

# Climate Change and Electricity Consumption in Sub-Saharan Africa: Any Causal Dynamics?

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# Background

- Sub-Saharan Africa is estimated to be the most vulnerable to the effects of climate change, esp.
  - Agriculture, flooding, water supply etc.
- Are there any implications on energy (electricity) demand?
  - Cooling ?? Heating???
- The aim of this study is to investigate:
  - Response of electricity consumption to shocks in temperature and GDP.
  - Response of GDP to shocks in temperature

# Methodology

## ❖ Econometric Approaches

- Structural Vector Auto-regressive (SVAR) model
- Structural Vector Error Correction model (SVECM)
- Impulse Response and Variance Decomposition techniques

## ❖ Data : Time series annual data (1971-2009)

- Average Temperature (degrees Celsius)
- Real GDP
- Urbanization
- Electricity Consumption (Kwh per capita)

## ❖ Countries (11- SSA)

- Cameroun, Congo D.R., Cote d'Ivoire, Ghana, Kenya, Senegal, Sudan, Togo, Zambia, Zimbabwe.

# Findings & Discussions

- Effects of Contemporaneous shocks

| Countries     | Temperature to Electricity | Temperature to real GDP | Real GDP to Electricity |
|---------------|----------------------------|-------------------------|-------------------------|
| South Africa  | —                          | —                       | +                       |
| Kenya         | —                          | —                       | +                       |
| Zimbabwe      | —                          |                         |                         |
| Congo, D.R.   |                            | +                       |                         |
| Ghana         |                            | +                       |                         |
| Togo          |                            | +                       | +                       |
| Zambia        |                            | —                       | +                       |
| Cameroun      |                            |                         | +                       |
| Cote d'Ivoire |                            |                         | +                       |

# Results & Discussions

## Impulse Response: Medium-Long term Response to Temperature Shocks

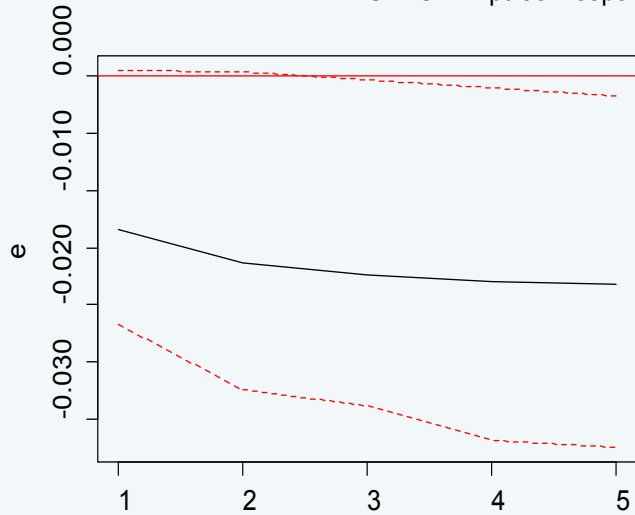
| Countries     | Electricity | Real GDP |
|---------------|-------------|----------|
| South Africa  | –           | +        |
| Kenya         | –           | –        |
| Zimbabwe      | –           | +        |
| Congo, D.R.   | +           | +        |
| Ghana         | +           | +        |
| Togo          | +           | +        |
| Zambia        | +           | –        |
| Cameroun      | +           | –        |
| Cote d'Ivoire | +           | +        |
| Sudan         | –           | +        |
| Senegal       | +           | –        |



# Response of Electricity to Temperature Shocks

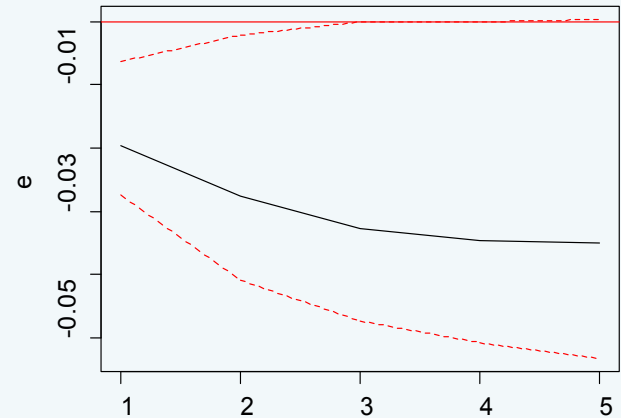
## Kenya

SVECM Impulse Response from tem



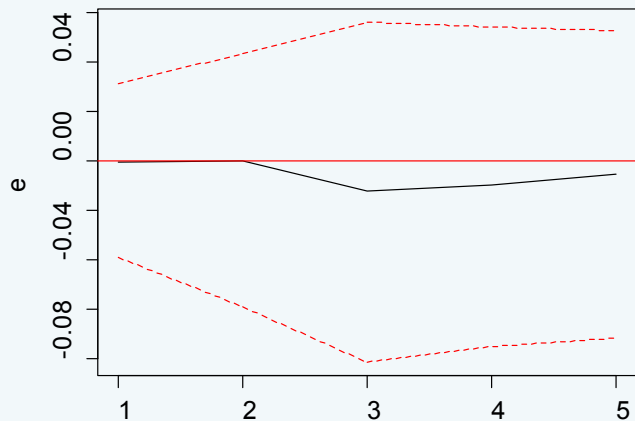
## South Africa

SVECM Impulse Response from tem



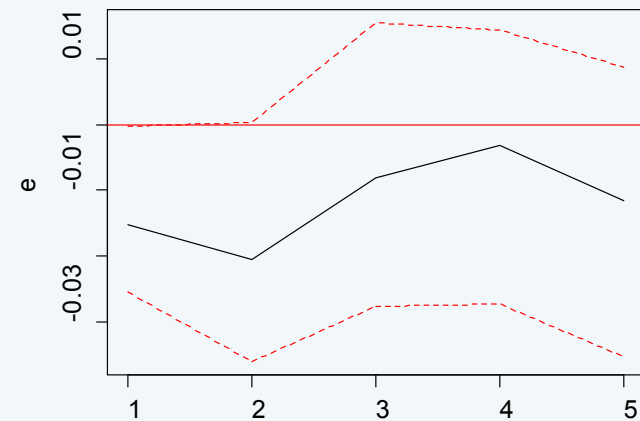
## Sudan

SVECM Impulse Response from tem



## Zimbabwe

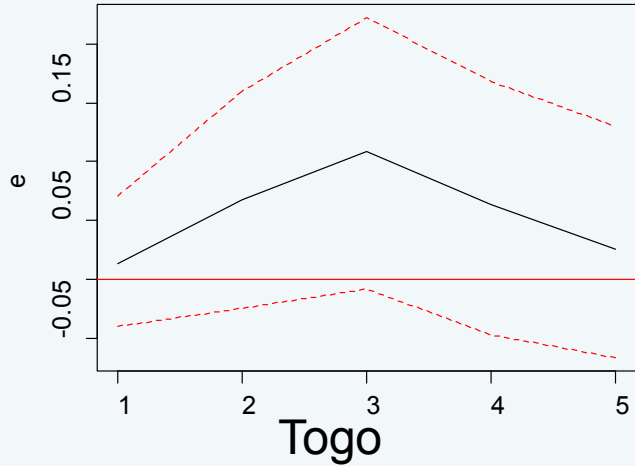
SVECM Impulse Response from tem



# Response of Electricity to Temperature Shocks

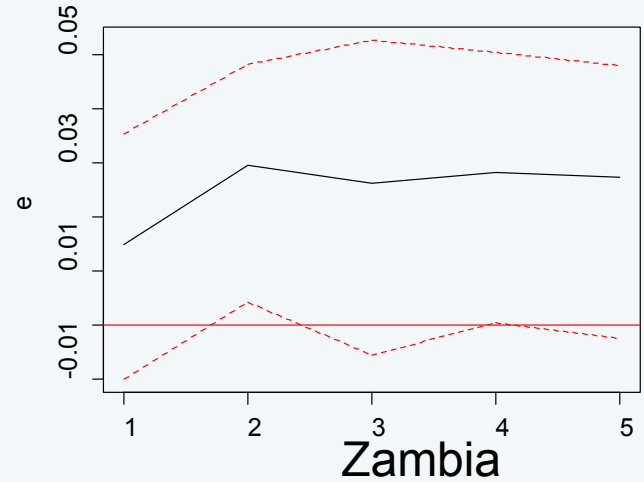
Ghana

SVECM Impulse Response from tem

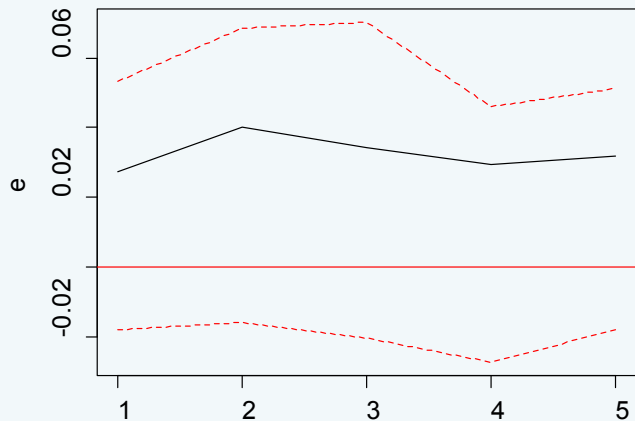


Senegal

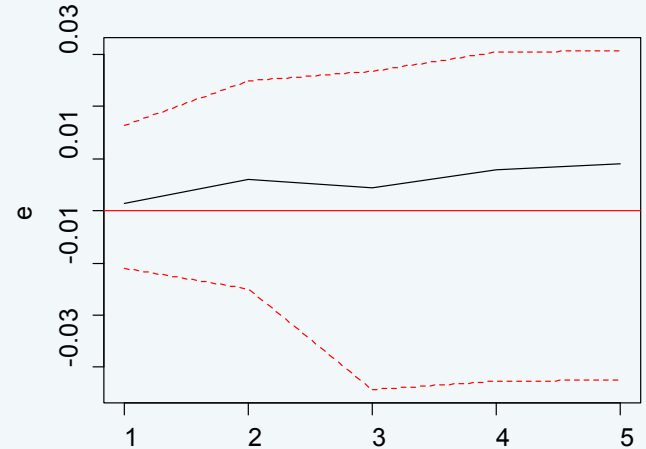
SVECM Impulse Response from tem



SVECM Impulse Response from tem



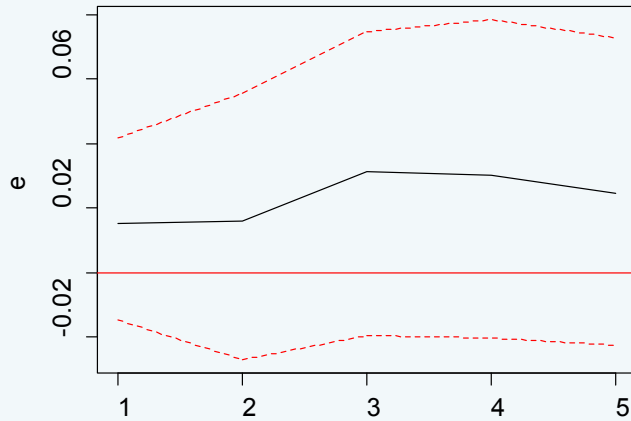
SVECM Impulse Response from tem



# Response of Electricity to Temperature Shocks

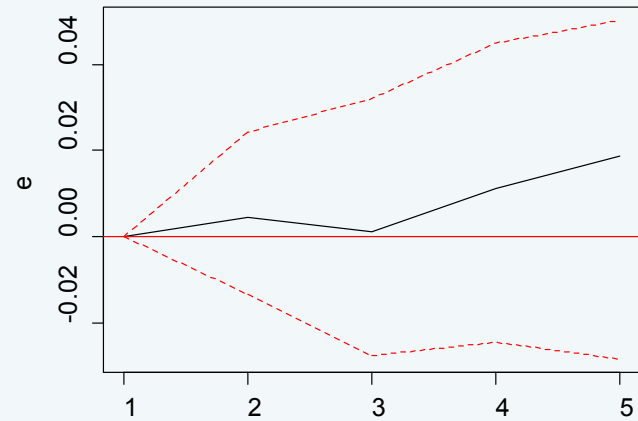
Cameroun

SVECM Impulse Response from tem



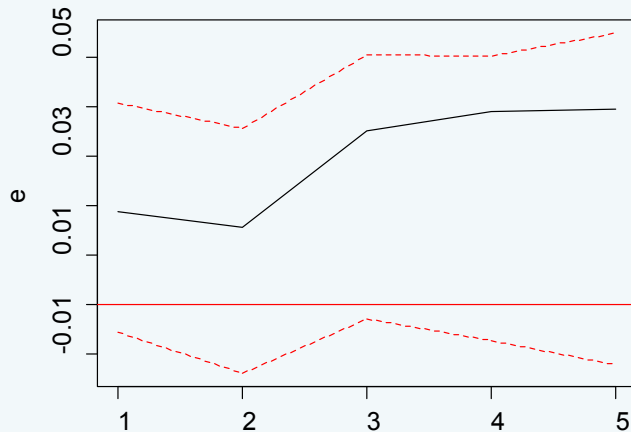
Congo, D.R.

SVECM Impulse Response from tem



Cote d'Ivoire

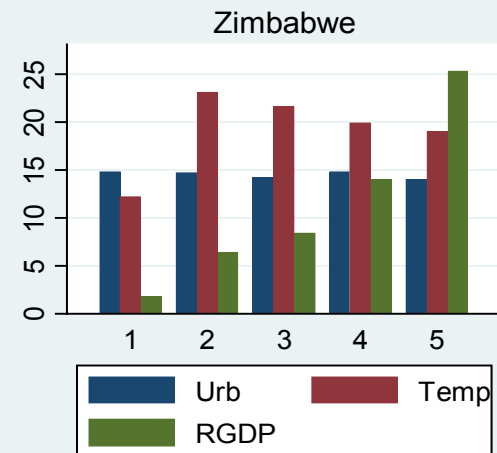
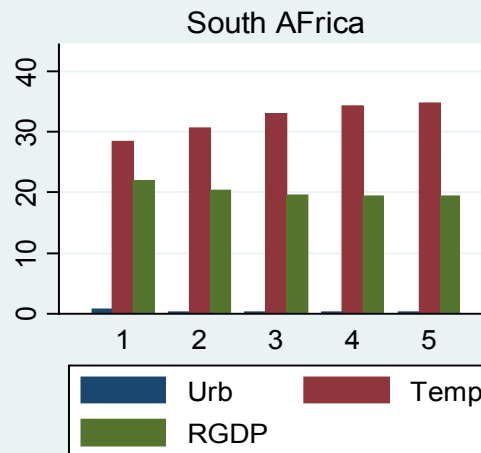
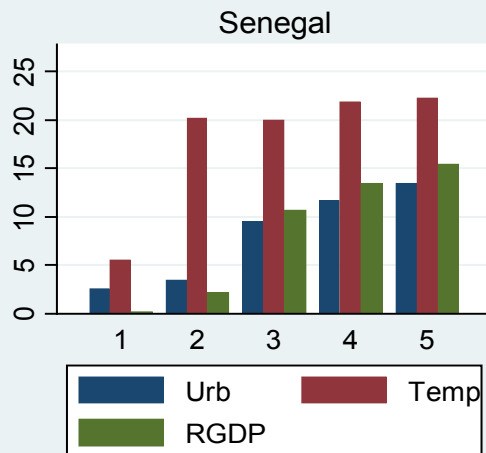
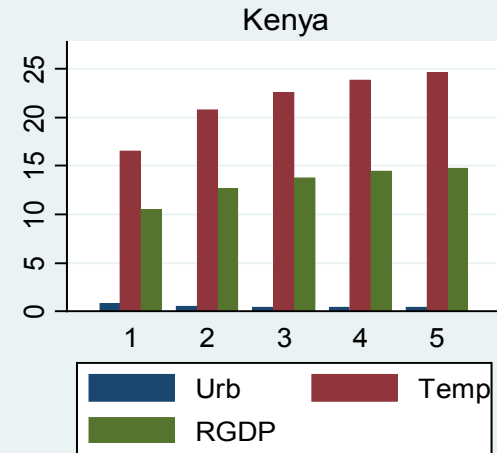
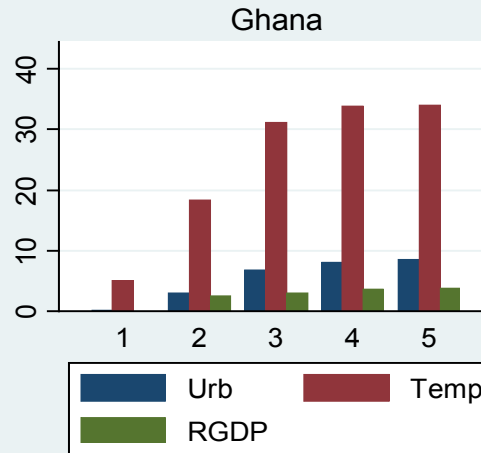
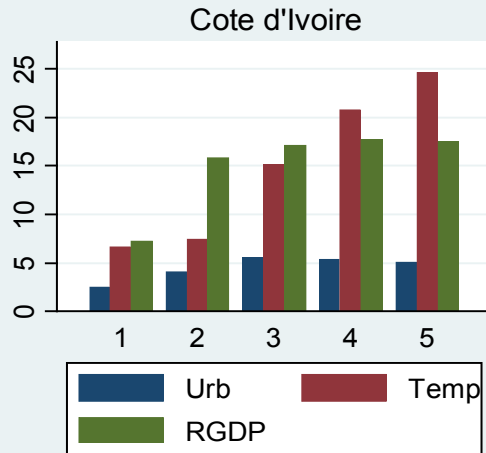
SVECM Impulse Response from tem





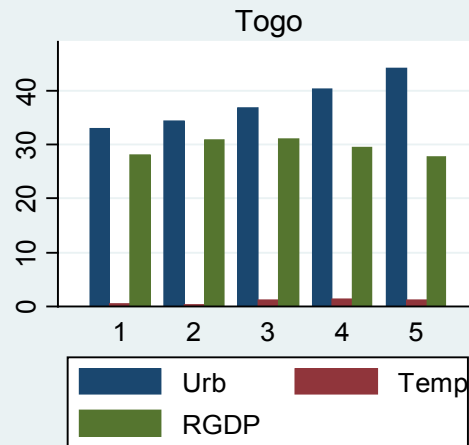
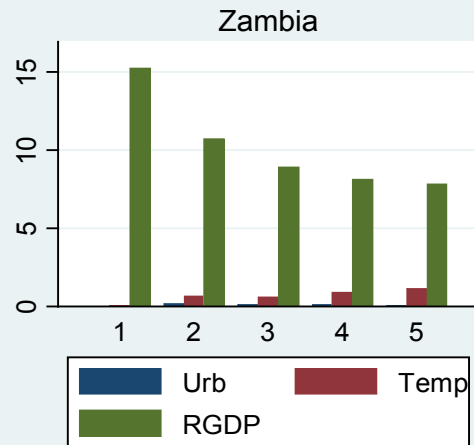
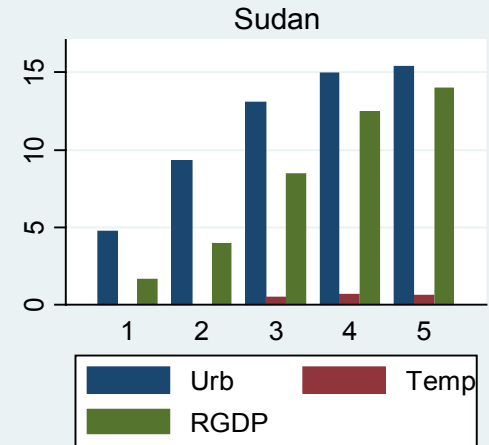
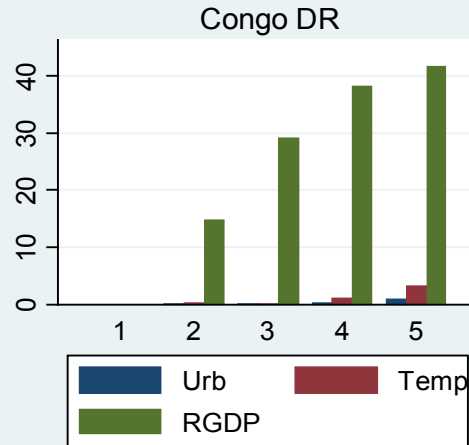
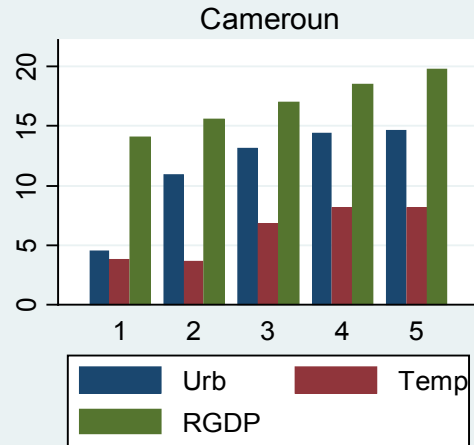
# Variance Decomposition

## Contributions to Variations in Electricity consumption (%)



# Variance Decomposition

## Contributions to Variations in Electricity consumption (%)



# Conclusions

- Shocks in temperature has a **positive** and **permanent** effect on electricity consumption in **Cameroon, Congo DR., Cote d'Ivoire, Senegal and Zambia**, whereas the effects turns to be **transitory** in the case of **Ghana and Togo**.
- In South Africa and Kenya, effects are **negative** and **persistent**, but **transitory** in **Sudan and Zimbabwe**.
- Temperature shocks account for larger shares of variabilities in electricity consumption in **Ghana, Kenya, Senegal, South Africa and Zimbabwe**.
- Shocks in economic growth account for larger shares of variabilities in electricity consumption in **Cameroon, Congo and Zambia**.
- Shocks in urbanization account for larger shares of variabilities in electricity consumption in **Sudan and Togo**.

# Policy Recommendations

- Effects of climate change on electricity and real GDP varies, hence the need for country specific policies.
- Diversification of energy sources, especially renewable energy like solar, wind, bio-energy to ensure adequate supply of electricity to meet rising demand.
- Intensification of Adaptation strategies to curtail the negative effects of climate change on energy and economic growth via agriculture (esp. in **Kenya, Cameroun, Senegal and Zambia**)

*THANK YOU FOR  
YOUR ATTENTION*



***The End***