



ANADOLU UNIVERSITESI

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOOU and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

Impact of climate change on households' welfare in Burkina Faso 24th Annual Conference on Global Economic Analysis

Abdoul Karim ZANHOOU and Bulent ACMA

ANADOLU UNIVERSITY

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ANADOLU ÜNİVERSİTESİ

OUTLINES

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- 1 Introduction and Motivation
- 2 Introduction and Motivation
- 3 Previous works
- 4 Methodology Framework
- 5 Simulation results



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

- Climate change is one of the biggest challenges of the 21st century.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOOU and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Climate change is one of the biggest challenges of the 21st century.
- The threat from climate change is now real, urgent, serious and it is growing over night (Timoci Naulusala 2017)



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOOU and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Climate change is one of the biggest challenges of the 21st century.
- The threat from climate change is now real, urgent, serious and it is growing over night (Timoci Naulusala 2017)
- Burkina Faso is one of the African countries already affected by climate change.



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

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- The threat from climate change is now real, urgent, serious and it is growing over night (Timoci Naulusala 2017)
- Burkina Faso is one of the African countries already affected by climate change.
- It is classified as the 20th most vulnerable country to climate change in the world.



ANADOLU UNIVERSITESI

Introduction and Motivation

- However, it is the 35th least ready to face the climate change threat in the world

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- However, it is the 35th least ready to face the climate change threat in the world
- In the country, climate change is such that "in a single area, it can be observed both floods and drought within a few months" (González et al. 2011).



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

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- In the country, climate change is such that "in a single area, it can be observed both floods and drought within a few months" (González et al. 2011).
- The country will be remarkably affected since its economy is mainly agricultural.



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- However, it is the 35th least ready to face the climate change threat in the world
- In the country, climate change is such that "in a single area, it can be observed both floods and drought within a few months" (González et al. 2011).
- The country will be remarkably affected since its economy is mainly agricultural.
- More than one-third of Burkina Faso's land is degraded with a rate of 360,000 hectares (890,000 acres) per year.



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

- In the country, climate change is characterized by floods, droughts, strong winds and high variability in the duration of the rainy and dry seasons.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- In the country, climate change is characterized by floods, droughts, strong winds and high variability in the duration of the rainy and dry seasons.
- The temperature level in Burkina Faso has risen in the last 50 years.



Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- In the country, climate change is characterized by floods, droughts, strong winds and high variability in the duration of the rainy and dry seasons.
- The temperature level in Burkina Faso has risen in the last 50 years.
- World-Bank, (2011) predicts that temperatures level will increase by 3 to 4°C in the decade of 2080-2099 from their level of 1980-1999 in Burkina Faso.
- Also a 1.4-1.6°C rise of temperature is expected by 2050 (GIEC, 1997).



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

- Rainfall level is also affected by the Climate change in the country.

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



ANADOLU UNIVERSITESI

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Rainfall level is also affected by the Climate change in the country.
- It is expected a 10% drop in the rainfall level by 2050.



ANADOLU UNIVERSITESI

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Rainfall level is also affected by the Climate change in the country.
- It is expected a 10% drop in the rainfall level by 2050.
- The table below show a variation of some rainfall indicators in Burkina Faso.



ANADOLU UNIVERSITESI

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

	1961–1969	1990–2009
<i>ANNUAL RAINFALL AMOUNT (MM/Y)</i>	895	817 (–9 %)
<i>DATE OF THE SEASON ONSET (DAYS)</i>	5-Dec	16-May
<i>DATE OF THE END OF SEASON (DAYS)</i>	30-Sep	30-Sep
<i>SEASON DURATION (DAYS)</i>	141	137 (–3 %)
<i>NUMBER OF RAIN DAYS (DAYS)</i>	53	48 (–9 %)
<i>MEAN DAILY RAINFALL (MM/D)</i>	14	13 (–7 %)
<i>MAXIMUM DAILY RAINFALL (MM/D)</i>	68	68
<i>MEAN DRY SPELL LENGTH (DAYS)</i>	3	3

Figure: Changes in rainfall regime over Burkina Faso,
(Boubacar , et al., 2014))



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

- In this context climate change will be an obstacle for food security in the country.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



ANADOLU UNIVERSITESI

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- In this context climate change will be an obstacle for food security in the country.
- In mid-2020, there were more than two million severely food insecure people in Burkina Faso



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- In this context climate change will be an obstacle for food security in the country.
- In mid-2020, there were more than two million severely food insecure people in Burkina Faso
- Therefore, it is essential to assess the possible climate change effects and identify adaptation and mitigation strategies.



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- However, the topic of climate change is not well investigated in the literature for the country.



ANADOLU ÜNİVERSİTESİ

Introduction and Motivation

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- However, the topic of climate change is not well investigated in the literature for the country.
- Therefore, this paper aims to fill this gap by analyzing the households' welfare impact of climate change in Burkina Faso.



Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- There are two types of studies analyzing climate change effect on households welfare:



ANADOLU ÜNİVERSİTESİ

Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- There are two types of studies analyzing climate change effect on households welfare:
- On one hand, there are studies examining the impact of climate change on welfare using , production, consumption, and households' income as indicators.



Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- There are two types of studies analyzing climate change effect on households welfare:
- On one hand, there are studies examining the impact of climate change on welfare using , production, consumption, and households' income as indicators.
- On the other hand, studies analyzing the effect of global warming on households' subjective well-being.



ANADOLU UNIVERSITESI

Previous works

- The few existing researches in Burkina Faso analyze climate change households' welfare impact using quantitative measures.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Previous works

- The few existing researches in Burkina Faso analyze climate change households' welfare impact using quantitative measures.
- For instance, Ouedraogo et al. (2006) evaluate the impact of climate change on agriculture production

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- The few existing researches in Burkina Faso analyze climate change households' welfare impact using quantitative measures.
- For instance, Ouedraogo et al. (2006) evaluate the impact of climate change on agriculture production
- Diarra et al. (2017) examine climate change's impact on cotton production



Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- The few existing researches in Burkina Faso analyze climate change households' welfare impact using quantitative measures.
- For instance, Ouedraogo et al. (2006) evaluate the impact of climate change on agriculture production
- Diarra et al. (2017) examine climate change's impact on cotton production
- Zidouemba (2017) uses a CGE model to analyze the economic impact of climate change in Burkina Faso



Previous works

- All these studies show a negative impact of climate change in Burkina Faso.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- All these studies show a negative impact of climate change in Burkina Faso.
- For instance, Zidouemba (2017) shows that rural and urban low-income households will be the most affected by global warming in Burkina Faso.



ANADOLU UNIVERSITESI

Previous works

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- All these studies show a negative impact of climate change in Burkina Faso.
- For instance, Zidouemba (2017) shows that rural and urban low-income households will be the most affected by global warming in Burkina Faso.
- In this paper, we propose a new methodology combining a partial and General equilibrium models to analyze climate change welfare effect on households in Burkina Faso.



ANADOLU ÜNİVERSİTESİ

METHODOLOGY FRAMEWORK

- Modeling the effects of climate change on households' welfare requires considering many climatic and economic aspects.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



ANADOLU UNIVERSITESI

METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Modeling the effects of climate change on households' welfare requires considering many climatic and economic aspects.
- Many methods were developed to analyze climate change effect on households welfare



ANADOLU UNIVERSITESI

METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Modeling the effects of climate change on households' welfare requires considering many climatic and economic aspects.
- Many methods were developed to analyze climate change effect on households welfare
- Among these methods, the CGE models are widely used in studies



METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Modeling the effects of climate change on households' welfare requires considering many climatic and economic aspects.
- Many methods were developed to analyze climate change effect on households welfare
- Among these methods, the CGE models are widely used in studies
- In this paper we combine IMPACT and GTAP models to examine the climate change impact on welfare



ANADOLU ÜNİVERSİTESİ

METHODOLOGY FRAMEWORK

- The IMPACT was established by IFPRI in the early 1990s.

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



METHODOLOGY FRAMEWORK

- The IMPACT was established by IFPRI in the early 1990s.
- It is a partial equilibrium model, using for analyzing food production, food demand and prices, trade, income and the population at the national and global level.

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



METHODOLOGY FRAMEWORK

- The IMPACT was established by IFPRI in the early 1990s.
- It is a partial equilibrium model, using for analyzing food production, food demand and prices, trade, income and the population at the national and global level.
- The last version of IMPACT model includes 159 countries, 154 basins, and 62 agricultural commodities markets.

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

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- It is a partial equilibrium model, using for analyzing food production, food demand and prices, trade, income and the population at the national and global level.
- The last version of IMPACT model includes 159 countries, 154 basins, and 62 agricultural commodities markets.
- IMPACT contains global model, regional and national sub-models.



METHODOLOGY FRAMEWORK

Impact of climate change on households' welfare in Burkina Faso

24th Annual Conference on Global Economic Analysis

Abdoul Karim ZANHOUE and Bulent ACMA

Introduction and Motivation

Introduction and Motivation

Previous works

Methodology Framework

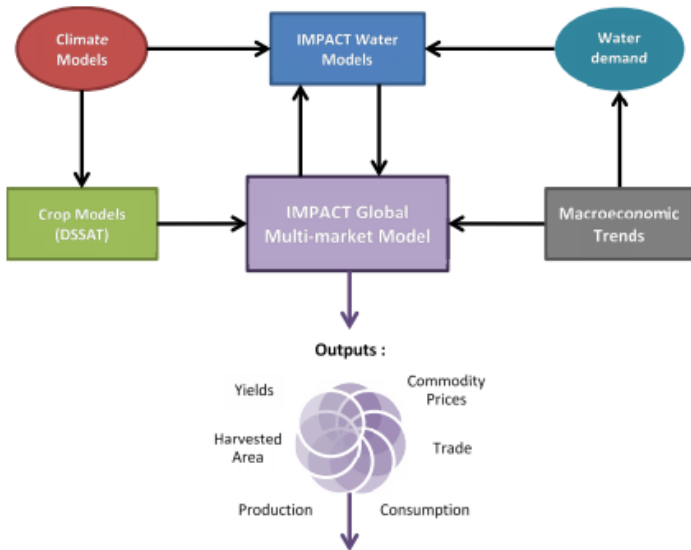
Simulation results

- The IMPACT was established by IFPRI in the early 1990s.
- It is a partial equilibrium model, using for analyzing food production, food demand and prices, trade, income and the population at the national and global level.
- The last version of IMPACT model includes 159 countries, 154 basins, and 62 agricultural commodities markets.
- IMPACT contains global model, regional and national sub-models.
- The figure bellow presents the structure of the IMPACT model



ANADOLU UNIVERSITESI

METHODOLOGY FRAMEWORK



Impact of climate change on households' welfare in Burkina Faso
24th Annual Conference on Global Economic Analysis

Abdoul Karim ZANHOUE and Bulent ACMA

Introduction and Motivation

Introduction and Motivation

Previous works

Methodology Framework

Simulation results



ANADOLU ÜNİVERSİTESİ

METHODOLOGY FRAMEWORK

- In GTAP model, welfare is capturing by the variation of the regional household's per-capita utility

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



ANADOLU ÜNİVERSİTESİ

METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- In GTAP model, welfare is capturing by the variation of the regional household's per-capita utility
- It is a money-metric indicator that quantifies the change in the household's utility



METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- In GTAP model, welfare is capturing by the variation of the regional household's per-capita utility
- It is a money-metric indicator that quantifies the change in the household's utility
- Therefore, we compute the change of welfare by comparing the level of welfare at the baseline scenario and at the climate scenarios



ANADOLU UNIVERSITESI

METHODOLOGY FRAMEWORK

- For calibrating the model, we use the GTAP Africa2 data that we aggregated in 10 regions and 3 sectors

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



ANADOLU UNIVERSITESI

METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- For calibrating the model, we use the GTAP Africa2 data that we aggregated in 10 regions and 3 sectors
- Two types of scenarios were defined



METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- For calibrating the model, we use the GTAP Africa2 data that we aggregated in 10 regions and 3 sectors
- Two types of scenarios were defined
- A baseline scenario describing the world economic situation assuming a constant climate



METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- For calibrating the model, we use the GTAP Africa2 data that we aggregated in 10 regions and 3 sectors
- Two types of scenarios were defined
- A baseline scenario describing the world economic situation assuming a constant climate
- Four Climate change scenarios as defined previously in the chapter III are compared to the baseline scenario



METHODOLOGY FRAMEWORK

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
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Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

Table 1 present the different scenarios

Scenarios	SSP	RCP	ESM
SSP2-GFDL	2	8.5	GFDL
SPP2-HGEM	2	8.5	HGEM
SSP2-IPSL	2	8.5	IPSL
SSP2-MIROC	2	8.5	MIROC

Table: The different scenarios



Results

- The IMPACT outcomes show that climate change will lead to an increase in total harvested cropland with an average rate of 1.5%

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



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Results

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- The IMPACT outcomes show that climate change will lead to an increase in total harvested cropland with an average rate of 1.5%
- Besides, it is revealed that climate change will lead to a decrease in cereals yields.



Results

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- The IMPACT outcomes show that climate change will lead to an increase in total harvested cropland with an average rate of 1.5%
- Besides, it is revealed that climate change will lead to a decrease in cereals yields.
- The average estimated yields losses are 5, 7, 6% respectively in the SSP2-IPSL, SSP2-GFDL, SSP2-HGEM scenarios.



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Results

- Finally, IMPACT outcomes predicts that climate change will negatively affect cereals total production

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Results

Impact of climate
change on
households'
welfare in Burkina

Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Finally, IMPACT outcomes predicts that climate change will negatively affect cereals total production
- SSP2-ISPL, SSP2-HGEM, SSP2-GFDL respectively shows that climate change will cause 4.7, 4.8 and 6.7% decline in cereals' total production



Results

Impact of climate
change on
households'
welfare in Burkina

Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- Finally, IMPACT outcomes predicts that climate change will negatively affect cereals total production
- SSP2-ISPL, SSP2-HGEM, SSP2-GFDL respectively shows that climate change will cause 4.7, 4.8 and 6.7% decline in cereals' total production
- The results of this chapter will be integrated in a Computable General Equilibrium (CGE) model to simulate the climate change impact on household's welfare



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Climate change's impact on GDPs

- The change in GDP is presenting in the figure bellow

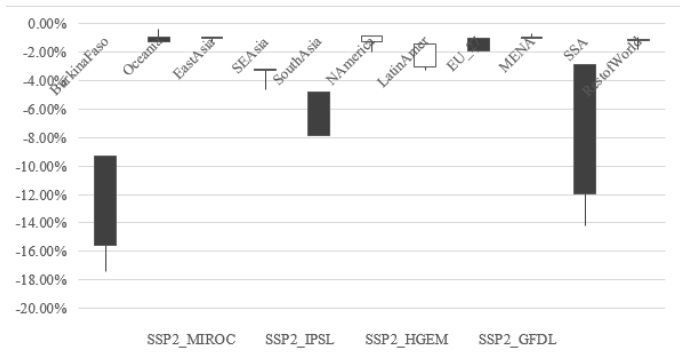


Figure: Effect of climate change on GDP 2005-2050



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Climate change's impact on GDP

- It shows that climate change will lead to GDP losses in most of the regions

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



Climate change's impact on GDP

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- It shows that climate change will lead to GDP losses in most of the regions
- The extent of the losses is very variable among region



Climate change's impact on GDP

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- It shows that climate change will lead to GDP losses in most of the regions
- The extent of the losses is very variable among region
- In Burkina Faso, the smallest drop in GDP is 9.33%, estimated in the MIROC scenario



Climate change's impact on GDP

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- It shows that climate change will lead to GDP losses in most of the regions
- The extent of the losses is very variable among region
- In Burkina Faso, the smallest drop in GDP is 9.33%, estimated in the MIROC scenario
- The largest decline rate estimated at 17.39% is found in the IPSL scenario.



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Climate change impact on Households' demand

- It is presented the variation in the households' agriculture products demand in Burkina Faso.

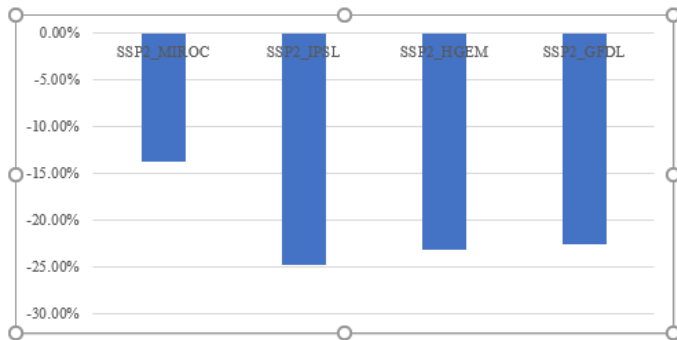


Figure: Effect of climate change on household's agriculture products demand in Burkina Faso 2005-2050

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24th Annual Conference on Global Economic Analysis

Abdoul Karim ZANHOUE and Bulent ACMA

Introduction and Motivation

Introduction and Motivation

Previous works

Methodology Framework

Simulation results



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Climate change impact on Households' demand

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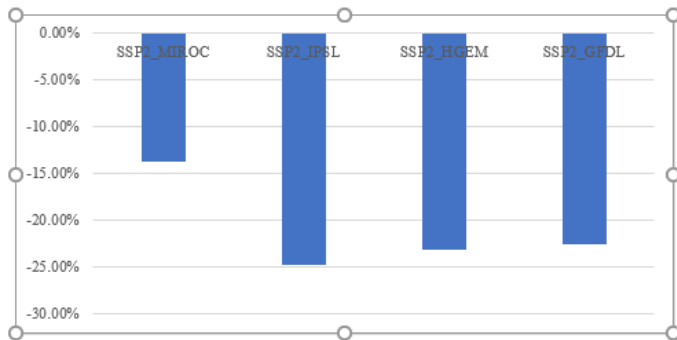


Figure: Effect of climate change on household's agriculture products demand in Burkina Faso 2005-2050

Impact of climate change on households' welfare in Burkina Faso

24th Annual Conference on Global Economic Analysis

Abdoul Karim ZANHOUE and Bulent ACMA

Introduction and Motivation

Introduction and Motivation

Previous works

Methodology Framework

Simulation results



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Climate change impact on Welfare

- The welfare change due to climate change in Burkina Faso is displayed below.

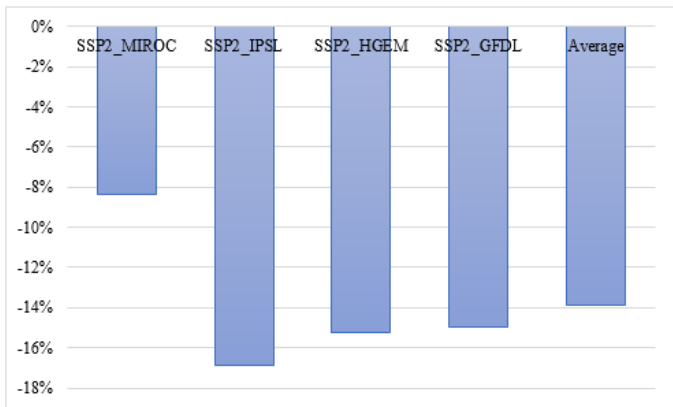


Figure: Effect of change in welfare in climate change

Impact of climate change on households' welfare in Burkina Faso

24th Annual Conference on Global Economic Analysis

Abdoul Karim ZANHOUE and Bulent ACMA

Introduction and Motivation

Introduction and Motivation

Previous works

Methodology Framework

Simulation results



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Climate change impact on Welfare

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- On average climate change will lead to a 14% decrease in global welfare in Burkina Faso



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Climate change impact on Welfare

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- On average climate change will lead to a 14% decrease in global welfare in Burkina Faso
- In the other regions, the extent of welfare loss is very variable



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Climate change impact on Welfare

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- On average climate change will lead to a 14% decrease in global welfare in Burkina Faso
- In the other regions, the extent of welfare loss is very variable
- Sub-Saharan African countries will be the most affected



Climate change impact on Welfare

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- On average climate change will lead to a 14% decrease in global welfare in Burkina Faso
- In the other regions, the extent of welfare loss is very variable
- Sub-Saharan African countries will be the most affected
- Europe will be less concerned and will even benefit from climate change according to some scenarios



CONCLUSION

- This study is a starting point for an extended literature analyzing the climate change effect in Burkina Faso

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



CONCLUSION

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- This study is a starting point for an extended literature analyzing the climate change effect in Burkina Faso
- It proposed a new methodology to combine a partial and general equilibrium model to analyze climate change welfare effect



CONCLUSION

- The analysis presented can be improve in many aspect

Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results



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CONCLUSION

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- The analysis presented can be improve in many aspect
- The use of a dynamic model would be useful for considering dynamic indicators



CONCLUSION

Impact of climate
change on
households'
welfare in Burkina
Faso

24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

- The analysis presented can be improve in many aspect
- The use of a dynamic model would be useful for considering dynamic indicators
- Also, dis-aggregating the regional households in different types of households (rural and urban) will be useful for adaptation strategies



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Impact of climate
change on
households'
welfare in Burkina
Faso
24th Annual
Conference on
Global Economic
Analysis

Abdoul Karim
ZANHOUE and
Bulent ACMA

Introduction and
Motivation

Introduction and
Motivation

Previous works

Methodology
Framework

Simulation results

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