

# Economic Impacts of Climate Change for South Africa: An Economy-Wide Perspective to 2050

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**national treasury**

Department:  
National Treasury  
REPUBLIC OF SOUTH AFRICA



# Introduction

- ***Understanding the economic impacts of climate change is necessary for informing long term planning and policy making***
  - Overall growth, employment and welfare; Regional development and activity; Vulnerable groups and regions
  - Policies that minimise negative impacts - need significant time leads to be implemented and take effective
- ***Assesses macro and socio economic impacts of climate change by 2050***
  - Collaboration between Economic Policy Unit (National Treasury) and World Institute for Development Economics Research (UN University)
  - Long-Term Adaptation Scenarios: Dynamic Computable General Equilibrium Model (DCGE) - final block of integrated modelling framework therefore draws on inputs from other studies
  - Two global climate scenarios (no emissions constraint; ~480ppm by 2100) with 367 possible climate futures
- ***Detailed crop-based DCGE model based on South African water management areas***
  - 2002 Social accounting matrix (SAM); 2000/2005 water accounts
  - Recursive dynamic
  - Regional and sectoral disaggregation provides relevant detail on the spatial and industrial characteristics of the economy



# Characteristics of the South African economy

	Share of total (%)				Export intensity	Import intensity
	GDP	Employment	Exports	Imports		
<b>Total GDP</b>	100.00	100.00	100.00	100.00	13.48	13.31
<b>Agriculture</b>	4.32	7.87	3.65	2.17	15.05	9.27
Field crops	1.79	2.93	0.59	1.46	5.93	13.53
Horticultural crops	1.00	1.85	2.16	0.23	42.05	7.08
Livestock	1.28	2.80	0.85	0.27	10.88	3.46
Other agriculture	0.26	0.29	0.05	0.21	3.89	13.53
<b>Industry</b>	33.38	29.27	75.84	83.46	22.17	21.96
Mining	8.72	4.96	33.72	10.28	71.10	43.45
Manufacturing	19.90	17.65	42.12	73.18	16.87	23.30
Electricity generation	2.03	0.98	0.00	0.00	0.00	0.00
Water distribution	0.45	0.17	0.00	0.00	0.00	0.00
Construction	2.27	5.50	0.00	0.00	0.00	0.00
<b>Services</b>	62.30	62.86	20.51	14.37	5.46	4.13

Source: South Africa 2002 Water-SAM. Import intensity is the share of imports in total domestic demand. Export intensity is the share of exports in total domestic output.

## Services largest contributor to growth and employment followed by Manufacturing

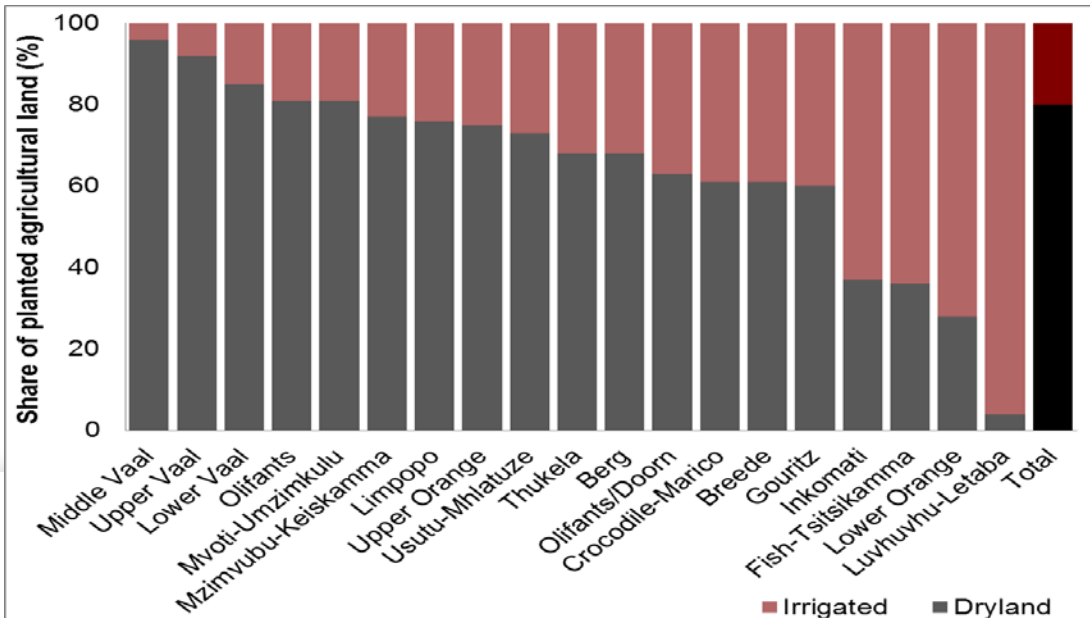
- Agriculture: strong links; large employer; food security
- Most cultivated land in South Africa is used for dryland farming

## Cropping and water use characteristics differ → regions affected in varying degrees

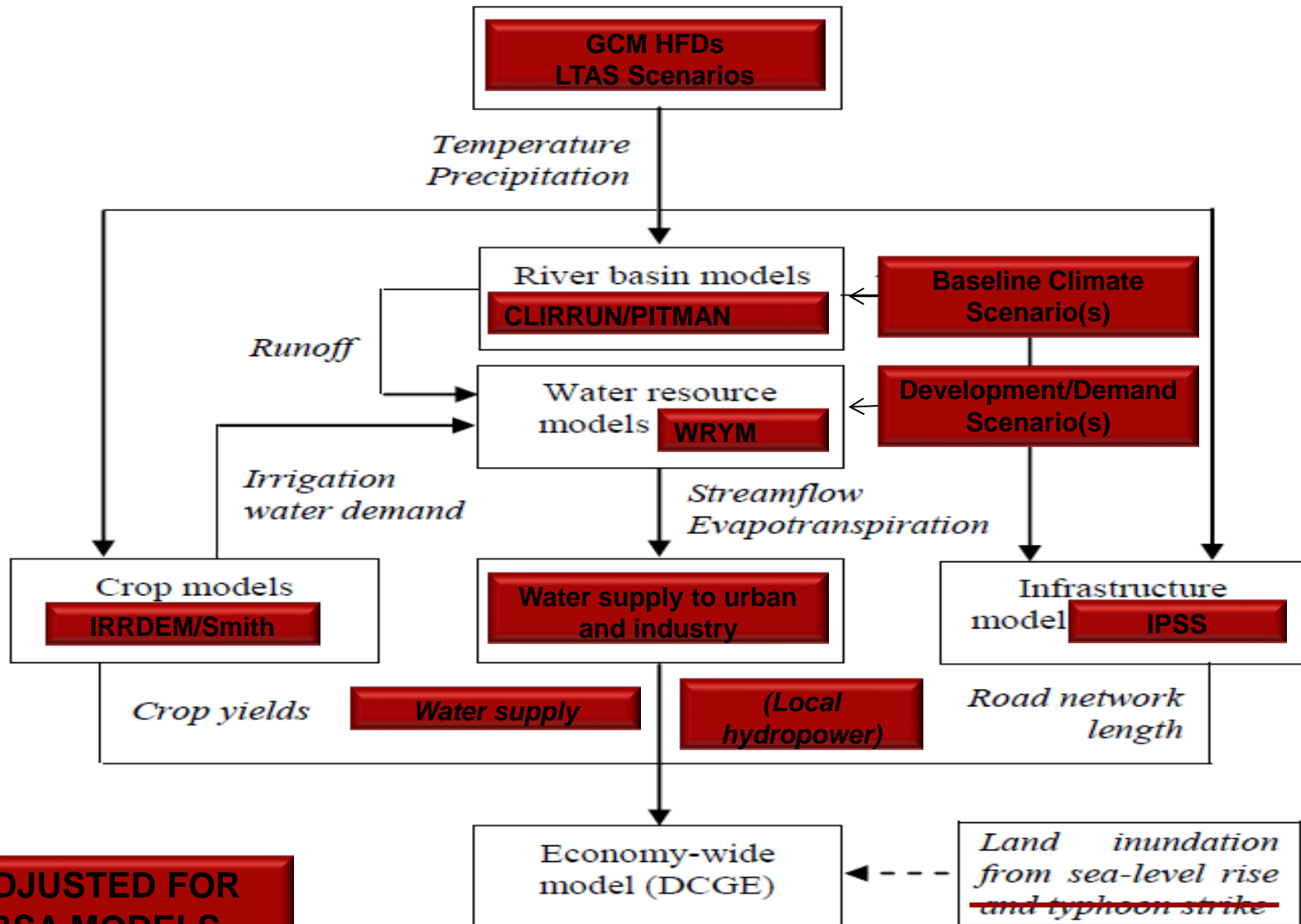
- Vaal region: 52.3% of cultivated land; largest producer of cereals and grains
- Olifants/Doorn, Breede and Berg areas: 83% of deciduous fruit production; use 22% of irrigation water supply.

## Poverty acute in provinces with larger rural populations dependent on dryland agriculture

- e.g. Mzimvubu-Keiskamma



# Integrated Modelling Framework



# Climate Change Impact Channels

## Baseline

- This presents the business as usual path for South Africa without annual weather or climate shocks or changes in world prices. No climate change is assumed.

## World Prices

- World prices changes to 2050 as projected by Paltsev (2012) are imposed as derived from the unconstrained global emissions scenario.

## Road Infrastructure

- World prices plus additional costs for rehabilitating and maintaining existing road infrastructure networks. Increased road infrastructure spending negatively impacts productivity. This result is captured by reducing the growth in TFP in accordance with existing literature on the links between transport and economy-wide productivity growth.

## Irrigation

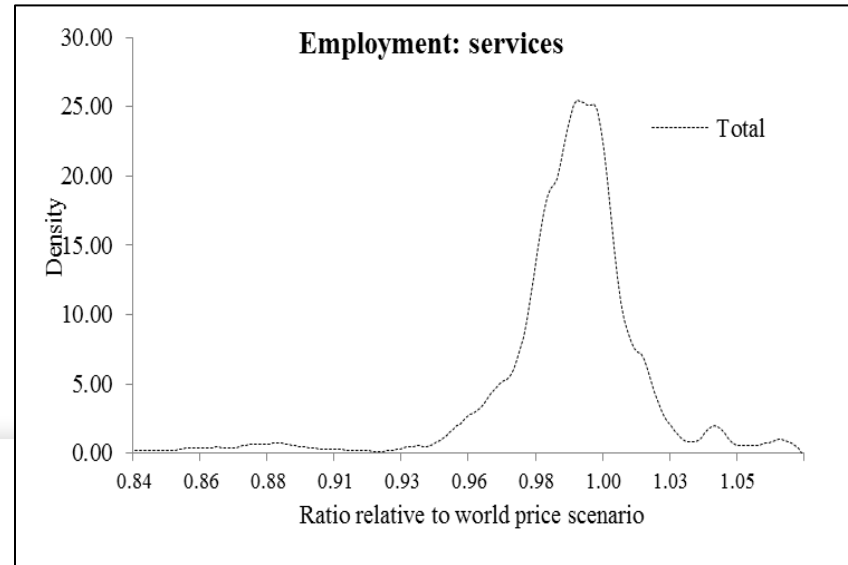
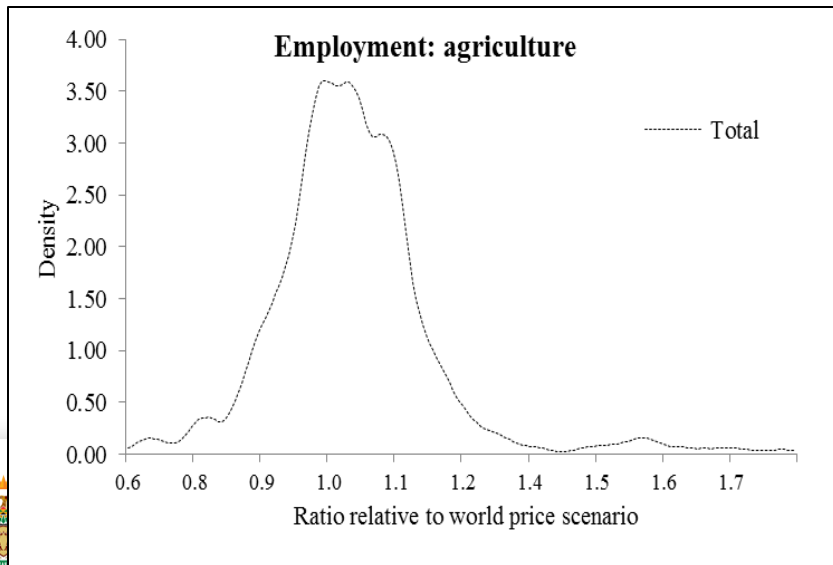
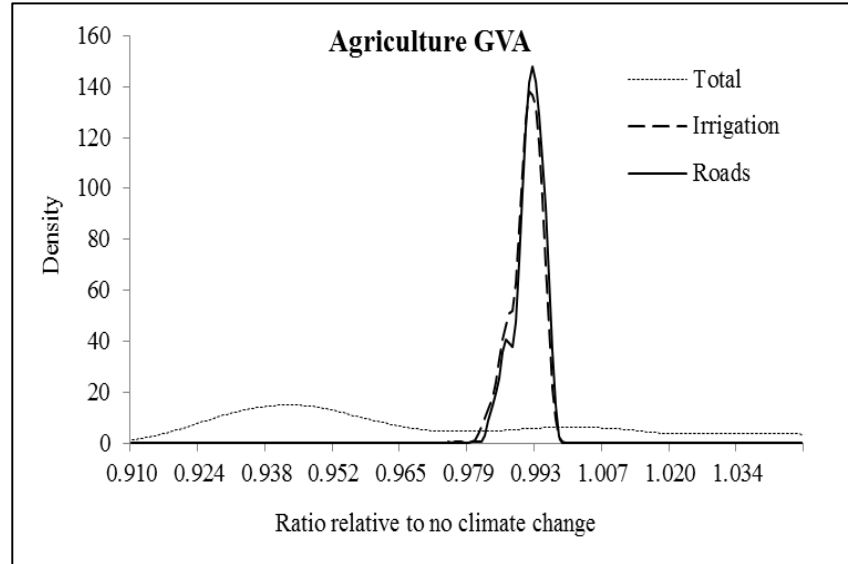
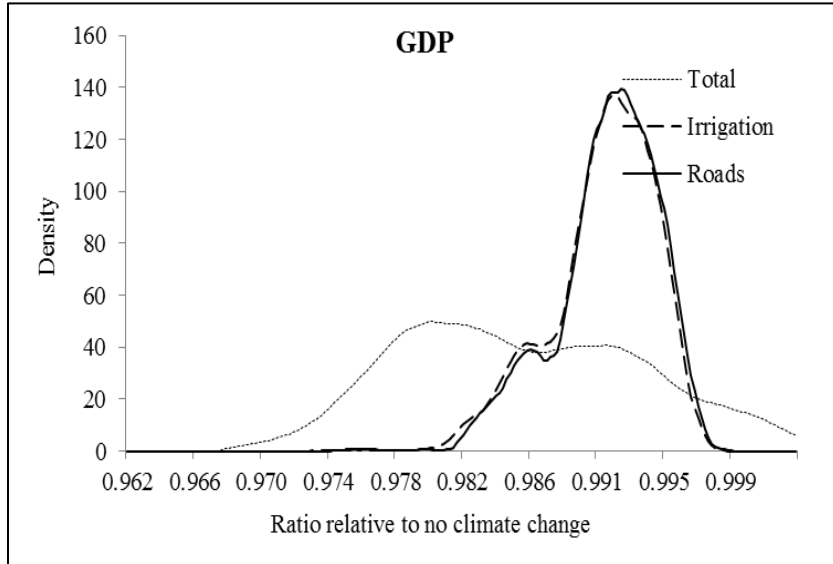
- Roads plus the impact of climate change on the availability of water by water management area.

## Dryland Agriculture

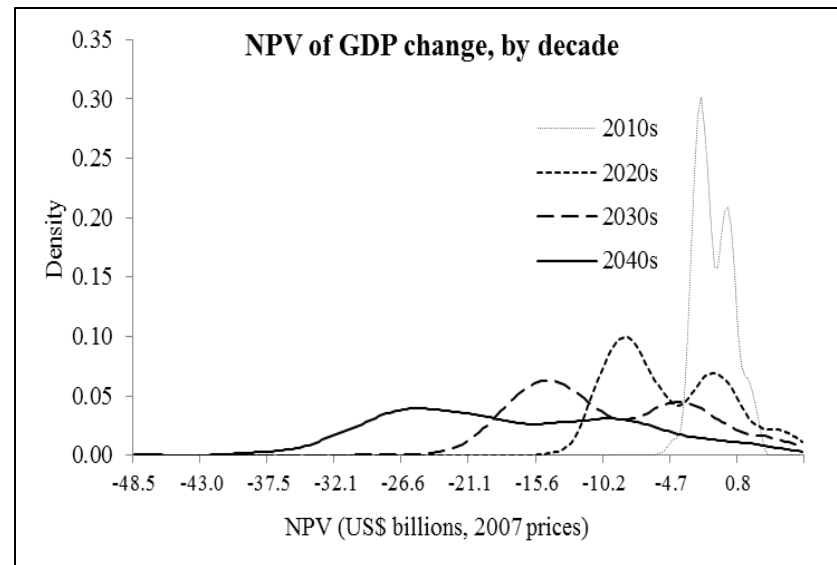
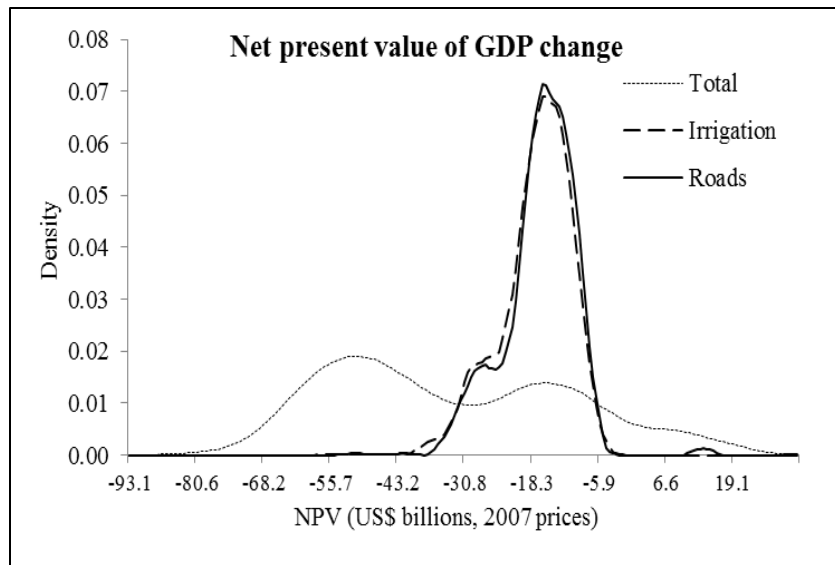
- Irrigation plus climate change temperature and precipitation impacts on the productivity of dryland agriculture.



# Small annual real GDP and employment declines with agriculture most affected



# But costs increases over time, particularly in net present value (NPV) terms



- In terms of NPV of losses, the total value of GDP losses induced by climate change is noteworthy.
- Total discounted GDP losses:
  - Roads: -US\$1.5 to -US\$55.1bn (median: -US\$16bn)
  - Including irrigation: -US\$2.7 to -US\$58.2bn (-US\$17bn)
  - Total scenario (more variable, 96% of climates show losses) : -US\$93 to +US\$31bn (-US\$37bn)  
→ nearly 10% of 2012 GDP
- GDP losses by decade in the final scenario. As might be expected, the estimated impact on GDP becomes more negative and the distribution wider in successive decades. The likelihood of positive NPV outcomes also falls dramatically, from 22% in the 2010s to 4% in the 2040s.

# In summary

- The impacts of climate change on overall economic growth are predominately negative, although not large, especially over the next 10-20 years.
- The impact however becomes more pronounced over time (particularly post 2050) with the cumulative cost to the economy rising, particularly in NPV terms. By 2050 the cumulative cost is estimated to be US\$37bn or 10 per cent of 2012 GDP.
- There are significant regional differences and high levels of climate change uncertainty. This uncertainty declines marginally under the global constrained emissions scenario.
- Agriculture is the most negatively affected sector. The dependence of many regions with high poverty rates on agriculture in general and dryland farming in particular generates an undesirable positive correlation between zones of high variability and areas with substantial poverty.
- The results identify two primary areas of adaptation:
  - **On-going maintenance and possible improvement of the existing water transfer system through investment or institutional/policy reform.** On aggregate, climate change has a small impact on the ability to meet water demand, because of South Africa's well-functioning water transfer network. A decline in the productivity of this network would increase the costs associated with climate change.
  - **Upgrading of road and other transport infrastructure to make them less susceptible to changes in temperature and rainfall.** Cullis *et al.* (2014) shows that the initial cost of adaptation for road infrastructure is relatively small if started early.
  - **Others** include making water use more efficient and measures to help move factors of production from low value to high value uses.
- Adaptation strategies have to be looked at in combination with mitigation measures, as both are required to achieve the greatest benefits.