

Trade Impacts of Global Climate Change Policy: The Case of New Zealand

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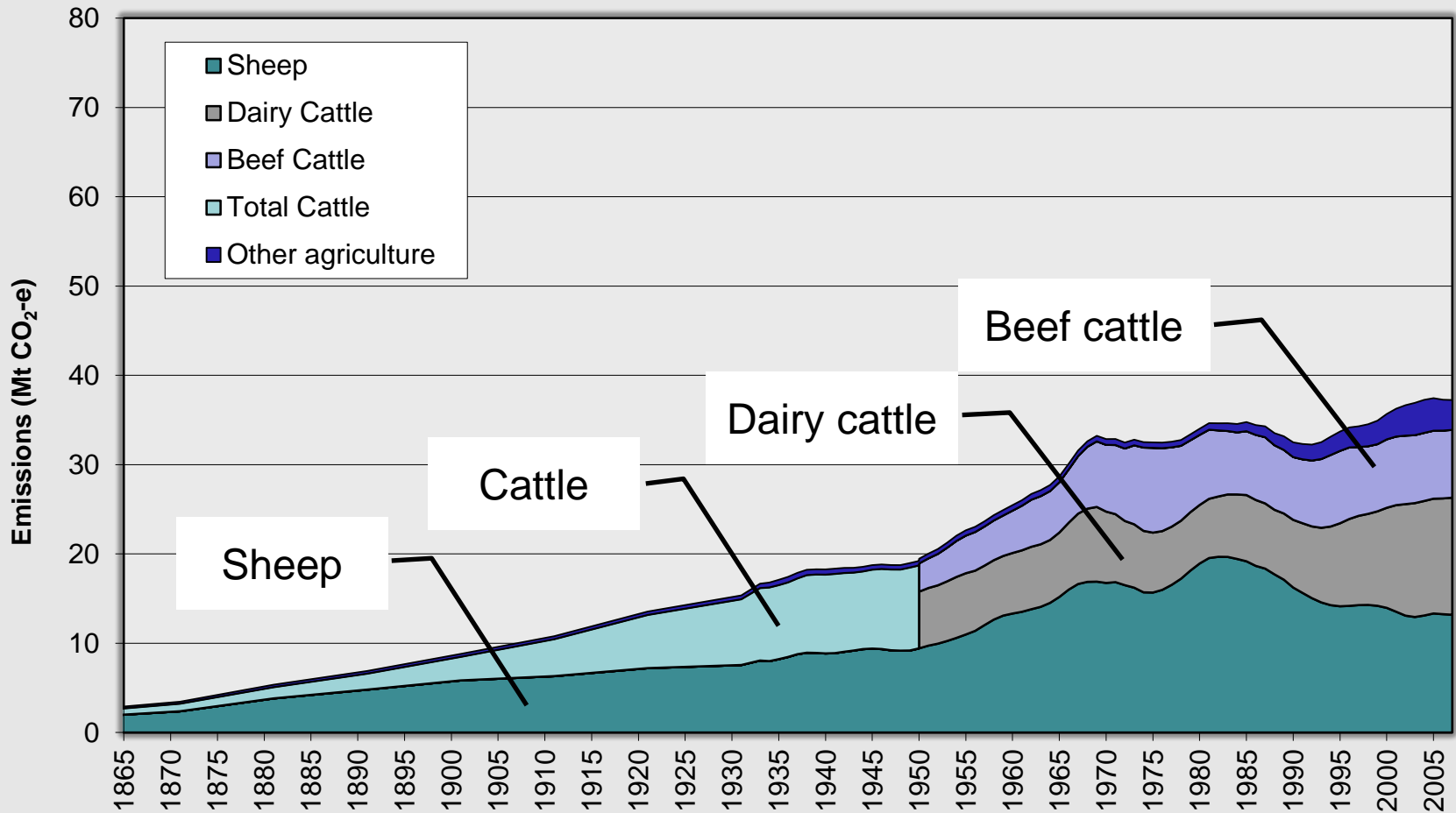
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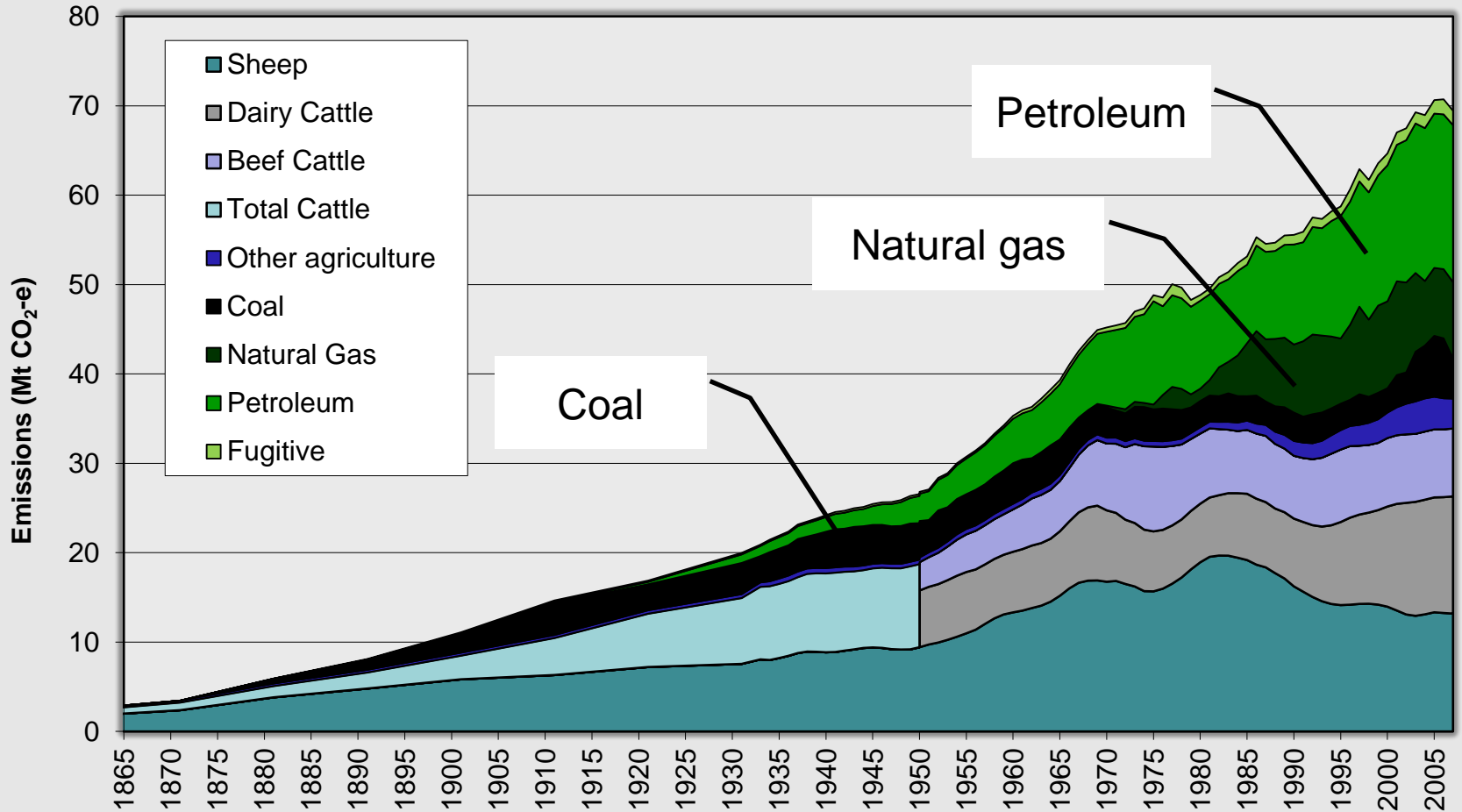
New Zealand Context

- 4.4 million people
- Land area similar to Italy or Britain
- 33 million sheep
- 10 million cattle, including 6m dairy cattle
- 95% of meat exported, 95% of dairy exported
- Agricultural exports contribute 37% of merchandise exports by value
- Extensive production: grazed pastures
- Agricultural emissions about 50% of NZ total

NZ GHG emissions 1865–2007



NZ GHG emissions 1865–2007



Responses

- Emissions Trading Scheme commenced in 2008, with phased entry and grandfathered emissions
 - Forestry (2008)
 - Transport, stationary energy, industrial processes (2010)
 - Waste and synthetic gases (2013)
 - Agriculture (2015)
- Suite of other initiatives
- Ratified KP and tabled 2020 commitments at Copenhagen and Cancún

GTAP-AEZ-GHG* model

- Developed by Golub, Hertel and colleagues
- Combination of standard **GTAP** model with **GTAP-AEZ** and **GTAP-E**, plus extra features
- Standard **GTAP**: Global General Equilibrium model
- **GTAP-AEZ**: adds land-use change
- **GTAP-E**: adds energy emissions
- also emissions from agriculture, forestry sequestration and agricultural mitigation

* A mouthful!

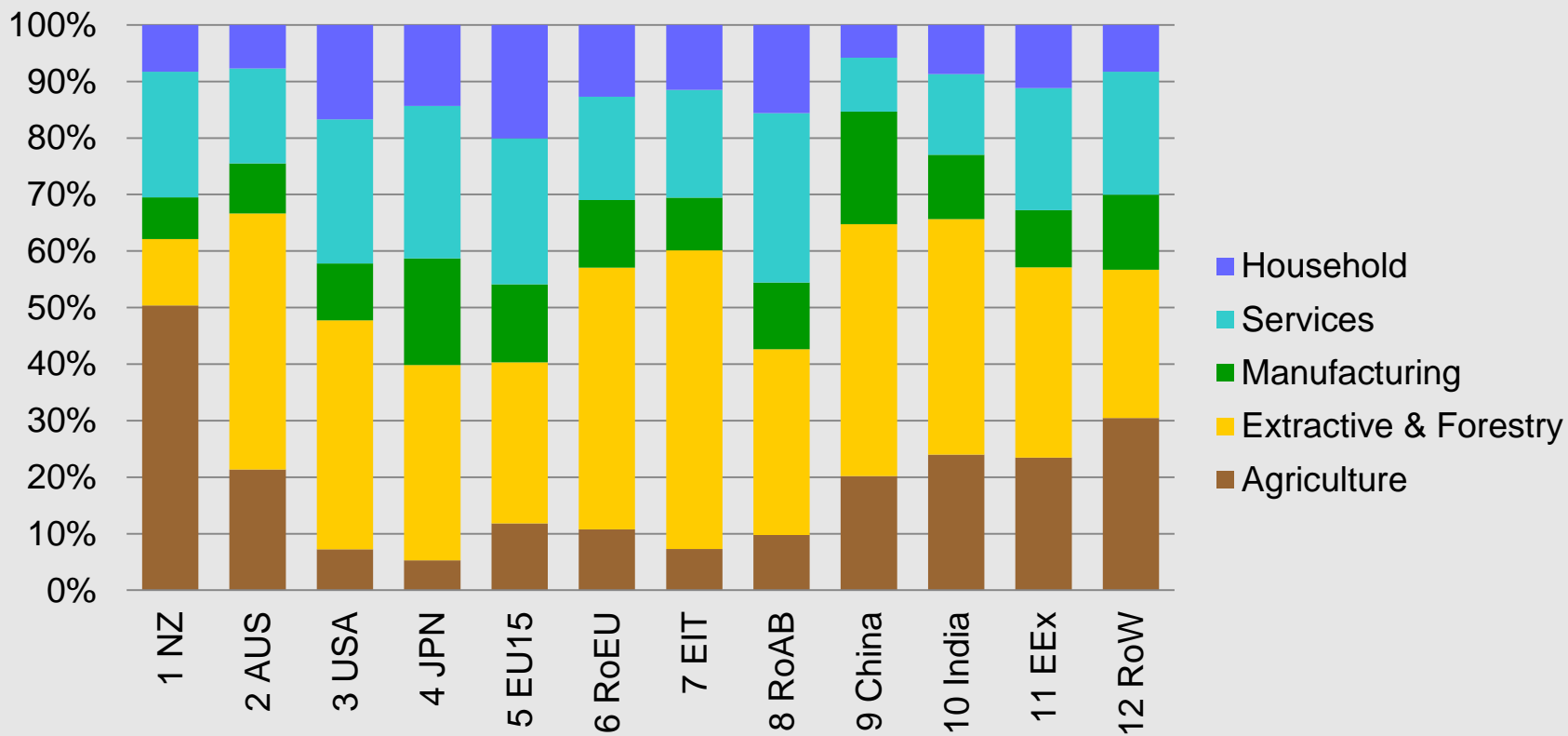
CO₂ and non-CO₂

- CO₂ is about 80% of world emissions
- Most modelling efforts focus on CO₂
- But ignoring the other 20% ignores many potential reduction options
- And important for some countries, such as New Zealand

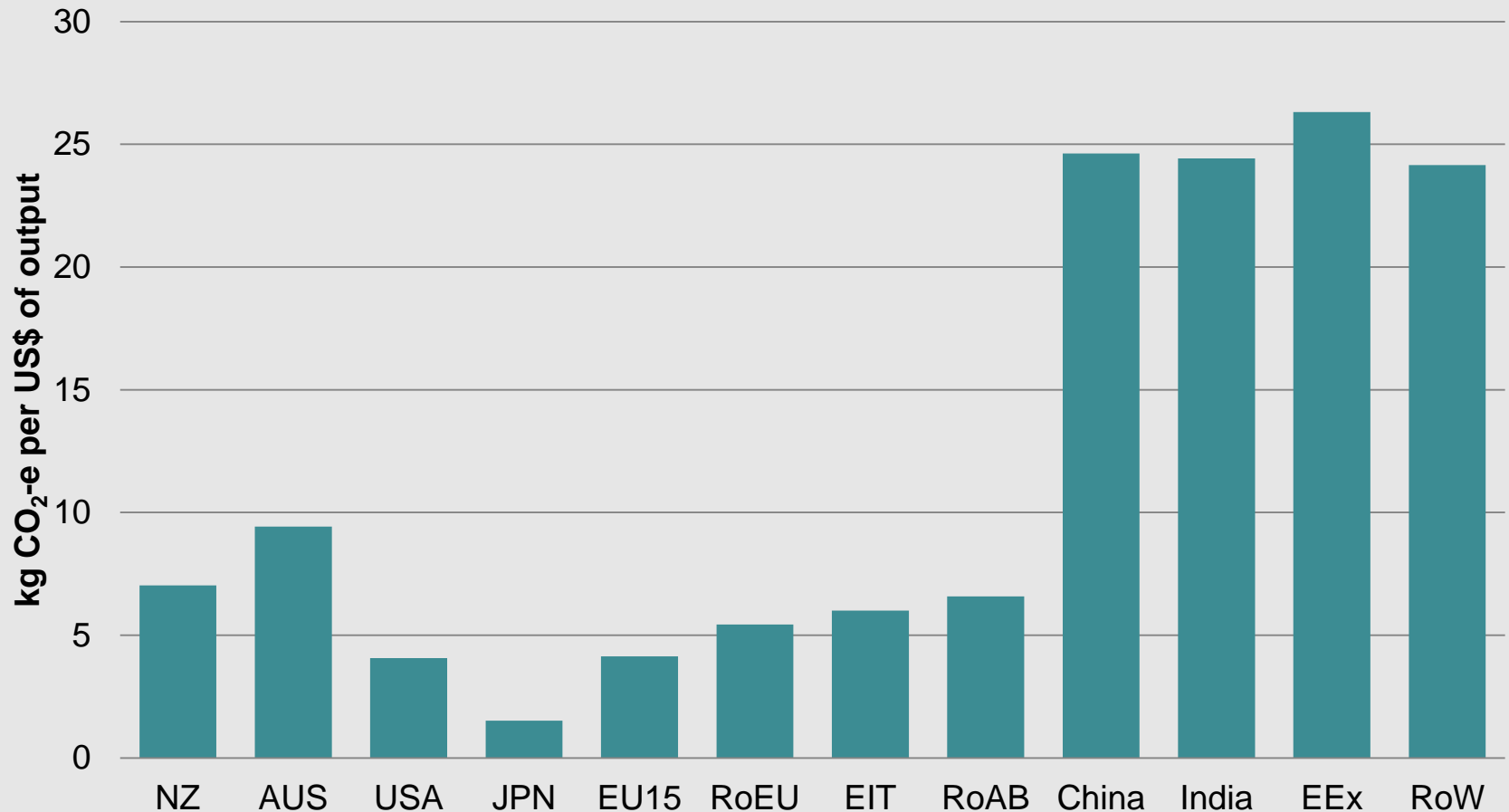
Model data

- GTAP 7.0 database: world economy divided into 113 regions each of 57 sectors
- Aggregated to 12 regions and 20 sectors
- CO₂ emissions database
- Non-CO₂ emissions database

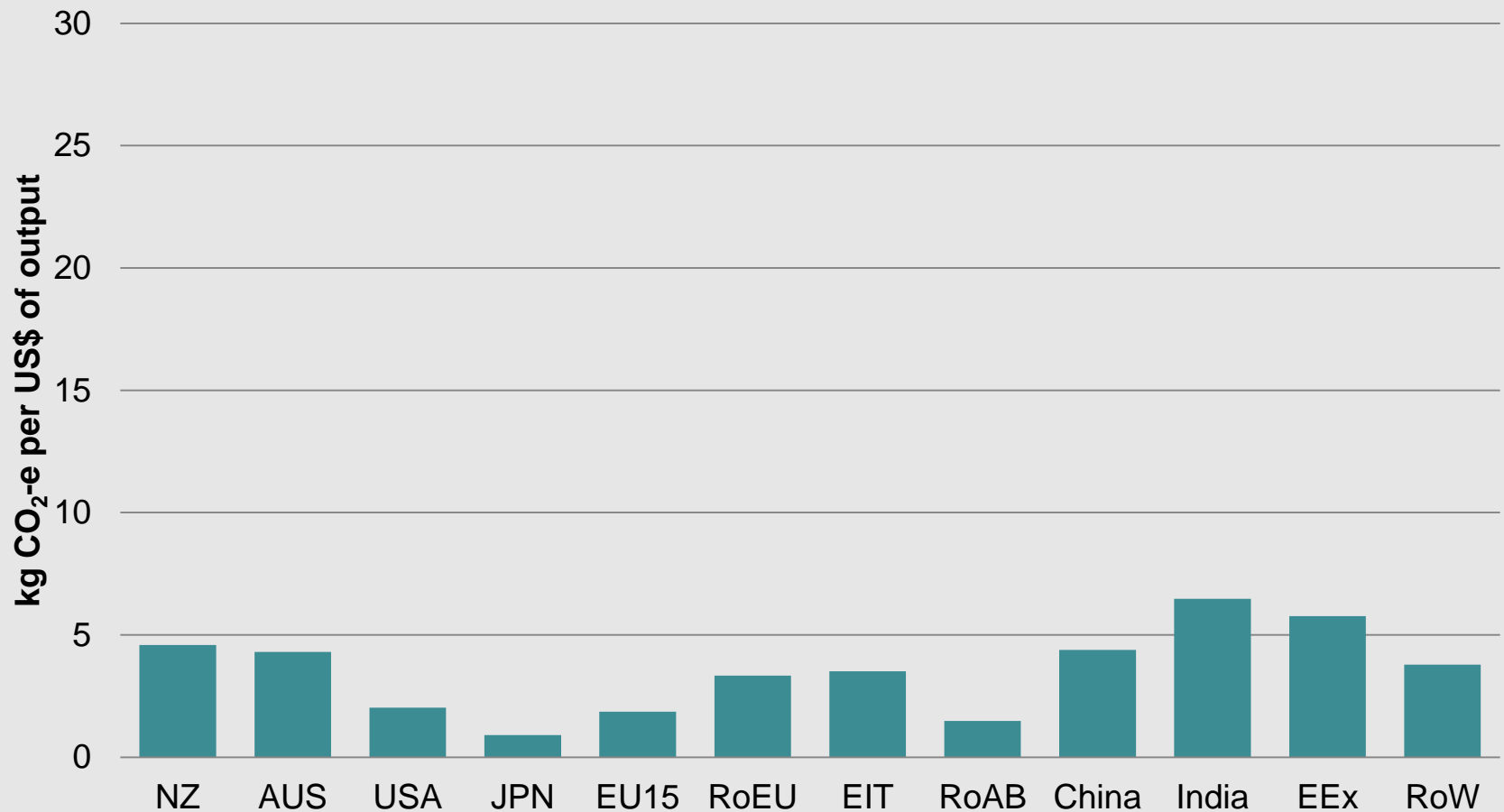
Sectoral emissions by region



Ruminant livestock sector emissions intensities



Raw milk sector emissions intensities



Scenarios

- 2020 targets (min and max)
- International emissions trading:
 - None
 - Between Annex-B parties only
 - Global

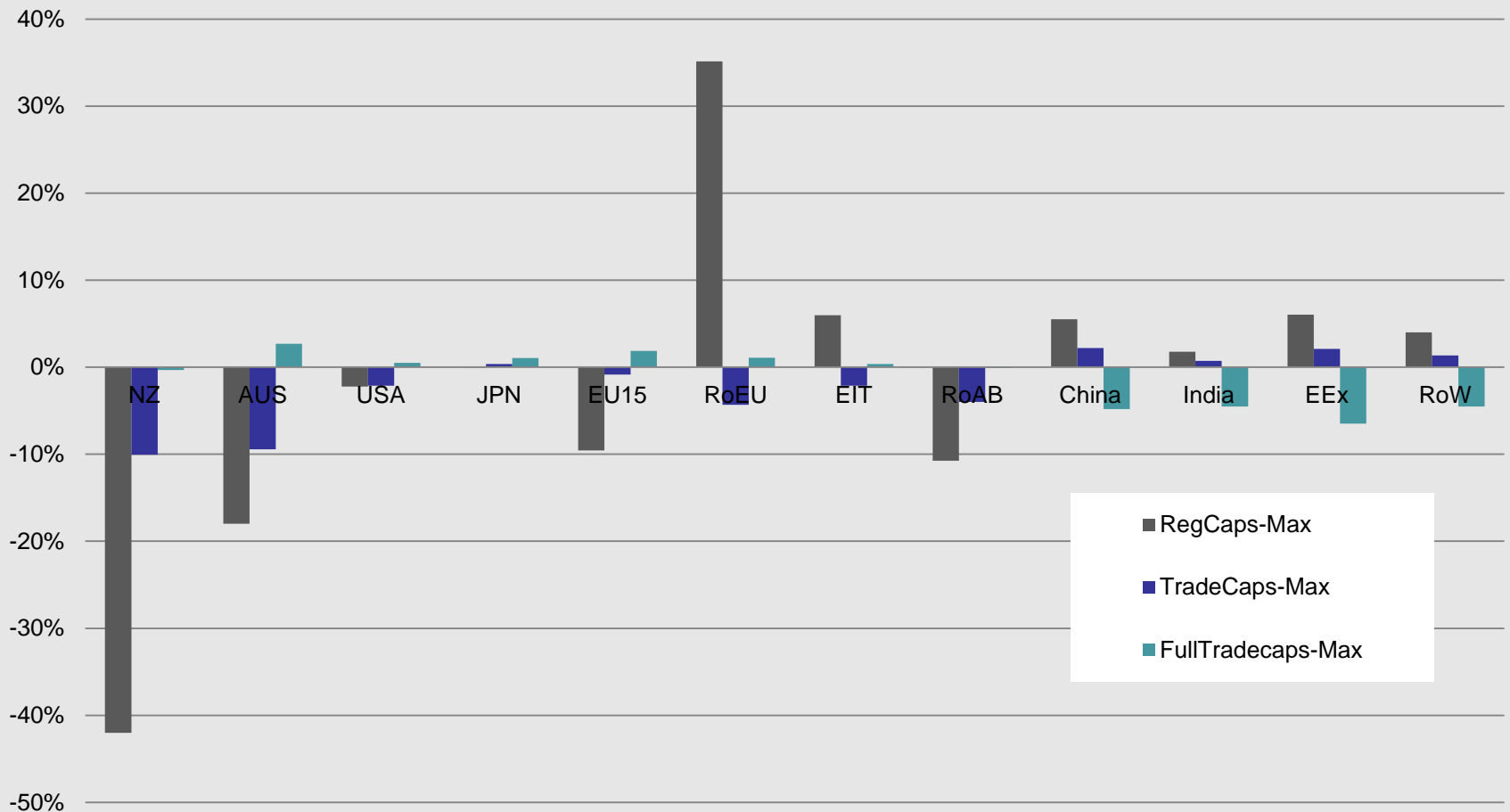
Commitments

Region	Range	Copenhagen target by 2020 (%)	Base year	Target reduction from 2004 (%)
NZ	Min	-10	1990	-28.2
	Max	-20		-36.2
AUS	Min	-5	2000	-8.1
	Max	-25		-27.4
USA		-17	2005	-17.6
JPN		-25	1990	-20.1
EU15	Min	-20	1990	-15.7
	Max	-30		-26.3
RoEU	Min	-20	1990	27.2
	Max	-30		11.3
RoAB				
Norway	Min	-30	1990	
	Max	-40		
Switzerland	Min	-20	1990	
	Max	-30		
Canada		-17	2005	
Total RoAB		<i>at lower offers</i>		-19.7
		<i>at higher offers</i>		-20.9

Results: NZ trade effects

	Aggregate export price index (% change)		Aggregate export volume (% change)		Change in trade balance (US\$m)	
	Beef and sheep meat	Dairy products	Beef and sheep meat	Dairy products	Beef and sheep meat	Dairy products
<i>No international C trading</i>						
Min. emission cuts	12.7	8.0	-50.8	-32.4	-1,476	-925
Max. emission cuts	19.7	12.4	-65.3	-45.0	-1,937	-1,306
<i>International C trading within bloc</i>						
Min. emission cuts	1.7	1.1	-7.0	-4.1	-178	-104
Max. emission cuts	4.0	2.6	-15.9	-9.6	-412	-247
<i>Full world international C trading</i>						
Min. emission cuts	1.1	0.8	-1.6	-1.5	-20	-27
Max. emission cuts	2.3	1.6	-3.4	-3.2	-42	-57

Regional changes in cattle and sheep production



Regional changes in raw milk production



Results: no trading

Region	Minimum emission reductions			Maximum emission reductions		
	Total change in welfare	Contribution of terms of trade	Contribution of allocative efficiency	Total change in welfare	Contribution of terms of trade	Contribution of allocative efficiency
NZ	-238	297	-550	-549	426	-997
AUS	-1,408	-1,088	-281	-3,909	-746	-2,975
USA	-13,255	10,871	-24,572	-11,981	12475	-24,819
JPN	-6,377	6,690	-12,558	-6,062	7164	-12,698
EU15	-18,022	13,532	-31,341	-62,141	20621	-82,446
RoEU	1,037	513	421	1,208	688	400
EIT	-10,984	-5,632	-5,485	-14,560	-7397	-7,369
RoAB	-9,349	-3,558	-6,005	-11,974	-5301	-6,963
China	614	708	290	254	551	87
India	2,306	1,157	1,066	2,692	1340	1,269
EEx	-26,060	-27,773	1,323	-32,925	-34887	1,362
RoW	5,876	4,129	2,299	7,021	4817	2,801

Results: trading within Annex B

Region	Minimum emission reductions				Maximum emission reductions			
	Total change in welfare	Contribution of terms of trade	Contribution of allocative efficiency	Contribution of carbon trading	Total change in welfare	Contribution of terms of trade	Contribution of allocative efficiency	Contribution of carbon trading
NZ	-75	56	-28	-105	-251	127	-100	-282
AUS	-840	-481	-330	6	-2,808	-839	-1,079	-792
USA	-7,065	2,240	-4,211	-5,034	-12,249	6,208	-12,896	-5,663
JPN	-631	1,714	-1,115	-1,124	-1,589	3,744	-3,070	-1,981
EU15	-2,776	3,027	-2,884	-2,927	-13,242	6,245	-8,650	-10,785
RoEU	1,718	555	-251	1,375	2,944	1,301	-1,079	2,650
EIT	4,792	45	-3,929	8,562	10,020	-47	-8,433	18,223
RoAB	-2,622	-1,224	-681	-761	-6,194	-3,004	-1,869	-1,410
China	179	117	138	0	413	429	203	0
India	644	310	303	0	1,452	707	680	0
EEx	-7,255	-7,800	421	0	-16,830	-18,096	1,004	0
RoW	2,005	1,429	733	0	4,436	3,167	1,652	0

Results: full international trading

Region	Minimum emission reductions				Maximum emission reductions			
	Total change in welfare	Contribution of terms of trade	Contribution of allocative efficiency	Contribution of carbon trading	Total change in welfare	Contribution of terms of trade	Contribution of allocative efficiency	Contribution of carbon trading
NZ	-3	58	-5	-55	-44	122	-18	-146
AUS	-810	-604	-118	-69	-2,038	-1,053	-321	-617
USA	-2,837	1,420	-1,361	-3,002	-5,138	3,243	-3,431	-5,204
JPN	576	1,404	-88	-598	959	2,765	-311	-1,189
EU15	219	2,156	-312	-1,572	-2,588	4,151	-1,117	-5,486
RoEU	839	292	-36	555	1,156	591	-200	718
EIT	843	-567	-2,338	3,690	366	-1,319	-4,750	6,267
RoAB	-1,607	-930	-251	-409	-3,462	-2,008	-578	-841
China	-516	229	-1,164	765	-40	865	-3,588	3,426
India	231	411	-265	197	798	898	-711	840
EEx	-6,906	-5,950	-986	278	-14,262	-12,550	-2,409	1,229
RoW	1,665	2,077	-380	220	3,634	4,280	-1,112	1,003

Results: welfare changes across scenarios (%)

Region	Minimum emission reductions			Maximum emission reductions		
	No trading	Annex B trading	Full trading	No trading	Annex B trading	Full trading
NZ	-0.2	-0.1	0.0	-0.6	-0.3	0.0
AUS	-0.2	-0.1	-0.1	-0.6	-0.4	-0.3
USA	-0.1	-0.1	0.0	-0.1	-0.1	0.0
JPN	-0.1	0.0	0.0	-0.1	0.0	0.0
EU15	-0.1	0.0	0.0	-0.5	-0.1	0.0
RoEU	0.2	0.3	0.1	0.2	0.5	0.2
EIT	-1.4	0.6	0.1	-1.9	1.3	0.0
RoAB	-0.6	-0.2	-0.1	-0.8	-0.4	-0.2
China	0.0	0.0	0.0	0.0	0.0	0.0
India	0.4	0.1	0.0	0.4	0.2	0.1
EEx	-0.9	-0.2	-0.2	-1.1	-0.6	-0.5
RoW	0.2	0.1	0.0	0.2	0.1	0.1

Thoughts

- 2020 targets presented at Copenhagen were politically palatable
- NZ 10%–20% below 1990 appears at face value to be in line with other parties' offers
- But it suggests considerably more cost than many other Annex-B parties
- NZ's per capita GDP lower than OECD average
- NZ Treasury advice to govt was on 'comparable effort': 6%–15% *above* 1990

Thoughts

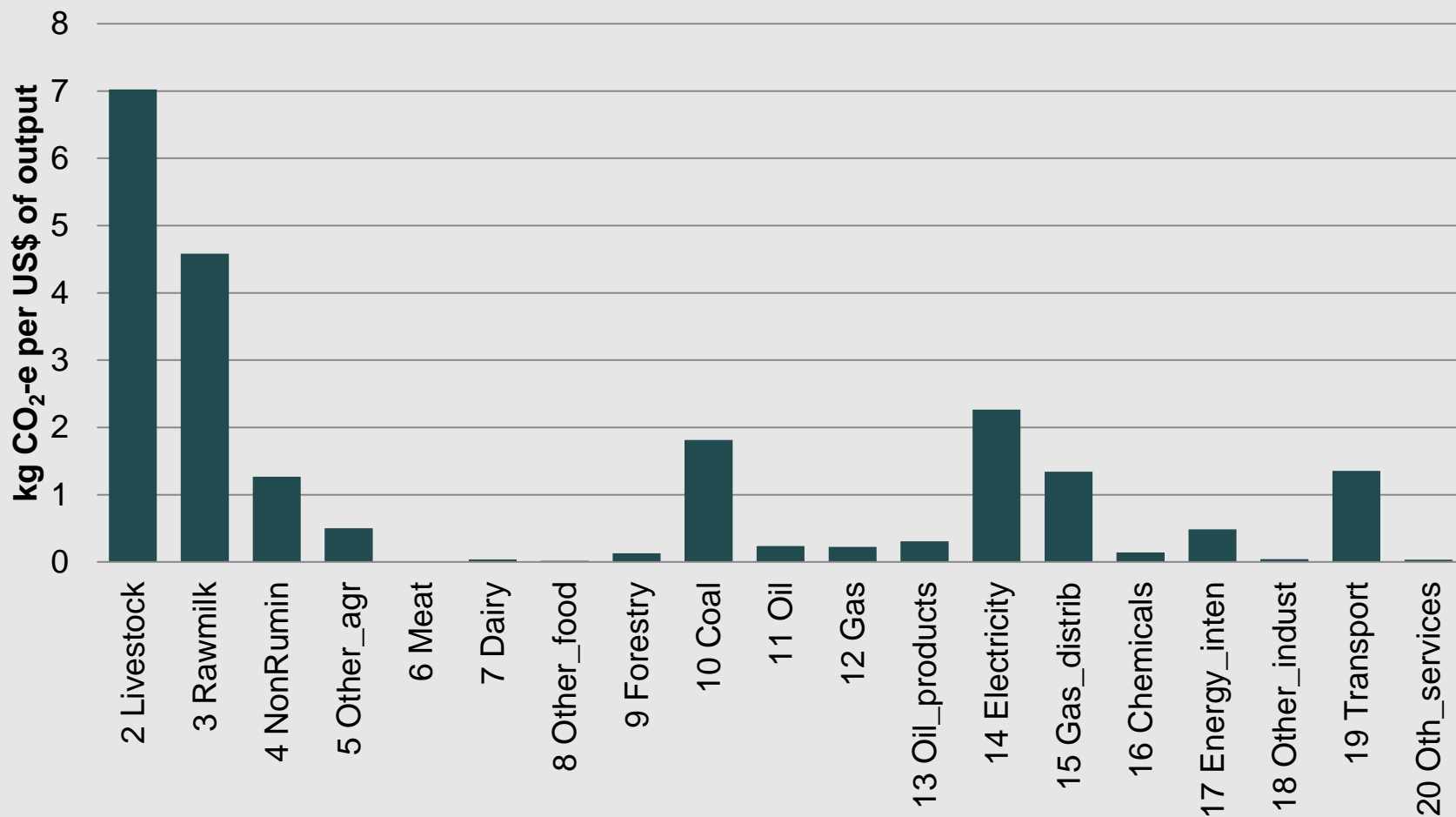
- Opening up emissions trading to developing countries looks good in a model
- But what are the consequences in those countries, especially when we're including non-CO₂ emissions, which are mainly from agriculture?

Future research

- GTAP 8: 2007 database
- 2020 projection
- Forestry sequestration
 - critical for NZ
- Agricultural MACCs
 - Including NZ-specific data
- Further analysis of within-NZ and global distributional effects
- Consequences of assumptions of the modelling approach

Obrigado

NZ sectoral emission intensities



MACC calibration

