Climate and Energy Finance Group (CEFGroup)

University of Otago Te Whare Wānanga o Otāgo New Zealand

Business School Te Kura Pakihi

The Role of Fundamentals and Policy in New Zealand's Carbon Prices

Ling Liao

Dr. Ivan Diaz-Rainey

Dr. Sebastian Gehricke

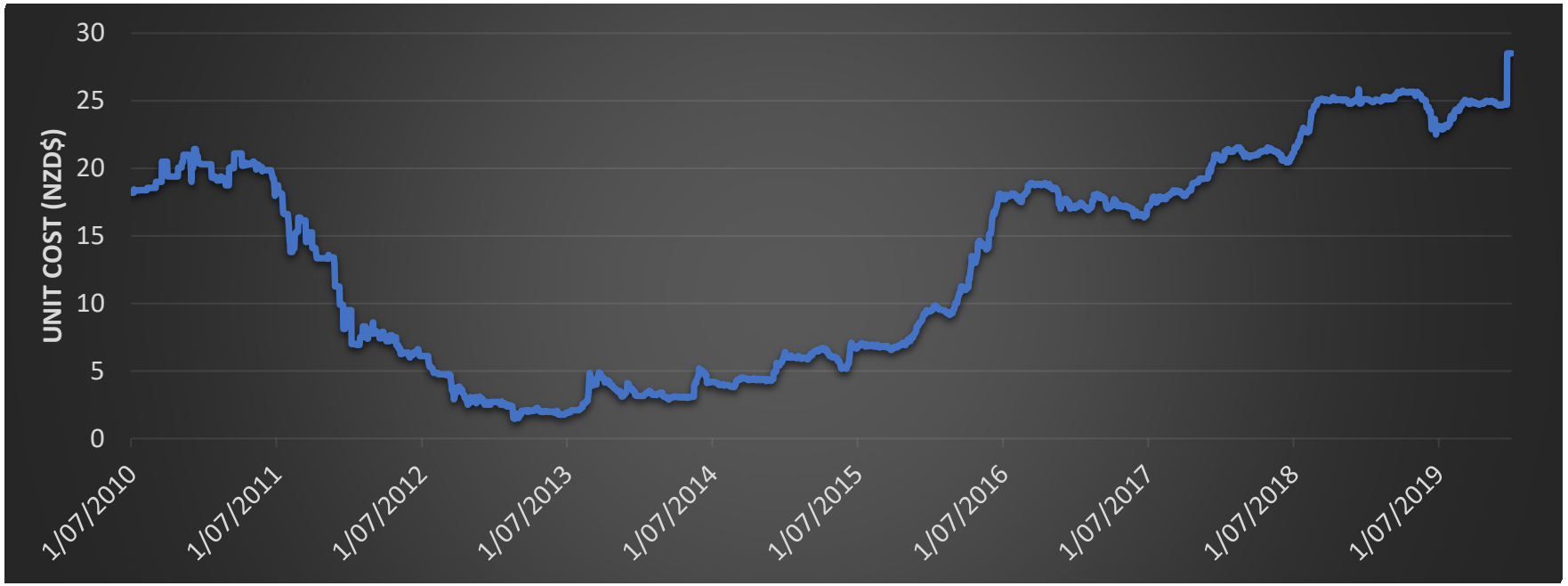
Dr. Duminda Kuruppuarachchi

Motivation & Research Question

- Ministry for the Environment (MfE, 2019), Stevenson et al (2017): New Zealand Units (NZUs) price is set by units supply and demand

- Research question: Does the balance between the allowances demand and supply from sectoral economic activities determine carbon prices in the New Zealand Emissions Trading Scheme (NZ ETS)?

Figure 1 presents NZU spot prices from July 1st, 2010 to December 31st, 2019. Data is sourced from Bloomberg.



Outline

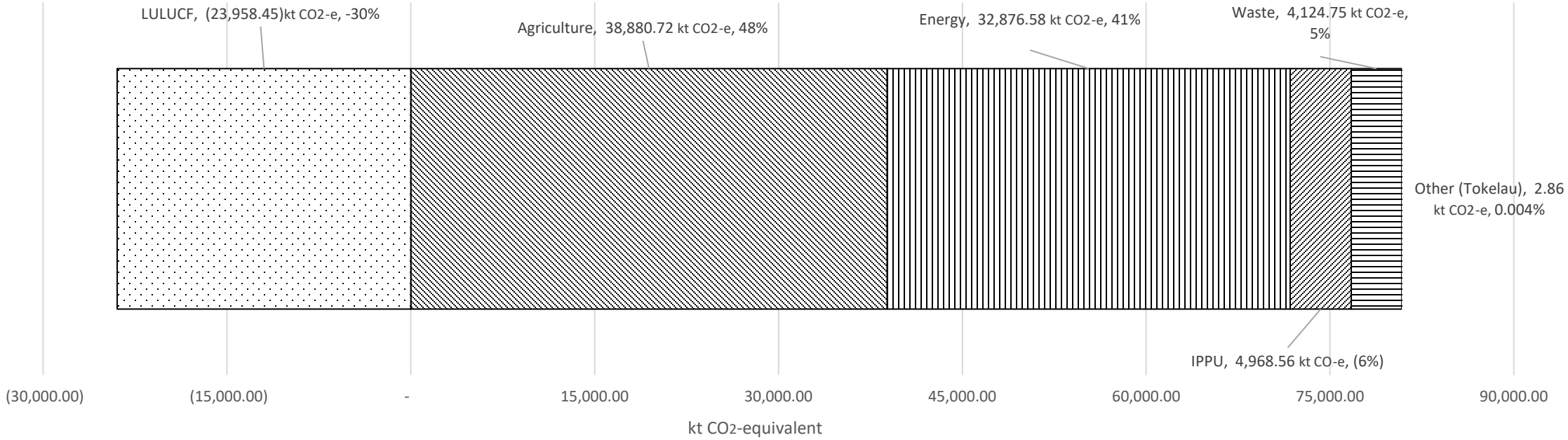
- Background
  - NZ emissions profile
  - NZ ETS
- Theory & Hypotheses
- Data & Methodology
- Key Results
- Conclusion

Background

NZ Emissions Profile

Figure 2 New Zealand's emissions by sector in 2017

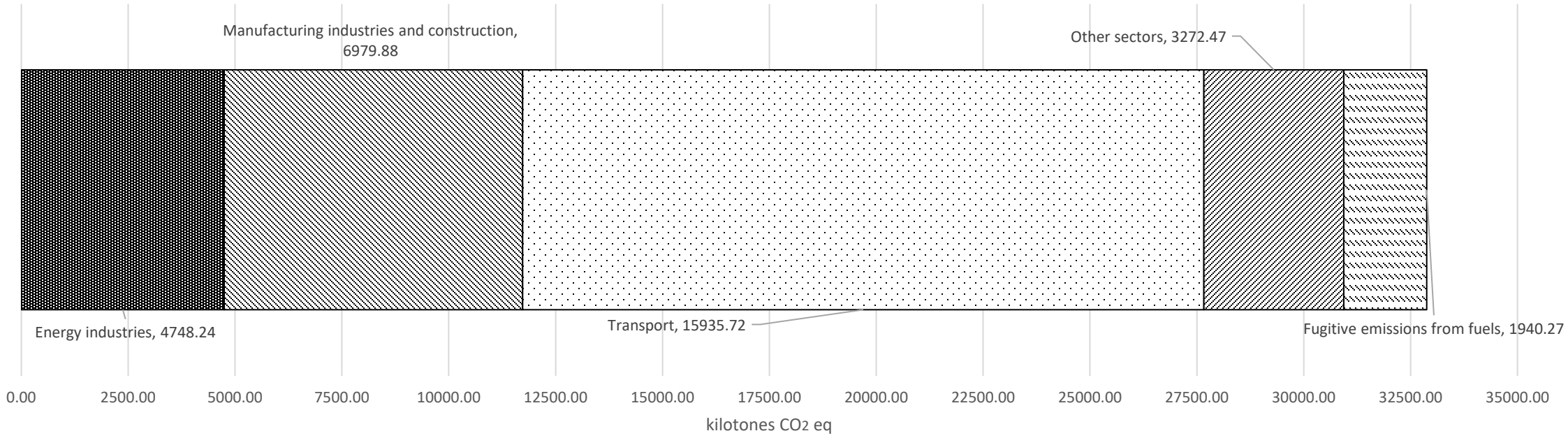
Figure 2 depicts NZ's emission breakdown by sector in Year 2017. LULUCF: land use, land use change and forestry. IPPU: Industrial Processes and Product Use. Data is sourced from New Zealand's Greenhouse Gas Inventory 1990–2017 (MfE 2019).



NZ Emissions Profile

Figure 3 Gross CO2 emissions from the energy sector, 2017

Figure 3 depicts an emission breakdown within the energy sector in Year 2017. Data is sourced from New Zealand's Greenhouse Gas Inventory 1990–2017 (MfE 2019).



NZ Emissions Profile

Figure 4 Gross CO2 emissions from the LULUCF sector, 2017

Figure 4 depicts an emission breakdown within the LULUCF sector in Year 2017. Data is sourced from New Zealand's Greenhouse Gas Inventory 1990–2017 (MfE 2019).

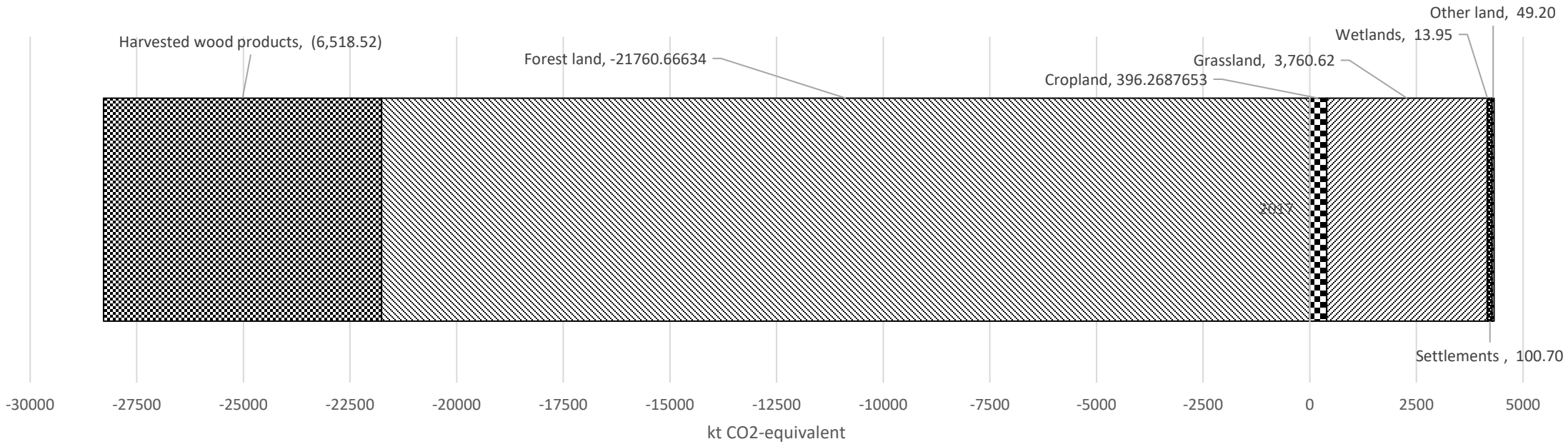
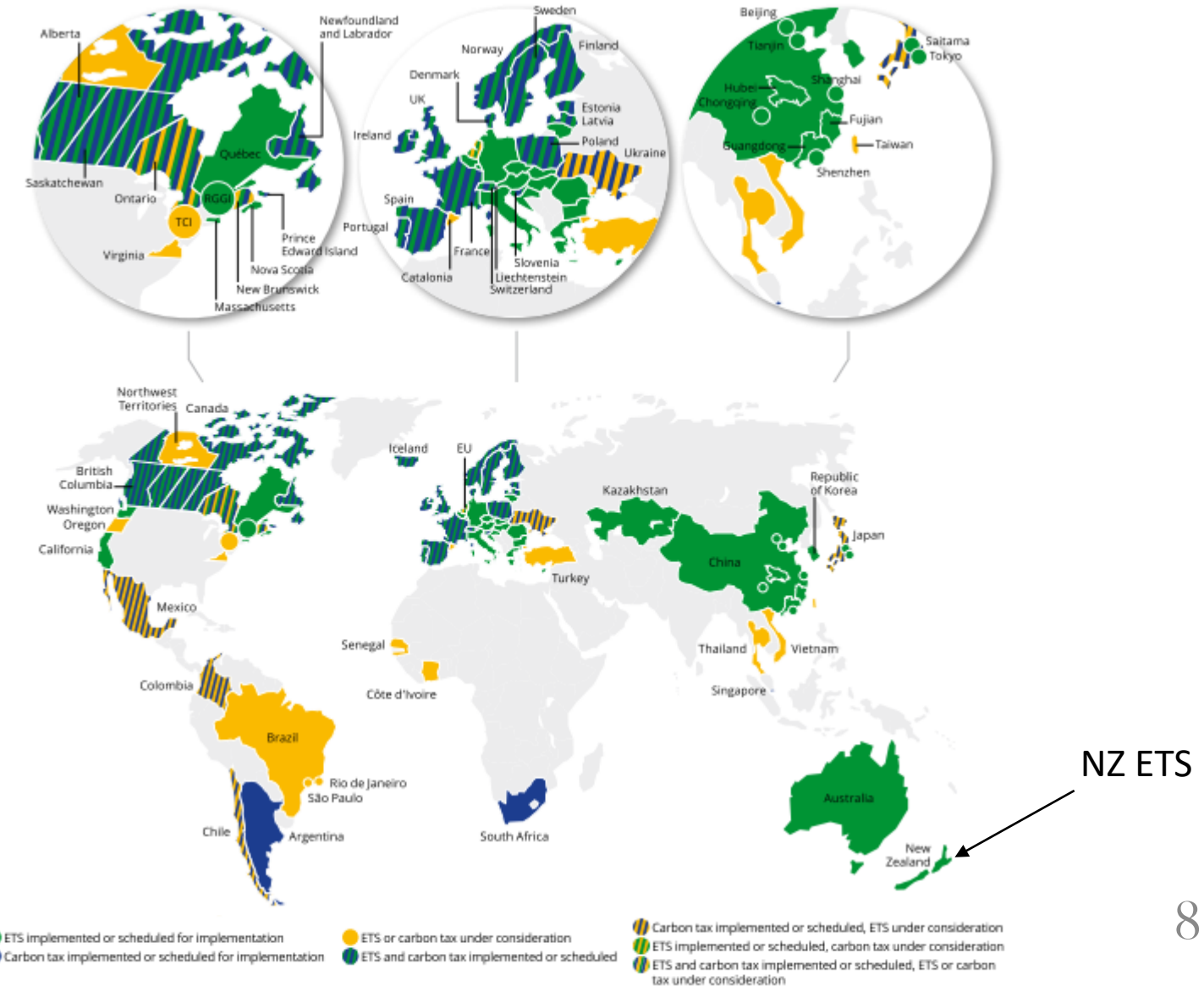
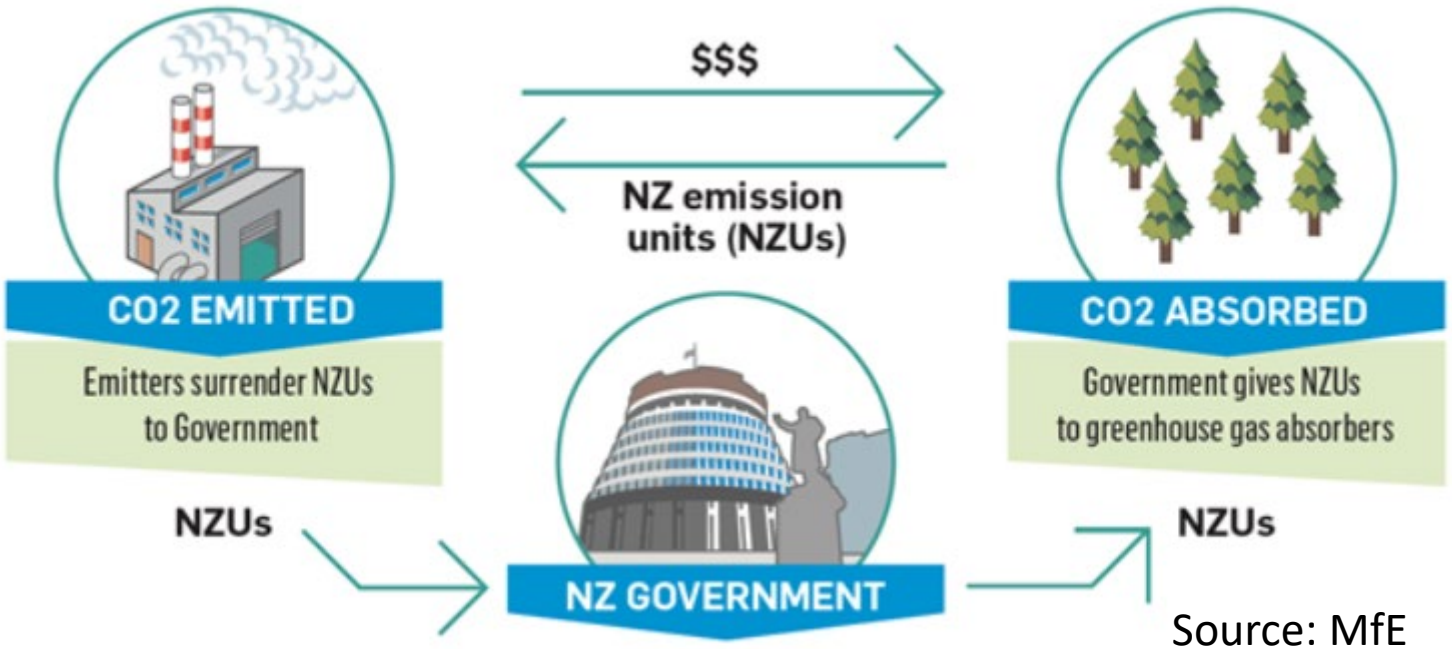


Figure 5 Summary map of regional, national and subnational carbon pricing initiatives

Figure 5 depicts regional, national and subnational carbon pricing initiatives implemented, scheduled for implementation and under consideration (ETS and carbon tax). (World Bank, 2019)



NZ ETS Overview



Source: MfE

NZ ETS Overview

- New Zealand Emissions Trading Scheme (NZ ETS): est. 2008; the second oldest national scheme
- NZ ETS Uniqueness:
  - Incentive system: no hard emissions cap
  - Upstream obligation: the broadest sectoral coverage in the world and intended to cover the major GHGs
  - Unlimited import unit period and unlimited banking provision
  - Forestry's role as a carbon sink: 27.5% of NZ gross total GHG emissions, 22 Mt CO2-e (MfE 2019)
  - Agriculture, the biggest emitter, to be enrolled in by 2025: 48% of NZ gross total GHG emissions (MfE 2019)

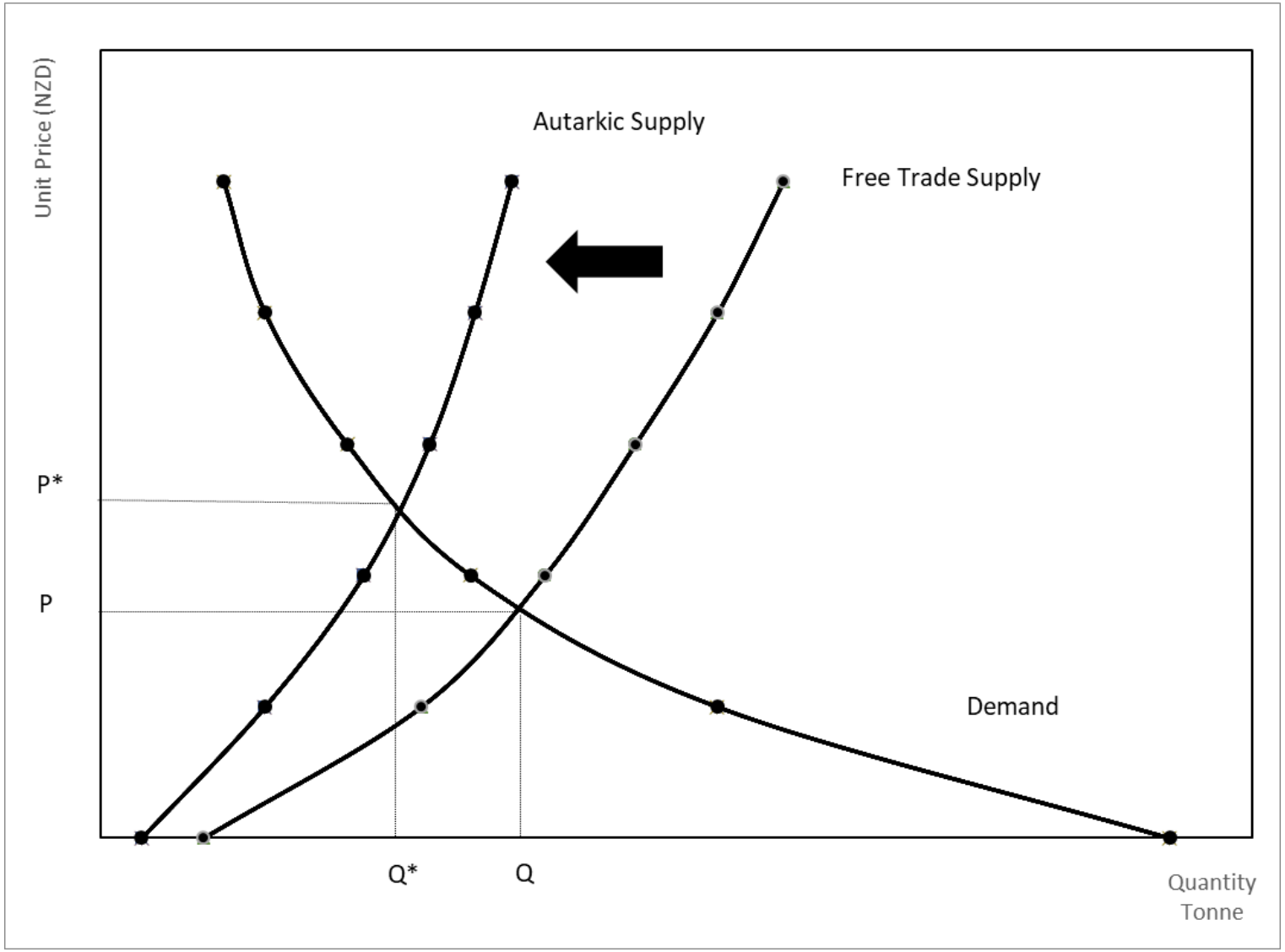
NZ ETS Evolution

- Full linkage to international Kyoto market (2008- May 2015): unlimited international offsets
  - 2008-2013: NZ Kyoto Commitment Period I
    - 2012 November: Delink announcement
  - 2014-May 2015: NZ Kyoto Commitment Period I True-up
  - unlimited banking provision
  - transitional unit obligation measures
  - fixed price option(FPO) for immediate surrender
- Autarkic market (**June 2015**- current)
  - 2008-current: unlimited banking provision
  - 2010-2018: transitional unit obligation measures
  - 2010-current: fixed price option(FPO) for immediate surrender
    - at NZ$25 till early 2020
    - at NZ$30 since June 2020

Theory & Hypotheses

Figure 6 NZ ETS aggregate supply and demand curves

Figure 6 depicts the interaction between NZU supply and demand curves under free trade condition (before delink) and under autarkic condition (after delink).



Supply and Demand Function

- Supply function

$$Q_S = f\left(Allo, Ent(P_{nzu}, P_{tim}), NetImport\left(P_{nzu}, P_{import}\right), FPO\right), \quad \textbf{Eq. 1}$$

- Demand function

$$Q_d = f\begin{pmatrix} E_T(P_{nzu}, P_{oil}, Travel), E_M(P_{nzu}, Man), E_C(P_{nzu}, Cons), \\ P_{nzu}, P_{oil}, P_{elec}\ , Gen, \\ E_E\begin{pmatrix} Hot_t, Cold_t, Anomaly, Temp, Storage \end{pmatrix} \end{pmatrix}, \quad \textbf{Eq. 2}$$

Literature Review

- Energy prices (Mansanet-Bataller et al., 2007; Hintermann, 2010)
- Renewables deployment (Koch et al, 2014; Chèze, Chevallier, Berghmans and Alberola, 2020; Van Den Bergh et al,2013)
- Climate (Christiansen et al., 2005; Mansanet-Bataller et al., 2007; Alberola et al., 2008; Benz and Trück, 2009; Hintermann, 2010)
- Banking (Chen and Tanaka, 2018; Alberola and Chevallier, 2009)
- International units (Diaz- Rainey and Tulloch, 2018; Koch et al,2014)
- Carbon price effect on timber price (Evison, 2008; Tee, Scarpa, Marsh, & Guthrie, 2014)
- Christiansen et al. (2005,CP): assessment of national allocation plans (NAPs), the linking policy, banking policy and the future status of the Kyoto Protocol is necessary.
- Perino and Willner (2017,CP) simulate allowance price paths with different market design options for EU ETS Phase IV.

Hypotheses

- **H1:** NZU prices experienced four structural breaks around November 10th, 2012 (Kyoto Protocol Commitment Period 2 withdrawal announcement), February 19th, 2013 (following a large ban on low integrity international units), June 1st, 2015 (New Zealand's Commitment Period 1 true-up period fulfilled) and May 27th, 2016 (one-for-two transitional measure phasing-out announcement).
- **H2:** Transportation, manufacturing, construction and stationary energy emissions allowances demands have a **positive** relationship with the NZU price.
- **H3a:** Banked allowances have a **negative** impact on NZU price.
- **H3b:** Domestic allowances supply (e.g. afforestation entitlements) and net importation have a **negative** relationship with the NZU price.

Data & Methodology

Variable	Label Name	Description	Source	Frequency
NZU_t	NZU return	*de-seasonalized* first log difference of NZU spot prices (NZ$ per ton)	Bloomberg	D/M/Q
Oil_t	Oil return	first log difference of Arabian Dubai Fateh Crude Spot Index (NZ$/barrel)	Bloomberg	D/M
$Elec_t$	Electricity return	de-seasonalized daily returns of electricity spot prices at Benmore Node 2201 (NZ$/MW)	Energy Link	D/M
EUA_t	EUA return	de-seasonalized first log difference of EUA futures close price (NZ$ per ton),	Capital IQ	D/M
Gen_t	Electricity generation	de-seasonalized total electricity generation output (Petawatt per hour)	Energy Authority	D/M/Q
$Storage_t$	Storage	de-seasonalized total active storage data over 9 sites (trillion m^3)	Energy Link/Energy Authority	D/M
$NetImport_t$	Net import	de-seasonalized net amount of international incoming transactions from overseas accounts to private accounts in the Register: Sum of AAUs, CERs, RMUs, and ERUs (in millions)	EPA OIA	D/M/Q
$Bank_t$	Banked units	de-seasonalized estimated private stockpile amount	EPA OIA	D/M/Q
DS_t	Domestic supply	de-seasonalized net amount of transactions from Crown controlled accounts into private accounts in the Register (in millions)	EPA OIA	D/M/Q
Ent_t	Entitlement	de-seasonalized total net allowance returns: sum of net MERs, VERs, PFSI NZU entitlements (in millions),	MPI OIA	M
$Allo_t$	Allocation	de-seasonalized freely-allocated units (in millions)	EPA/MPI OIA	M
Hot_t	*Extreme hot days*	Extreme hot, the upper 90% quintiles	NIWA	M
$Cold_t$	*Extreme cold days*	Extreme cold, the lower 10% quintiles	NIWA	M
$Anomaly_t$	*Temperature anomalies*	Monthly average temperature anomalies averaged over 7 locations (°C)	NIWA OIA	M
$Temp_t$	*Temperature*	Absolute mean temperature (°C)	NIWA OIA	M
Man_t	Manufacturing expenditures	second log difference purchases and operating expenditure of NZ manufacturing industries (billion NZ$)	Stats NZ	Q
$Cons_t$	Construction values	second log difference New Zealand total new plus altered building activities trend value (billion NZ$)	Stats NZ	Q
$Travel_t$	Travel emissions	de-seasonalized first log difference of total emissions from distance travelled by light, medium and heavy vehicles (kt CO2-e)	MoT	Q

Methodology

- To test structural breakpoints: Zivot-Andrews (1992) test
- To identify relationships:
  - Used in the monthly analysis of NZU returns and banked units, FDL model:

$$y_t = \delta_0 + \Sigma_{q=1}^{Q} \delta_{1,q} x_{1,t-q} + \cdots + \Sigma_{q=1}^{Q} \delta_{k,q} x_{k,t-q} + \epsilon_t, \qquad \text{Eq. 5}$$

  - Used in the monthly analysis of net import and domestic supply, ARDL model:

$$y_t = \delta_0 + \Sigma_{p=1}^{P} \gamma_p y_{t-p} + \Sigma_{q=1}^{Q} \delta_{1,q} x_{1,t-q} + \cdots + \Sigma_{q=1}^{Q} \delta_{k,q} x_{k,t-q} + \epsilon_t, \qquad \text{Eq. 6}$$

  - Used in daily and monthly analyses of the multiple-directional relationships, VARFDL model:

$$\mathrm{Y_t} = \mathrm{B_0} + \Sigma_{i=1}^{P} \mathrm{B_1 Y_{t-}}_i + \Sigma_{j=0}^{Q} \mathrm{B_2 X_{t-}}_j + \mathrm{E_t}, \qquad \text{Eq. 7}$$

Key Results

Table 1 presents two policy associated structural breakpoints (H1)

- Breakpoint in 2013 following a large ban on international units with low environmental integrity effective on December 18th, 2012 (Groser, 2012)
- Breakpoint in 2016 following the announcement of a gradual phasing-out of one-for-two 'transitional' measure on May 27th, 2016 (Bennett, 2016)

Panel A: BP test on daily NZU returns					
Breakpoint test using Zivot-Andrews unit root test					
Panel A presents the structural break tests on daily NZU returns. SBnzu1 is the first structural breakpoint dummy variable with the breaking date on **February 19th, 2013** (obs:658). SBnzu2 is the second structural breakpoint dummy variable with the breaking date on **June 21st, 2016** (obs:1486).					
	Minimum t-statistic	Observation	p<=1%	p<=5%	p<=10%
$SBnzu_1$	-44.812	658	-5.34	-4.8	-4.58
$SBnzu_2$	-24.777	1486	-5.34	-4.8	-4.58
Panel B: BP test on monthly NZU returns					
Breakpoint test using Zivot-Andrews unit root test					
Panel B presents the structural break tests on monthly NZU returns. SBnzu1is the first structural breakpoint dummy variable with the breaking month in **March, 2013** (obs:33). SBnzu2 is the second structural breakpoint dummy variable with the breaking month in **July, 2016** (obs:73).					
	Minimum t-statistic	Observation	p<=1%	p<=5%	p<=10%
$SBnzu_1$	-11.998	33	-5.34	-4.8	-4.58
$SBnzu_2$	-11.282	73	-5.34	-4.8	-4.58

$$NZU_t = \delta_0 + \delta_1 Travel_{t-6} + \delta_2 Gen_{t-4} + \delta_3 Man_{t-5} + \epsilon_t \quad (1)$$

$$Bank_t = \delta_0 + \delta_1 Gen_{t-6} + \delta_2 Travel_{t-3} + \delta_3 Man_{t-6} + \epsilon_t \quad (2)$$

Specification	Eq. 5 (1)	Eq. 5 (2)
N	31	30
Mean VIF	1.1700	1.1600
RMSE	0.2110	6.8750
R^2	0.3820	0.5230
Adj. R^2	0.3140	0.4680
F	5.5690	9.5070
	NZU_t	$Bank_t$
$Travel_{t-3}$		-0.476***
$Travel_{t-4}$		
$Travel_{t-6}$	0.320*	
Gen_{t-4}	-0.283*	
Gen_{t-6}		0.328**
Gen_{t-7}		
Man_{t-5}	0.337**	
Man_{t-6}		-0.167
$Cons_{t-3}$		
$Cons_{t-6}$		

Table 2 presents results related to H2:

Column (1) reveals the impact that sectoral emission activities have on NZU prices:

- Transportation: +
- Manufacturing: +
- Stationary energy: -
- Construction: no significant

Column (2) may imply different sectors' banking patterns:

- Transportation: private stockpile consumer
- Stationary energy: stockpile banker
  - The stockpile banked by the stationary energy sector allows the participants to fulfill their obligation by surrendering the banked units which were purchased at a cheaper price rather than purchasing new NZUs from the market when the current NZU return is high.
- Manufacturing and construction: seemingly not contributing to the banking.
  - favorable Emission Intensive and Trade Exposed (EITE) free-allocation provision encourages immediate NZUs spending rather than NZUs hoarding.

$$NZU_{1,t} = \delta_{1,0} + \sum_{j=1}^{2} \delta_{1,1}^{j} NZU_{1,t-j} + \Sigma_{j=1}^{2} \delta_{1,2}^{j} Elec_{2,t-j} + \Sigma_{j=0}^{2} \delta_{1,3}^{j} NetImport_{3,t-j} + \Sigma_{j=0}^{2} \delta_{1,4}^{j} EUA_{4,t-j} + \Sigma_{j=0}^{1} \delta_{1,5}^{j} Gen_{5,t-j} + \delta_{1,6} Storage_{6,t} + \delta_{1,7} SBnzu_1 + \delta_{1,8} SBnzu_2 + \epsilon_{1,t} \quad (11)$$

$$Elec_{2,t} = \delta_{2,0} + \sum_{j=1}^{2} \delta_{2,1}^{j} NZU_{1,t-j} + \Sigma_{j=1}^{2} \delta_{2,2}^{j} Elec_{2,t-j} + \Sigma_{j=0}^{2} \delta_{2,3}^{j} NetImport_{3,t-j} + \Sigma_{j=0}^{2} \delta_{2,4}^{j} EUA_{4,t-j} + \Sigma_{j=0}^{1} \delta_{2,5}^{j} Gen_{5,t-j} + \delta_{2,6} Storage_{6,t} + \delta_{2,7} SBnzu_1 + \delta_{2,8} SBnzu_2 + \epsilon_{2,t}$$

Specification	Eq. 7 (11) (A)	Eq. 7 (11) (B)
N	2342	
Mean VIF	1.2900	
RMSE	0.0246	1.0150
R^2	0.0310	0.0362
χ^2	74.9600	88.0100
	NZU_t	$Elec_t$
NZU_{t-1}	0.069***	-0.024
NZU_{t-2}	0.028	0.019
$Elec_{t-1}$	0.036*	-0.142***
$Elec_{t-2}$	0.018	0.040**
$NetImport_t$	-0.049**	0.010
$NetImport_{t-1}$	0.044**	0.024
$NetImport_{t-2}$	-0.018	0.037*
EUA_t	-0.014	0.032
EUA_{t-1}	0.062***	0.005
EUA_{t-2}	0.056***	0.003
Gen_t	-0.007	0.010
Gen_{t-1}	0.020	-0.093***
$Storage_t$	0.007	0.061***
$SBnzu_1$	0.111***	0.011
$SBnzu2$	-0.049**	0.006

Table 3 presents results related to H2

Column (11) reveals the mutual relationship between electricity return and NZU return:

- NZU return: marginally and **positively** affected by previous day's electricity return
- electricity return: not significantly affected by NZU return.

Explanation for the **positive** relationship: higher electricity prices yesterday ->

higher electricity demand yesterday ->

higher demand for NZUs the following day to fulfil the legal obligation ->

positively affects NZU return in the current day. ->

H2 related to the impact of stationary energy demand on NZU return still holds

Specification	Eq. 7 (12) (A)	Eq. 7 (12) (B)
N	2337	
Mean VIF	1.0600	
RMSE	0.0246	0.7360
R^2	0.0407	0.0372
χ^2	99.2300	90.2200
	NZU_t	$Bank_t$
NZU_{t-1}	0.067***	0.006
NZU_{t-2}	0.032	-0.002
NZU_{t-3}	-0.026	-0.021
NZU_{t-4}	-0.040*	0.028
NZU_{t-5}	-0.005	-0.047**
NZU_{t-6}	-0.038*	-0.016
NZU_{t-7}	0.057***	-0.004
$Elec_t$	0.006	0.025
$Elec_{t-1}$	0.035*	0.001
$Elec_{t-2}$	0.010	-0.007
$Elec_{t-3}$	-0.042**	0.055***
$Bank_{t-1}$	0.026	0.063***
$Bank_{t-2}$	0.010	0.067***
$Bank_{t-3}$	-0.049**	-0.005
$Bank_{t-4}$	-0.004	0.059***
$Bank_{t-5}$	0.003	0.088***
$Bank_{t-6}$	-0.019	-0.073***
$Bank_{t-7}$	-0.048**	0.002
EUA_t	-0.015	-0.028
EUA_{t-1}	0.059***	0.017
EUA_{t-2}	0.050**	-0.015
$SBnzu_1$	0.111***	-0.029
$SBnzu_2$	-0.051**	-0.027

$$NZU_{1,t} = \delta_{1,0} + \Sigma_{j=1}^{7}\delta_{1,1}^{j}NZU_{1,t-j} + \Sigma_{j=1}^{7}\delta_{1,2}^{j}Bank_{2,t-j} + \Sigma_{j=0}^{3}\delta_{1,3}^{j}Elec_{3,t-j} + \Sigma_{j=0}^{2}\delta_{1,4}^{j}EUA_{4,t-j} + \delta_{1,5}SBnzu_1 + \delta_{1,6}SBnzu_2 + \epsilon_{1,t} \quad (12)$$

$$Bank_{2,t} = \delta_{2,0} + \Sigma_{j=1}^{7}\delta_{2,1}^{j}NZU_{1,t-j} + \Sigma_{j=1}^{7}\delta_{2,2}^{j}Bank_{2,t-j} + \Sigma_{j=0}^{3}\delta_{2,3}^{j}Elec_{3,t-j} + \Sigma_{j=0}^{2}\delta_{2,4}^{j}EUA_{4,t-j} + \delta_{2,5}SBnzu_1 + \delta_{2,6}SBnzu_2 + \epsilon_{2,t}$$

Table 4 presents results related to H3a:
Column (12) depicts the mutual relationship between banked units and NZU return:

- lower past NZU returns promote more allowances purchases at a cheaper price for banking purpose
- banking **depreciates** NZU returns

	NZU_t	DS_t	$NetImport_t$
NZU_{t-1}	0.066***	0.017	-0.003
NZU_{t-2}	0.028	-0.007	0.027
NZU_{t-3}	-0.031	0.021	-0.032
NZU_{t-4}	-0.039*	0.019	0.014
NZU_{t-5}	-0.008	-0.011	-0.031
NZU_{t-6}	-0.036*	-0.023	0.018
NZU_{t-7}	0.052**	0.008	-0.004
$Elec_t$	0.006	0.001	0.016
$Elec_{t-1}$	0.035*	-0.017	0.016
$Elec_{t-2}$	0.012	0.003	-0.003
$Elec_{t-3}$	-0.036*	-0.014	0.077***
$Elec_{t-4}$	0.004	-0.058***	0.034*
DS_{t-1}	-0.014	0.016	0.059***
DS_{t-2}	0.012	0.055***	0.025
DS_{t-3}	-0.046**	0.047**	0.002
DS_{t-4}	-0.002	0.072***	-0.014
DS_{t-5}	0.046**	0.060***	0.029
DS_{t-6}	-0.034	-0.019	0.056***
DS_{t-7}	-0.015	-0.040*	-0.016
$NetImport_{t-1}$	0.039*	0.017	0.003
$NetImport_{t-2}$	-0.007	0.047**	0.010
$NetImport_{t-3}$	-0.033	-0.001	-0.086***
$NetImport_{t-4}$	-0.018	0.023	0.025
$NetImport_{t-5}$	-0.022	0.026	0.043**
$NetImport_{t-6}$	-0.027	0.009	-0.079***
$NetImport_{t-7}$	-0.098***	0.016	0.042**
EUA_t	-0.015	-0.031	-0.007
EUA_{t-1}	0.055***	0.033	-0.000
EUA_{t-2}	0.047**	-0.040**	0.014
Oil_t	0.022	-0.047**	-0.000
$Storage_t$	0.006	0.053**	-0.041**
$SBnzu_1$	0.121***	0.005	0.091***
$SBnzu_2$	-0.061*	0.069**	0.036
$SBnetimport$	-0.004	-0.077**	-0.200***

$$NZU_{1,t} = \delta_{1,0} + \Sigma_{j=1}^{7}\delta_{1,1}^{j}NZU_{1,t-j} + \Sigma_{j=1}^{7}\delta_{1,2}^{j}DS_{2,t-j} + \Sigma_{j=1}^{7}\delta_{1,3}^{j}NetImport_{3,t-j} + \Sigma_{j=0}^{4}\delta_{1,4}^{j}Elec_{4,t-j} + \Sigma_{j=0}^{2}\delta_{1,5}^{j}EUA_{5,t-j} + \delta_{1,6}Oil_{6,t} + \delta_{1,7}Storage_{7,t} + \delta_{1,8}SBnzu_1 + \delta_{1,9}SBnzu_2 + \delta_{1,10}SBnetimport + \epsilon_{1,t} \quad (13)$$

$$DS_{2,t} = \delta_{2,0} + \Sigma_{j=1}^{7}\delta_{2,1}^{j}NZU_{1,t-j} + \Sigma_{j=1}^{7}\delta_{2,2}^{j}DS_{2,t-j} + \Sigma_{j=1}^{7}\delta_{2,3}^{j}NetImport_{3,t-j} + \Sigma_{j=0}^{4}\delta_{2,4}^{j}Elec_{4,t-j} + \Sigma_{j=0}^{2}\delta_{2,5}^{j}EUA_{5,t-j} + \delta_{2,6}Oil_{6,t} + \delta_{2,7}Storage_{7,t} + \delta_{2,8}SBnzu_1 + \delta_{2,9}SBnzu_2 + \delta_{2,10}SBnetimport + \epsilon_{2,t}$$

$$NetImport_{3,t} = \delta_{3,0} + \Sigma_{j=1}^{7}\delta_{3,1}^{j}NZU_{1,t-j} + \Sigma_{j=1}^{7}\delta_{3,2}^{j}DS_{2,t-j} + \Sigma_{j=1}^{7}\delta_{3,3}^{j}NetImport_{3,t-j} + \Sigma_{j=0}^{4}\delta_{3,4}^{j}Elec_{4,t-j} + \Sigma_{j=0}^{2}\delta_{3,5}^{j}EUA_{5,t-j} + \delta_{3,6}Oil_{6,t} + \delta_{3,7}Storage_{7,t} + \delta_{3,8}SBnzu_1 + \delta_{3,9}SBnzu_2 + \delta_{3,10}SBnetimport + \epsilon_{3,t}$$

Table 5 presents results related to H3b

Table 5 mainly reveals the impact that allowances supply have on NZU prices:

- Domestic supply overall effect: 0
- net importation overall effect: -

$$NZU_t = \delta_0 + \delta_1 NetImport_t + \delta_2 NetImport_{t-1} + \delta_3 Ent_t + \delta_4 Ent_{t-1} + \delta_5 SBnzu_1 + \delta_6 SBnzu_2 + \epsilon_t \quad (5)$$

Specification	Eq. 5 (5)
N	113
Mean VIF	1.4700
RMSE	0.1030
R^2	0.3890
Adj. R^2	0.3550
F	11.2600
	NZU_t
NZU_t	
NZU_{t-1}	
NZU_{t-2}	
$NetImport_t$	-0.474***
$NetImport_{t-1}$	0.133
$NetImport_{t-2}$	
DS_{t-1}	
EUA_t	
EUA_{t-1}	
Oil_t	
Oil_{t-1}	
Gen_t	
$Allo_t$	
$Allo_{t-1}$	
Ent_t	-0.092
Ent_{t-1}	0.433***
$SBnzu_1$	0.430***
$SBnzu_2$	-0.265***
$SBbank$	

Table 6 presents results related to H3b

Column (5) reveals the impact that allowances supply have on NZU prices:

- net importation: -
- Afforestation entitlements) : +

Possible explanation but subject to further investigation:

- foresters' decision to plant or harvest is led by the trade-off between NZU prices and log prices

Conclusion

Conclusion

- Two policy associated structural breakpoints in NZU returns over the period of July 1st, 2010-December 31st, 2019.(H1)
    - in 2013 following a large ban on international units with low environmental integrity
    - in 2016 following the announcement of a gradual phasing-out of one-for-two ‘transitional’ measure
- Increased carbon activities from the manufacturing and transportation sectors tend to increase NZU prices, while activities from the stationary energy sector put downward pressure on NZU prices. This may be explained by the large stockpile (bank) of unit held by stationary energy sector. (H2)
- Banking (H3a) and net import negatively affect NZU returns (H3b).
- Carbon removal entitlements surprisingly positively affect NZU returns. (H3b)

Thank you!

Send comments or questions to: ling.liao@postgrad.otago.ac.nz