

Rising Energy Costs and the Food System: *The Case of the New Zealand Dairy Industry*



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Pacific Economic
Cooperation
Council

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Introduction

- A New Zealand perspective
 - distant exporter,
 - low input (?) pastoral production,
 - large scale processing
 - energy rich (?) but oil poor
 - Minimal distortion in agriculture and energy sectors

Sources

- Waikato University Economics Department
- Waikato University Engineering Department
- Massey University Energy Research Centre
- DEXCEL



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Context

- Economic agents respond to changes
 - From 1968-76 fuel, vehicle and wages rose between 250 and 300% but transport costs increased by 100%
- Surprises do occur
- Recently policy has focused on:
 - Supply
 - Reducing greenhouse gas emissions
 - Reducing fertilizer runoff
- A recent phenomena has been the change of land use from forestry to dairy. Will this continue?



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Electricity Consumption 2004



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Sector	Consumption	%	Energy	Lines	
	MWh		\$m	\$m	c/kWh
Agriculture	1,284,620	8.0	107.6	67.7	13.65
Dairy	752,980	4.7	38.2	28.2	8.82
Other food	621,975	3.9	40.3	21.2	9.89
Meat	643,370	4.0	42.3	17.2	9.25
Tot Industrial	16,151,006	100	953.6	354.8	8.10
All Sectors	35,794,819				11.22

Energy Use on the Farm (MJ/kgMS)



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	Waikato	Canterbury
Fertilizer	18	19
Electricity	17	15
Liquid Fuels	12	13
Irrigation		16
Total	47	63

Farm Data 2004



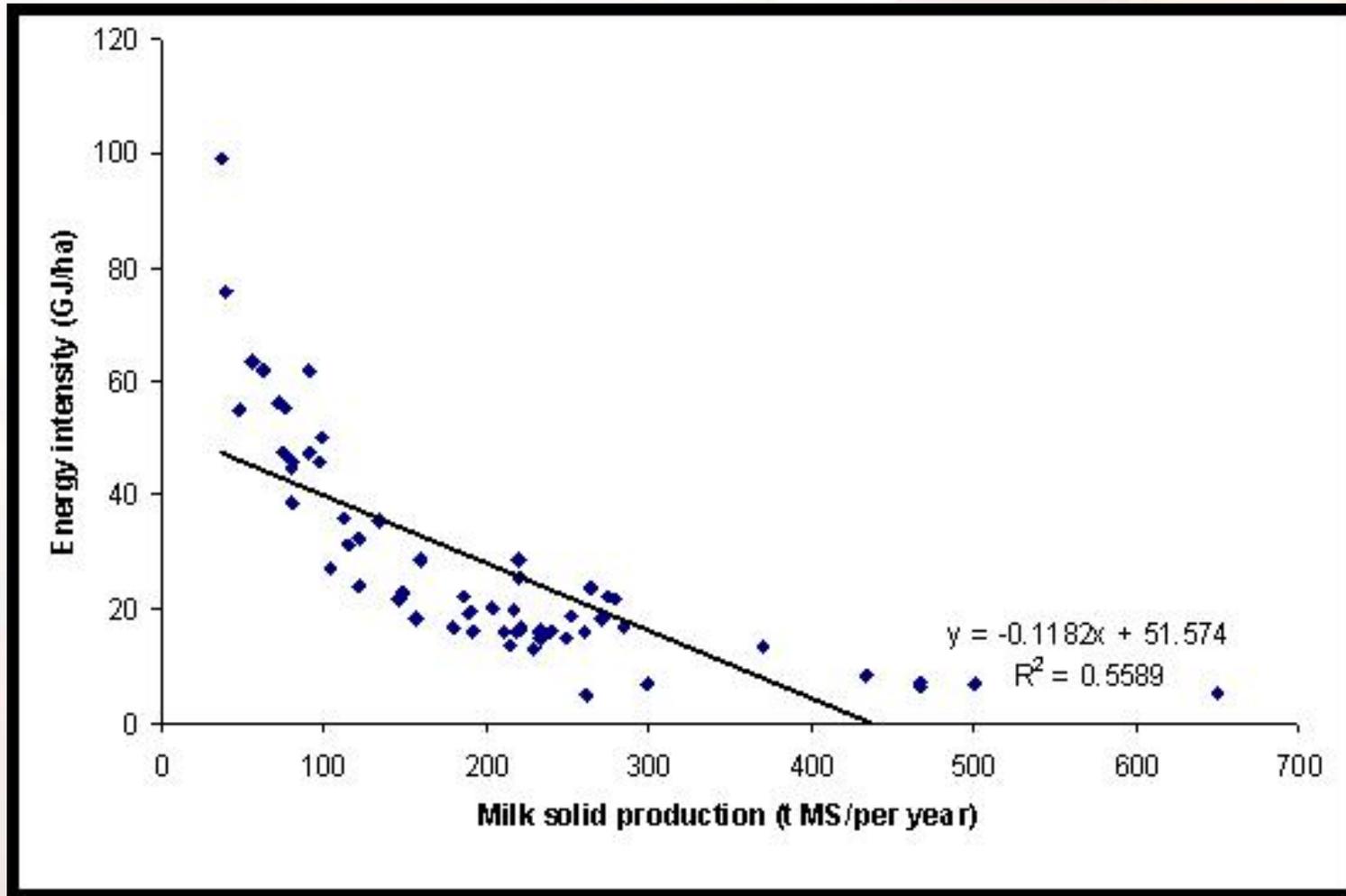
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	DEXCEL	MAF
Cows milked	312	306
Milk solids (kg)	106,626	104,201
Effective ha	112	116
Stocking density (cows/ha)	2.8	2.6
Production intensity (kgMS/ha)	952	898
Milk solids per cow (kg)	341	341

Energy Intensity and Farm Size



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Energy Use per cow (kWh)



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	Typical Farm	Energy Efficient Farm	Difference %
Water heating	32	23	28
Milk chilling	26	19	27
Milking machine	24	15	38
Water pumping	23	18	22
Miscellaneous	18	15	17

Potential Electricity Reduction on Farm

- Insulating water cylinders and milk vats
- Use of heat exchanges for precooling milk and preheating water
- Optimal sizing of water heaters and vacuum pumps
- Variable speed pumps
- Just in time water heating

- Note average farm dairy is 20.75 years with milking equipment 10.85 years old
- Potential savings equate to 1.5-3% of revenue



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Further possibilities at the farm

1. Reduced fertilizer use
2. More efficient vehicle use
3. Once a day milking
4. Changed time of milking/irrigation etc
5. Biogas digesters, windmills and solar panels



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Milk collection costs

- Tanker collection is optimized given existing sites
- Mega sites mean milk is hauled long distances
- There is some use of rail for long haul
- There is now academic consideration of reducing volume before transport from a few minor locations



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Factories and Processing

- Dehydration from 97% water to 3% water is very energy intensive
- Plant design has been compromised by an engineering focus on over design. Plant construction has been compromised by the rush to build plants in short time
- Better utilization of waste heat is coming. Cogeneration plants now exist at Te Rapa 275GWh, Hawera 477 GWh and Te Awamutu 203 GWh
- A whey to ethanol plant is operating at Hawera
- There is potential for a large increase in energy efficiency in quite a short time



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Post Factory Logistics

- Recent food miles report to MFAT is not yet released.
- Work in the 1970s concluded a 50% increase in oil prices could reduce farm gate prices for non dairy agriculture products in the order of 2 to 13%.
- The availability of shipping and concentration of ownership probably overrides the technical factors such as the speed at which ships ravel
- An inland port has been established in the Waikato to improve logistics



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Energy, Agriculture and the NZ Economy



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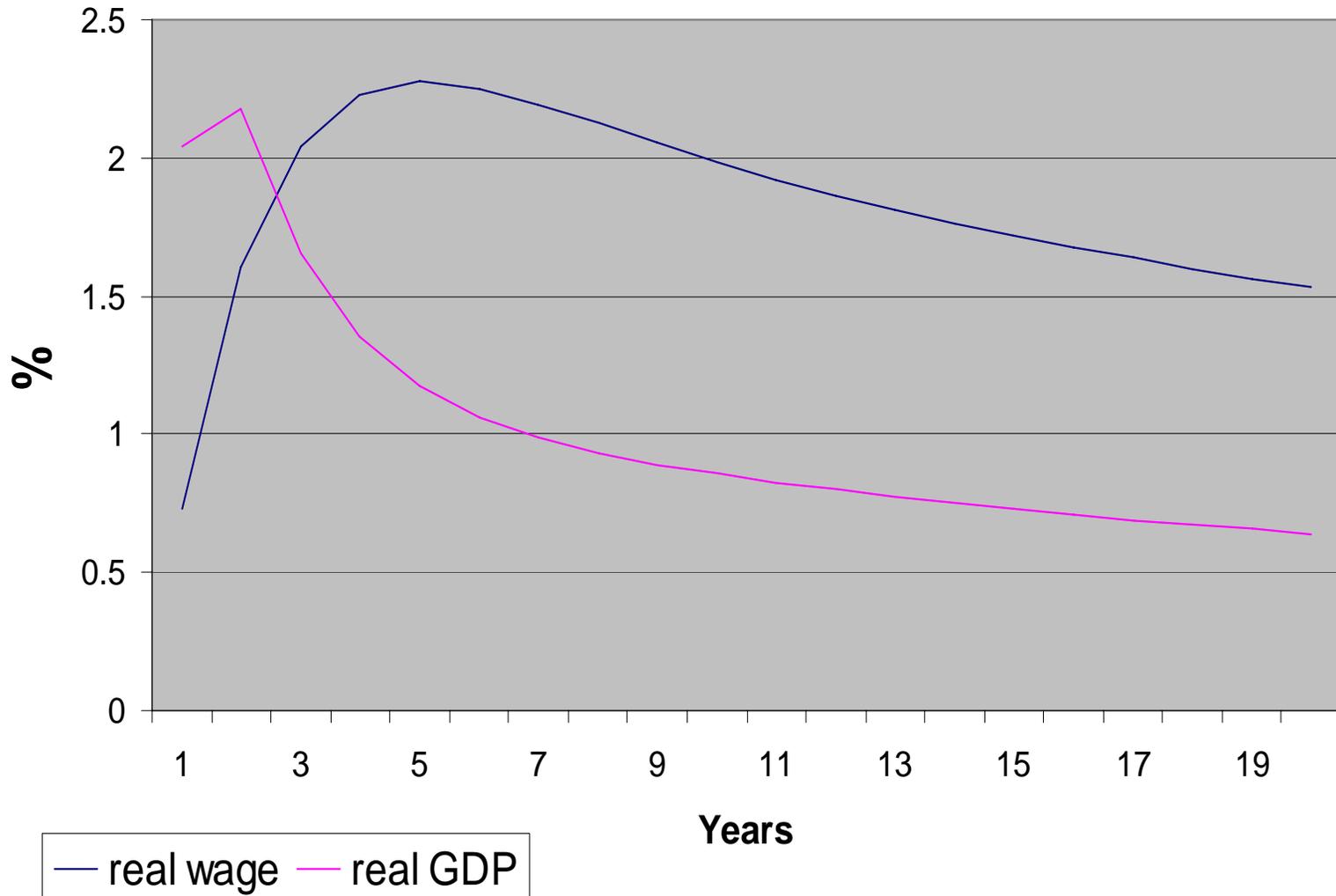
Higher energy prices adversely impact farm households via increasing costs of non farm activity

CGE modeling shows a sustained 1% increase in energy efficiency could increase the GDP trajectory by 0.8% per annum and real wages by more than 1%

Impact of a sustained increase in energy efficiency on GDP and wages



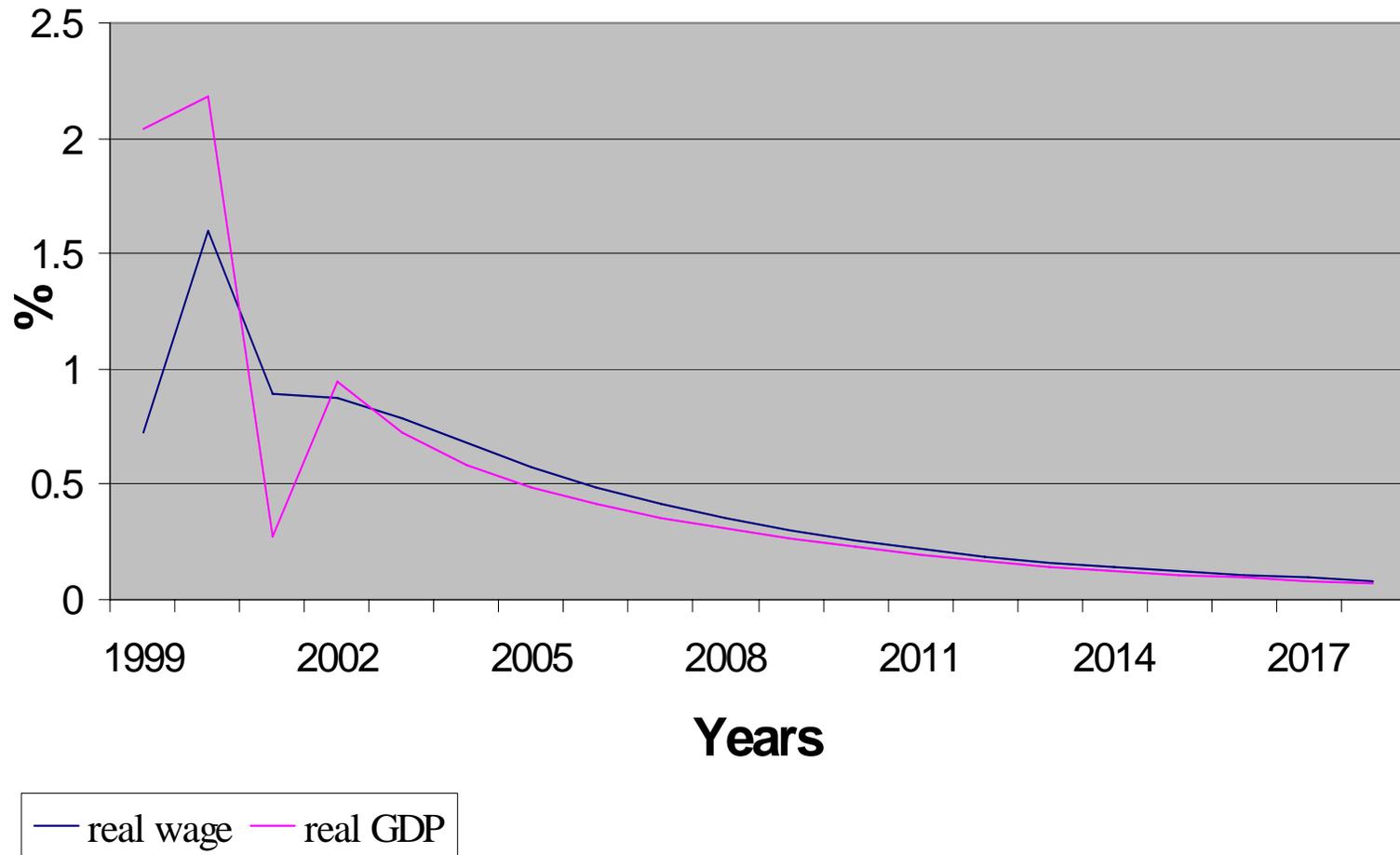
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Impact on GDP and wages of temporary increases in industry energy efficiency



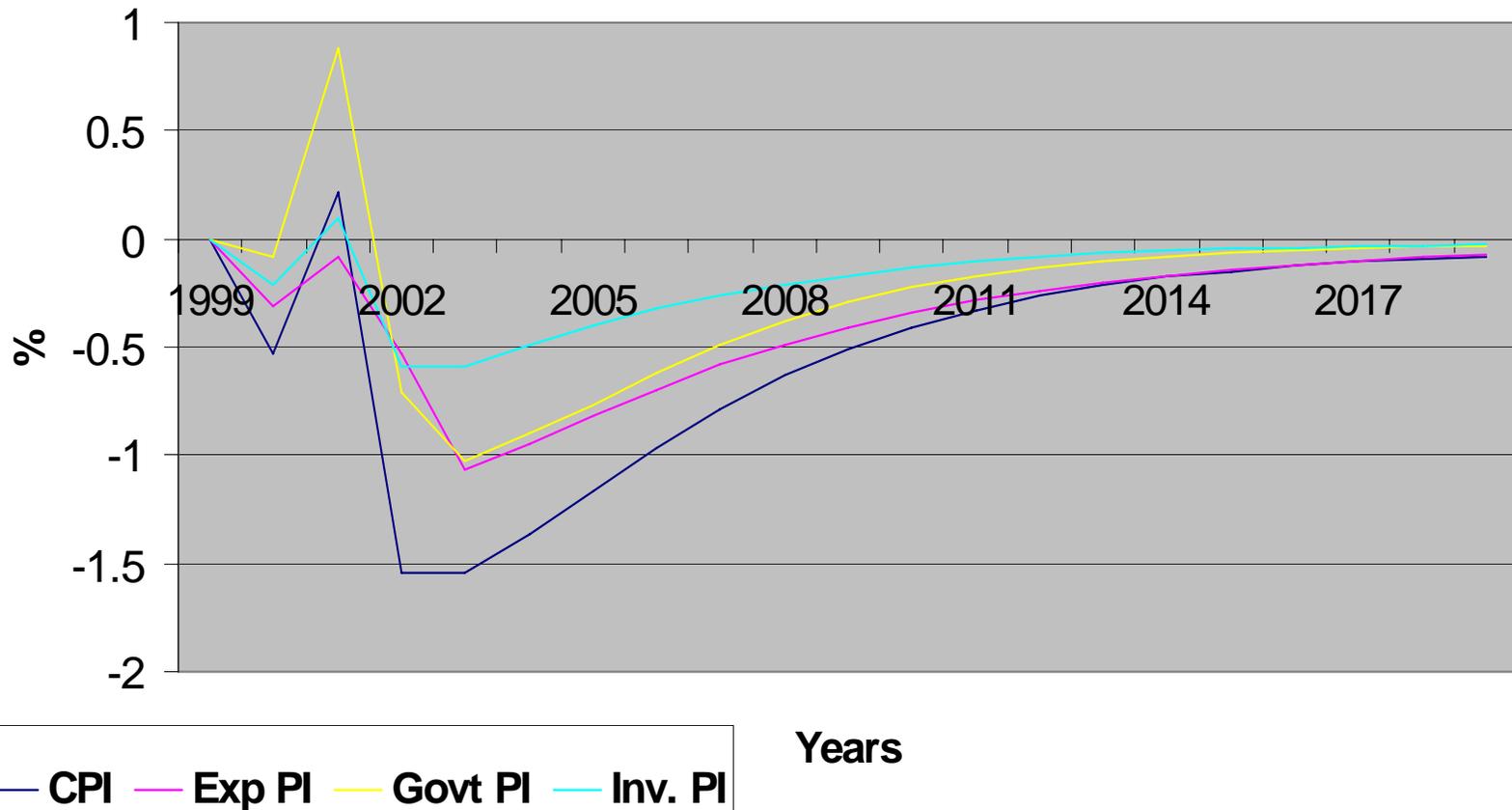
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Impact of a temporary increase in energy efficiency on selected price indexes



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Simulations of Taxes

- The simulations undertaken included the introduction of an energy tax, a carbon tax and a petroleum tax
- They measure the impact of each on the economy
- The rate of taxation is set so that each type tax collects revenue equivalent to 0.6 percent of GDP in the base-case.



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Effects of taxes on fossil fuel energy consumption & carbon emissions



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	Energy tax	Carbon tax	Petroleum products tax
Carbon Dioxide Emissions	-14	-18	-0.9
Fossil fuel energy use	-13	-16	-1.9

Table 3: Effect of taxes on selected macro variables



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	Energy tax	Carbon tax	Petroleum prod tax
Inc tax rate	-0.62	-0.68	-0.82
HH consump	-0.09	-0.10	-0.20
Wking K	-1.12	-1.26	-0.82
Fixed K	-1.58	-1.62	-0.75
Investment	-0.51	-0.54	-0.32
Vol X	-1.54	-1.70	-1.62
Vol M	-0.78	-0.89	-0.91
GDP	-0.38	-0.39	-0.29

Effects of taxes on sectors

	Energy tax	Carbon tax	Petroleum prod tax
Petrol prod	-1.52	-1.34	-1.62
Construction	-0.93	-0.80	-0.62
Mining	-4.12	-4.51	-2.00
Transport	-0.55	-0.50	-0.71
Wood prod	-0.43	-0.52	-0.41
Electricity	-3.21	-3.62	1.27
Metal prod	-3.66	-3.92	-3.12
Agriculture	-0.31	-0.42	-0.40



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Demand for Food in Export Markets

- Energy rich countries should be wealthier and may demand more and better food - energy poor countries may be in the opposite situation
- Granger causality analysis sheds some light. Australia and NZ are different from India and the Philippines
- At the same time we must take account of changing production and consumption patterns in other countries eg impact of grain prices on EU and US milk production
- Changing consumer choices about where and when they consume food is also important.



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Conclusion

- Higher energy prices are a timely shock to the NZ dairy sector
- Higher energy price have real costs but these are many opportunities for enhanced energy efficiency which have external benefits
- Analysts knowledge is most limited about energy consumption post the dairy factory and the impacts on demand for NZ exports



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