Environmental Tax Reform (ETR) and New Zealand Economic Performance: Modelling with E3ME

Sina Ahmadzadeh Mashinchi, Prof. Basil Sharp and Dr. Stephen Poletti
Department of Economics, University of Auckland

Abstract

This study analyses the potential environmental and macroeconomic impacts of environmental tax reform (ETR) in New Zealand using the E3ME model, a global macroeconometric model that links the world's economies to their energy systems and associated emissions. A number of different scenarios including a baseline are constructed to investigate the performance of the NZ ETS and other complementary mitigation policies over the commitment period (2021-2030). In the light of the model results, it is notable that the higher carbon prices especially in the early years would be necessary to achieve the ambitious GHG emissions target in New Zealand. The results also suggest that a combined NZ ETS and carbon tax approach with revenue recycling could lead to significant economic benefits. Therefore, a double dividend effect could be achievable, if New Zealand's government recycles the revenues from carbon taxes efficiently.

Introduction

New Zealand's National Circumstances

In 2013, New Zealand's total greenhouse gas emissions were 80.96 million tonnes of carbon dioxide equivalent (MtCO2e), 14.24 MtCO2e higher than the 1990 level of 66.72 MtCO2e, a 21 per cent increase.

Sector	kt CO_2 equivalent 1990	kt CO_2 equivalent 2013	Change from 1990 (kt CO_2 equivalent)	Change from 1990 (%)
Energy	23,994.6	31,658.9	+7,664.3	+31.9
Industrial Processes and Product Use	3276.0	5,071.5	+1,795.5	+54.8
Agriculture	34,350.6	39,177.3	+4,826.7	+14.1
Waste	5,099.0	5,054.0	–45.0	–0.9
Total (excluding LULUCF)	**66,720.2**	**80,961.6**	**+14,241.5**	**+21.4**
LULUCF	–28,654.5	–26,761.1	+1,893.3	–3.9
Net total (including LULUCF)	38,065.8	54,200.5	+16,134.8	+42.4

New Zealand's Emission Targets

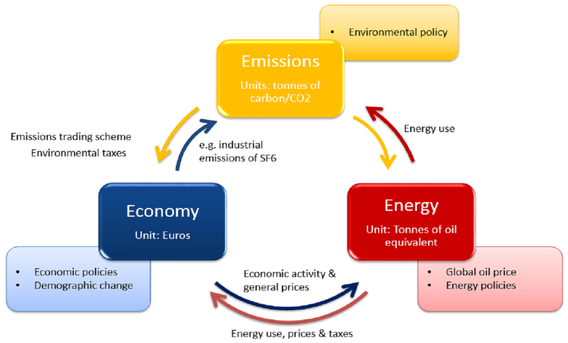
- 11% reduction in emissions below New Zealand's 1990 greenhouse gas emission levels by 2030
- 50% reduction in net greenhouse gas emissions from 1990 levels by 2050

Critiques of NZ ETS

- Does not have a cap
- Generous free allocations of emission units
- Piecemeal approach in implementing
- Foreign cheaper credits

Method

Most previous studies have used computable general equilibrium (CGE) based energy models. This study uses E3ME, a macro-econometric non-equilibrium hybrid simulation model, in New Zealand.



DATA

A large time-series database covering 1970–2014 annually is considered.

- OECD's STAN database, as the primary data source
- National statistics from Statistics New Zealand (SNZ)
- For GHG emissions: EDGAR database
- Other sources: GTAP, IEA, World Bank and IMF

Policy Scenarios

We constructed eight emissions reduction scenarios including a baseline to investigate the performance of the NZ ETS and other complementary mitigation policies over the commitment period (2021-2030).

Scenario	Mitigation Policy: NZ ETS	Mitigation Policy: Carbon Tax	Revenue Recycling
B1	$7 fixed	None	None
B2	$25 fixed	None	None
B3	$25 in 2016, Increasing by $10 each year	None	None
B4	$75 in 2016, Increasing by $20 each year	None	None
S1	None	$75 in 2016, Increasing by $20 each year	By reducing GST from 15% to 12.5%
S2	$50 fixed	$50 in 2016, Increasing by $20 each year	By reducing employers' social security contributions from 3% to 1%
S3	$75 in 2016, Increasing by $20 each year	$75 in 2016, Increasing by $20 each year	By reducing average income tax rates from 20.5% to 16%
S4	$75 in 2016, Increasing by $20 each year	$75 in 2016, Increasing by $20 each year	By reducing GST from 15% to 12.5%

Results

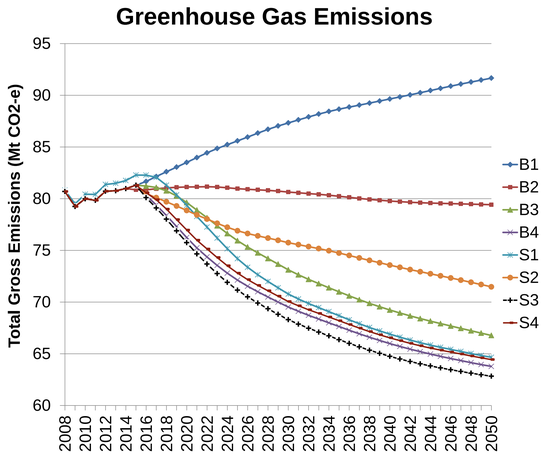
Baseline Summary

Under the baseline scenario (B1), NZ ETS with a spot carbon price around $7, GHG emissions will be increasing over the 2020-2050 periods. The results show that CO2 emissions primarily from transport and energy sectors are the main reason for total GHG growth and it will continue to increase with a significant pace under the current policies.

	2020	2030	2050
Economic Indicators			
RGDP	205.3	252.6	328.5
Employment (millions of persons)	2.321	2.548	2.656
Consumers' Expenditure	122.7	152.4	196.5
Investment	38.7	49.2	66.5
Exports	35.5	43.7	57.6
Imports	38.0	48.1	64.1
Consumer Price Index (2005=1)	1.275	1.600	2.605
Energy and Emissions			
Energy Demand (thousand toe)	19926	21629	24110
Total Gross Emissions (Mt CO2-e)	83.5	87.5	91.6
Carbon Dioxide (CO2)	*37.0*	*41.5*	*46.3*
Methane (CH4)	*36.1*	*36.2*	*36.5*
Nitrous Oxide (N2O)	*8.6*	*7.5*	*5.6*
Fluorinated Gases (FGAS)	*1.8*	*2.3*	*3.2*

Environmental Impacts of Policy Scenarios

The figure below shows simulated emissions path for the different plausible scenarios. In scenarios S2, S3 and S4, a complementary carbon tax on non-ETS sectors is considered beside the NZ ETS.



Macroeconomic Impacts of Policy Scenarios

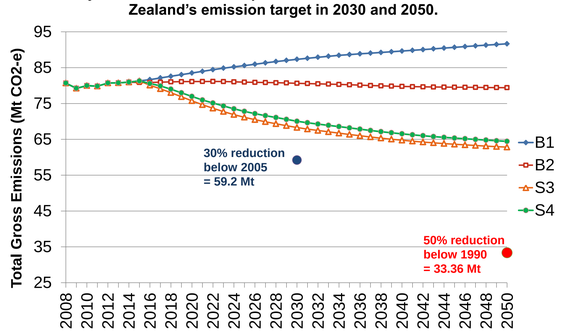
Estimated macroeconomic impacts in 2030

	B2	B3	B4	S1	S2	S3	S4
	% change from the Baseline						
GDP	-0.12	-0.46	-0.82	1.80	-1.69	-3.91	1.82
Employment	-0.02	-0.03	-0.09	0.47	-0.02	-0.05	0.45
Consumers' Expenditure	-0.22	-1.07	-1.66	1.61	-2.32	-5.80	1.76
Investment	-0.01	0.87	0.80	6.25	-2.78	-4.59	5.83
Exports	-0.05	-0.15	-0.22	-0.03	0.00	-0.16	-0.02
Imports	-0.11	-0.15	-0.30	2.08	-1.41	-2.74	2.03
Consumer Price Index	0.23	1.03	1.70	1.02	0.01	0.60	0.94
Industry Output	-0.22	-0.65	-1.20	3.79	-2.99	-6.70	3.85
Energy Demand	-6.46	-16.77	-23.48	-21.97	-12.12	-25.14	-22.27

Conclusions

- Higher carbon prices should be applied in the earlier stages
- A combined NZ ETS and carbon tax approach with revenue recycling could lead to the significant economic benefits
- A double dividend effect could be achievable

Projected GHG emissions path in selected scenarios and New Zealand's emission target in 2030 and 2050.



Acknowledgments

This study was funded by the Energy Education Trust of New Zealand (EETNZ) and the Energy Centre at University of Auckland Business School

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND