperatures that shorten the crop growth period. Downing (1992) also shows that shifts in agro-climate potential would affect national food production and land use in Zimbabwe.

Deressa et al. (2005), use the Ricardian model to analyze the impact of climate on South African sugarcane production, using time series data for both irrigated and dry land farming.

The authors show that climate change has significant non-linear impacts on net revenue with higher sensitivity to future increases in temperature than precipitation. Further, they find that doubling CO2, which leads to rises in temperatures by 2°C and precipitation by 7%, would have a negative impact on sugarcane production. They also find that irrigation in sugarcane production does not provide an effective option for reducing climate change damages in South Africa. Gbetibouo and Hassan (2005) also use the Ricardian approach to analyze the economic impact of climate change on major South African field crops. They find that crops are quite sensitive to marginal changes in temperature compared to changes in precipitation.

Contrary to findings by Deressa et al. (2005), they argue that irrigation would be an effective adaptation measure for limiting the harmful effects of climate change, and that the impact of climate change is agro-ecological zone specific and therefore that location is important in dealing with climate change issues.

Schulze et al. (1993) in a study of South Africa, Lesotho and Swaziland find climate change to be associated with potential increases in maize production, though they argue that it is likely to have little effect in marginal areas where yields are already low. Sivakumar (1992) in a study for Niger argues that climate has significant implications for agriculture because farmers tend to change their farming patterns with climate change and this is likely to have adverse environmental consequences. Onyeji and Fischer (1994) in a study for Egypt find that adverse climate change will lead to a decline in agricultural production and in GDP.

However, they argue that large instruments in adaptation are required to make significant gains in avoiding the adverse impacts of climate change on the economy. Yates and Strzepek (1998) argue that global warming is likely to have adverse consequences for the Egyptian economy. Benson and Clay (1998) in a study involving a number of African countries argue that developing countries in Africa may be less prone to climate change shocks than industrial countries.

Frank Millard (2005) shows that climate change had a significant effect on commercial navigation in Canada and the effect on the cost of shipping is estimated to be in millions of dollars

The recent food-price crisis exposed the fragility of the global food system. A paradigm shift is underway, caused by the deepening integration of agricultural, energy and financial markets in a resource-constrained world made more vulnerable by climate change (Wise and Murphy 2012).

3. IMPORTANCE OF THE STUDY

A recently released intergovernmental panel on climate change(IPCC[1]) report, as quoted in Iglesias(2006), suggests farmers in warmer and drier conditions in the Sahelian region of Africa have already curtailed their cropping seasons. Yields from rain-fed agriculture are expected to fall as much as 50 percent in some poor African countries. Fisheries production will likely also decline, according to the report. Rural regions in Latin America are also expected to be affected. In the region's drier areas, climate change is expected to lead to increases in the saline content of the soil, which reduces crop productivity. As previously productive lands become more arid, Latin America could also see greater desertification.

The situation is the same, not to say further accentuated, in Ethiopia. The country has been exposed to frequent climatic shocks mostly in the form of intermittent decline and total absence of rain in the usual rainy seasons of the country. These shocks have resulted in not only a consequent decline in agricultural production and food shortage and even famine but they have also led to a degeneration in the house hold level capability to produce food and attain food security. Climate change affects food security through a reduction in food production, by destabilizing food supplies, by limiting access to food due to a rise in food price and by crippling food utilization since climate change may initiate a vicious circle where infectious diseases, including water-borne diseases, cause or compound hunger, which, in turn, makes the affected population more susceptible to those diseases. (Schmidhuber and Tubiello, 2007).

4. STATEMENT OF THE PROBLEM

There have been quite numerous studies on many issues as related to food security and agricultural production in Ethiopia and quite some in Tigray (Tsegu, 2006; Devereux, 2000 and WFP, 2006.) which focused on the determinants of food security and impact of various interventions made by the government and other stake holders on the issue of food security. As related to climate change and food security some studies have been made for Ethiopia (Assefa et,al,2009; UNDP,2007 and Temesgen,et,al,2008;) which mostly focused on farmer perceptions and adapting strategies in the face of climate change. This shows that the study of effect of climate change on food security in Ethiopia has not been that much delved in to while in Tigray it is almost untouched and this study tries to contribute its part in filling this gap.

5. OBJECTIVIES OF THE STUDY

The overall objective of this study is to investigate the effect of climatic shocks on agricultural productivity and food security in Raya Azebo woreda of the southern zone of Tigray.

The specific objectives are:

- To assess the effect of climatic shocks on agricultural production
- To assess the effect of climatic shocks on food security
- To draw some recommendations

6. HYPOTHESIS

This study tries to test the following two hypotheses

- Climatic shocks as represented by rain failure have an important negative effect on agricultural output of farm households
- Climatic shocks as represented by rain failure have an important positive effect on the food insecurity level of farm households

7. DATA AND METHODOLOGY

Data for this study is mainly primary which collected using questionnaire is. A representative sample of 103 households is interviewed from whom 97 are found to be useful. This sample is generated from four rural districts (Tabias) in Raya Azebo woreda of the southern zone in Tigray. The sampling technique used is random sampling based on the list of residents of the districts obtained from administration offices of the districts (Tabias).

This study employs what is usually known as the Ricardian method as developed by Mandelson et al (1994) to measure the value of climate in US agriculture. This method enables accounting for the direct impact of climate on crop yields as well as the indirect substitution among different inputs including the introduction of various activities, and other potential adaptations to a variety of climates by directly measuring farm prices or revenues.

The value of land reflects the sum of discounted future profits, which may be derived from its use. Any factor that influences the productivity of land will be reflected in land values of net revenue. Therefore, the value of land or net revenue contains information about the value of climate as one attribute of land productivity. By regressing land values or net revenue on a set of environmental inputs, the Ricardian approach makes it possible to measure the marginal contribution of each input to farm income as capitalized in land value.

Following Mandelson et al (2000) the Ricardian approach involves specifying a net revenue function of the following form.

$$\mathbf{R = \sum P_i Q_i(X, F, G, Z) - \sum P_x X} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{1}$$

Where **R** is net revenue per hectare, $\mathbf{P_i}$ is the market price of crop **i** $\mathbf{Q_i}$ is output of crop **i, X** is a vector of purchased inputs, **F** is a vector of climate variables, **G** is a set of soil variables and Z is a vector of household characteristics.

8. RESULTS AND DISCUSSION

8.1 DESCRIPTION OF THE STUDY AREA

Tigray is one of the regional states in the Ethiopia which is located at 12^{o}15 -4^{o}57 longitude and 36^{o}27- 39^{o}59 latitude. The region of Tigray shares common borders with Eritrea in the north, the State of Afar in the east, the State of Amhara in the south, and the Republic of the Sudan in the west. According to the 2007 CSA census Tigray has a population of 4,314,456, out of which about 80% are livening in rural areas with their livelihoods strongly tied with agriculture. The profile of Tigray posted on Tigray online, states that from the total land area in the region 1.5 million hectares of land is cultivable, of which one million hectares is being cultivated, while 420,877 hectares of land is terraced. The region is also known for its export items of cotton, incense, sesame and minerals. Administratively, the region is divided in to seven zonal administrations, namely, Western, North western, Central, Eastern, South eastern, Southern and Mekelle special zones.

For this purpose of this study the Southern Zone which has a population of 1,085,959 will be taken. From this zone one woreda; namely, Raya Azebo woreda whose population is 147,063 is taken. This woreda has a vast plain land which is suitable for crop production and animal husbandry as well. However, this woreda has been exposed to frequent rain failures. The recent rain failure had almost a spell of three consecutive years. The frequency of the rain failures is said to have increased somewhat in recent years compared to the situation before two three decades. A lot of people feel that this could be associated with global warming.

The tabias of focus in this woreda are Genetie, Worebaye, Hade Alga and Tsigea. The total population of this tabias is around 25, 000. The tabias are more or less similar in livelihoods since almost completely they depend on agriculture. The type of agriculture practiced is subsistence which makes it completely dependent on the vagaries of nature.

8.2 DESCRIPTION OF HOUSEHOLDS IN THE SAMPLE

A total of 103 households are interviewed with a questionnaire from the four tabias that are chosen for this study. But only 97 questionnaires are found to be useful while the rest 6 turned out to be incorrectly filled.

TABLE 3.1: SAMPLE DISTRIBUTION BY SEX OF HH HEAD AND TABIAS

Name of tabia	Female headed	Male headed	Total
Genetie	9	22	31
Tsigaa	7	19	26
Worebaye	5	13	18
Hadealga	7	15	22
Total	**28**	**69**	**97**

Source own survey 2011

The above table shows that in the sample the proportion of female headed households is quite large since they constitute almost 30 percent (29.9) of total households in the tabias.

The classification of households according to family size and level of education gives the following picture.

TABLE 3.2: HOUSEHOLD SIZE AND EDUCATION LEVEL OF SAMPLE HOUSEHOLDS

Tabia	Household size			Level Education			
	≤ 2	≤ 4	> 4	illiterate	literate	primary	Above primary
Genete	7(22)	16(51.6)	8(25.8)	23(74.2)	5(16.1)	3(9.7)	0
Tsigaa	7(31.8)	15(57.7)	4(30.8)	16(61.6)	5(19.2)	3(11.5)	2(7.7)
Worebaye	5(27.8)	10(55.5)	3(16.7)	11(61.1)	5(27.8)	2(11.1)	0
Hadealga	8(36.4)	11(50)	3(13.6)	14(63.6)	5(22.7)	3(13.6)	0

Source own survey 2011 (figures in parenthesis are percents)

From the above table it is pretty obvious that household size is mostly in the range up to four while in terms of education most of the households are illiterate which makes success rate of various programs and projects to be low.

8.3 RAINFALL VARIABILITY AND AGRICULTURAL OUTPUT

In order to quantify the effect of climatic shocks on agricultural output, the Ricardian approach as explained in the previous two sections of this document is used. Since this approach demands the computation of net revenue per a hectare of land that will be used a measure of the rent value of the land data on farm yield, output prices, inputs used and their cost is collected. Data on a set variables that determine net revenue are also collected this set included household characteristics, soil variables, farm inputs, labour and livestock. Climatic shocks as represented by variability in rain fall and frequency of droughts are included as additional determinants of net revenue. This is then supposed to represent the effect of climatic shocks on food production and hence by extension on food security since the availability of food to agricultural households has a lot to do with own food production.

In the following we present the summery of the statistics of data collected with a view to see the dispersion of data around the mean which can be good representation of data normality.

TABLE 3.3 SUMMERY STATISTICS ON VARIABLES OF INTEREST

S.N	Variable	Obs	Mean	St.D	Min	Max
1	Yield value	97	6122.526	6458.108	275	33700
2	Education of HH head	97	1.072165	2.227889	0	13
3	HH size	97	3.927835	3.093163	1	18
4	Marital Status	97	0.7216495	0.4505152	0	1
5	Fertilizer use	97	18.93814	50.24416	0	356
6	Oxen day used for production	97	33.25773	28.01684	5	115
7	Hired labour for production	97	19.5567	27.0343	0	185
8	Soil type (fertility)	97	0.3298969	0.4726179	0	1
9	Land ownership	97	0.8350515	0.373062	0	1
10	Size of land tilled	97	1.595361	1.806183	0	12
11	Live stock owned	97	3.309278	4.106298	0	20
12	Rain failure	97	0.6185567	0.4882643	0	1

The above statistical table shows the mean and standard deviation of the date collected from the study area. From the table we can see that the value of average production in the area is around six thousand birr which can be judged to be very small. But when we look at this value per hectare of land it becomes 3826 birr per hectare (6122.5/1.6). It can also be observed that average household size is found to be around four which is almost equal to the national average household size in Ethiopia. Another important observation we have is on average about 61% the households have reported a rainfall which is less than what they think is normal. So this shows that the variable which we took as a sign of climatic shock is quite important in the area.

The next thing we do will be estimating the effect on our set of explanatory variable on the value of agricultural output using econometric approach. First let's put present the list of variables used in this study and expected signs of variables in each regression based on theory and prior established researches.

TABLE 3.4: LIST OF VARIABLES IN THE NET REVENUE REGRESSION AND EXPECTED SIGNS

Variable shorthand	Expected sign
Yield value	Dependent variable
Education of HH head	+
HH size	+
Marital Status	+
Fertilizer use	+
Oxen day used for production	+
Hired labour for production	+
Size of land tilled	+
Live stock owned	+
Rain failure	-

Now we estimate the value of yield per hectare of land (taking its log) on a set of household related and land related features including rainfall variability as one determinant variable. The result we obtained is given by the following table.

TABLE 8.5: REGRESSION OF LOG YIELD PER HECTARE ON A SET OF EXPLANATORY VARIABLES

Variable	Coefficient	S.E Robust
Education of HH head	0.0233465	0.320724
HH size	-0.0245727	0.284018
Marital Status	-0.1573	0.174469
Fertilizer use	-0.002871**	0.0011471
Oxen day used for production	0.0269658***	0.0026394
Hired labour for production	0.0079736*	0.0046848
Size of land tilled	0.0492043	0.0510072
Live stock owned	0.0439366*	0.0236947
Rain failure	-0.3609131**	0.1742326
Constant	6.918086	0.1995965

Number of obs = 97 F (9, 87) = 17.98 Prob > F= 0.0000 R-squared = 0.5892 Root MSE = .74832

**** = significant at 1% level, **= significant at 5% level and * = significant at 10% level

The result shows that oxen day used for production, hired labour and livestock owned have a positive and statistically significant effect on the value of agricultural output. This finding is not only intuitive but also in tandem with previous findings of studies on similar topics. This result also shows those household related features are not significant determinants of agricultural output in the area. The result as regards the effect of rain variation from the normal on agricultural output is found to be negative and significant. This finding is in consonance with previous similar studies on the subject.

8.4 RAIN FALL VARIABILITY AND FOOD INSECURITY

Agricultural production in the context of the study area is tantamount to food production since farmers in this area are mostly subsistence farmers. The climatic shocks as measured by respondents' assessment of the rain that they get compared to what they may call best. Respondents were asked to reply wither the negative deviation of the rain they got in this season is large or small. So it becomes a dummy variable which takes one when they say the variation is large – which means the rain they got is very small compared to the so called best- and zero when they say the rain they got is not that smaller from the so called best rain.

In order to see how rain fall variability as measured in the above way affects the food security status of the households, households were asked to tell themselves whether they feel food secure or insecure by their own judgment. So the dependent variable namely food insecurity is a binary variable which is one when the household responded food insecure while it takes the values of zero when the household responds food secure. The result of this logit regression is given by the following table.

TABLE 8.6: LOGISTIC REGRESSION OF FREQUENCY OF FOOD SHORTAGES ON A SET OF EXPLANATORY VARIABLES

Variable	Coefficient	S.E
Education of HH head	-0.959756	0.1181021
HH size	0.998167	0.1173479
Marital Status	0.1294658	0.5812322
Fertilizer use	-0.0049874	0.0048689
Land ownership	-0.783277	0.9003972
Size of land owned	-0.0094699	0.2289707
Live stock owned	-0.0073185	0.0632274
Value of Agri. Asset	0.0006192	0.0004348
Loan taking/not	0.0359832	0.5675511
Rain failure	0.7698322	0.5720356
Constant	0.8745111	1.088051

The result shows that the explanatory variables are with the correct sign but are not significant. And as such it can be said that use of fertilizer, land ownership, livestock ownership and level of education of the household head are factors that work against food insecurity. On the other hand, household size and rain failures and marital status that looks to contribute to increased food insecurity. The variable of interest which is rain failure appears to have a positive link to the probability of becoming food insecure.

9. CONCLUDING REMARKS

This study has indicated that climatic shocks as represented by rain fall variability have a significant adverse effect on the level of agricultural production. The impact on food insecurity is also found to be plausibly that of accentuating food insecurity. Thus the main recommendation that can be drawn is that there is a need to encourage and help farmers in developing coping up mechanisms. The government can also think of expanding irrigation schemes in this area as various studies have shown that the area is rich in underground eater.

10. LIMITATIONS

The main limitation of this study is the inability to get data on temperature and rainfall which is peculiar to the study sites which are tabias. These are the lowest administrative levels in the context of Ethiopia. As a result of this, the study is forced to resort to the perception of the rain level by farmers' which is used as a proxy for climatic shocks.

11. SCOPE FOR FURTHER RESEARCH

The issue of climate change and its effect on various things is still an area that needs to be explored in further detail and with much more rigorous approaches. So in relation to the topic that this study tried to explore we foresee further research mainly in relation to the effect of climate change on agricultural productivity by employing data over a relatively large area and longer time span. Therefore, study of this topic using a vast cross sectional, time serious and/or panel data together with more advanced research methodologies will be worth doing.

ACKNOWLEDGMENTS

I am grateful for the financial support we received from Mekelle University to undertake this research. Without this financial grant the research would not have been possible.

REFERENCES

1. ----- (2006) Agricultural Growth and Poverty Reduction: A Scoping Study Ottawa, IDRC
2. ----- (2007) "Climate Change National Adaptation Programme Of Action Of Ethiopia, June, Addis Ababa,Ethiopia
3. Assefa Admassie, Berhanu Adenew, and Abebe Tadege, (2006) "Perceptions of Stakeholders on Climate Change and Adaptation Strategies in Ethiopia" IFPRI and EEA

4. Deressa T, Hassan R & Poonyth, D, 2005 "Measuring the economic impact of climate change on South Africa's sugarcane growing regions", Agrekon 44(4): 524–542.
5. Devereux, S. (2000) "Food insecurity in Ethiopia" A discussion paper for DIFID, AA, Ethiopia
6. FAO(2008) "Climate Change and Food Security: A Frame Work Document", Rome
7. Hunter, Lori,M., (2009) "Rural Livelihoods and Climate Change", Population Reference Bureau, USA
8. Iglesias , Ana (2006) "Climate Change and Agriculture" Universidad Politecinica de Madrid ,Spain
9. Inglesis A & Minguez MI, (1997) "Modeling crop-climate interactions in Spain: Vulnerability and adaptation of different agricultural systems to climate change", Mitigation and Adaptation Strategies for Global Change 1:273-88.
10. Kabubo-Mariara J. and Fredrick K. Karanja (2007) "The Economic Impact of Climate Change on Kenyan Crop Agriculture: A Ricardian Approach", The World Bank Policy Research Working Paper Series 4334
11. Kurukulasuriya P & Rosenthal S. (2003) "Climate change and agriculture: A review of impacts and adaptations" Paper No. 91 in Climate Change Series, Agriculture and Rural Development Department and Environment Department, World Bank, Washington, DC
12. Ludi, Eva (2009) "Climate Change Water and Food Security" London Odi
13. Mohamed AB, Van Duivenbooden N & Abdoussallam S. (2002) "Impact of climate change on agricultural production in the Sahel – Part 1. Methodological approach and case study for millet in Niger", Climate Change 54(3): 327–48.
14. NEPAD (2002)"Comprehensive Africa Agriculture Development Programme"
15. Onyeji SX & Fischer G. (1994) "economic analyses of potential impacts of climate change in Egypt" Global Environmental Change and Policy Dimensions 4(4): 281–299.
16. Ouedraogo M., Leopold Some and Youssouf Dembele (2006) "Economic Impact Assessment of Climate Change on Agriculture in Burkina Faso: A Ricardian Approach", Center for Environmental Economics and Policy in Africa (CEEPA)
17. Rosenzweig C & Iglesias A (eds). (1994) "Implications of climate change for international agriculture: Crop modeling study" (EPA 230-B-94-003), US Environmental Protection Agency, Washington DC
18. Rosenzweig C & Parry ML. (1994) "Potential impact of climate change on world food supply" Nature 367: 133–138.
19. Schmidhuber, T., Tubiello,F.N.,(2007) "Global Food Security Under Climate Change"
20. Schulze RE, Kiker GA & Kunz RP. (1993) "Global climate change and agricultural productivity in southern Africa". Global Environmental Change 3(4): 330–349.
21. Shah, M., Fisher, G. and Van Velthuzien,H.m (2008) "Food Security and Sustainable Agriculture: The Challenges of Climate Change in Sub Saharan Africa". Luxembourg
22. Tigray on line; available at http://www.tigraionline.com/tigraistate.html
23. Timothy A. Wise and Sophia Murphy (2012) "Resolving the Food Crises: Assessing Global Policy Reforms since 2007"
24. Tol RSJ, (2002) "Estimates of the damage costs of climate change", Environment and Resource Economics 21: 47–73.
25. Tsegu, G., (2006). "Impact of Household Extension Package on Food Security and Income of the Rural Households in Tigray: The Case of Kilte Awlaelo Woreda". Addis Ababa University
26. UNDP (2008) "Fighting Climate Change: Human Solidarity in a Divided World"; New York, UNDP
27. WFP(2009) "Food Security And Vulnerability In Selected Towns Of Tigray Region of Ethiopia", Addis Ababa, Ethiopia
28. Wiggins (2008) Rising Food Prices – A Global Crisis; Briefing Paper, London, Odi

REQUEST FOR FEEDBACK

Dear Readers

At the very outset, International Journal of Research in Commerce, Economics & Management (IJRCM) acknowledges & appreciates your efforts in showing interest in our present issue under your kind perusal.

I would like to request you tosupply your critical comments and suggestions about the material published in this issue as well as on the journal as a whole, on our E-mail**infoijrcm@gmail.com** for further improvements in the interest of research.

If youhave any queries please feel free to contact us on our E-mail **infoijrcm@gmail.com**.

I am sure that your feedback and deliberations would make future issues better – a result of our joint effort.

Looking forward an appropriate consideration.

With sincere regards

Thanking you profoundly

Academically yours

Sd/-
Co-ordinator

DISCLAIMER

ABOUT THE JOURNAL

In this age of Commerce, Economics, Computer, I.T. & Management and cut throat competition, a group of intellectuals felt the need to have some platform, where young and budding managers and academicians could express their views and discuss the problems among their peers. This journal was conceived with this noble intention in view. This journal has been introduced to give an opportunity for expressing refined and innovative ideas in this field. It is our humble endeavour to provide a springboard to the upcoming specialists and give a chance to know about the latest in the sphere of research and knowledge. We have taken a small step and we hope that with the active co-operation of like-minded scholars, we shall be able to serve the society with our humble efforts.

Our Other Journals