

The potential economic impacts of climate change in South Africa: A probabilistic assessment

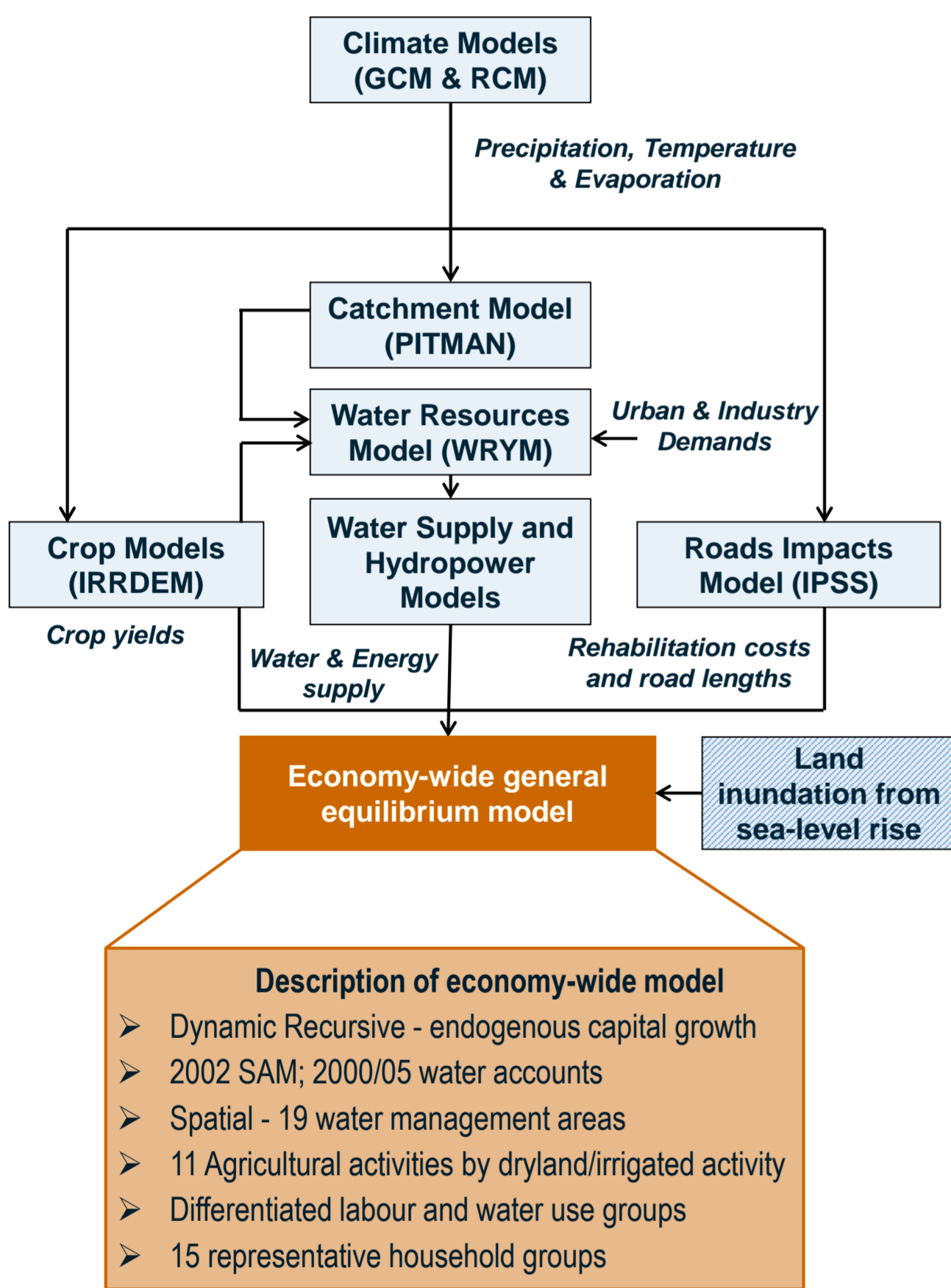
Arndt, C.¹, Cullis, J.D.S.², Alton, T.³, Gabriel, S.³, Hartley, F.³, Makrelov, K.³ and Strzepek, K.M.⁴
¹UNU-WIDER, ²Aurecon SA, ³RSA National Treasury, ⁴MIT Joint Program on the Science and Policy of Global Change

Key Points

- Climate change negatively affects South Africa. While the impacts are small within the next 10-20 years, they become more pronounced over time if no action is taken.
- Global efforts to decrease emissions reduce the potential impact, particularly in the agriculture sector, and provide a more confident area of possible outcomes.
- The key climate impact channels arise from more rapid depreciation of transport networks and productivity declines in dryland agriculture. The water resource management system remains robust and limits the negative impact on water availability.
- Key areas of adaptation identified include roads and infrastructure; maintenance and improvements to the water resource management system; a shift from dryland to irrigated agricultural production; efficient water use; and the facilitation of resource movement to high value uses.

Methodology

- 3 Key Impact Channels: Road Infrastructure, crop yields, water availability (urban, industry, irrigation)
- 367 Potential Climate Futures; 2 Global Climate Futures



Profile of South African Agriculture

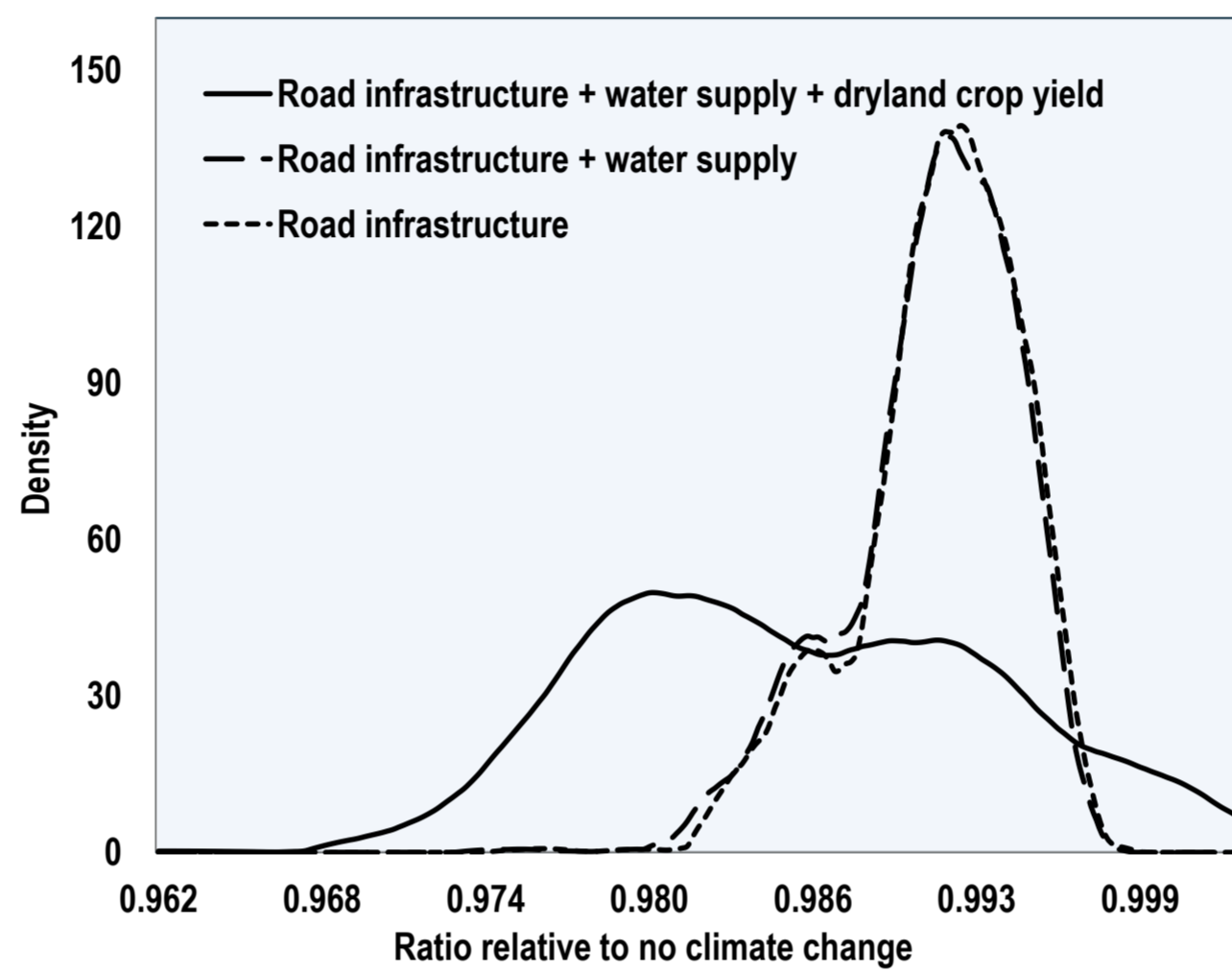
	GDP	Employment	Exports	Imports
Agriculture	4.3	8.3	3.8	2.2
Field crops	1.8	3.2	0.6	1.5
Horticultural crops	1.0	1.8	2.2	0.3
Livestock	1.3	2.9	0.8	0.3
Other agriculture	0.3	0.3	0.2	0.2
Industry	33.4	30.3	76.3	81.6
Mining	8.7	5.8	31.9	11.2
Manufacturing	19.9	18.6	44.3	70.3
Electricity	2.0	1.1	0.0	0.0
Water distribution	0.4	0.2	0.0	0.0
Construction	2.3	4.6	0.0	0.1
Services	62.3	61.5	19.9	16.2

Source: Own Calculations, 2002 SAM

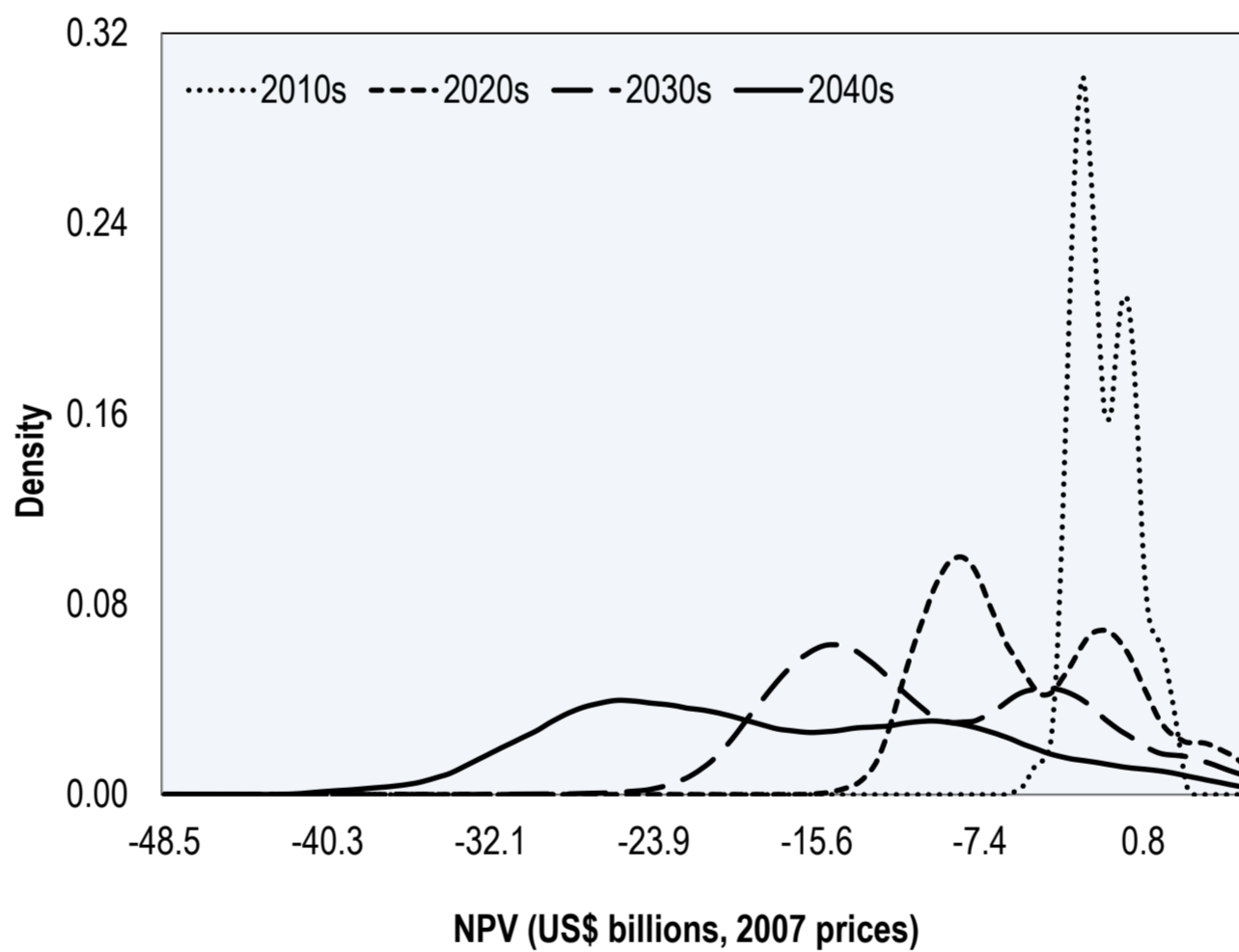
- Agriculture is largely dryland (80%) with irrigated lands mainly used for horticulture crops. Main crops include summer and winter cereals; sugarcane.
- The Vaal region is the largest agricultural producer of summer and winter cereals (61%; 37%); oilseed (64%).
- Sugarcane is largely produced in dryland fields in Kwa-Zulu Natal (Mvoti-Umzimkulu, Usutu-Mhlatuze, Thukela) and Mpumalanga (Inkomati).
- Poverty acute areas (Limpopo, KwaZulu-Natal, the Eastern Cape, Mpumalanga) are dependent on dryland agriculture for employment and subsistence farming.

Impacts on Real GDP and Welfare

- Total impact on the level of real GDP ranges between -3.8% to +0.3% by 2050. On average, real GDP is 1.5% lower.
- The decline is primarily driven by the negative impact on road infrastructure and dryland agricultural productivity. Uncertainty around the impact on dryland crop yields, broadens the range of potential impacts.
- Water availability has a marginal negative impact as South Africa's extensive water transfer system ensures that the share of water demand met remains relatively unchanged.
- While average inequality impacts are relatively small, high levels of uncertainty in poverty acute areas is a major concern.



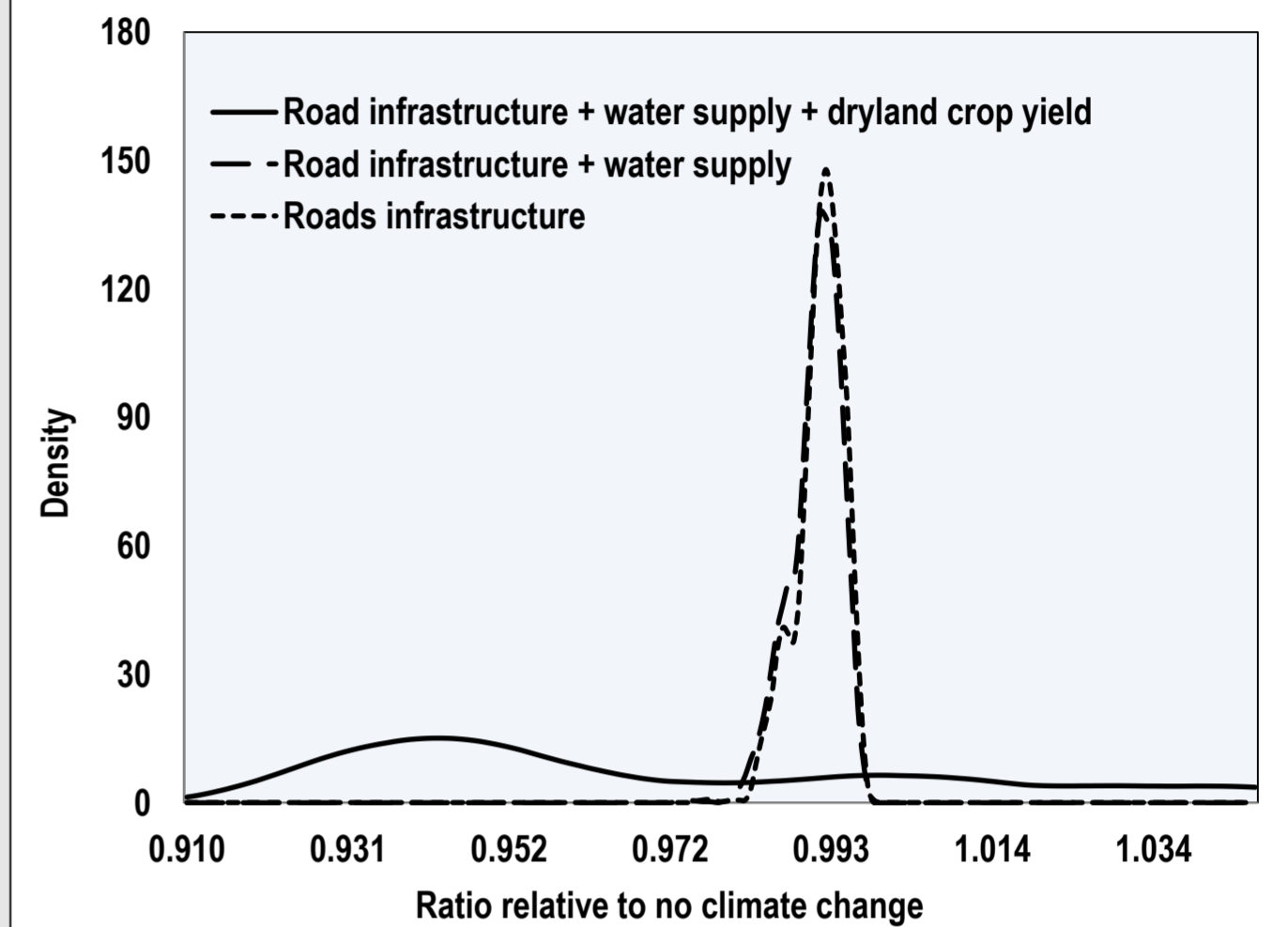
- While impacts on GDP are small on an annual basis, these reductions accumulate through time. Consequently, the net present value of losses is noteworthy at around US\$37 billion (2007 prices) or 10 per cent of 2012 real GDP.



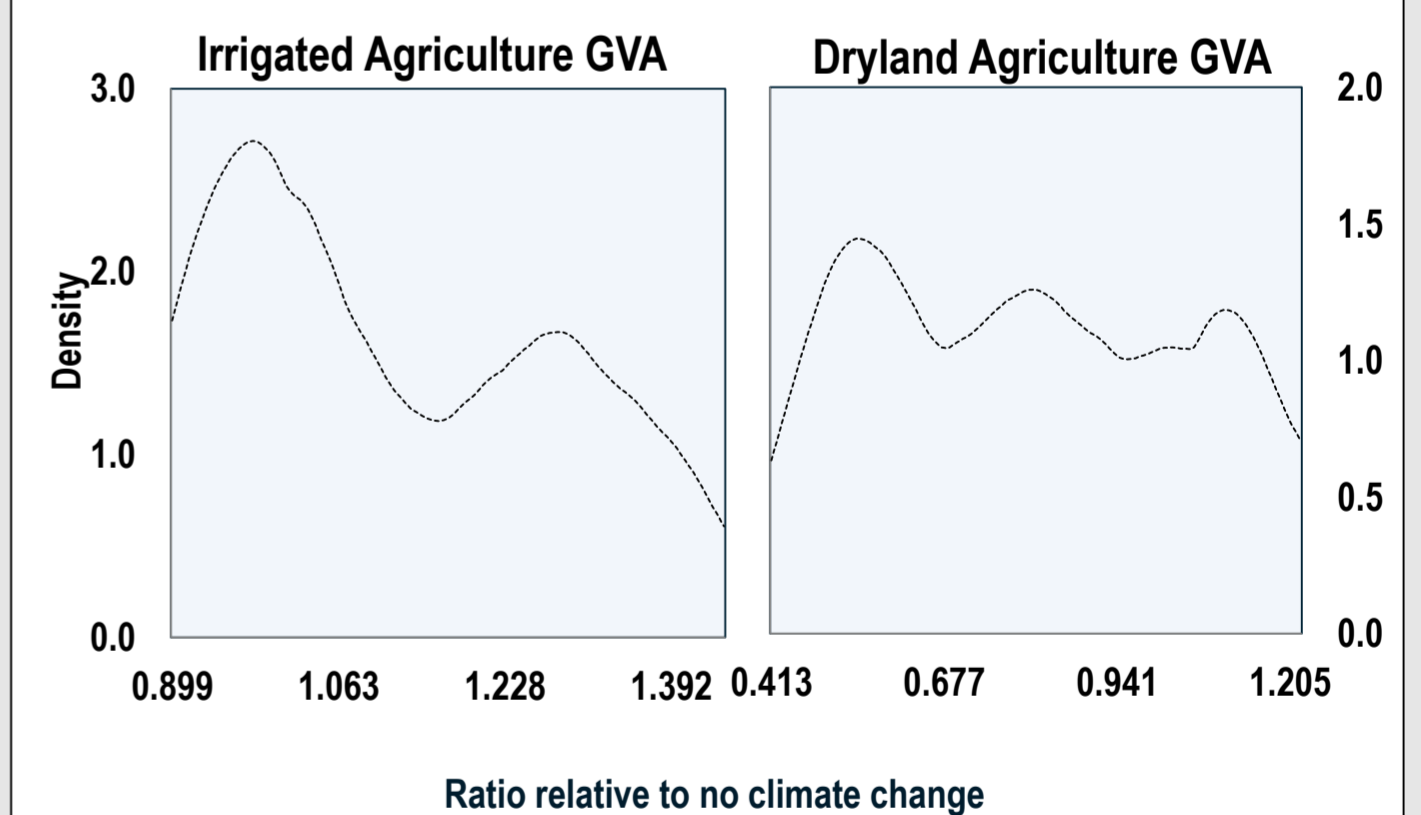
- The uncertainty of climate change impacts are reduced under the L1S scenario as successful global mitigation reduces the variability in climatic changes. The range of potential outcomes is also marginally less negative.

Implications for the Agriculture Sector

- Road infrastructure and water supply channels have a clear negative impact on Agriculture GVA as illustrated by the small range of outcomes.
- Including the impact on dryland crop yields broadens the possible impacts of climate change. The results show that agricultural GVA could rise by up to 4.7% and decline by as much as 9%. The increase in variation highlights the uncertainty regarding the impact on dryland agriculture.



- While the impacts on GVA in agriculture as a whole are broad, the implications within the agricultural sector are more pronounced.
- The change in dryland agriculture GVA is very broad ranging between -58.7% and 22.1%. Consistent with average negative impacts on dryland crop productivity, the median impact is estimated at -20.3%.
- However, movement in irrigated agriculture is in the opposite direction. Real value added in irrigated agriculture is expected to increase, sometimes substantially. Hence, as productivity in dryland agriculture declines, the relative attractiveness of irrigated agriculture increases.
- Overall, the model points to an ability to expand (or contract) irrigated agricultural area as an important endogenous adaptation channel.



Large Regional Variations in Impact on Agriculture

- Undesirable positive correlation between regions with highly variable outcomes (and large negative impacts) and high poverty rates (e.g. Kwa-Zulu Natal - WMA 6, 7 and 11).
- Overwhelmingly strong evidence of a decline in Agriculture GVA in domestically important farming areas such as the Vaal region.
- Producers of high value exported agriculture commodities face a > 90% probability of lower value add (e.g. WMA 17 and 19).

Standard Deviation of Impact Distribution

