

Employment impacts of a global dairy shock

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Model overview

- Static computable general equilibrium (CGE) model simulated for 2025
- Represents two regions (New Zealand and Rest of World) and 33 sectors
- The model is calibrated to the benchmark year using the Global Trade Analysis Project (GTAP) Database
- The model is calibrated to 2025 using projections (GDP, labour force, land use etc.) from the C-PLAN model and other sources

Sectors

Agriculture, forestry & fishing		Energy-intensive manufacturing	
Dairy farming		Chemical, rubber & plastic products	
Beef and sheep farming		Cement manufacturing	
Other animal products		Non-ferrous metals (e.g., aluminium)	
Fruit and vegetables		Iron & steel	
Other horticulture			
Forestry		Other manufacturing	
Fishing		Mining of metal ores	
		Dairy products	
Energy extraction & distribution		Meat products	
Crude oil extraction		Other food processing	
Refined oil products		Wood and paper products	
Coal extraction		Textiles, clothing & footwear	
Natural gas extraction and distribution		Motor vehicles and parts	
Electricity, transmission and distribution		Other manufacturing	
Transport		Construction & services	
Road Transport		Construction	
Air transport		Accommodation and food services	
Water transport		Business services	
Private transport		Other services	

Model specifications and closures

- Decision making is based on real prices (there are no nominal prices in the model)
- Flexible real wages
- Full employment in some scenarios and unemployment in others
- Fixed capital account balance and adjustments in the (implicit) real exchange rate
- Endogenous government deficits (surpluses) funded by lump sum transfers from (to) households

Benchmark representation of the global economy

Baseline external drivers

e.g., GDP and land use projections

Baseline representation of the global economy in
2025

Dairy shock

e.g., Synthetic dairy production

Global economy in 2025 with trade shock

Supply chain disruption scenarios (1)

- Production of synthetic dairy production in the Rest of World at half the cost of conventional dairy production (production to synthetic dairy limited to baseline level of conventional dairy production)
- Scenarios differ with respect to:
 - Full employment/unemployment
 - Land use change
 - Government responses

Supply chain disruption scenarios (2)

- Alternative employment specifications
 - Full employment: All displaced workers are re-employed in other sectors
 - Unemployment: 50% of displaced workers become unemployed
- Alternative land use specifications
 - Land-use change from dairy to other uses
 - No land use change
- Alternative government responses
 - No response
 - Labour subsidies to hold employment constant at baseline levels in selected sectors

Scenarios

Scenario	Displaced workers unemployed	Land use change	Labour subsidy
ue0_luc_nosub	x	✓	x
ue50_luc_nosub	✓	✓	x
ue0_luc_sub	x	✓	✓
ue50_luc_sub	✓	✓	✓
ue0_noluc_nosub	x	x	x
ue50_noluc_nosub	✓	x	x
ue0_noluc_sub	x	x	✓
ue50_noluc_sub	✓	x	✓

Land use change

- Each 100 ha of dairy land can be converted to:
 - 72.7 ha of land for beef & sheep farming
 - 3.7 ha of land for other animal products
 - 1.4 ha of land for fruit & vegetables
 - 5.2 ha of land for other horticultural crops
 - 15.3 ha of land for production forests
 - 1.7 ha of land for permanent forests
- The amount of dairy land converted is determined endogenously based on economic conditions
- There is also land-use change in the Rest of the World

Results with full employment and land use change (ue0_luc_nosub)

The dairy shock when there is full employment

- Results are reported for:
 - **baseline**: Business as usual in 2025
 - **ue0_luc_nosub**: synthetic dairy production with no unemployment, land use change and no government response
- The impacts of the dairy technology are evaluated by comparing results for the **ue0_luc_nosub** scenario to the **baseline** scenario

New Zealand GDP and welfare, % change relative to the baseline

	ue0_luc_nosub
GDP	-1.44%
Welfare	-3.10%

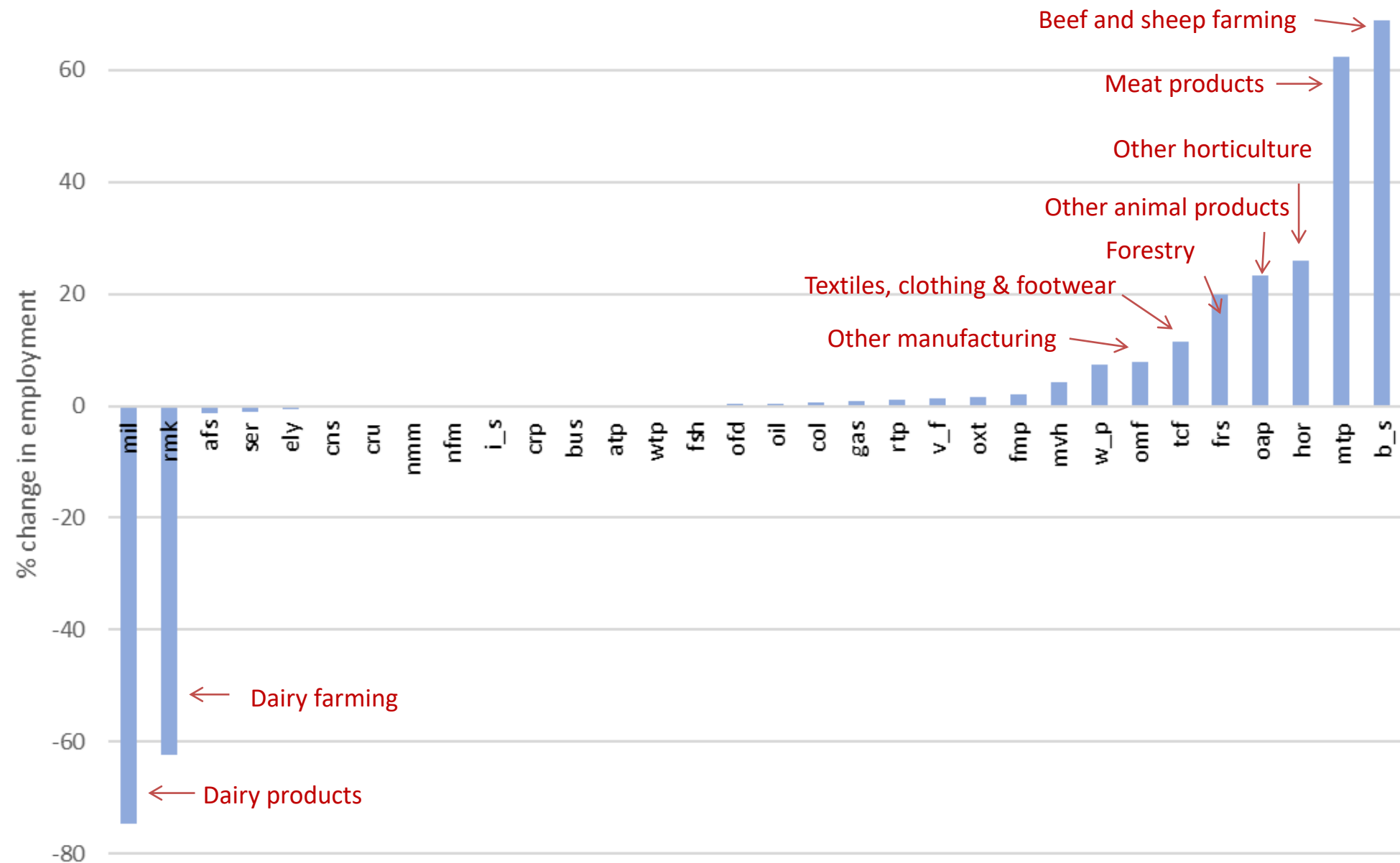
New Zealand land use, millions of ha

	baseline	ue0_luc_nosub
Dairy	2.22	0.91
Beef and Sheep	6.82	7.77
Other animal products	0.35	0.40
Vegetables and fruit	0.13	0.15
Other horticulture	0.49	0.56
Forestry	1.60	1.80

New Zealand land rents, % change relative to the baseline

	ue0_luc_nosub
Dairy	-85.04%
Beef and Sheep	-92.70%
Other animal products	-39.46%
Vegetables and fruit	-27.67%
Other horticulture	-87.72%
Forestry	-51.37%

Employment changes by sector, 2025 ,%, (dairy_ue0_luc_nosub)



Employment changes by sector, 2025, number of workers (dairy_ue0_luc_nosub)



Summary: With full employment...

- The shock reduces New Zealand GDP by ~1.5%
- There are large decreases in land rents/values, particularly in dairy and sheep & beef land
- The largest employment decreases are in dairy farming and milk processing
- The largest employment increases are in beef and sheep farming and meat processing

Results with full employment and no land use change (ue0_luc_nosub)

No land use change

- No-land-use-change scenarios could be interpreted as all unwanted dairy land being used for permanent forests to sequester carbon
- This interpretation holds for both New Zealand and the Rest of the World
- The impact on emissions in 2025 will be minor
- No land use change in the Rest of the World prevents an increase in the global supply of non-dairy agricultural products and the associated price decreases for these commodities

New Zealand GDP and welfare, % change relative to the baseline

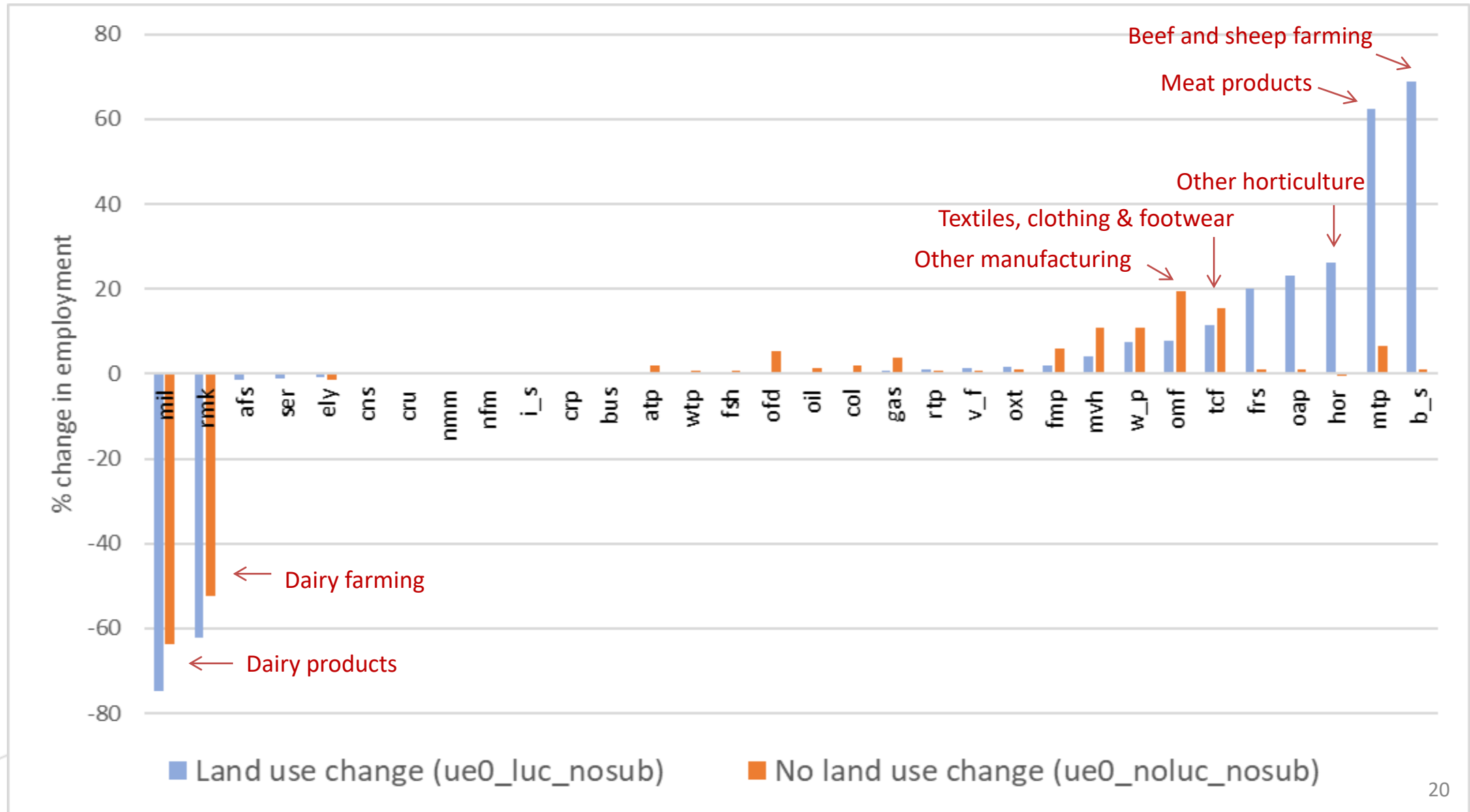
	Land use change (ue0_luc_nosub)	No land use change (ue0_noluc_nosub)
GDP	-1.44%	-1.67%
Welfare	-3.10%	-3.17%

New Zealand land rents, % change relative to the baseline

	Land use change (ue0_luc_nosub)	No land use change (ue0_noluc_nosub)
Dairy	-85.04%	-100.00%
Beef and Sheep	-92.70%	22.09%
Other animal products	-39.46%	21.03%
Vegetables and fruit	-27.67%	14.00%
Other horticulture	-87.72%	-19.14%
Forestry	-51.37%	23.72%

← Dairy farming is the largest user of other agriculture

Employment changes by sector, 2025, % (full employment)



Summary: When there is no land use change...

- The shock reduces New Zealand GDP by 1.67%
- The rent/value of dairy land falls by 100%, and rent/value for most other land types increase
- The largest employment decreases are in dairy farming and milk processing
- The largest employment increases are in manufacturing industries

The impact of unemployment

Unemployment: 50% of workers released from contracting sectors become unemployed

New Zealand GDP and welfare, % change relative to the baseline

	Land use change		No land use change	
	Full employment (ue0_luc_nosub)	Unemployment (ue50_luc_nosub)	Full employment (ue0_luc_nosub)	Unemployment (ue50_luc_nosub)
GDP	-1.44%	-2.10%	-1.67%	-2.32%
Welfare	-3.10%	-4.26%	-3.17%	-4.31%

Employment changes by sector, 2025, % (land use change)



Employment changes by sector, 2025, % (no land use change)



Summary: When there is unemployment...

- Decreases in GDP and national welfare are larger than when there is full employment
- Employment outcomes in negatively affected sectors are similar or worse than when there is full employment
- Employment increases in expanding sectors are less than when there is full employment
- The conclusions hold for both land use change and no land use change scenarios (although different sectors expand in the two scenarios)

The impact of government support

Government support: A labour subsidy to maintain baseline employment in dairy farming and dairy processing

New Zealand land use, millions of ha

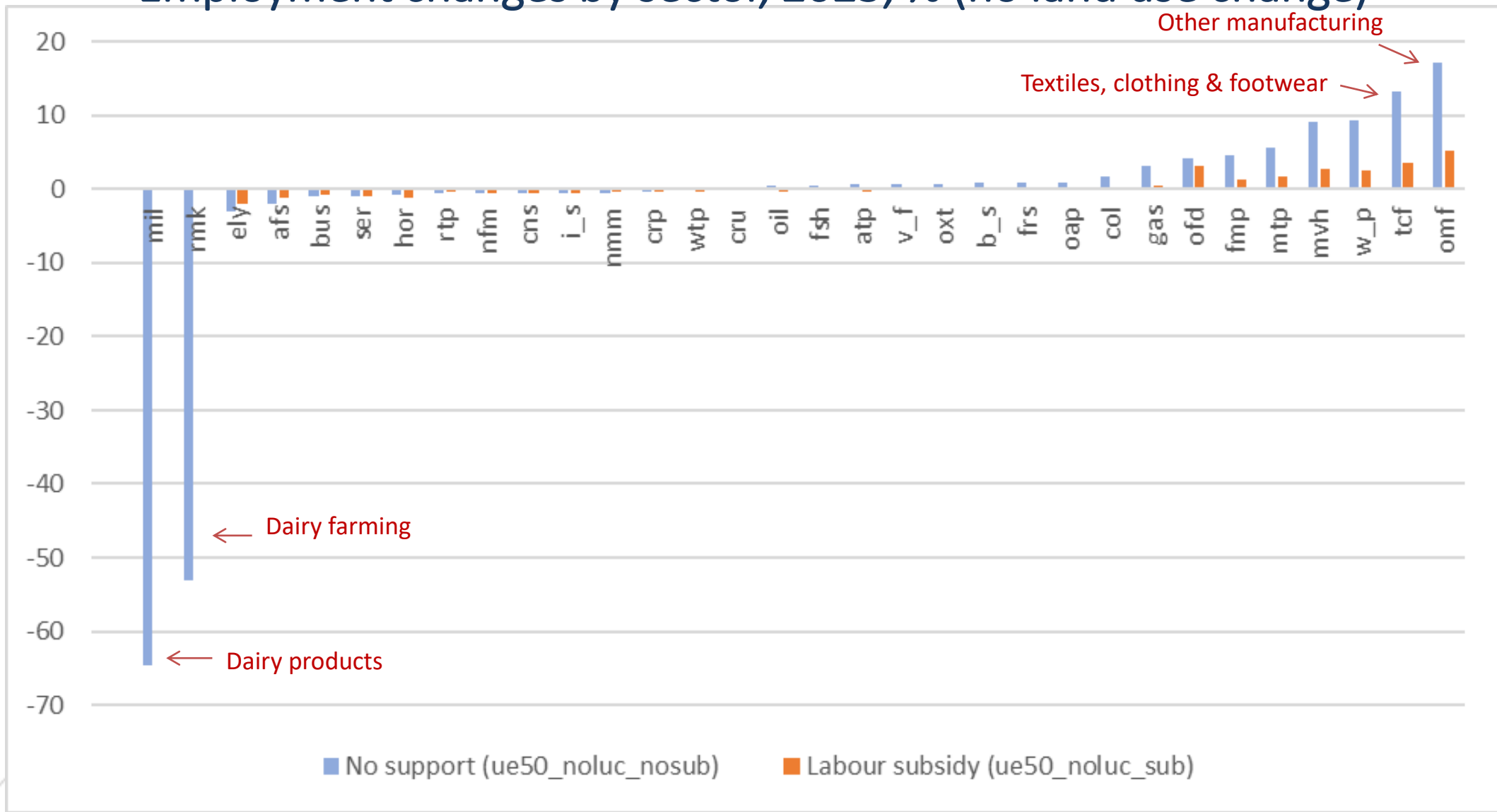
	Baseline (baseline)	No labour subsidy (ue50_luc_nosub)	Labour subsidy (ue50_luc_sub)
Dairy	2.22	0.91	1.83
Beef and Sheep	6.82	7.78	7.10
Other animal products	0.35	0.40	0.36
Vegetables and fruit	0.13	0.15	0.14
Other horticulture	0.49	0.56	0.51
Forestry	1.60	1.80	1.66

- The labour subsidy reduces the amount of land use change (when possible)

Employment changes by sector, 2025, % (land use change)



Employment changes by sector, 2025, % (no land use change)



Subsidy rates (%) and values (NZD million/year)

	Land use change			No land use change		
Sector	Percent	Total cost	Cost per job saved	Percent	Total cost	Cost per job saved
Dairy farming	398.4	15,432.0	0.36	146.2	5,661.7	0.13
Dairy processing	69.3	1,043.2	0.05	36.0	541.5	0.03
Total/average	293.9	1,6475.3	0.26	111.2	6,203.2	0.10

- Large subsidy values reflect the magnitude of the shock
- When there is land use change, the subsidy must also compete with the incentive to use dairy land for other uses

Summary: Government support

- Labour subsidies reduce land use change (when possible) from dairy farming to other agricultural activities
- Labour subsidies to maintain employment are large, especially when there is land use change
- Labour subsidies reduce employment increases in expanding sectors in both land use change cases (although different sectors expand in each case)

Conclusions (1)

- Synthetic dairy production in the Rest of the World leads to a large reduction in employment (up to 75%) in the dairy farming and dairy processing sectors
- When there is land use change, employment in other agricultural sectors increases (especially in sheep & beef farming and meat products)
- When there is no land use change, the largest employment increases are in manufacturing sectors
- When there is unemployment, employment increases in expanding sectors are lower than when there is full employment (and different sectors expand in the two land use cases)

Conclusions (2)

- Labour subsidies to maintain full employment in dairy related sectors are large, and reduce employment increases in expanding sectors (and different sectors expand in the two land use cases)