

Impact of climate change on agriculture and the food system

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abare

Projected impacts of climate change

Region and sector	Temperature change	Projected impact
Canada: cow/calf and dairy production	5°C increase in mean summer temperature	-10%
USA: Aggregate crop production	2.8 - 5.2°C increase in global average temperatures	-0.7 to +1.7%
USA: Dairy milk production	Doubling of CO ₂	-2.2%
Australia: annual milk production per cow	<1°C	-6%
Australia: value of irrigated agricultural production in the Murray Darling Basin	4-5°C	-92%

Projected impacts of climate change

Region and sector	Temperature change	Projected impact
China: wheat yields	1°C	-5.4 to -1.5%
India: wheat yields	0.5 – 1.5°C	-5 to -2%
Argentina: wheat yields	Doubling of CO ₂	-10 to -5%
Argentina: pasture productivity	2020, SRES A2	+1 to +9%
Brazil: wheat yields	Doubling of CO ₂	-50 to -15%

ABARE's illustrative analysis

- climate change – assumed to reduce Australian agricultural productivity by 17 per cent at 2050, relative to reference case
- agricultural productivity assumed to decline in other key countries by between +1 and 25 per cent at 2050, relative to the reference case (based on Cline 2007)
- contraction in global economic activity – consistent with Stern Review
 - 5 per cent in developed countries at 2050, relative to reference case
 - 10 per cent in developing countries at 2050, relative to reference case

Impacts of climate change on global agricultural productivity

at 2050, relative to the reference case, without carbon fertilisation

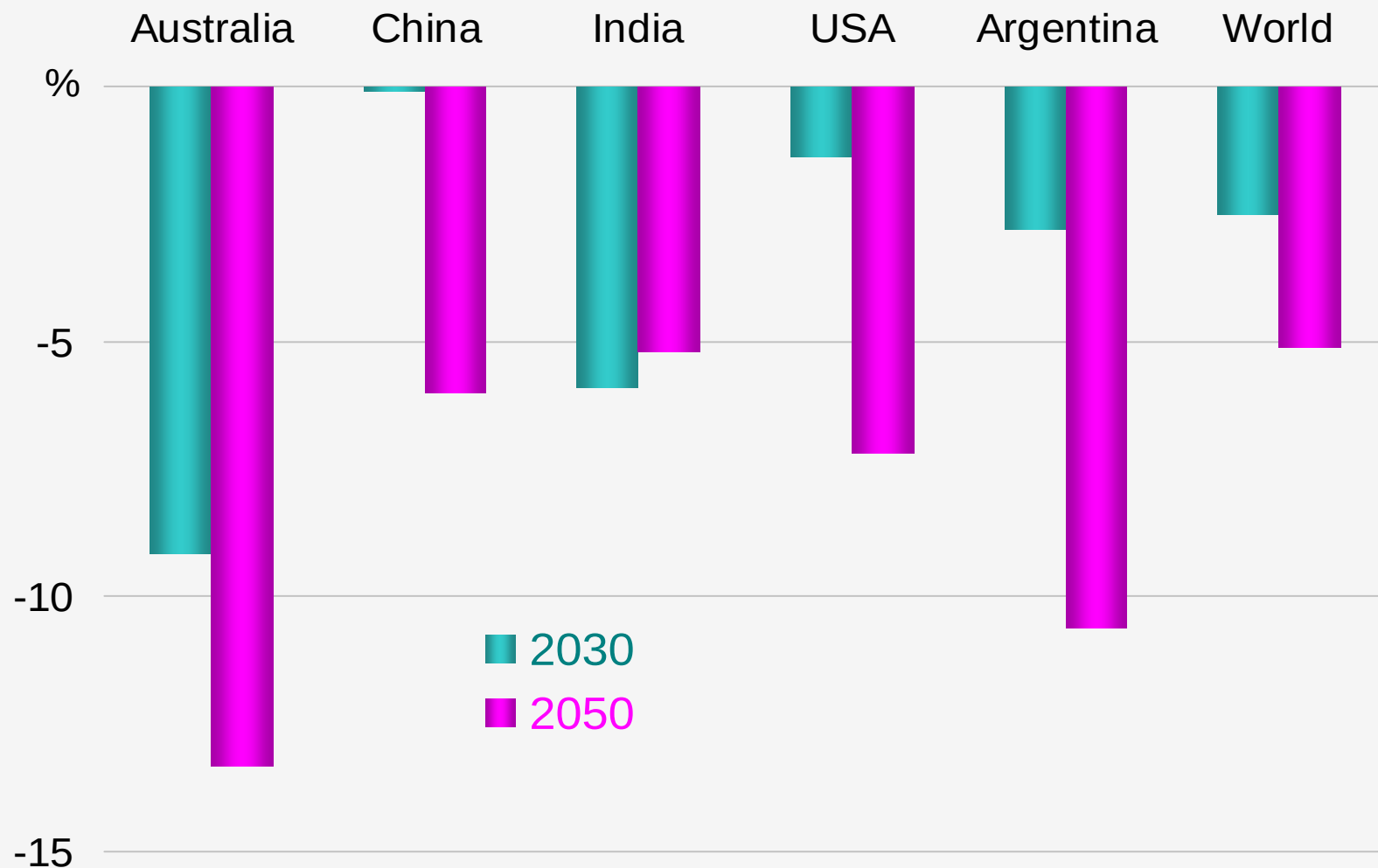
Australia	-17
United States	-4
European Union	-4
Rest of Europe	-4
Canada	-1
Japan	-4
New Zealand	+1

China	-4
India	-25
Brazil	-10
Argentina	-7
ASEAN	-12
Least developed countries	-18
Rest of the world	-13

based on Cline (2007)

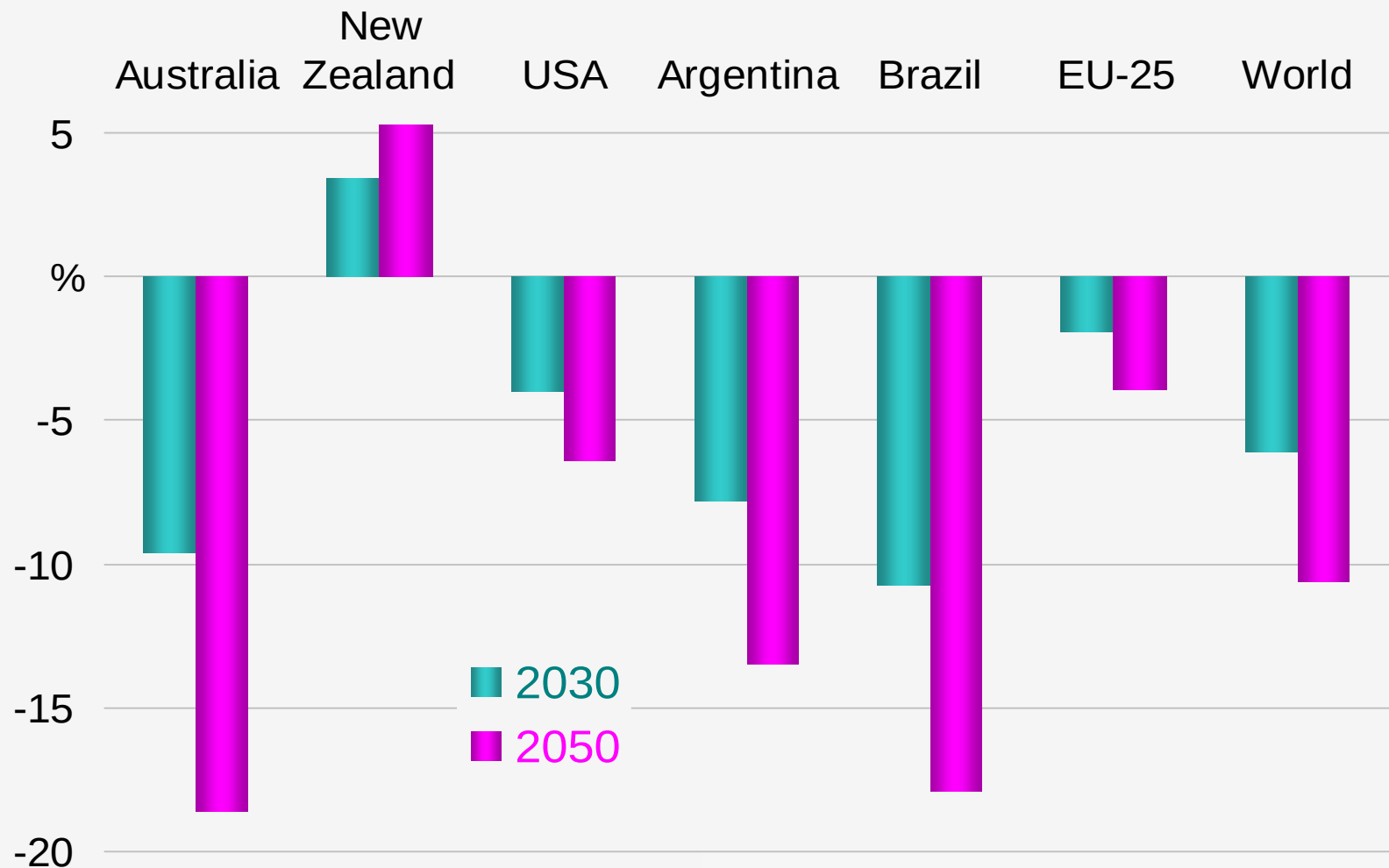
Climate change – percentage change in global wheat production

relative to the reference case (no adaptation or mitigation)



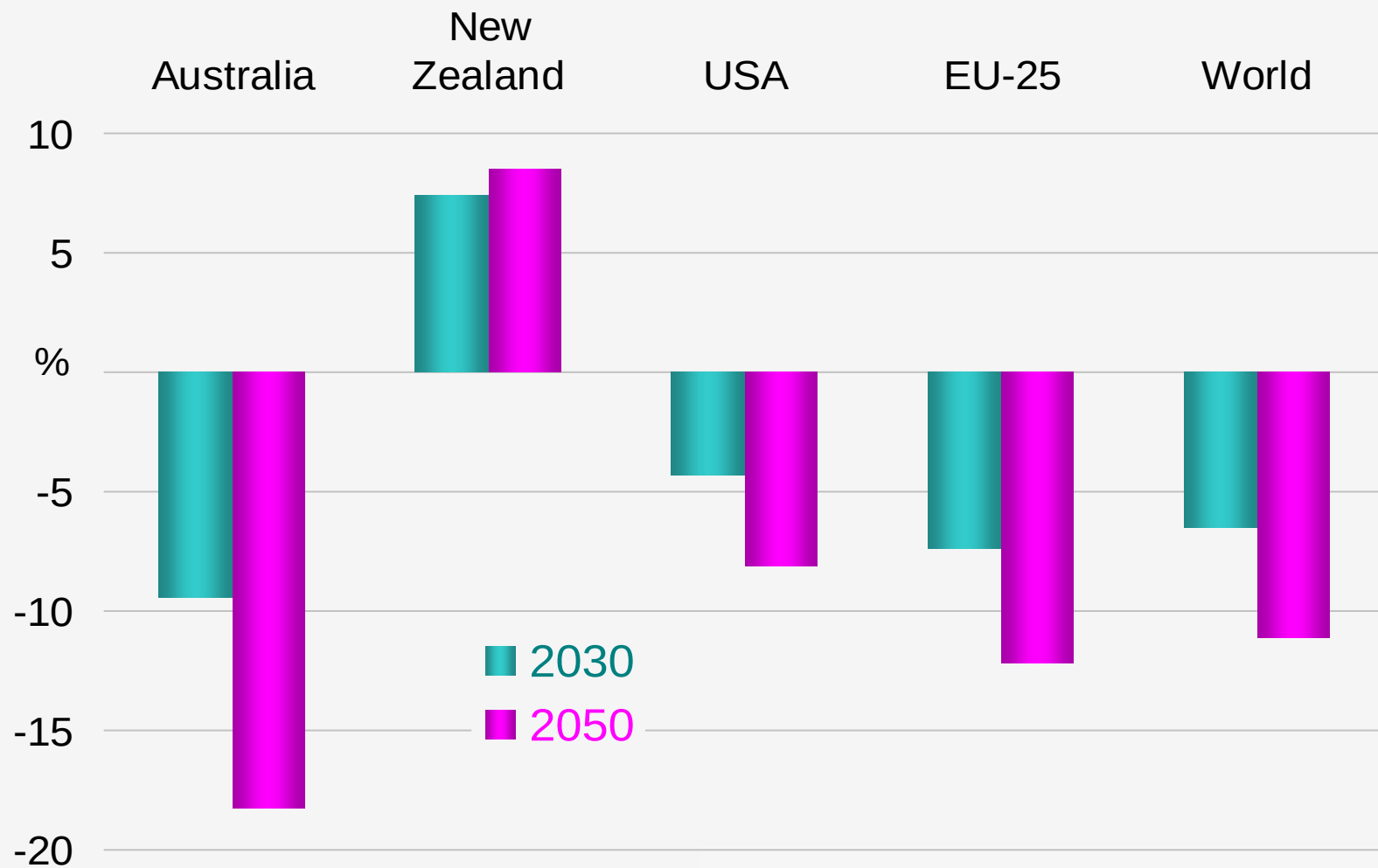
Climate change – percentage change in global beef production

relative to the reference case (no adaptation or mitigation)



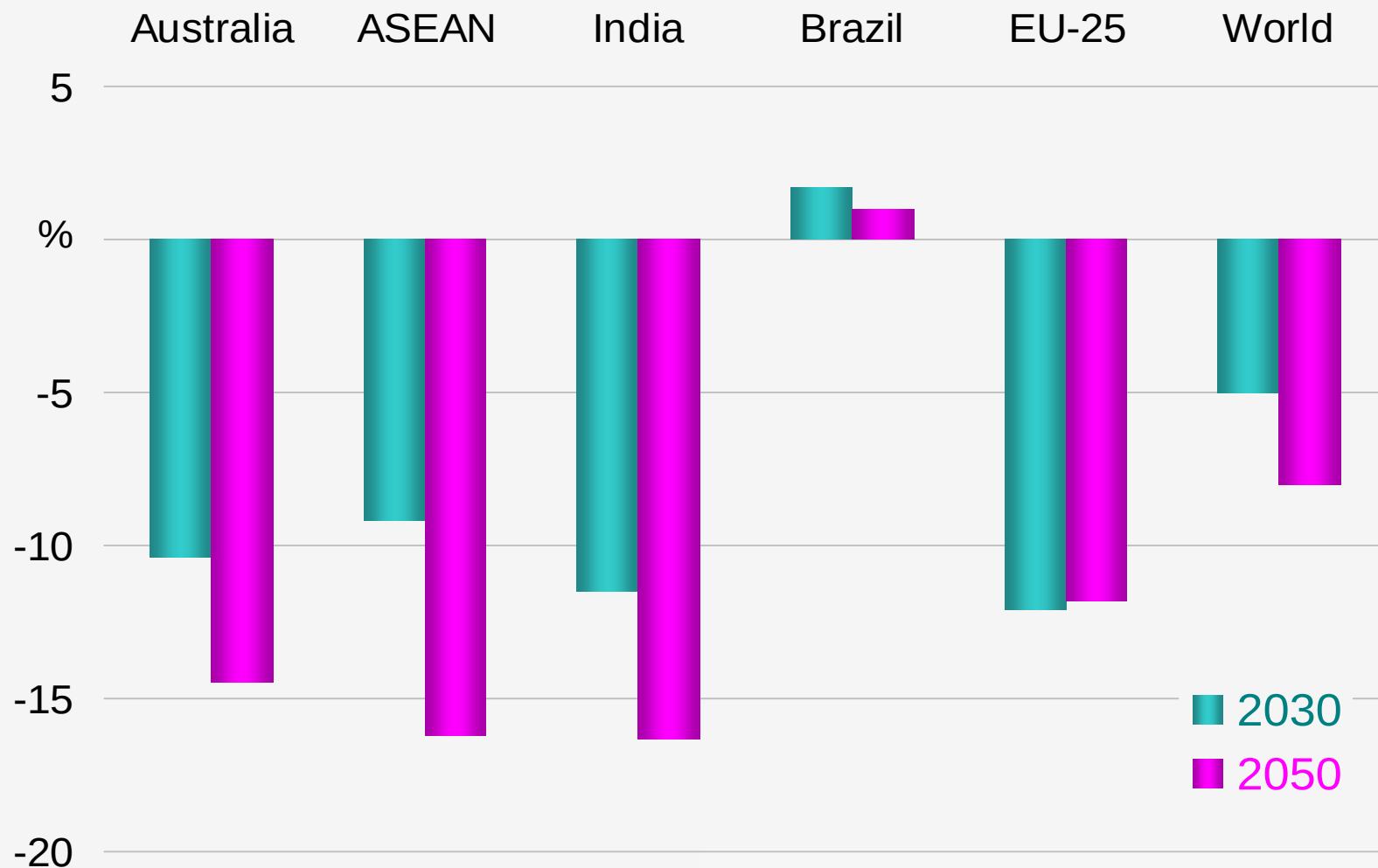
Climate change – percentage change in global dairy production

relative to the reference case (no adaptation or mitigation)



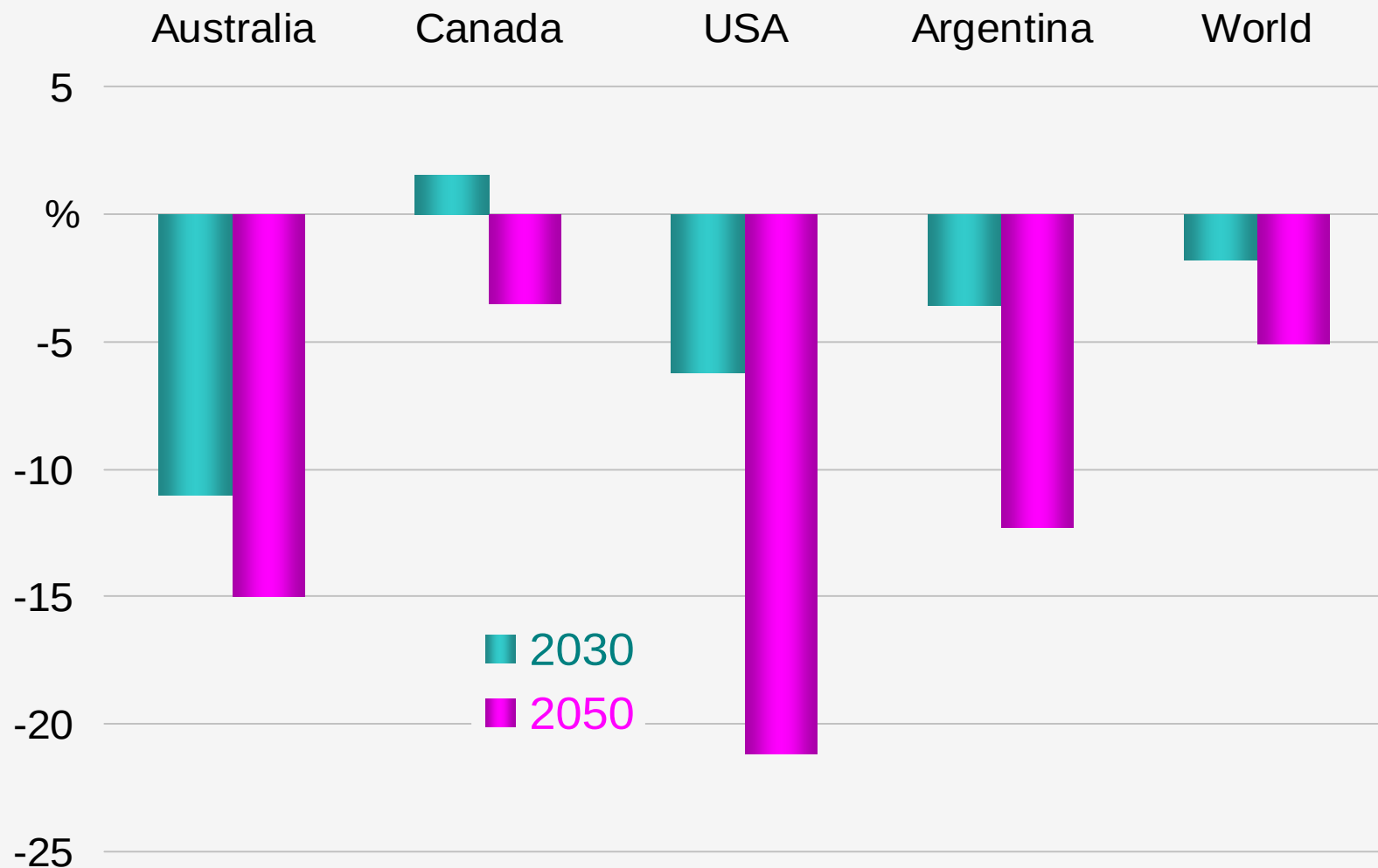
Climate change – percentage change in global sugar production

relative to the reference case (no adaptation or mitigation)



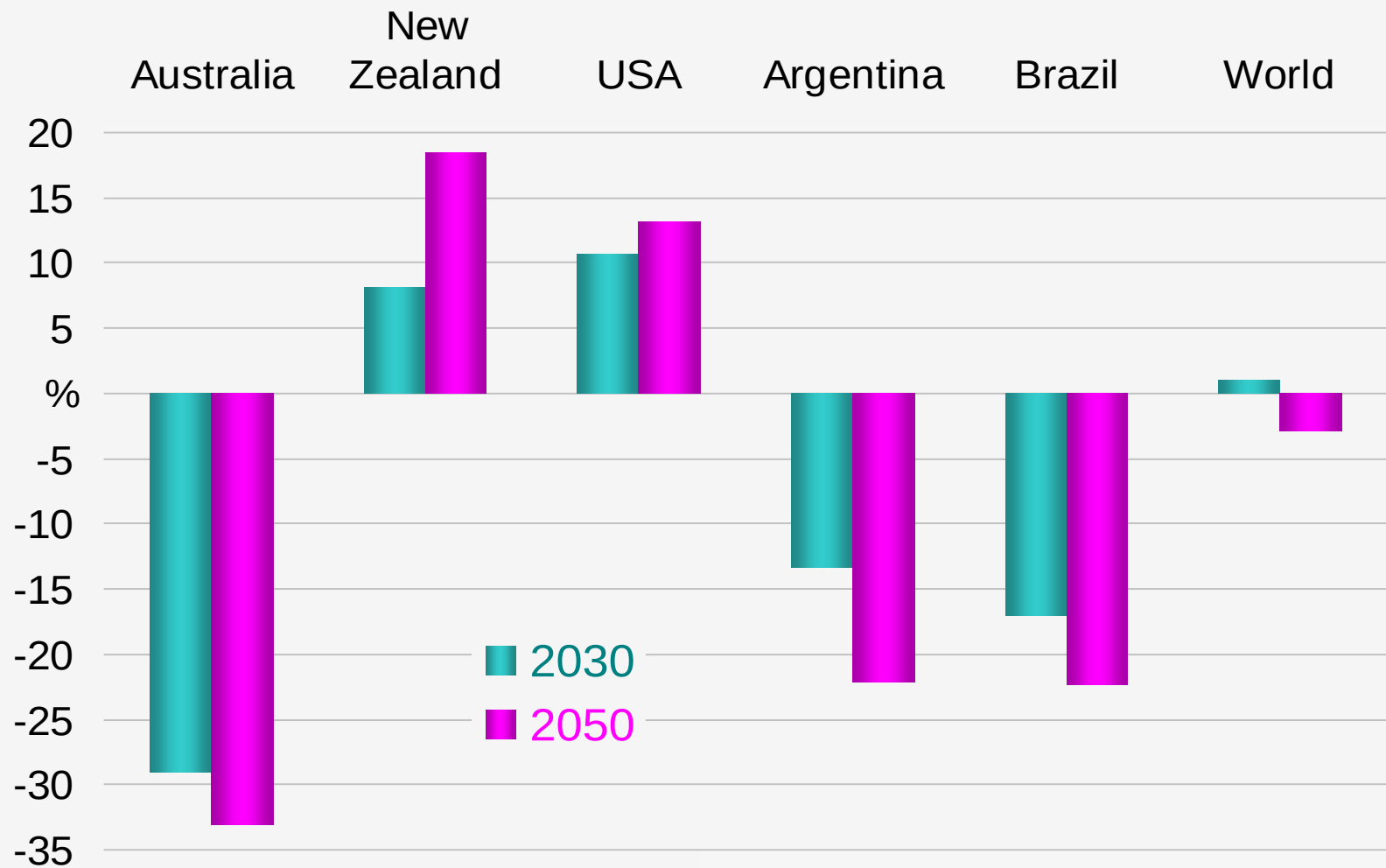
Climate change – percentage change in global wheat exports

relative to the reference case (no adaptation or mitigation)



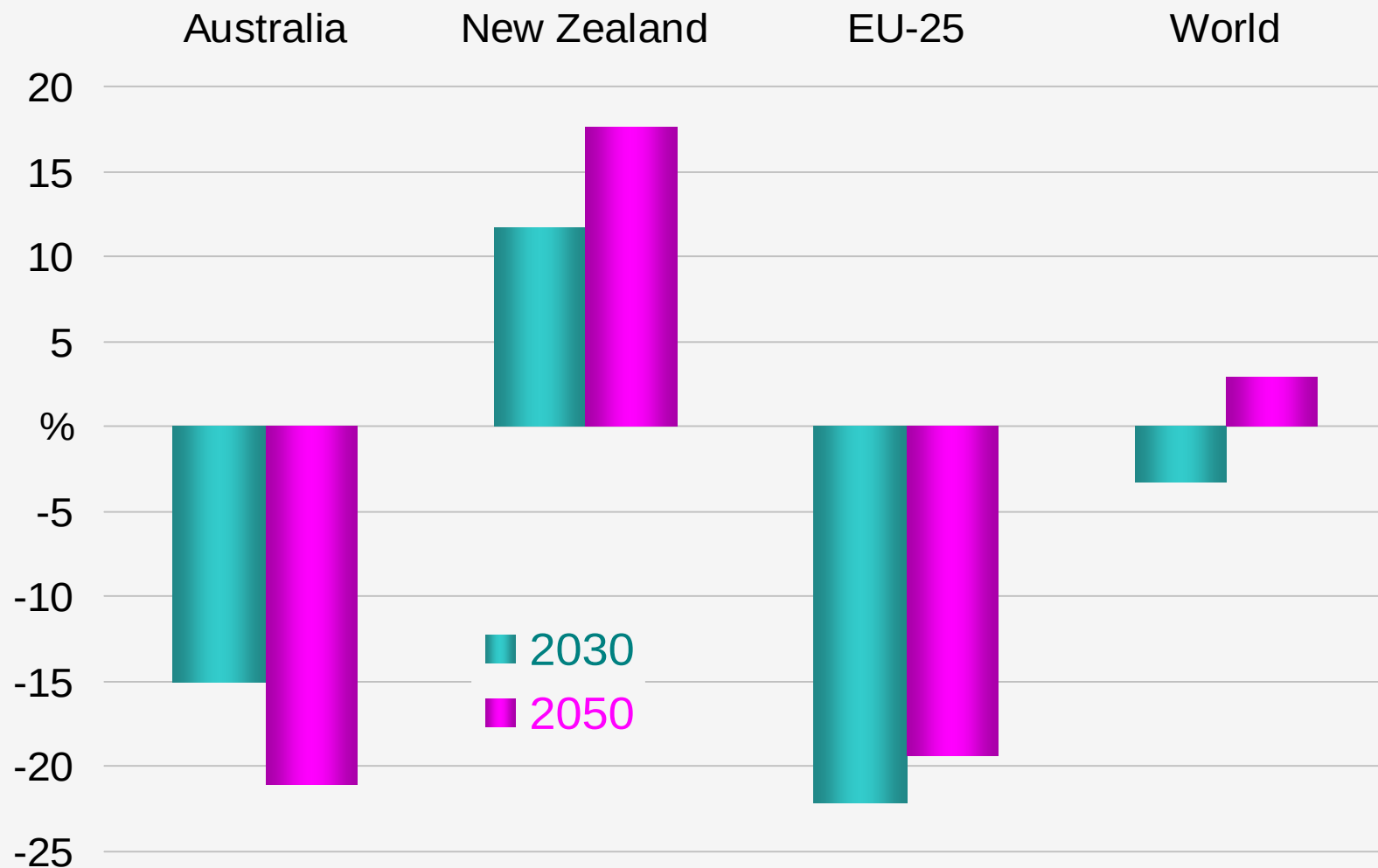
Climate change – percentage change in global beef exports

relative to the reference case (no adaptation or mitigation)



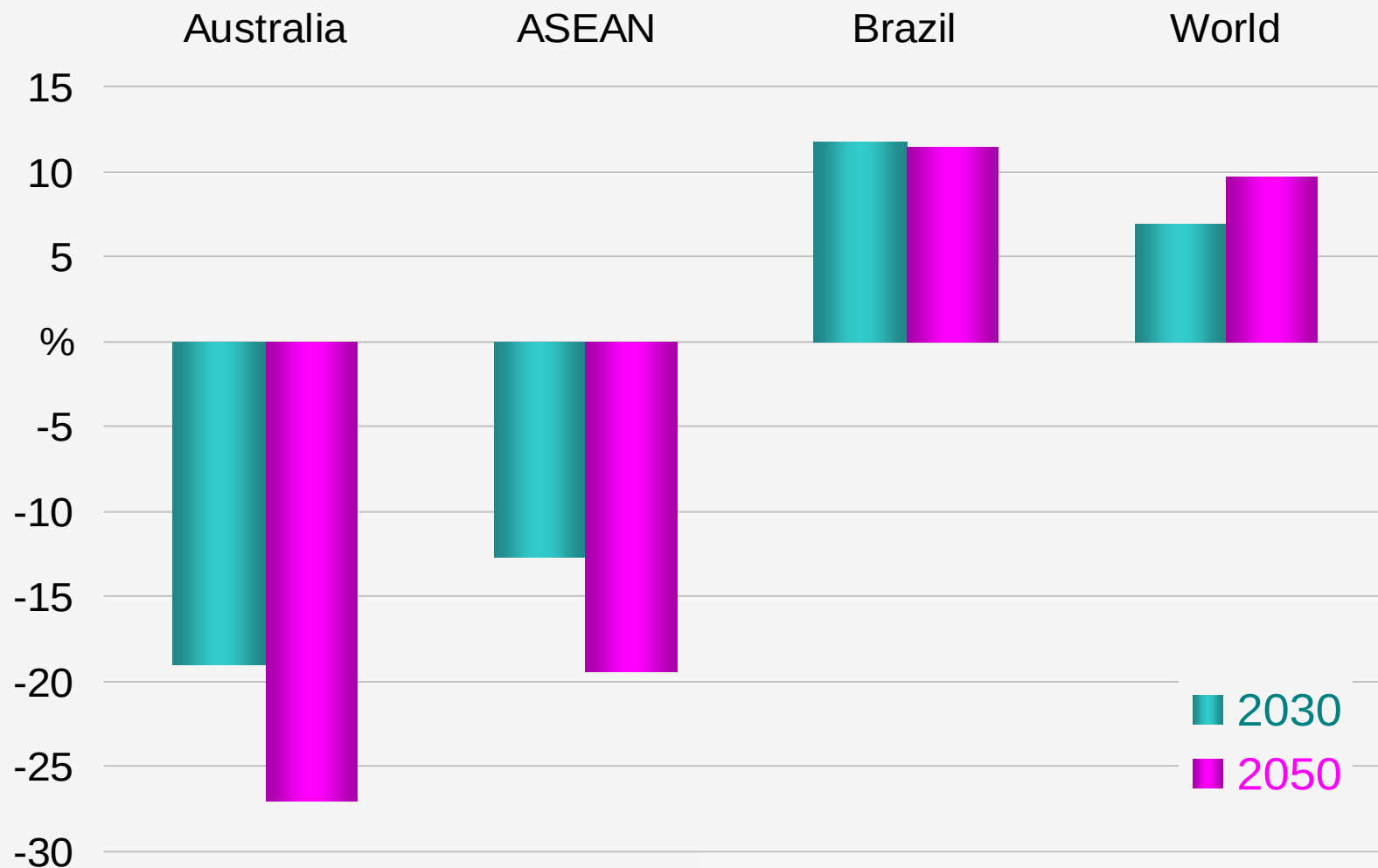
Climate change – percentage change in global dairy exports

relative to the reference case (no adaptation or mitigation)



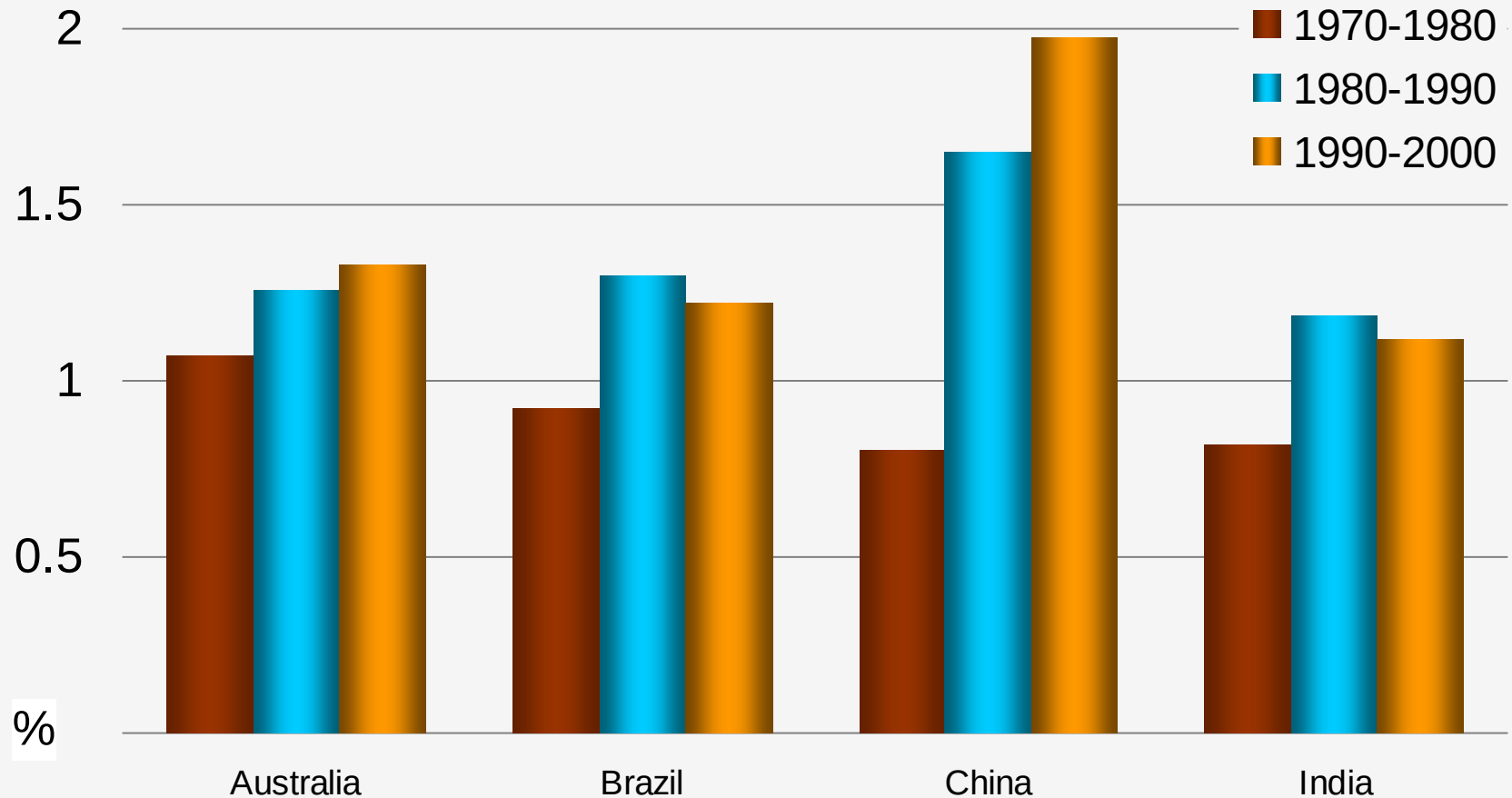
Climate change – percentage change in global sugar exports

relative to the reference case (no adaptation or mitigation)



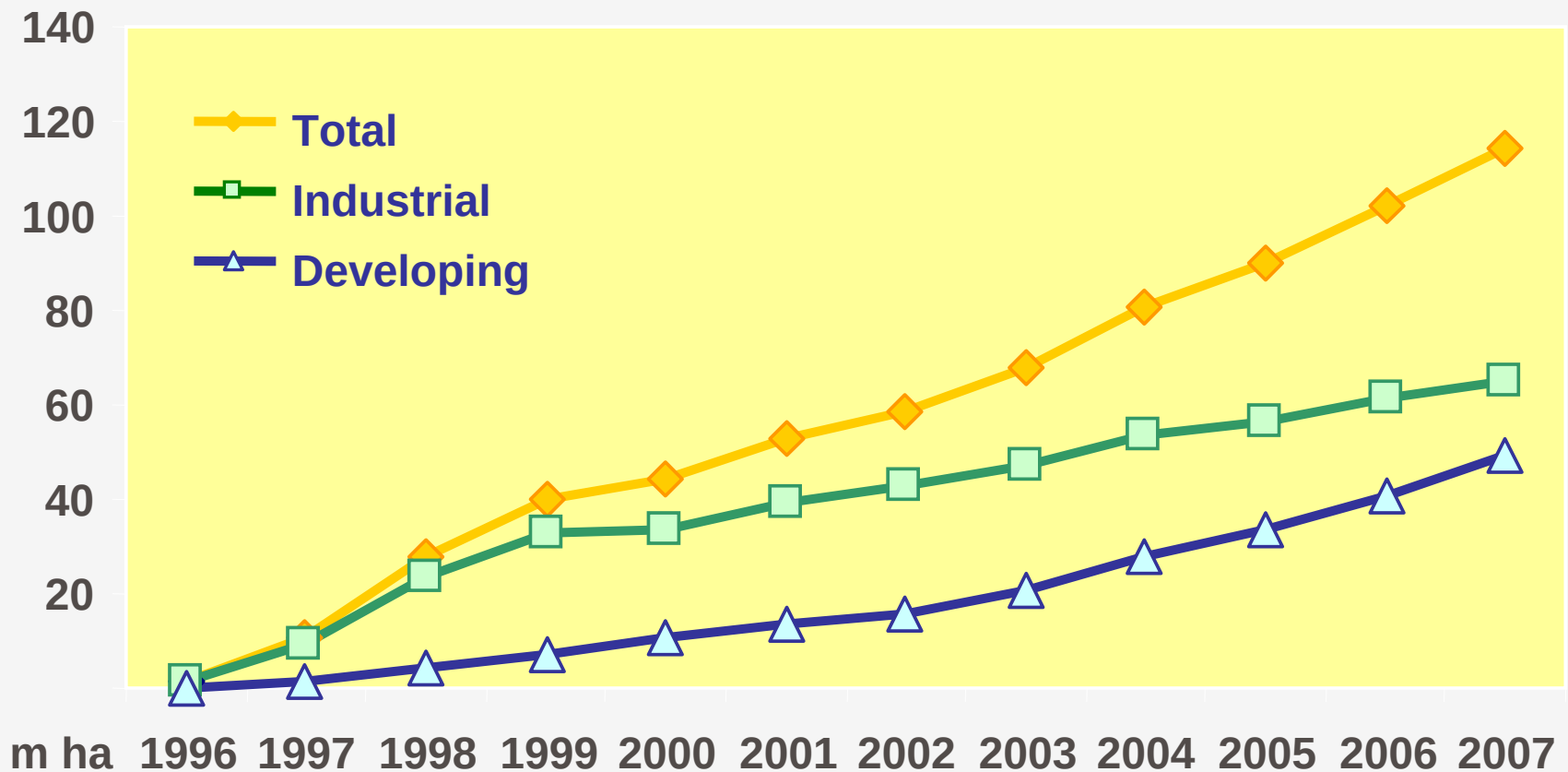
Comparison of agricultural productivity growth rates

% per year



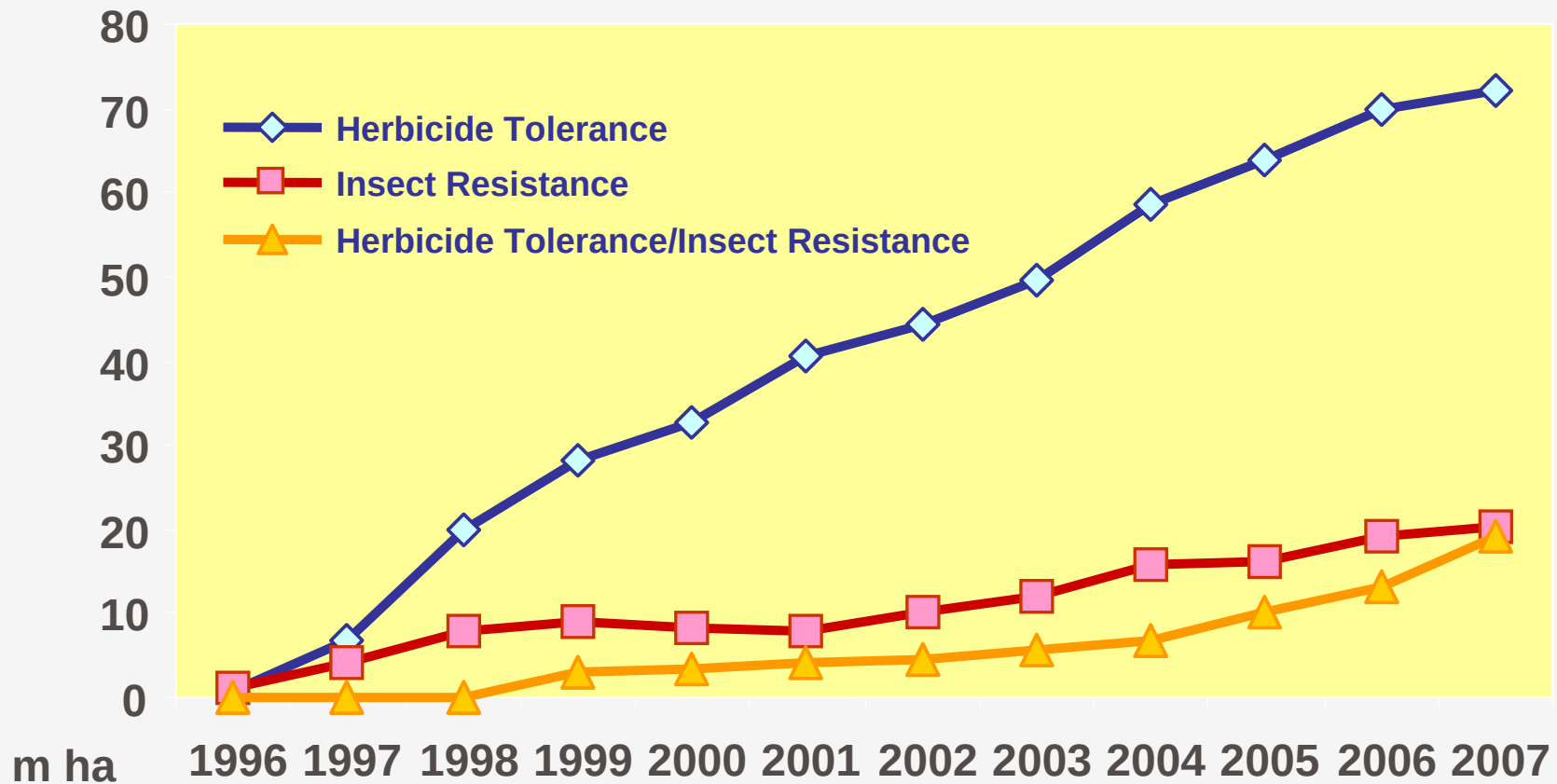
Source: Rao et al. 2004

Global area of GM crops (1996-2007)



Source: Clive James, 2007

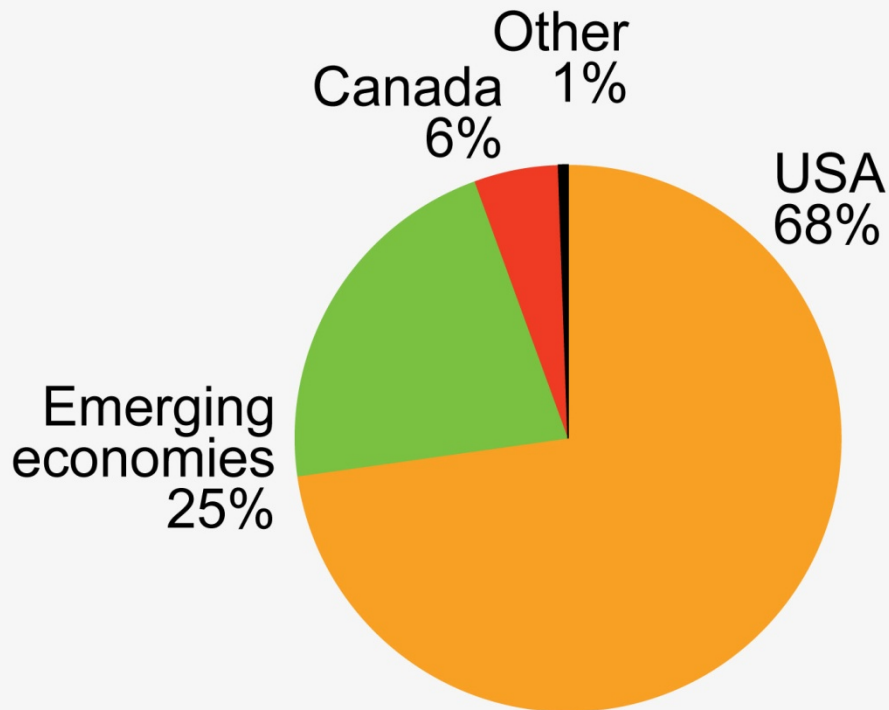
Global area of GM crops by trait (1996-2007)



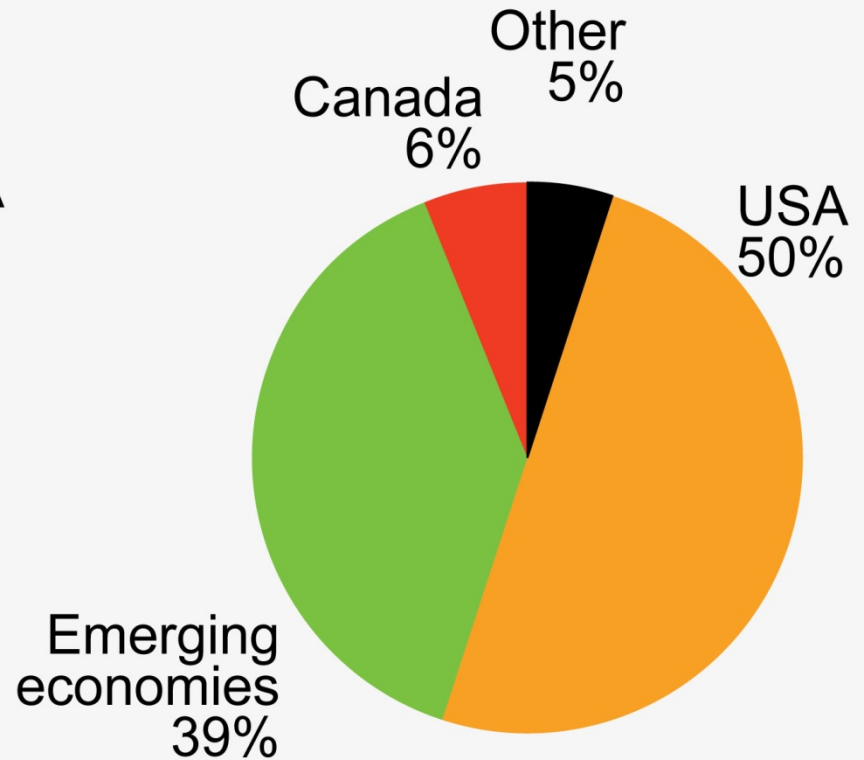
Source: Clive James, 2007

GM crop uptake by country

2001
53 million ha



2007
114 million ha



GM technology and climate change

- Increased resistance to pests and disease
- Increased resistance to salinity, heat and frosts
- Enhanced drought tolerance
- Lower use of herbicide and pesticide sprays can reduce fossil fuel use
- Use of conservation tillage on herbicide tolerant plants

Source: ISAAA (2006); Lee (2007) Spangenberg (2007)

Way forward

- Raising agricultural productivity
 - International public sector action
 - Improved incentives and institutions
 - Revitalise CGIAR framework
- Expand the global reform issues
 - Export restrictions, bio fuel policies, GM technology
- Fix the incentives facing agriculture
 - Revitalise the Doha Round
 - Ensure flow of imports and exports in good and bad times

Source: Subramanian (2008)

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