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The New Zealand Emissions Trading Scheme de-link from Kyoto: impacts on banking and prices

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Abstract

The New Zealand Emissions Trading Scheme (NZ ETS) presents an opportunity to compare the theory of linked emissions trading with practice. From 2009 until late 2012 New Zealand was linked to the Kyoto market and there was no indication that this link would be broken. In November 2012 the New Zealand government announced that it would not proceed with the second commitment period of the Kyoto Protocol and future linking became uncertain. This de-link was confirmed by the government in December 2013 and it was announced that it would take effect from 31 May 2015. After this date overseas Kyoto units were no longer acceptable for surrender within the NZ ETS. We find that prices within the NZ ETS behaved as theory would predict. In a climate of certain linking, from 2011 when New Zealand began buying overseas units to surrender, New Zealand Unit (NZU) prices were roughly equal to Kyoto prices. Once the possibility of a future de-link emerged, NZU and Kyoto prices decoupled. NZU prices traded at a price reflecting their anticipated future scarcity – for New Zealand as a buyer of units this implies that NZUs traded at a higher price. In anticipation of the coming de-link NZ ETS participants banked (almost) all of their NZUs for future use and used cheap Kyoto units to meet (almost) all of their current obligations. The long delay between the announcement and implementation of de-linking led to a large bank of NZUs.

JEL codes

Q54; Q58

Keywords

New Zealand Emissions Trading Scheme (NZ ETS), climate change, mitigation, emissions trading, linked tradable permit market, Kyoto units, Certified Emission Reductions (CERs), Emission Reduction Units (ERUs), greenhouse gas, carbon markets.

Summary haiku

Linking is risky.
Others' units surrendered,
Much revenue lost.

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1 Introduction

The least-cost approach to limiting atmospheric concentrations of CO₂-equivalent gases to 450 parts per million (ppm) requires about 65% of discounted abatement costs, out to 2100, to occur in developing countries.¹ Linking emissions trading schemes, where units originating in one scheme can be used to meet obligations in another, is one way to facilitate resource flows from those who can pay to those who can (more easily) mitigate. The New Zealand Emissions Trading Scheme (NZ ETS), which began in 2008, was designed so that NZ ETS participants could buy foreign units without limit. This allowed New Zealand to set a target it could be confident of meeting even if domestic mitigation proved difficult and aimed to allow New Zealand to meet its Kyoto target in a globally cost-effective way. Understanding how these linkages affected the New Zealand market is critical both for policy makers in New Zealand and designers of international emissions trading schemes who are considering linkages.

Pizer and Yates (2013) show that when two schemes are fully linked and expected to be so indefinitely, and if markets are competitive, units from both sources will trade at the same price. However most of the New Zealand market effectively had a one-way link.² When the Kyoto price was higher than the NZU price, New Zealanders would have liked to sell their NZUs overseas. Because most could not, Kyoto units may have traded at a premium.

When markets de-link and the de-link is known in advance, prices will diverge immediately (at the announcement rather than at the de-link itself) provided that the high-cost region (which was New Zealand at the time of the de-link) cannot bank enough units before the de-link to lower the future price to the current price of the low-cost region.³ The price of the high-cost unit (NZUs) is then determined by their scarcity in the de-linked future. We test this hypothesis using data on NZUs and international Kyoto unit prices, coupled with data on the types of units New Zealand participants banked and surrendered.

The NZ ETS has experienced two different linking situations. From 2009 until late 2012 New Zealand was linked to the Kyoto market as a buyer of units (meaning that NZ ETS participants

¹ See Edmonds, Clarke, Lurz and Wise (2008) p. 372

² After legislative amendments in November 2009 (enacted before non-forestry sectors assumed unit obligations and received free allocation), all NZ ETS participants could buy and surrender eligible Kyoto units from overseas but only forestry participants could sell New Zealand Units (NZUs) overseas. Foresters could exchange their NZUs for an equivalent number of New Zealand government Assigned Amount Units (AAUs), which they could then sell to overseas markets. The rationale for this change was the addition of a \$25 fixed-price option to the NZ ETS, which created a potential arbitrage opportunity for industrial firms continuing to receive free allocation on an output basis. Firms could have met their obligations using the fixed price option and then sold their freely allocated NZUs abroad at a higher price. Now they can only bank the NZUs if the secondary market exceeds the fixed price. In practice only a small number of NZ AAUs were ever sold overseas because buyers were limited, and so, for simplicity, in this paper we speak of New Zealand as having only a one-way link in the linked period. Buyers included a Japanese company and the Norwegian and Danish governments. As of 30 December 2014, 1.2 million units were sold overseas out of a total of over 146 million NZUs and AAUs that entered private holdings. See appendix for details. Since 18 November 2015, international transfers of units to or from the New Zealand Emission Unit Register (NZEUR) have no longer been available (NZEUR website).

³ Pizer and Yates cover two different types of de-linking corresponding to the different ways units might be treated post link. What they call “asymmetric de-linking” corresponds to when post-de-link, the units can only be used in their region of origin. This is what happened in the New Zealand case.

could surrender certain international units) and there was no indication that this link would be broken. In November 2012 the New Zealand government announced that it would not proceed with the second commitment period of the Kyoto Protocol and future linking became uncertain (Groser 2012). The government confirmed the de-link in December 2013 and announced it would take effect from 31 May 2015 (Bridges 2013). After this date overseas Kyoto units were no longer acceptable for surrender within the NZ ETS.⁴

The New Zealand experience presents an opportunity to compare theory with practice and for academics and policy makers to learn more about the nature of linking emissions trading schemes. Specifically, we look at two things: the relationship between NZU prices and international Kyoto unit prices; and which types of units New Zealand firms choose to surrender rather than bank for later use.

Ranson and Stavins (2015) discuss why emissions trading schemes link and de-link but do not explore linking empirically. There is a growing empirical literature on the determinants of carbon prices, with many studies focused on the European Union Emissions Trading System (EU ETS). This literature mostly considers demand-side factors that are expected to influence carbon prices through their influence on marginal abatement costs. For example, several papers study the effects of oil, gas and coal prices on European Union Allowance (EUA) prices.⁵ These papers generally find a positive relationship between the EUA price and the oil and gas prices, but mixed results for the effect of the coal price on the EUA price. Rickels, Görlich and Peterson (2014) show that these mixed results can be explained by researchers using different fuel prices within each fuel category.⁶ Koch et al. (2014) discuss the drivers of the fall in EUA prices. An important takeaway from this literature is the difficulties and nuances that arise when trying to empirically determine the effects of fundamentals on markets. Specifically, authors have proposed transaction costs, liquidity issues, and uncertainty as candidate explanations for some of the inconsistent findings (Rickels et al. 2014).

In New Zealand, supply-side factors are more likely to have been key drivers of prices. Linking can be thought of as a supply-side factor as it affects the price of units available to New Zealand participants. In contrast to the EU ETS, the NZ ETS imposed no quantity limit on surrendering Kyoto units from inception until 31 May 2015. Because the NZ ETS was built around linking to Kyoto markets, the government has never applied an explicit domestic cap to

⁴ NZ ETS participants could still surrender NZ AAUs (e.g. that were issued to participants in the Permanent Forest Sink Initiative, Projects to Reduce Emissions or Negotiated Greenhouse Agreements).

⁵ E.g. Alberola, Chevallier and Chèze 2008; Hintermann 2010; Mansanet-Bataller, Pardo and Valor 2007; Rickels et al. 2007; Aatola, Ollikainen and Toppinen 2013; Lutz, Pigorsch and Rotfuß 2013.

⁶ For example Rickels et al. (2014) explore the relationship between 12 different coal prices and the EUA prices, and argue that it is not obvious which price a researcher should adopt as “the” coal price.

the scheme, leaving future unit supply undefined.⁷ Because the future supply of units is unknown, the NZU prices after the de-linking announcement are impossible to model. Several papers by Richter and co-authors (Mundaca and Richter, 2013; Richter and Mundaca, 2013; and Richter and Chambers, 2014) discuss some of the patterns of prices and uses of domestic and international units. Diaz-Rainey and Tulloch (2016) carry out a financial analysis of prices in the New Zealand ETS but do not focus on the effect of de-linking. Their analysis is consistent with an inability to identify fundamental demand-side drivers of NZU prices.

Unlike the EU ETS, the NZ ETS is very small relative to the Kyoto market, and it was thus a price taker. This paper focuses on the issue of how linkages have affected the NZ ETS price and surrender behaviour.

We find that the NZ ETS behaves as theory would predict. Over the duration of certain linking, there were two distinct price periods. First, when non-forestry sectors would have liked to sell units overseas but could not, NZU prices were around NZD20 and below Kyoto prices. Second, from June 2011 when Kyoto prices had begun to fall, NZU prices were roughly equal to Kyoto prices and NZ ETS participants had started buying some international units for compliance.⁸ Once the possibility of a future de-link emerged, NZU and Kyoto prices decoupled. NZU prices diverged from the Kyoto price and traded at a price reflecting their anticipated future scarcity – for New Zealand as a buyer of units this implies that NZUs traded at a higher price. In anticipation of the coming de-link NZ ETS participants banked (almost) all of their NZUs for future use and used cheap Kyoto units to meet (almost) all of their current obligations. The effect of New Zealand's long delay between the announcement and occurrence of de-linking has been to create a large participant-held bank of NZUs as the market anticipated a de-linked world of increased scarcity.

The rest of this paper is laid out as follows: Section 2 gives background on features of the NZ ETS that are relevant to our linking model. For more detail on the NZ ETS see Leining and Kerr (2016). Section 3 details the model that we use; Section 4 describes the data; Section 5 discusses our empirical results, and Section 6 concludes.

⁷ This does not mean that the number of NZUs issued is large. Relative to many ETSs, free allocation of units in the New Zealand system is very restricted. Legislative amendments passed in 2012 require a cap to be set before any NZUs are auctioned to increase supply, but this has not (yet) been put into practice.

⁸ The first unit surrender date in the NZ ETS was 31 May 2011 for all sectors that had entered to date (e.g. forestry, stationary energy and industrial processes).

2 Background on the NZ ETS

The NZ ETS has its own units, New Zealand Units (NZU), which are issued for free allocation and removals. However, a key feature of the NZ ETS is its linkages to other systems. From the beginning of the scheme firms with obligations were able to submit Kyoto units (Ministry for the Environment 2013a), namely:

- Certified Emission Reductions (CERs), which are units issued for projects in developing countries that reduce emissions below business as usual and contribute to sustainable development;
- Emission Reduction Units (ERUs), which are units issued for emission-reduction projects in Annex B (industrialised) countries and which require cancellation of an equivalent number of Assigned Amount Units (AAUs) by the host country;⁹ and
- Removal Units (RMUs), which are awarded to Annex B countries for net removals in the forestry sector.

Crucially, the way Kyoto units are treated in the NZ ETS has changed over time.¹⁰ Initially it was assumed that Kyoto units would be available to New Zealand firms indefinitely, but on 9 November 2012 New Zealand announced it would not join the second commitment period of the Kyoto Protocol (Groser 2012). This fuelled speculation that New Zealand would no longer have access to Kyoto units and hence that the government would no longer allow them in the ETS.¹¹ This speculation proved to be correct and on 6 December 2013 it was confirmed that Kyoto units would no longer be allowed for surrender after 31 May 2015 (Bridges 2013). After 31 May 2015 firms could use only NZUs to meet their surrender obligations.

3 Data

Our main source of data on prices is CommTrade Carbon (the New Zealand Carbon branch of OMF), which has been one of the largest market players since the ETS began. We observe daily carbon spot prices for NZUs, CERs, and ERUs from 1 January 2011 – 1 January 2016.¹² The CER

⁹ Assigned Amount Units (AAUs) are allocated to Annex B countries at the beginning of each commitment period in relation to their Kyoto target. Imported AAUs are not accepted in the NZ ETS; NZ AAUs are but few have been issued to private holders. Throughout this paper, unless otherwise stated, 'Kyoto unit' refers to the following types of Kyoto units: CERs, ERUs and RMUs.

¹⁰ Some qualitative restrictions applied to CERs and ERUs that were eligible in the NZ ETS. From inception, the NZ ETS did not accept ERUs and CERs associated with nuclear projects or CERs associated with forestry projects in the Clean Development Mechanism (CDM) (tCERs and ICERs). From December 2011, CERs associated with industrial-gas destruction projects involving HFC-23 and N₂O were prohibited. From December 2012, ERUs associated with industrial-gas destruction projects and both ERUs and CERs associated with large hydro projects were prohibited.

¹¹ The Environmental Protection Authority quickly announced that Kyoto units would be available until at least the end of 31 May 2015 (Environmental Protection Authority 2012).

¹² We also have some sparse price data from January 2008 but there were few trades and these data were not consistently recorded.

and ERU prices reflect prices from international trades that have been converted to New Zealand dollars using that day's exchange rate. The NZU price reflects data on trades occurring through the CommTrade platform. We cross-checked these NZU prices with data from another broker and found them to be almost identical.¹³

One weakness of our NZU data set is that in many instances there are no trades on a given day. The sparsity of the data partly reflects a lack of liquidity in a small nascent market. Although forestry participants, including those with liabilities for deforestation, had been included in the ETS since 1 January 2008, stationary energy and liquid fuel participants, who are the major source of demand, did not enter until 1 July 2010.

For our analysis the price is, in some cases, recorded as that of the last trade before that date (so that in cases where there are no trades for, say, five days we observe the same price on each day). In other cases when there are no trades the price is recorded as missing. This is problematic because if we observe, say a NZU price of \$20 for each of five consecutive days, when there are no trades on that day and the Kyoto price is changing on each day, then it is unfair to claim the two prices are different, as the latent NZU price (the price at which it would have traded had there been any trades) may well have been the same. On the other hand it is possible, when we observe a series of days with the same NZU price, that there were in fact trades on those days, all occurring at exactly the same price.

To resolve this difficulty we conduct our analysis in two ways. Firstly we use all of the data including the data with repeated NZU prices, and secondly we exclude all the NZU prices that are the same as the last observed day. Our results are unaffected.

4 Results

4.1 Prices

¹³ For example the average difference in NZU price between the two platforms was about 2 cents, and not statistically significant. Throughout our analysis we only use the CommTrade Carbon data, both for simplicity, and because we have access to the data for a more recent period.

Figure 1 shows that prior to late June 2011 CERs traded at a non-trivial premium relative to NZUs. The divergence in the early period illustrates the importance of New Zealand's effective one-way link rather than two-way link. Had the link been two-way, participants would have had an incentive to sell their units to overseas buyers at a higher price. Given New Zealand is small enough in the international market to be a price taker, then a two-way link likely would have resulted in NZUs trading at the higher CER price observed in this early period.

Figure 1: NZU, CER, and ERU prices in NZD over time



NZU and Kyoto prices were approximately equal prior to the government's 9 November 2012 announcement and then, as predicted by theory, they diverged.¹⁴ This divergence in price following the linking announcement illustrates the importance of linkages on the New Zealand price as well as the importance of market expectations. Had the de-link been announced later NZU prices would have remained low for longer. As we can see in **Error! Reference source not found.**, prices actually began to diverge more than one month before the announcement. This suggests that some traders thought that New Zealand's withdrawal from Kyoto was likely and anticipated the probable effect on markets: the Minister's announcement was not a complete surprise to all.

¹⁴ The theoretical prediction is subject to the caveat that New Zealanders banked all their NZUs for future use, which as we will see in Figure 3, happened bar a trivial number of surrenders.

Figure 2: Prices from 1 August to 31 December 2012



Figure 1 provides strong *prima facie* evidence for the effects of New Zealand's linking policy on price. We also apply several statistical tests to confirm this.

First we calculate the correlation between NZU prices and CERs, and the correlation between NZU prices and ERUs both before and after the November 9 announcement. As shown in Table 1 these are almost 1 for both CERs and ERUs in the period before New Zealand announced its de-link, and negative thereafter. Both of these changes are statistically significant.

Table 1: Correlation between NZUs and Kyoto Units pre- and post-announcement

	Pearson's correlation coefficient	95% Confidence Interval	
CER pre-announcement	0.99	0.98	0.99
CER post-announcement	-0.59	-0.64	-0.54
ERU pre-announcement	0.97	0.96	0.98
ERU post-announcement	-0.42	-0.48	-0.35

Second we obtain a difference in difference estimate of the effect. That is, we estimate, Equation (1).

$$\text{price}_{t,j} = \alpha_{NZU} + \lambda_t + \beta(\text{NZU} \times \text{post}) \quad (1)$$

Where $\text{price}_{t,j}$ is the price for unit of type j on day t . α_{NZU} is a dummy for the NZU unit that captures the average difference between the NZU and the Kyoto units. λ_t are daily fixed effects,

and β , the coefficient of interest, is the difference-in-difference estimate of the effect of the de-linking announcement. That is, it represents the extra difference between the Kyoto unit price and the NZU price, after accounting for the initial (pre-period) difference.

The identifying assumption behind a difference-in-difference estimate is that in the absence of ‘treatment’ (in our case the linking announcement) the two prices would have moved in parallel. If the New Zealand and Kyoto markets were always perfectly integrated and linked, α_{NZU} and β would both equal zero.

Table 2 presents our baseline difference-in-difference results, all of which exclude repeated NZU observations. The differences across specifications are changes in the time period of data. With a long period before the announcement (1), α_{NZ} is negative reflecting the effect of the limitations on international sales of NZUs. NZUs were, on average, trading around NZD1.26 below international units. When this pre-period is reduced to one year (2), this coefficient becomes small and insignificant. When we shorten the pre-announcement period to include only the last six weeks of the pre-period ([3] and [4]), α_{NZU} is positive and significant at the 1% level. While this difference is only around 33 cents, and so is small relative to the movement of about \$20 observed over the full period, it shows some evidence of anticipation.

In all specifications β is positive, significant at the 1% level, and meaningful in magnitude. The difference-in-difference estimate gets larger as the period following the announcement is extended, between (3) and (4).¹⁵ The divergence grew over time as the NZU experienced upward shocks (possibly reflecting gradually increasing confidence in the future stringency of the NZ ETS as the government confirmed and then implemented the de-link) while Kyoto units experienced negative shocks.

Table 2: Difference-in-difference results

	(1)	(2)	(3)	(4)
NZU	-1.267*** (0.163)	-0.031 (0.051)	0.332*** (0.076)	0.332*** (0.075)
Post × NZU	4.368*** (0.184)	3.241*** (0.088)	1.043*** (0.095)	2.878*** (0.103)
Daily Fixed effects	Yes	Yes	Yes	Yes
N	980	1317	171	1131
Number of separate days	490	439	57	377
R-squared	0.979	0.937	0.943	0.834
Start date	25-Jan-11	8-Nov-11	20-Sep-12	20-Sep-12
End date	23-Mar-15	23-Mar-15	21-Dec-12	23-Mar-15
Notes: Column (1) only includes NZUs and CERs because our data for ERUs do not go back as far. Columns (2), (3), and (4) include data on NZUs, CERs and ERUs. Observations are at the day-unit type level. Robust standard errors are reported in parentheses. Stars denote: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.				

¹⁵ Results with other date ranges and showing that the treatment of missing data does not affect (3) are presented in Table 3 in the appendix.

4.2 Surrender and banking

The New Zealand Emission Unit Register (NZEUR) provides data on the types of units surrendered in each calendar year. These data are shown in Figure 3.¹⁶ Changes in total surrenders partly reflect changes in gross emissions (and the increase from 2011 to 2012 reflects the mid-year entry date of the stationary energy and liquid fuel sectors) but are mostly driven by surrender of units to cover harvesting or deregistration of forestry ETS participants. Forestry participants were able to take advantage of low Kyoto prices to reduce their liabilities and to deforest (Kerr, Carver, and Dawson 2016).

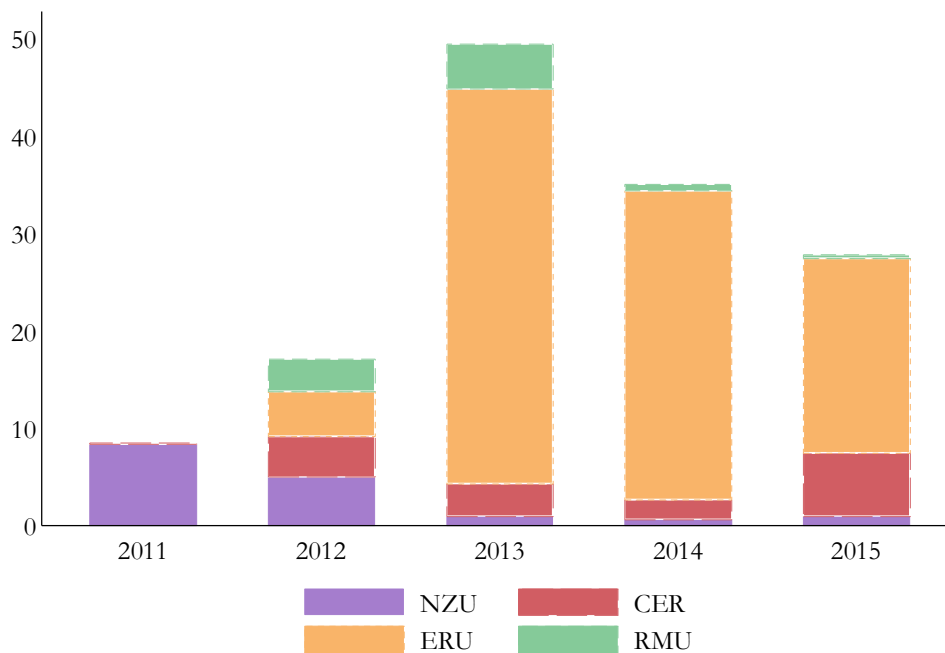
Participants in the NZ ETS with surrender obligations have until 31 May each year to surrender their units (corresponding to the obligations incurred from the emissions in the previous year), and in practice this means that most units are surrendered in May. This means that the May price largely determines choices on which units to surrender.

Comparing the May prices to surrender data each year matches what theory would predict almost exactly. In 2011, when May Kyoto prices were higher than NZUs, participants surrendered NZUs almost exclusively. This is also consistent with the sell-link being binding at this period. In May 2012 prices were approximately equal for both types of units and firms surrendered substantive amounts of both NZUs and Kyoto Units. Between the de-link announcement in November 2012 and its activation after May 2015, NZUs traded at a premium and New Zealand firms surrendered almost exclusively Kyoto units, saving their NZUs for later use.¹⁷

¹⁶ See the New Zealand Emission Unit Register for annual surrender and other data.

¹⁷ We imagine that the small amount of NZUs surrendered reflect small operators with large transactions costs of trading. Since many view the cheap Kyoto units as non-additional it is also possible that some non-profit-maximising participants may have surrendered NZUs in an attempt to be more “green”.

Figure 3: Number and type of units surrendered in the NZ ETS over time



Note that a small number of AAUs are included in this graph as NZUs
Data Source: New Zealand Emissions Unit Register

As participants have surrendered almost exclusively Kyoto units in recent years, the bank of NZUs available for future use (sometimes referred to as the private stockpile) has grown. Using data from the NZEUR it is possible to estimate the size of the bank over time. This procedure is described in the appendix, and the estimates are shown in Figure 4. This growth reflects the new units that the New Zealand government has allocated to emissions-intensive, trade-exposed companies and for removals (the New Zealand government is yet to auction any units).

By July 2015 when the arbitrage had ended there were around 140 million NZUs in the bank. This is nearly four times the 32 million units surrendered in 2014¹⁸ and nearly twice New Zealand's projected 2015 net emissions of 67.9 million tonnes.¹⁹ These holdings of NZUs and NZ AAUs have a domestic value in August 2016 of about \$2.5 billion. Some of these units are held in anticipation of future liabilities; for example some foresters bank units as their forest grows in order to meet their liabilities when the forest is harvested.

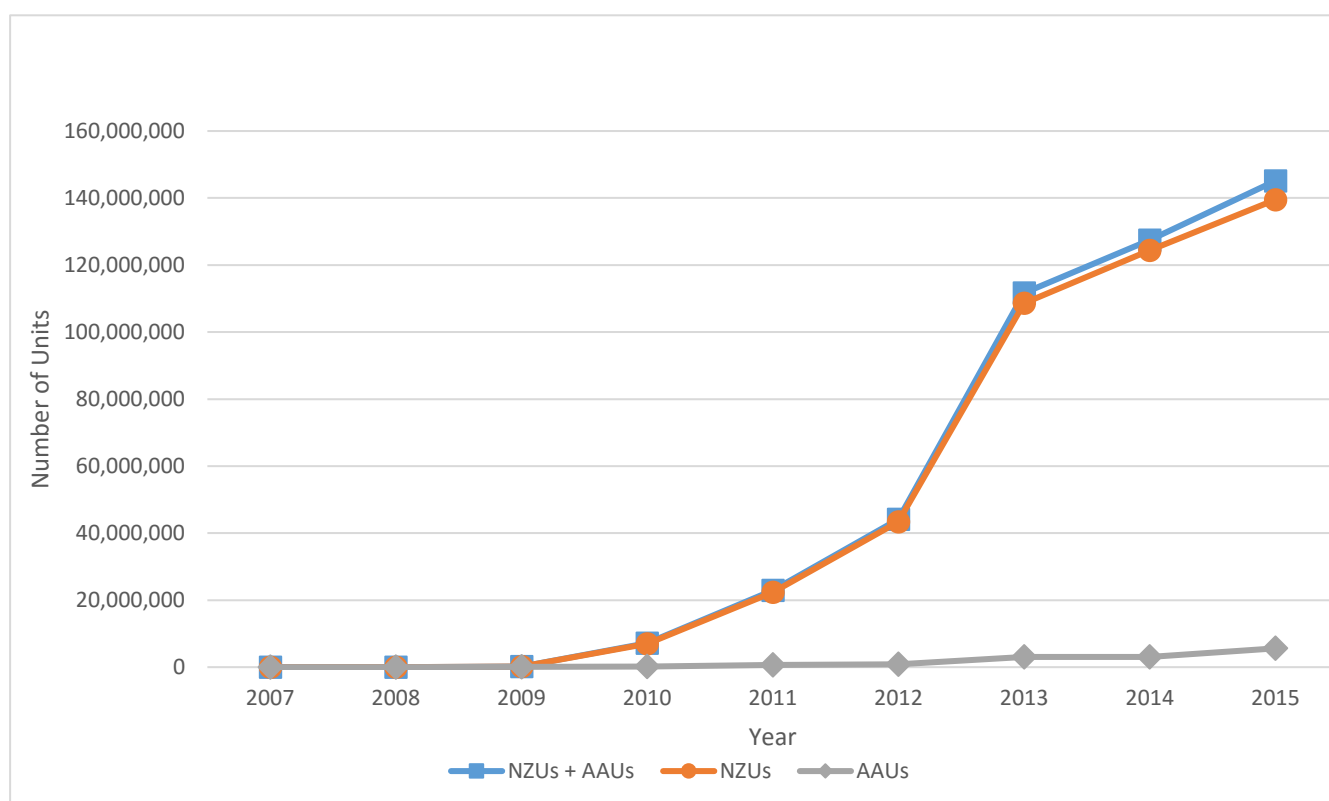
In May 2016 New Zealand firms again surrendered a new tranche of units; these were NZUs (and possibly a small number of NZ AAUs, which are also still eligible for surrender) with the de-link now in effect. Had New Zealand de-linked earlier, say in late 2012 at the time of the announcement, then clearly most of the surrenders in 2013, 2014 and 2015 would have been

¹⁸ Environmental Protection Agency, 2015. p. 13

¹⁹ Ministry for the Environment, 2013b, p.100

NZUs and the NZU bank would have been smaller.²⁰ The government would probably have needed to auction NZUs and would have raised revenue.

Figure 4: Estimated size of the NZU bank over time



5 Conclusion

From theory economists expect linking arrangements to have important effects on prices, surrender and banking behaviour. Specifically Pizer and Yates (2013) have shown that prices should be equal across systems when two-way linking is expected to continue, and deviate once future linkages are uncertain with participants in high-cost regions, such as New Zealand, banking all their own units for future use and surrendering only cheap overseas units.

We find that this simple theory accords very well with reality. The NZU price reaction to the de-linking announcement (rather than the de-link itself) also shows strong evidence of the New Zealand carbon market reacting in the present to news about the future: a key property of any well-functioning market. Even a small, nascent and relatively illiquid market that faces considerable uncertainty about medium-term demand and supply reacts rationally to changes in supply-side factors. The long period of price divergence has led to a large privately held bank

²⁰ It is not straightforward to calculate the size because forester behaviour would have been different in this scenario so both allocation and surrender of NZUs would have been affected.

that is a liability to the New Zealand government in the post-Paris world and reduces the government's ability to raise revenue by auctioning NZUs.

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Appendix

Additional regressions

Table 3: Appendix regressions

	(1)	(2)	(3)
Post × NZU	1.102*** (0.086)	1.465*** (0.061)	1.342*** (0.08)
NZU	0.334*** (0.07)	0.045 (0.052)	0.263*** (0.059)
Daily fixed effects	Yes	Yes	Yes
N	204	531	270
Number of separate days	68	177	90
Repeated NZU obs. excluded	NO	YES	YES
R-squared	0.953	0.989	0.969
Start date	20-Sep-12	8-Mar-12	10-Aug-12
Start date	28-Dec-12	11-Jul-13	15-Feb-13
Notes: Robust standard errors in parentheses. Stars denote: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.			

Estimating the size of the ‘bank’

The New Zealand Emission Unit Register (NZEUR)’s Holding & Transaction Summary does not provide an estimate of the stock of private holdings, the bank. However it does provide information on the flows of units into and out of private hands each year. From these it is possible to construct a good estimate of the bank’s size. From the NZEUR, we can see details about allocations and surrender over time, up until December 2015. In this section we explain how we calculated the bank in 2015; previous years are calculated using the same methodology.

Table 4 summarises the information for NZUs. NZUs can find their way into private holdings in one of two categories listed in the NZ EUR Holding & Transaction Summary: “units transferred for entitlements” or “units allocated”. By the end of 2015 these categories added up to 155.7 million NZUs. NZUs are subtracted from private holdings when they are surrendered to meet emissions obligations, cancelled voluntarily, or converted to NZ AAUs (by eligible participants)

for overseas sale.²¹ By the end of 2015, these categories added up to 16.3 million units.²² Taking the inflows and outflows together there were 139.5 million NZUs in private holdings at the end of 2015.

Table 4: Inflows and outflows of NZUs to 30 December 2015

Total NZUs allocated	70,922,938
Total NZUs transferred for entitlement	84,837,773
Total NZUs put into bank	155,760,711
Total surrendered	14,996,995
Total voluntarily cancelled	29,645
Total replacements	Unknown
Transferred overseas directly	0
Converted to AAUs (and then transferred)	1,236,690
Total NZUs removed from bank	16,263,330
Estimated NZUs in bank (end of 2014)	139,497,381

Table 5 summarises the equivalent information for AAUs. Like NZUs, NZ AAUs enter private holdings through the category titled “units allocated”. However, unlike NZUs, no NZ AAUs have entered the system through “units transferred for entitlement”. NZ AAUs also enter private holdings (briefly) when NZUs are converted to NZ AAUs for overseas sale.²³ By summing these categories we see that approximately 10.4 million AAUs have entered private holdings. NZ AAUs leave private holdings when they are surrendered, voluntarily cancelled, or transferred overseas. These subtract a total of approximately 4.8 million units from the bank. The private bank of NZ AAUs was therefore around 5.6 million units at the end of 2015.

²¹ NZUs can leave or enter private holdings in two more ways: they can be transferred back to the New Zealand government for repayment or transferred to participants as reimbursement. This usually occurs when an entity is allocated units and the size of the allocation is subsequently revised. This number is not reported in the NZEUR Holding & Transaction Summary, but can be found in the annual reports on the EPA website. Unfortunately these numbers are not broken down by unit type, but net reimbursements are around half a million, and so for our purpose small enough to be ignored when calculating the bank.

²² The information for the number of NZUs surrendered and cancelled can be found on the NZEUR Unit [Holding & Transaction Summary page](#). Information on the NZUs converted for overseas sale can be found on the [NZU conversions page](#).

²³ A small number of international AAUs (5,281,818) have entered private holdings from overseas transfers. International AAUs are no longer allowed to be surrendered in the NZ ETS so we don’t want to include them in our estimate of the bank, and hence we exclude them from our calculations. These units may be counted in the outflows, through units transferred overseas, in which case we should include them in the inflow. At any rate, how we deal with these units is not too important relative to the size of the bank, as can be seen from Figure 4.

Table 5: Inflows and outflows of AAUs to 30 December 2015

Total AAUs allocated	3,833,764
Total NZUs converted to AAUs for overseas sale	1,236,690
Total foreign AAUs transferred into NZ	5,281,818
Total AAUs put into bank	10,352,272
Total surrendered	710,020
Total voluntarily cancelled	45,194
Transferred overseas directly	3,995,806
Total AAUs removed from bank	4,751,020
Estimated AAUs in bank (end of 2014)	5,601,252

Taking the bank of NZUs and NZ AAUs together, we estimate that there were 145.1 million units eligible for future surrender at the end of 2015.²⁴

²⁴ This is close to the government estimate for 1 July 2015 of 140 million (Ministry for the Environment, 2015).

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