Exploring the Impacts of Changing Energy Costs on New Zealand Agriculture to 2030: A GTAP-E-RD Application

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Te Whare Wānanga o Waikato

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23rd Annual Conference on Global Economic Analysis

17-19 June 2020

INTRODUCTION

- Considerable uncertainty exists about future fuel prices and carbon costs
  - Different trajectories may have significant potential impacts on New Zealand agriculture
  - We explore the impact of a range of possible changes in fuel and carbon prices on New Zealand's key agro-food sectors, particularly dairy, beef and sheep
- We use the new GTAP-E-RD (GTAPv7) model to project the global economy to 2030
  - Assuming relatively conservative increases in NZ carbon emission prices with moderate changes in world oil & gas prices
  - We then consider the impact of a range of alternative scenarios

Outline of Presentation

- Modelling Framework and Data
- Baseline Simulation
- Policy Simulations
- Results
- Concluding Comments

Modelling Framework and Data

- We use the new GTAP-E-RD (Corong et al., 2019)
- And GTAP version 10A database
  - Base year of 2014, aggregated to 16 regions and 34 sectors
  - Including carbon dioxide emission data distinguished by fuel type and user
  - Supplemented with the GTAP non-carbon dioxide emissions data on other greenhouse gas emissions
- Beef and sheep are important sectors of focus here
  - We split the GTAP beef and sheep meat (cmt)
  - As well as the associated cattle and sheep (ctl)

Regions and sectors modelled

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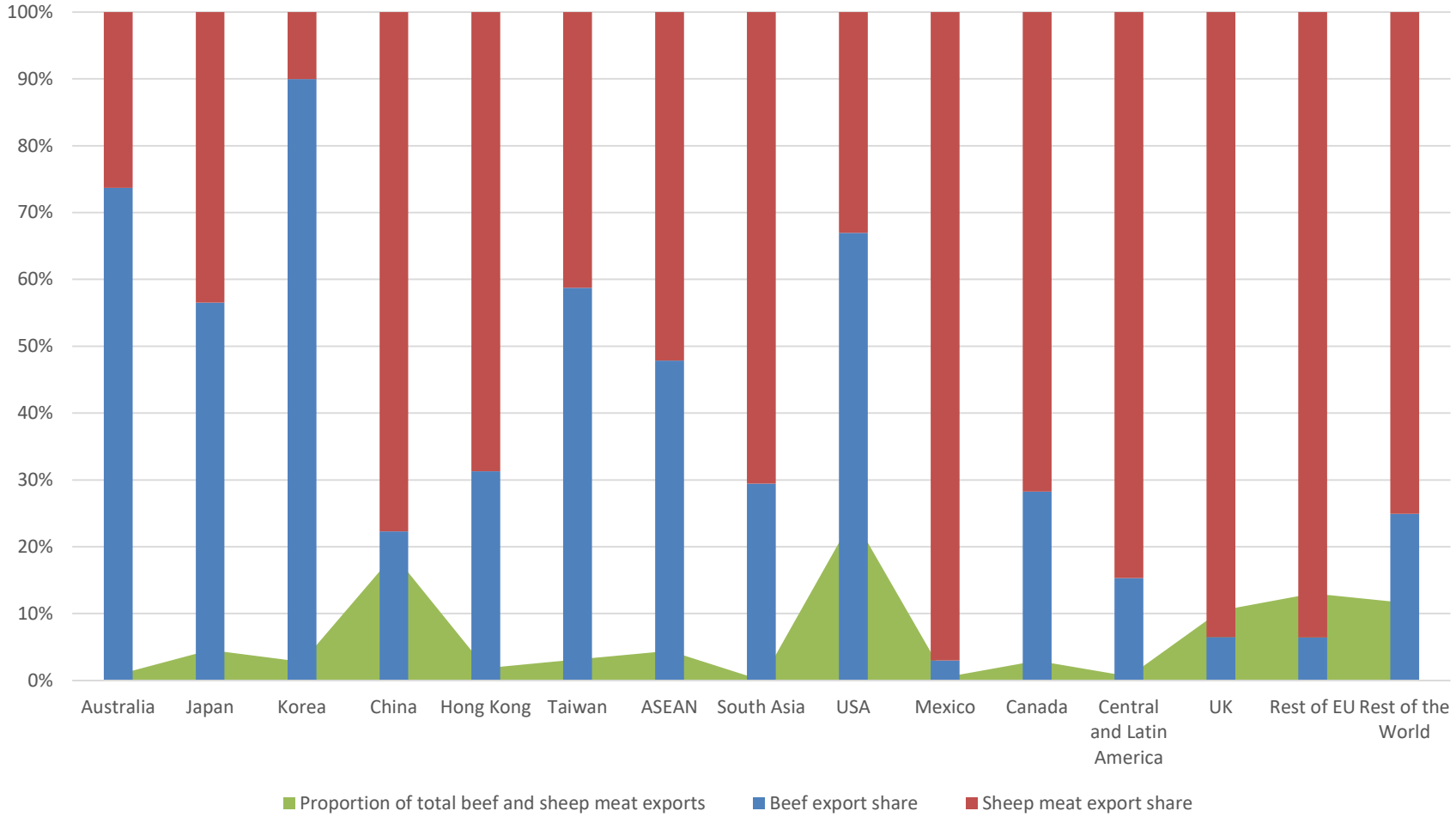
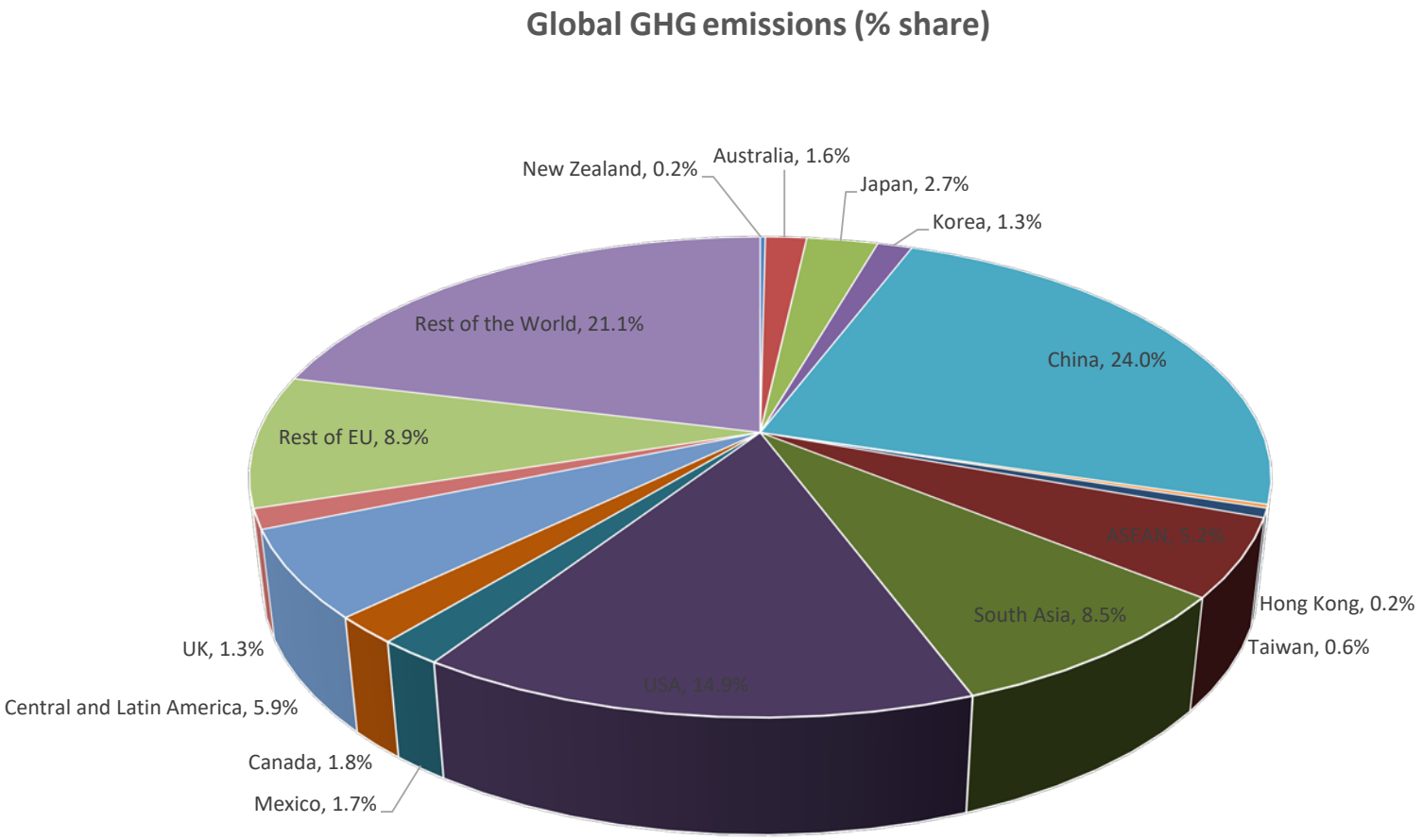
Regions Modelled
New Zealand
Australia
United Kingdom
Rest EU
China
Japan
Hong Kong
Taiwan
South Korea
ASEAN
South Asia
United States
Canada
Mexico
Central and Latin America
Rest of the World

Sectors Modelled	
Rice	Coal
Fruit_Veg	Oil
Sugar	Gas
OtherCrops	OthMinerals
RawMilk	TextilesWAP
Cattle	MotorVehicle
Sheep	Electronics
OtherAnimal	OthMachinery
Wool	OthManuf
Beef	ChemRubPl
Sheepmeat	PetroCoal
OtherMeats	MineralProds
Dairy	MetalProds
ProcFoods	AirOthTrn
Bev_Tob	ElecWatGas
ForWoodPaper	Construction
Fisheries	OtherServices

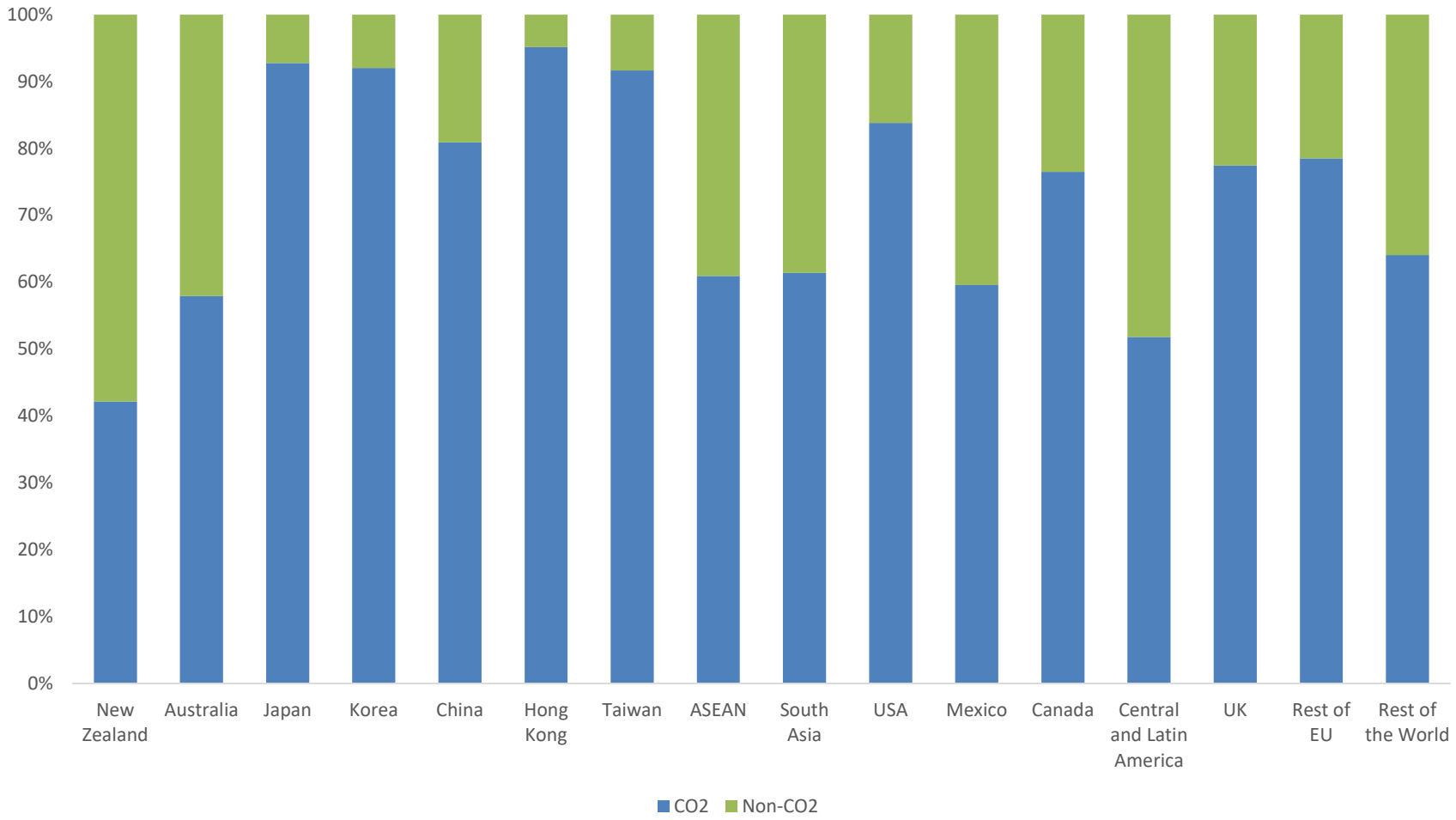
New Zealand beef and sheep meat export shares by market, 2014 (%)



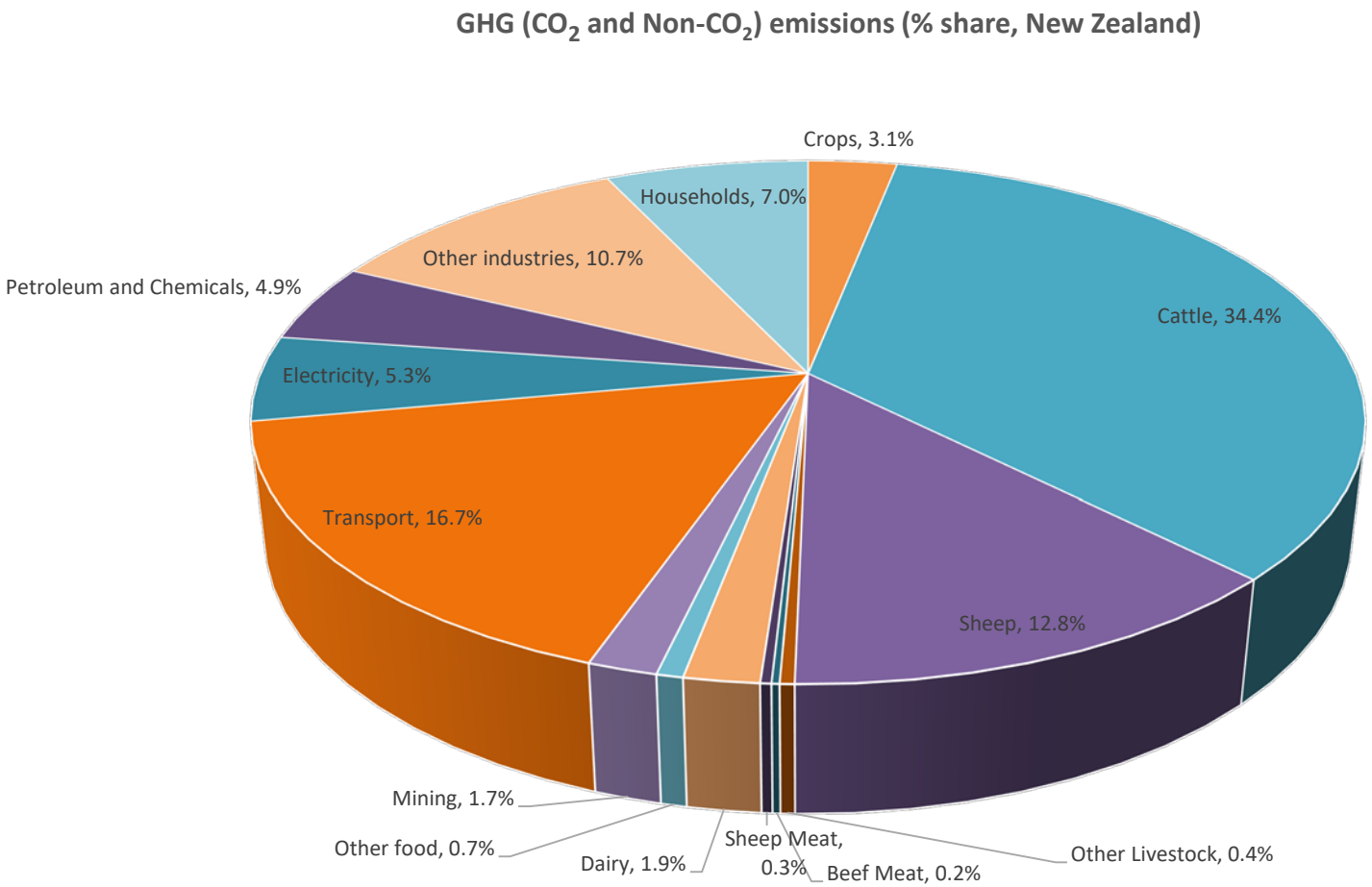
Global GHG emission shares, 2014 (%)



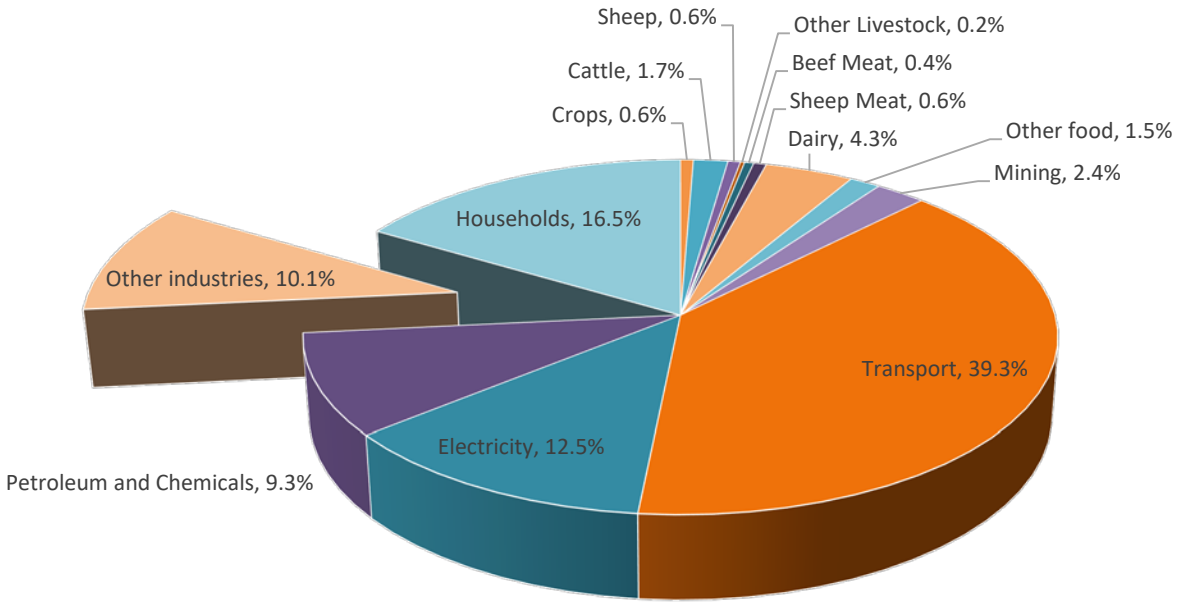
Shares of CO2 and non-CO2 in total emissions by country/region, 2014 (%)



Shares of total GHG emissions by activity, New Zealand, 2014 (%)

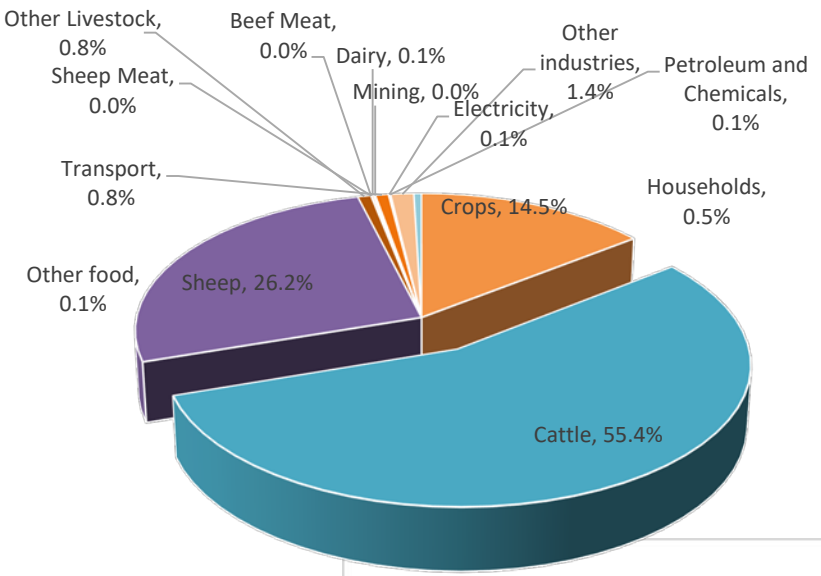


Emission shares by industry and type of GHG, New Zealand, 2014 (%): CO_2

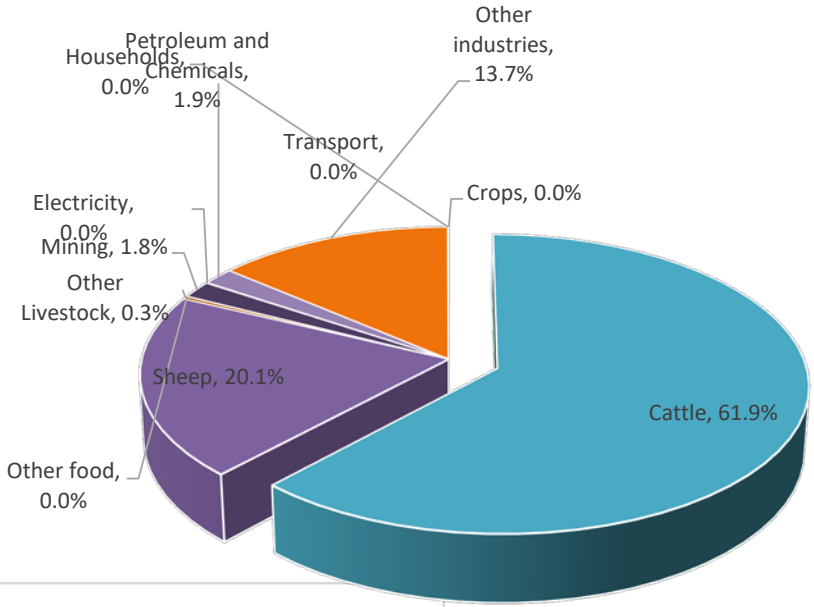


National CO_2 emissions (% share)

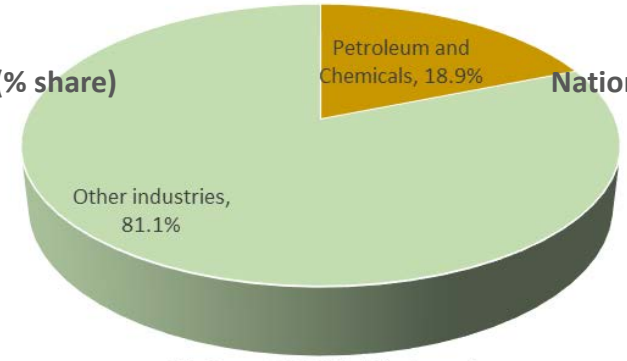
Emission shares by industry and type of GHG, New Zealand 2014 (%): Non-CO_2



National N_2O emissions (% share)

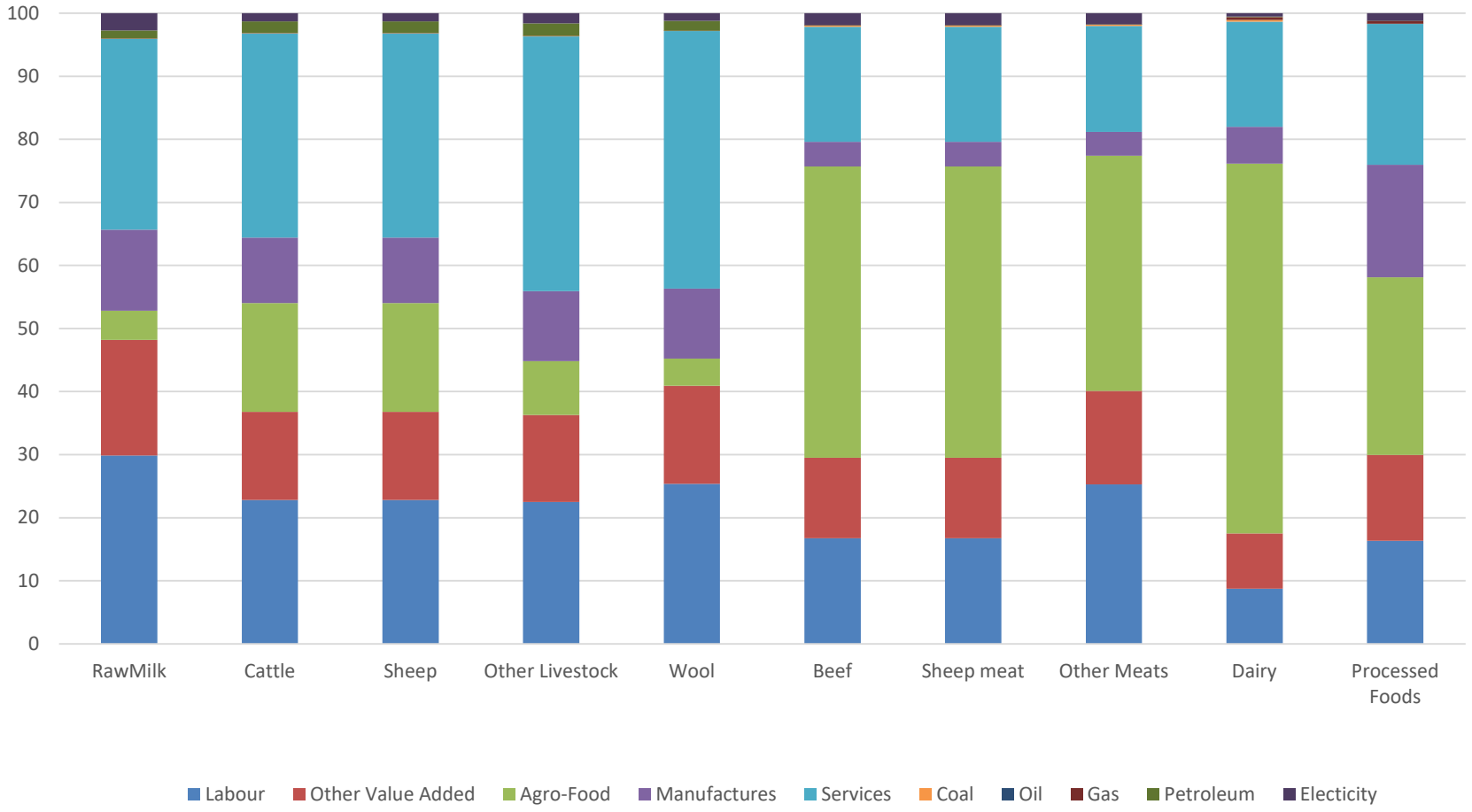


National CH_4 emissions (% share)



National FGAS (% share)

Cost shares by industry, New Zealand, 2014 (percent)



BASELINE SIMULATION

- We project NZ and other economies to 2030
  - Drawing on Shared Socio-economic Pathways (SSPs) (O'Neill et al., 2014)
  - Middle of the road: 'business as usual' trends, SSP2
- We include projections for
  - GDP per capita
  - Population
  - Labour supply
  - Labour productivity adjusts to hit GDP target
  - Upward sloping supply for fixed and sluggish factors

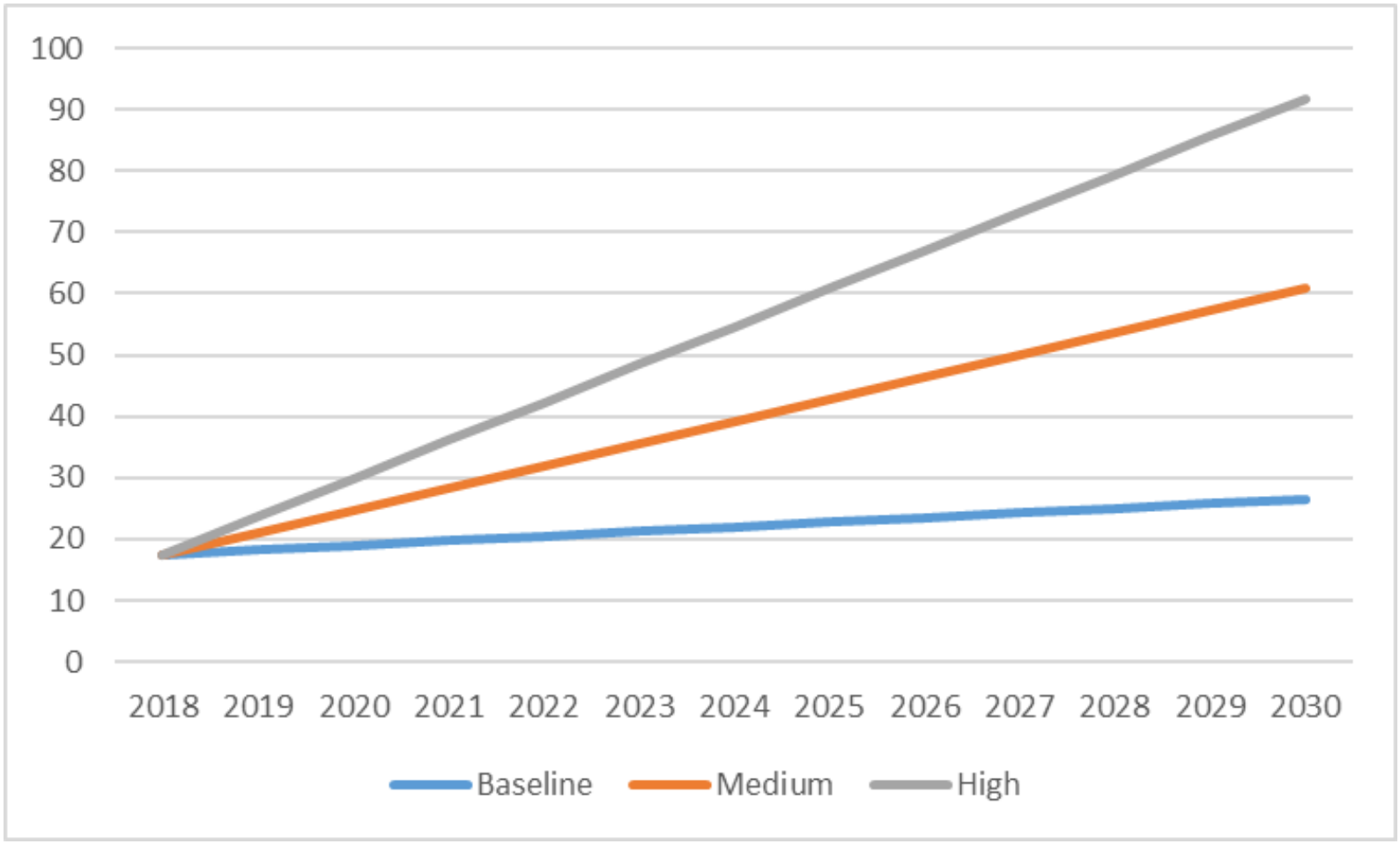
Baseline emission and fuel price assumptions

- In the baseline, we include projections of New Zealand carbon emission prices, as well as and oil and gas prices
  - For NZ carbon prices, we draw on low scenario carbon price projection from Concept Economics et al. (2018)
    - Baseline assumption of US$17.5 in 2018 per tonne of CO_2 emissions, rising to US$26.6 by 2030
  - For baseline oil and gas prices, we draw on EIA's (2019) moderate reference case projections
    - Oil prices projected to be US$89.67 per barrel and natural gas prices at US$4.27 per BTU by 2030

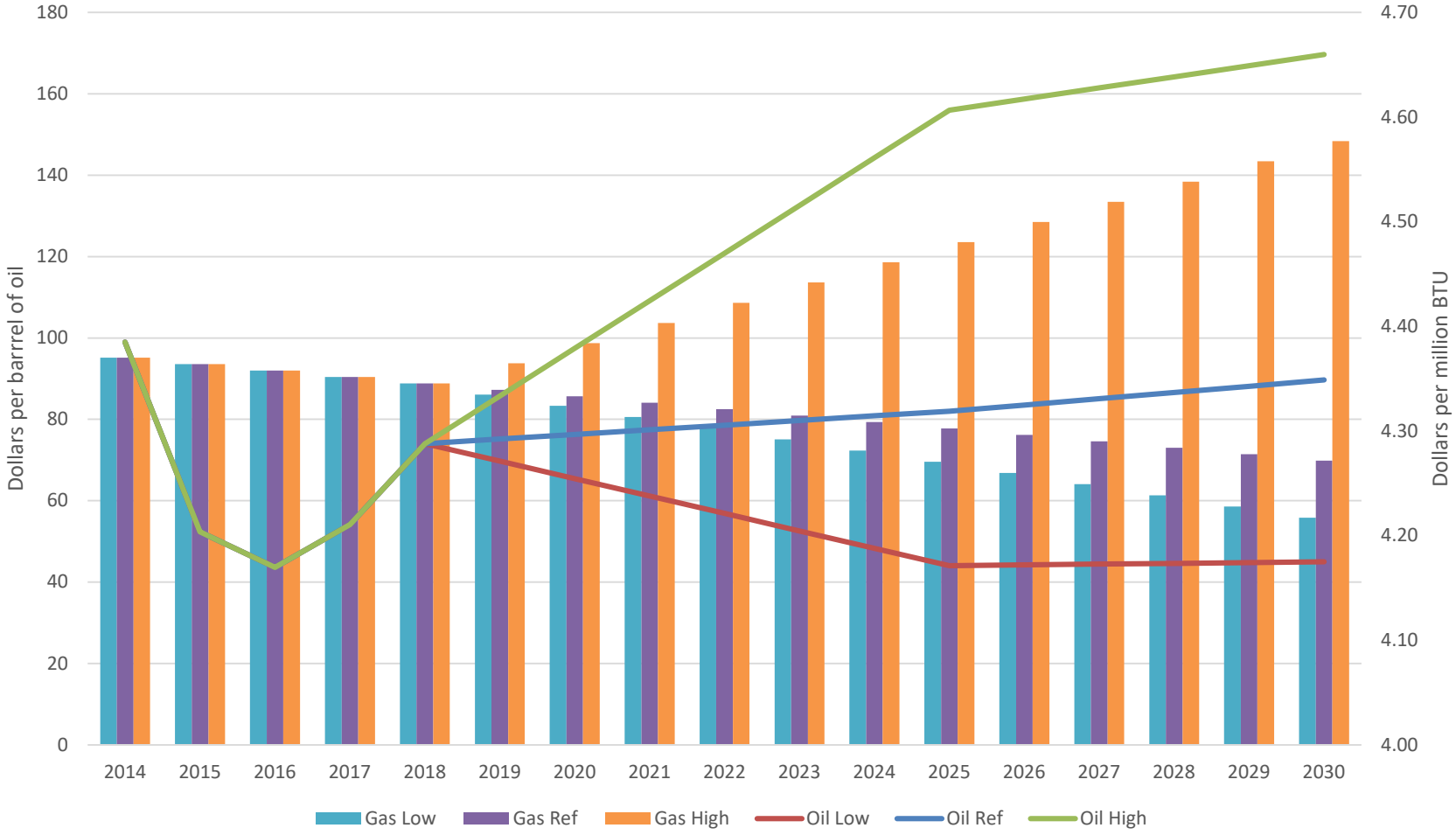
POLICY SIMULATIONS

- We model five scenarios:
  1. New Zealand carbon emission prices rising to a moderate level in 2030
  2. New Zealand carbon emission prices rising to a relatively high level in 2030
  3. Global carbon emission prices rising to a moderate level in 2030
  4. Oil and gas prices rising by a lower than baseline amount
  5. Oil and gas prices rising by a higher than baseline amount

Carbon emission price under baseline, medium and high price scenarios, 2018 to 2030 (US dollars)



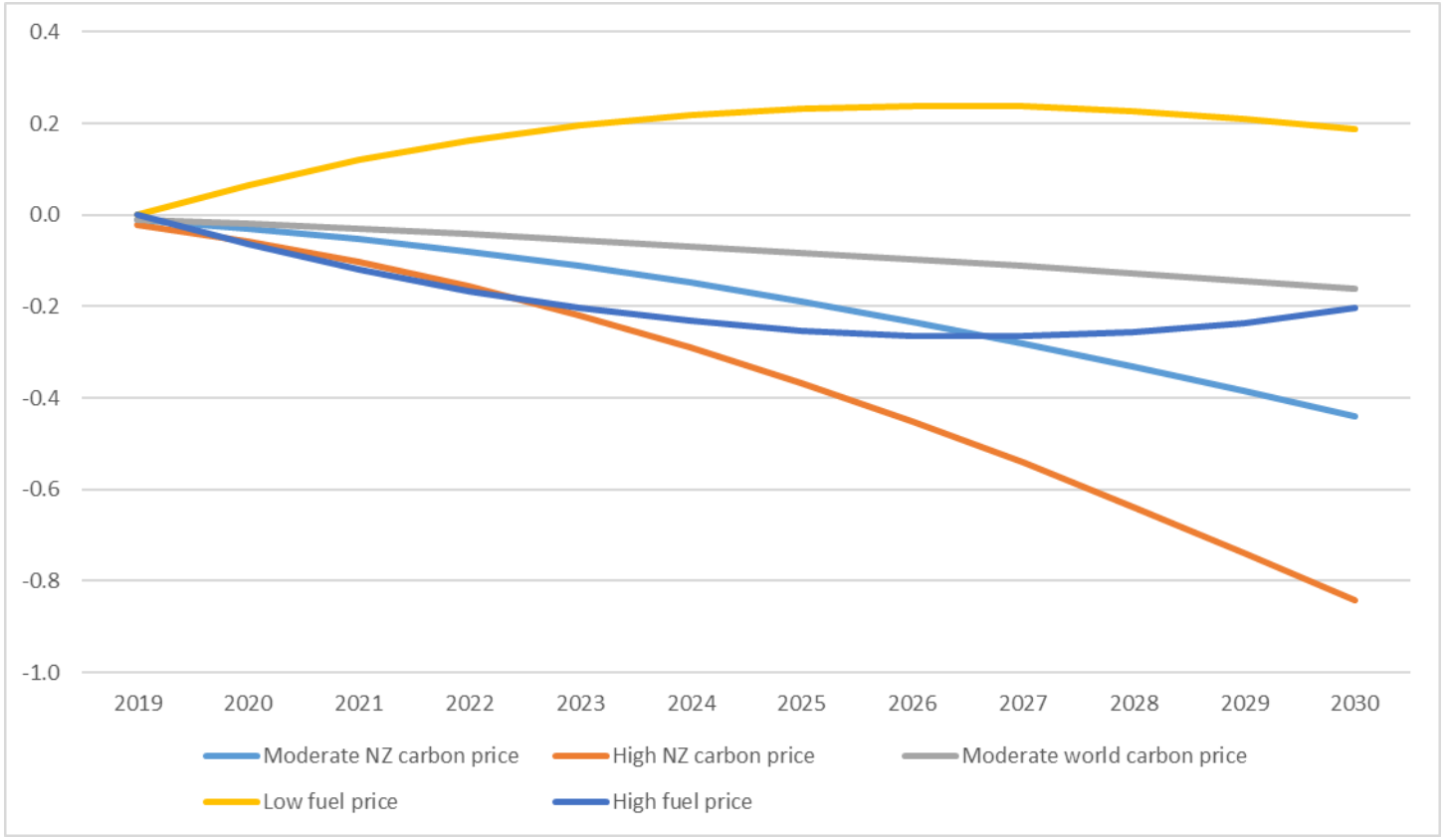
Oil and gas price projections, alternative scenarios, 2018-2030 (US$ per barrel of oil and US$ per million BTU gas)



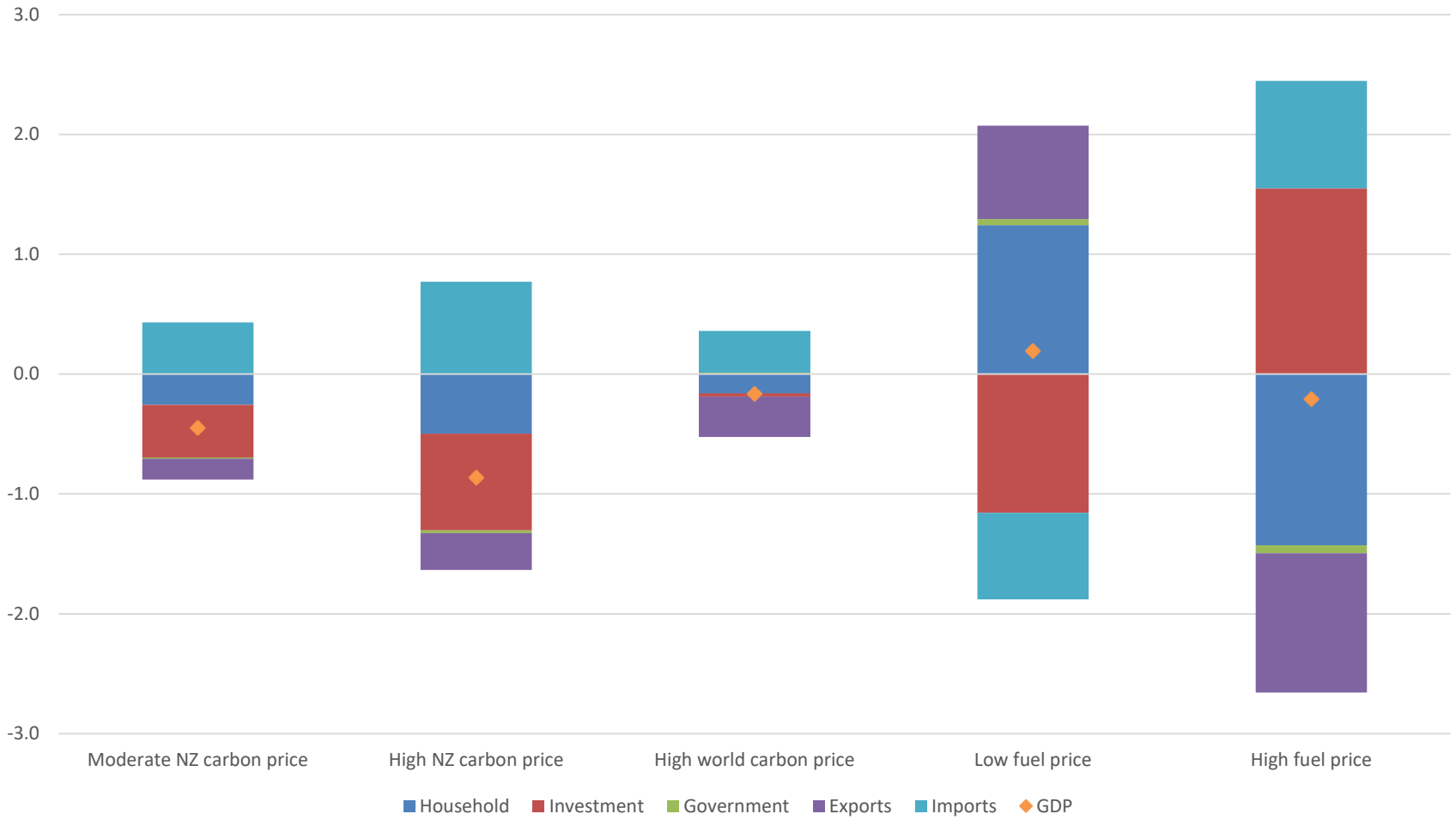
RESULTS

- We present some selected summary results:
  - NZ's real GDP
    - And decomposition of contributions
  - NZ's real exports
  - Total world CO_2 emissions
  - NZ's total CO_2 and non-CO_2 emissions
    - Impact on NZ's CO2 emissions
  - Real output, selected NZ agricultural sectors

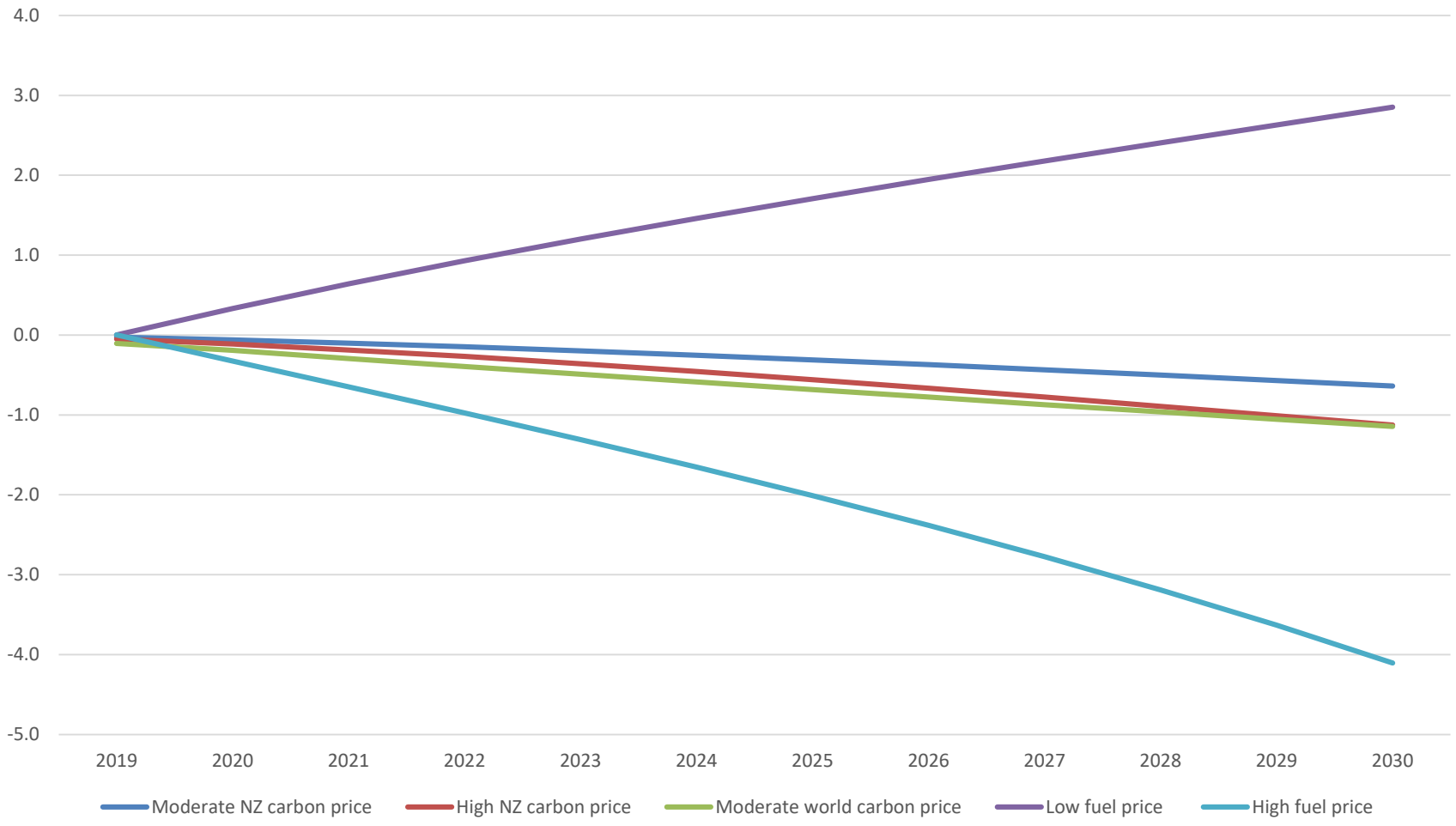
Impact on NZ's real GDP, 2020-2030 relative to baseline (%, cumulative)



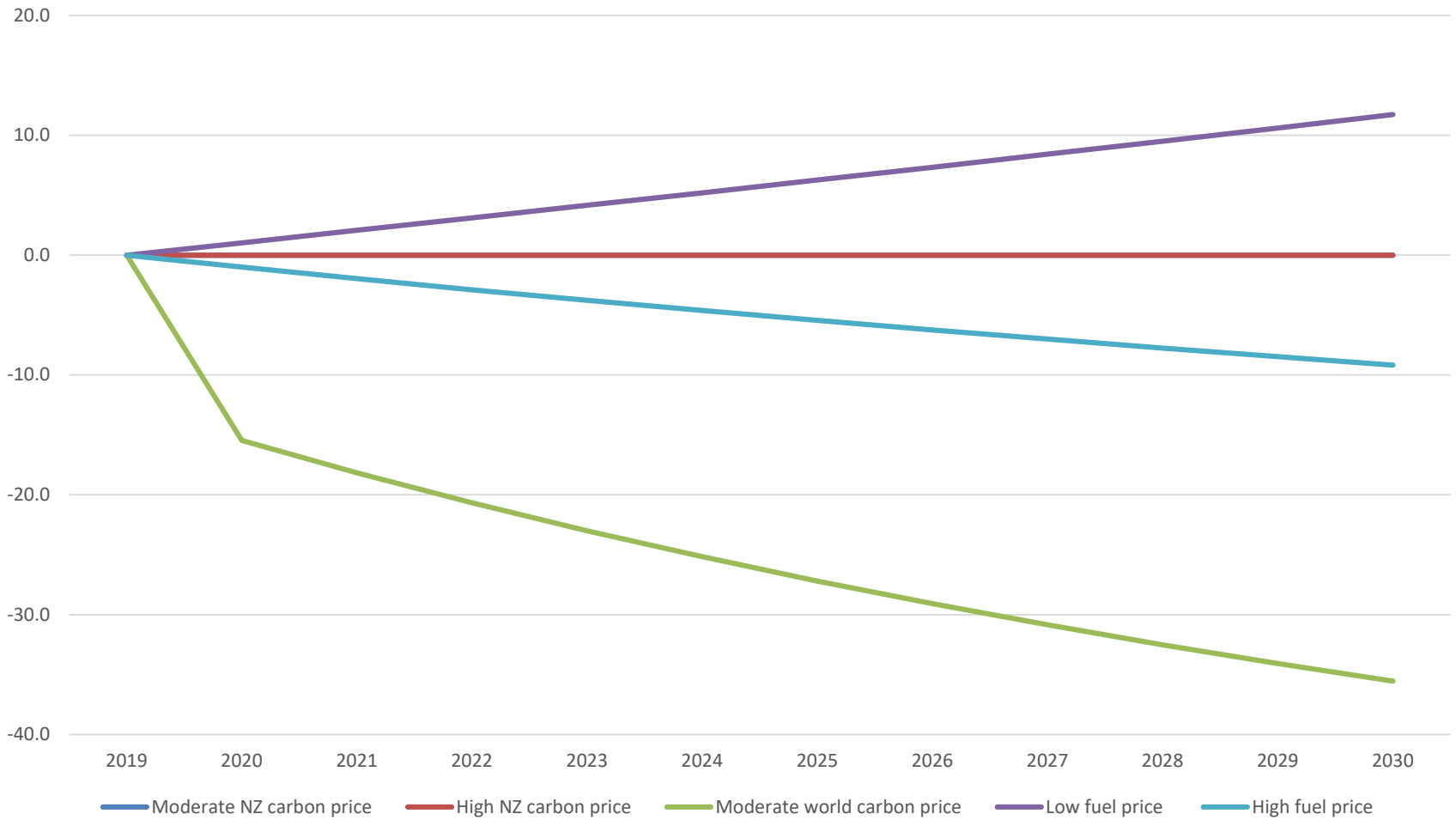
Decomposition of contributions to NZ real GDP change, 2030 (%)



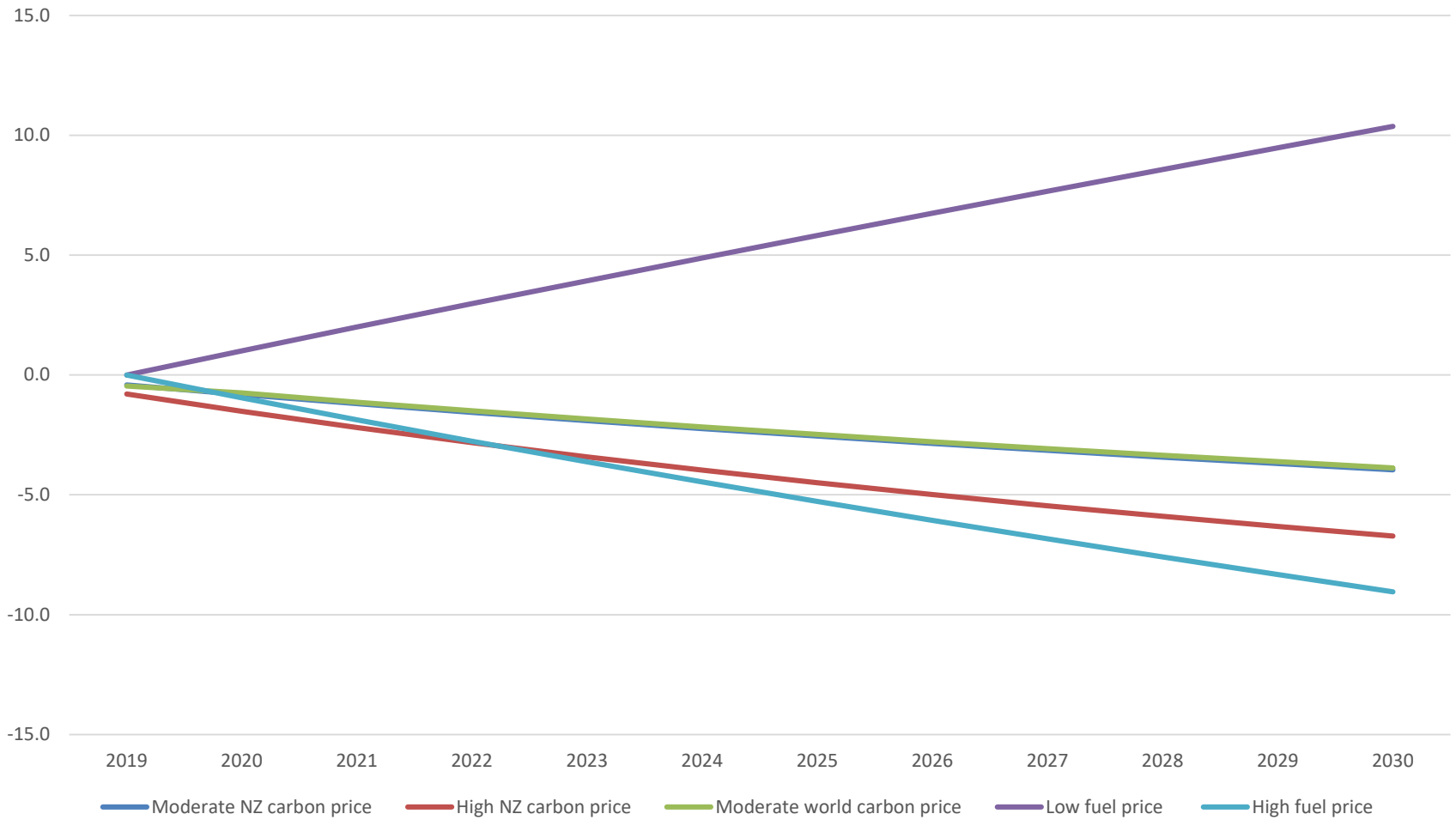
Impact on NZ's real exports, 2020-2030 relative to baseline (%, cumulative)



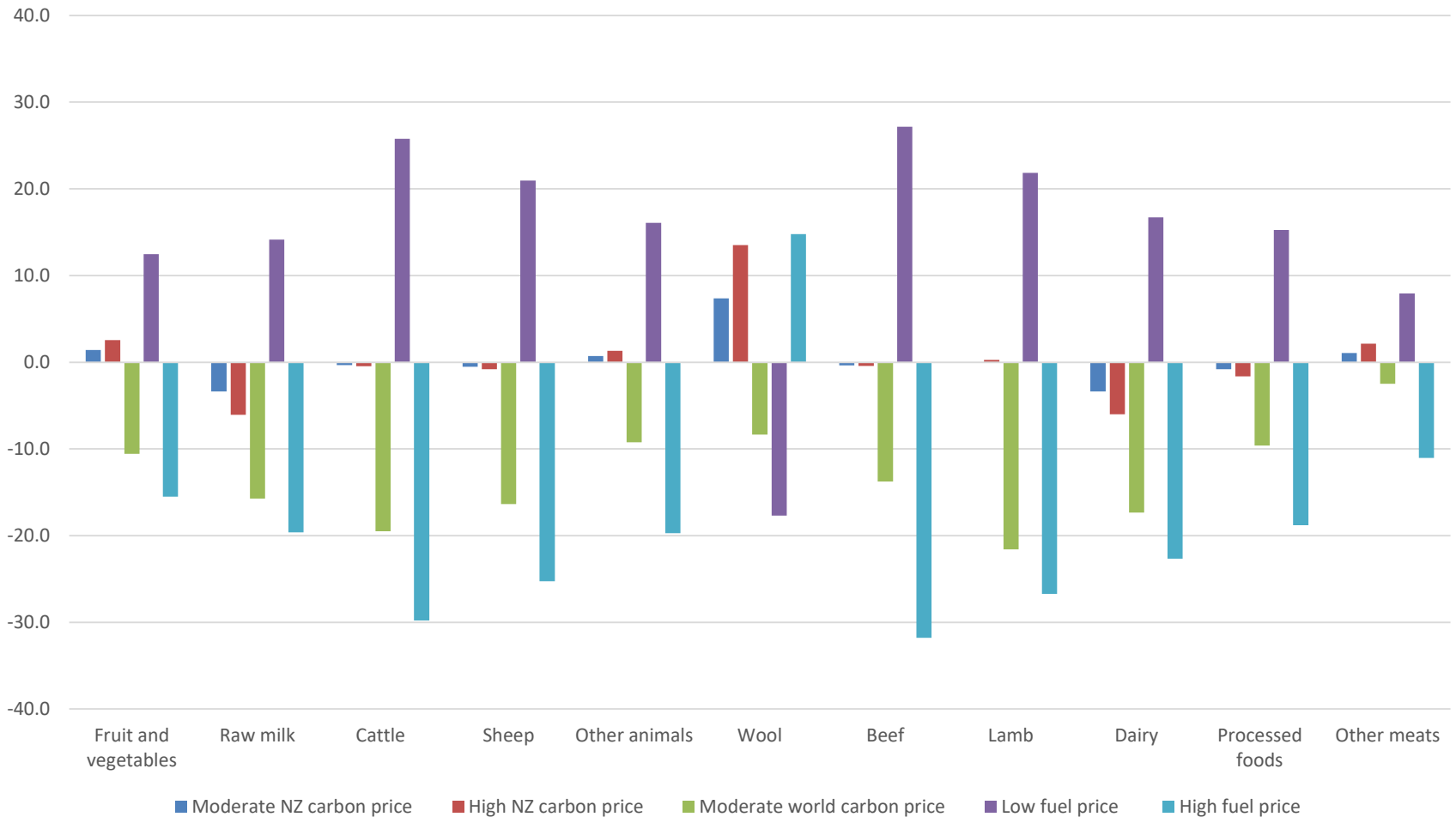
Impact on total world CO_2 emissions, relative to 2030 baseline (%, cumulative)



Impact on NZ's total CO_2 and non-CO_2 emissions, 2020-2030 (%, cumulative)



Impact on real output, selected NZ agricultural sectors, 2020-2030 (%)



Concluding Comments

- We find increases in NZ carbon emission prices cause
  - Some reductions in real GDP
  - Substantial reductions in carbon emissions in NZ (though small global impact when NZ alone increases carbon prices)
- In the scenarios where increases in global carbon prices or global fuel prices impact all countries
  - We find a smaller negative impact on New Zealand's real GDP, suggesting the costs are shared amongst countries
  - The impact on global emissions is much more substantive
- For key NZ agricultural sectors
  - Exports and output tend to decline with increases in carbon and fuel prices
  - But significant reductions in emissions

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Thank you!