

Post implementation review of the prudential arrangements

23 October 2018



Executive summary

- 1.1 In March 2015 the Electricity Authority introduced new wholesale settlement and prudential security arrangements (new arrangements).
- 1.2 The purpose of the new arrangements is to ensure purchasers in the wholesale electricity market can meet their financial obligations while avoiding undue costs (for purchasers).
- 1.3 The aims of the changes introduced are to reduce payment risk faced by generators, reduce costs for large industrial purchasers, and ensure purchasers' costs don't impact retail competition.

Confirming whether the new arrangements have met expectations

- 1.4 We do post implementation reviews to determine how past regulatory decisions are affecting the electricity sector. This post-implementation review (review) evaluates the outcomes of the new prudential arrangements against the cost benefit analysis that was used to support the decision to introduce them. Two of the specific questions asked were:
 - Are the arrangements lowering costs for retailers (purchasers) and thereby supporting retail competition?
 - Are generators facing reduced payment risk under the new arrangements?

Analysing the data to deliver positive findings

- 1.5 This section notes what we analysed, some of the findings, and some data limitations.

Splitting the market into five groups helped focus the analysis

- 1.6 We split the market into five groups. This helped to assess the effects of the new prudential arrangements on different market segments. The five groups were:
 - the five largest gentailers
 - participants other than the five largest gentailers
 - net purchasers
 - retailers
 - direct purchasers.

Analysing the before and after data

- 1.7 We included data for all participants through time. We used a 15-year time horizon and calculated the minimum cost of capital necessary for the benefits to outweigh the costs of the new arrangements.
- 1.8 We looked at data for each group to get an overview of the effects of the new arrangements. Then we used statistical analysis to assess the impact of the new arrangements. Specifically, we assessed the new arrangements against the cost–benefit analysis (CBA) we did when we designed the new arrangements. This CBA covered retail competition, credit risk faced by generators, and costs by direct purchasers. Specifically, the CBA analysis expected and predicted these changes from the aims of the new arrangements:
 - increased retail competition and new entry
 - improved productive efficiency from reduced costs for generators

- improved productive efficiency from reduced costs for direct purchasers.
- 1.9 We analysed the total daily prudential security positions for the **five largest gentailers**. The prudential security they lodged averaged \$184 million before the new arrangements, increased afterwards, and then dropped to below \$150 million. The minimum security required (exposure) increased, but then dropped to below \$50 million.
- 1.10 We analysed the total daily prudential security positions for the **participants other than the five largest gentailers**. The prudential security they lodged decreased slightly. Then from mid-2017 security lodged increased as spot prices increased due to dry hydro conditions. Unlike before the new arrangements, no participants had negative exposure.
- 1.11 We analysed the daily average spot prices against exposure for **net purchasers**. The effect of the spot price on exposure can be volatile because hydro conditions vary from year to year. Removing the effect of the spot price gives a relatively flat trend. This indicates that exposure relative to spot price hasn't changed materially. The exposure increased slightly faster than the spot prices. This has reduced the risk of sellers not being paid, because purchasers are more likely to be unable to pay when spot prices are high.
- 1.12 We measured the concentration in the **retail market**, as it's generally the case that a less concentrated industry is more competitive. We also looked at the market sizes of retailers already in the market against smaller retailers and retailers new to the market. We found that since the prudential arrangements were changed, retail competition has continued to improve, and we observe no detrimental effect.
- 1.13 We measure the costs for **direct purchasers**. These appear to have stayed the same.

Analysing the limitations on data used

- 1.14 The data from prudential statements sometimes omitted the security type (usually before the new arrangements came into force), and therefore our analysis is incomplete, although we believe it is robust.
- 1.15 For competition, we do not think we can identify the incremental effect of individual regulatory changes. Instead we check a range of indicators and look for the absence of a negative effect.
- 1.16 The proportions of different security types changed under the new arrangements but it is difficult to determine the cause of this or quantify this effect.
- 1.17 The new arrangements delivered benefits not included in the cost benefit analysis. For example, they allowed purchasers to use prudential security for settlement. While we couldn't measure these secondary, flow-on benefits, anecdotally we understand the benefits have been positive.

Assessing the findings to reveal lowered costs and reduced risk

- 1.18 Our analysis of the findings about the new arrangements has delivered some key conclusions. We conclude that:
- costs have become less volatile
 - retail costs have fallen and retail competition has continued to strengthen
 - credit risk for generators has fallen and overall risk remains low
 - costs faced by direct purchasers have not changed
 - excess has decreased, reducing costs incurred unnecessarily
 - some prudential security types are now used more often.

We develop these key conclusions further in the following subsections.

Costs have become less volatile

- 1.19 We can use the standard deviation to measure volatility: the higher the standard deviation, the higher the volatility. The standard deviations in security lodged and excess (the difference between the minimum required security and security lodged) both decreased once the new arrangements were in place. This suggests that the security lodged and excess are now less volatile.

Retail costs have fallen and become less volatile and retail competition has continued to strengthen

- 1.20 Retailer costs have fallen because of:
- reduced over-procurement of prudential security
 - reduced volatility of prudential security requirements
 - more options for retailers to meet prudential requirements.
- 1.21 We're confident the total cost of prudential security has fallen and become less volatile. These lower costs should flow through to the retail market, making it more competitive.

Credit risk for generators has fallen and overall risk remains low

- 1.22 Each generator's credit risk has reduced because under-procurement of prudential security has fallen. The overall risk of short-payments to generators remains low as well. Also, as prudential security is more likely to cover a purchaser's liabilities, generators now face lower credit risk.
- 1.23 The average prudential security lodged is still around 3.3 times the average exposure. So prices would need to be at least 3.3 times higher than expected when exposure is calculated for the purchaser's security not to cover their excess. This assurance has helped to reduce seller's risk.

Costs faced by direct purchasers have not changed

- 1.24 The costs for direct purchasers appear to have stayed the same.

Excess has decreased, reducing costs incurred unnecessarily

- 1.25 The number of incidents of very high excess and negative excess for individual participants have both decreased. Further, the size of negative excess incidents has fallen. Also, the number of periods where a participant has negative excess have reduced. This means that costs incurred unnecessarily have fallen. Excess is important as it is a cost that purchasers do not have to incur—reduced excess is therefore indicative of reduced unnecessary expense.

Some prudential security types are now used more often

- 1.26 Prudential security requires an acceptable credit rating or an acceptable form of security. Many different forms of acceptable security exist. The most common prudential security type is a letter of credit. The five largest gentailers chose it as their form of security. Letters of credit initially increased, then decreased from mid-2015 to mid-2017. All other groups increased their use of letters of credit, cash, and surety bond. Cash deposit also became slightly more popular.

Delivering positive benefits, including substantial savings

- 1.27 The new arrangements cost an estimated \$1.56 million to implement. Even so, if the average cost of security is 6 per cent, then the new arrangements save each participant

about \$100,000 a year on average in financing costs. This means the new arrangements could save participants collectively between \$3.6 million and \$5.8 million every year.

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2 Post-implementation review to assess the effectiveness of regulatory change

2.1 This paper presents the Authority's post-implementation review of the wholesale settlement and prudential security arrangements introduced in March 2015. The purpose of a post-implementation review is to evaluate an initiative against its expected outcomes. From the Authority's perspective, this enables learning about how regulatory decisions are affecting the sector and whether further policy action is required.

3 Understanding these definitions is necessary to understand this analysis

Term	Definition
Prudential security lodged or <i>Security</i>	The amount of security lodged by participants with the clearing manager. The types of security lodged include cash, unconditional guarantee or acceptable credit rating, unconditional third party guarantee such as a bank guarantee, and surety bond. In the tables and figures in this paper we use <i>Security</i> for prudential security lodged.
Outstanding financial exposure	A participant's unsettled actual amounts of prudential security. It includes invoiced amounts such as spot market purchases/sales, reconciled amounts and estimates.
Prudential exit period	The prudential exit period is the period over which the clearing manager forecasts liabilities. It is 19 days for retailers and 8 days for direct connect participants (direct purchasers).
Exit period prudential margin	The forecast amount the clearing manager expects a participant to incur over that participant's prudential exit period—the forecast obligation for the exit period. The clearing manager makes four estimates for each business day—one on each of the previous three business days, and one on the actual day.
Total net exposure	Outstanding financial exposure plus the exit period prudential margin.
Minimum security required or <i>exposure</i>	The minimum of four estimates of the day's total net exposure. A participant must lodge the minimum security required with the clearing manager. In the tables and figures in this paper we use <i>Exposure</i> for minimum security required.
FTR allocated amount:	The prudential amount allocated to each FTR participant if all of their FTR bids were accepted.

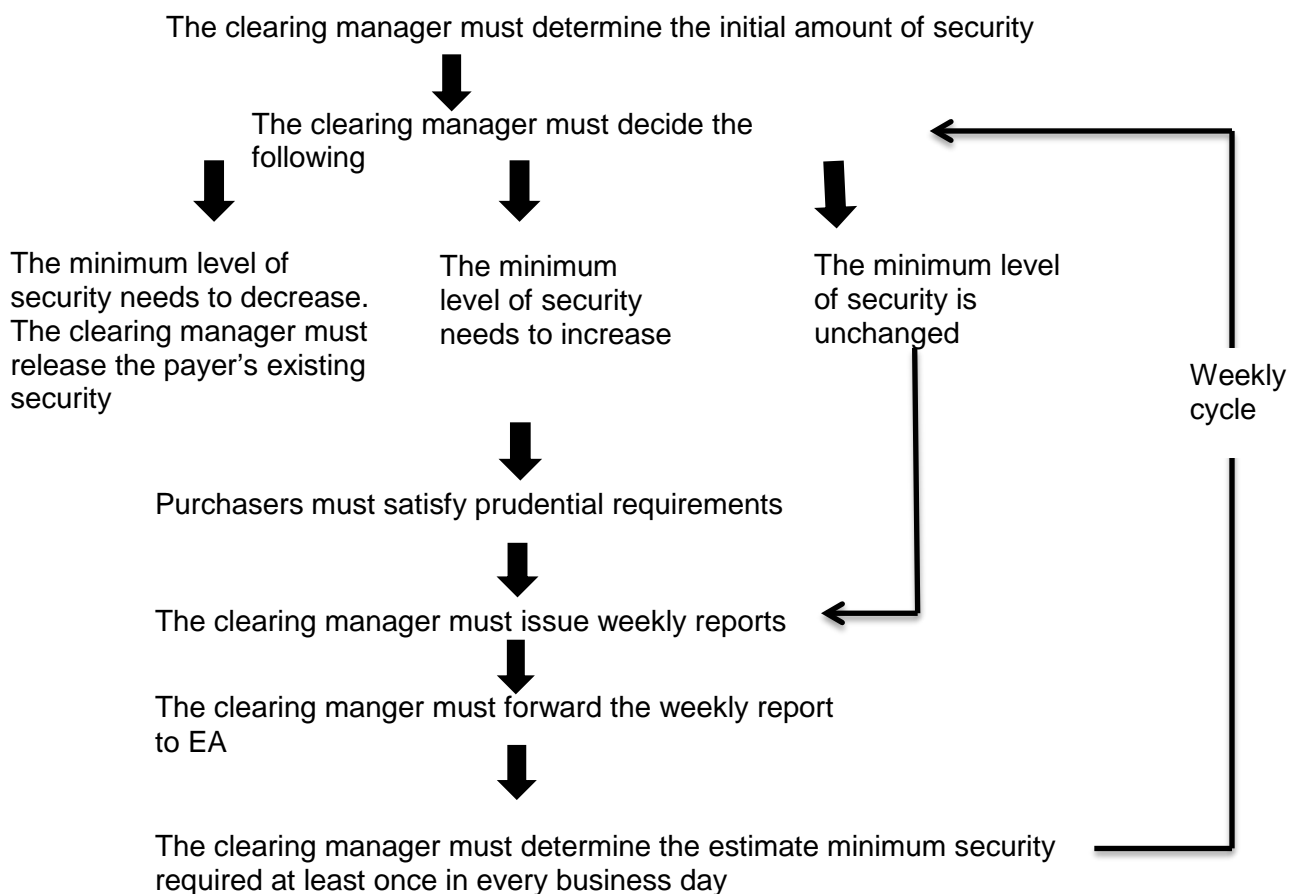
Term	Definition
Excess	Prudential security lodged and held by clearing manager less the minimum security required and FTR allocated amount.

4 Background

Prudentials cover amounts payable for past purchases and forecasts of future purchases

- 4.1 Part 14A of the Code contains prudential requirements for the wholesale electricity market in New Zealand. Prudential arrangements help ensure that market participants meet their financial obligations in the wholesale market if they are under financial distress. In this way they effectively reduce the risk to sellers of non-payment. As security is costly, the new arrangements aim to avoid undue costs on purchasers.
- 4.2 For each participant on each business day, the clearing manager provides an estimate of the minimum security required. The estimate has to be consistent with the general prudential requirements and the financial transmission rights (FTR) prudential requirements, and it must be adjusted for pre-payments. The general prudential requirements include spot market purchases and/or sales, ancillary services, wash-ups, lodged hedge settlement agreements and FTR holdings. Figure 1 explains how the prudential security works for the wholesale market.

Figure 1: Prudential security weekly cycle



- 4.3 The general prudential requirements have two components:
- (a) An historic component consisting of outstanding financial exposure.
 - (b) A forward component that is the exit period prudential margin.
- 4.4 The outstanding financial exposure covers each participant's unsettled amounts and so is a *measure of what a participant owes*. The participant expects to incur the exit period prudential margin over that participant's prudential exit period and so is *an estimate of what the participant will owe over the exit period*.
- 4.5 The prudential exit period is 19 days for retailers and 8 days for direct purchasers. Each business day for each participant, the clearing manager provides:
- (a) Forward estimates of the exit period prudential margin for the next 3 business days.
 - (b) An estimate for the current day of a participant's prudential requirements.
- 4.6 The minimum security required is the outstanding financial exposure and the minimum estimate of the exit period prudential margin. The clearing manager then checks—for each participant—the amount of prudential security held meets the minimum security required. If it does not, then participants are required to meet this minimum by 1600 hours on each business day.

5 The Authority changed the regime in March 2015

- 5.1 The Wholesale Advisory Group's *Settlement and Prudential Security Review* consultation paper in June 2013 reviewed a number of problems including two key questions regarding prudential arrangements:
- (a) whether the arrangements were raising costs for retailers (purchasers) and inhibiting retail competition
 - (b) whether generators were facing heightened payment risk because the level of security was lower in New Zealand than in other markets.
- 5.2 The changes of settlement and prudential security arrangements for the wholesale electricity market came into force on 24 March 2015.
- 5.3 The Authority's decision on those issues in the *Settlement and Prudential Security Review* decision paper in December 2013 states the Authority had decided to:
- (a) *retain monthly settlement rather than move to weekly settlement*
 - (b) *introduce a conservative adder to achieve required security levels, which is based on a targeted probability of loss given default (PLGD) of 25% or around \$10 to \$20/MWh*
 - (c) *set the required prudential security level covering the exit period on a static basis rather than a dynamic basis*
 - (d) *assign the role of directing the disconnection of defaulting direct purchaser to the Authority rather than the clearing manager*

- (e) *manage physical market credit risk and credit risk on hedge settlement agreements (HSAs) through a common pool rather than “ring fencing” the credit risk on each HSA*

There have been minor code amendments decided by the EA

- (f) *the clause 14A.1.2(3)b: that a participant's security agreement must “create a first ranking security interest in the participant's rights in relation to the cash deposit”. has been modified to read: “create a first ranking security interest in respect of the cash deposit”.*
 - (g) *the clause 14.9(4) providing: in deciding whether to agree to the cancellation of a hedge settlement agreement, the clearing manager may consult with the Authority*
 - (h) *the clause 14A.11 clarified: the clearing manager is entitled to be paid as a beneficiary from the trust funds*
 - (i) *the Code clarified the obligation to pay participants subject to subparts of clause 14.34(1)*
 - (j) *the clause 14.51(3) is being amended in the decision paper to ensure that the full range of securities is covered.*
- 5.4 The overall intent of the changes was to reduce the costs that purchasers face for prudentials without increasing the risk to sellers. The details of the changes to settlement and prudential security arrangements and the reasons for these changes are set out in Appendix A.

6 Description and analysis of the data

Findings from an initial look at the data

- 6.1 The purpose of this section is to explore what the data can tell us about what occurred with prudential security since the changes were made.
- 6.2 Overall, we find the new arrangements:
- (a) lowered the total amount of prudential security (Security) held with the clearing manager
 - (b) increased the minimum prudential security requirements (Exposure) faced by participants.
- 6.3 This suggests the new arrangements lowered costs for purchaser and reduced risk for generators.

Graphical analysis of the data


- 6.4 This section shows what has happened with security lodged, exposure, and excess before and after the changes were implemented. The section uses charts to do this. Note the data on which our analysis is based is incomplete, because there were many instances of missing security type data.
- 6.5 We used the Prudential Statements published by the clearing manager from 6 June 2013 to 20 December 2017. We excluded Deutsche Bank and Transpower. We did this because before the new arrangements came into force, the clearing manager used a \$100 million place holder for security lodged to represent security derived from the two companies having an acceptable credit rating. The new arrangements included a

software change that removed the need to lodge a place holder. Including data from Deutsche Bank and Transpower would mean a \$100 million fall in security held, which does not represent a real saving and would have biased the results.

- 6.6 For each participant, the statements include a prudential security position summary covering security position, security lodged summary, total exposure, previous and forward exposure. Figure 2 shows an example of a Prudential Statement published on NZX's website.¹
- 6.7 Current exposure in Figure 2 is the outstanding final exposure. Exit period exposure in Figure 2 is the exit period prudential margin.

¹ https://s3-ap-southeast-2.amazonaws.com/nzx-prod-c84t3un4/comfy/cms/files/files/000/002/761/original/SAMP_20160211_prudential_statement.pdf

Figure 2: An example of a Prudential Statement

Prudential Statement		Sample Customer Limited		
Energy Clearing House Limited				
Prudential Statement for DD February 2016 (assessed at: dd -mm-2016 08:49AM)				
Prudential Security Position Summary				
Total Security Lodged				\$450,000.00
less Minimum Security Required				\$305,455.01
Amount Available for Reduction				\$144,544.99
Security Lodged Summary				
Cash - ANZ				\$225,000.00
Cash - ASB				\$225,000.00
Total Security Lodged				\$450,000.00
Exposure Detail (48 Days)	Current Exposure	Exit Period Exposure	Total Exposure	
Component	01/01/16 to 18/02/16	19/02/16 to 28/02/16	01/01/16 to 28/02/16	
Spot Market Purchase	\$181,615.18	\$129,190.50	\$310,805.68	
Spot Market Sales	\$0.00	\$0.00	\$0.00	
Ancillary Services	\$518.86	\$246.46	\$765.32	
Washup Amounts	\$0.00	\$0.00	\$0.00	
Hedge Settlement Amounts	(\$6,700.73)	(\$44,339.85)	(\$51,040.58)	
FTR Amounts	\$0.00	\$0.00	\$0.00	
Other Amounts	\$0.00	\$0.00	\$0.00	
GST	\$27,320.11	\$19,415.54	\$46,735.65	
Pre Payments			\$0.00	
Total Exposure (Net)	\$202,753.42	\$104,512.65	\$307,266.07	
Total Security Required			\$307,266.07	
Previous Exposure Calculation (for 22-Feb-2016).				
Date Calculated	Exposure	(Pre)Payments	Net Exposure	
17-Feb-2016	\$305,455.01	\$0.00	\$305,455.01	
18-Feb-2016	\$306,612.67	\$0.00	\$306,612.67	
19 Feb-2016	\$308,186.77	\$0.00	\$308,186.77	
22-Feb-2016	\$307,266.07	\$0.00	\$307,266.07	
Min. Security Required (calc. 17-Feb-2016)	\$305,455.01	\$0.00	\$305,455.01	
Forward Exposure Calculation (from -Feb-2016).				
Date Calculated	Exposure	(Pre)Payments	Net Exposure	
23-Feb-2016	\$313,033.99	\$0.00	\$313,033.99	
24-Feb-2016	\$318,801.91	\$0.00	\$318,801.91	
25-Feb-2016	\$333,867.75	\$0.00	\$333,867.75	
<small>This statement is the clearing manager's estimates as required by clause 14A.5 of the Electricity Industry Participation Code 2010. Participants must provide the minimum security required as described by clause 14A.6. Acceptable security is described in Schedule 14A.1 of the Code. The clearing manager's cash deposit account is 01-0505-0421345-03.</small>				

Analysis

- 6.8 In this section we split the market up into various groups:
- (a) The five largest gentailers
 - (b) Participants excluding the five largest gentailers
 - (c) Net purchasers
 - (d) Retailers
 - (e) Direct purchasers.
- 6.9 We present an overview of the effects of the new arrangements for each of these groups. Note that it is necessary to understand the definitions in section 3 above to understand this section.
- 6.10 Figure 3 shows the total daily prudential security positions from 6 June 2013 to 20 December 2017. We use this same style of chart throughout this report. The light blue shows the period the new arrangements apply to. The brown line is the security lodged—how much security purchasers have lodged with the clearing manager. The blue is the exposure—how much security purchasers are required to lodge with the clearing manager. The red line is excess—the difference between the security lodged and the exposure.
- 6.11 Figure 3 shows the prudential security lodged increased slightly, then decreased (*Security* in the chart's legend). The minimum security required (*Exposure*) increased after the arrangements introduced on 24 March 2015.
- 6.12 Exposure increased when the new arrangements were introduced because the way the clearing manager calculated the total net exposure changed to include an “adder” which reduces instances of negative excess.

Figure 3: Prudential security by all participants

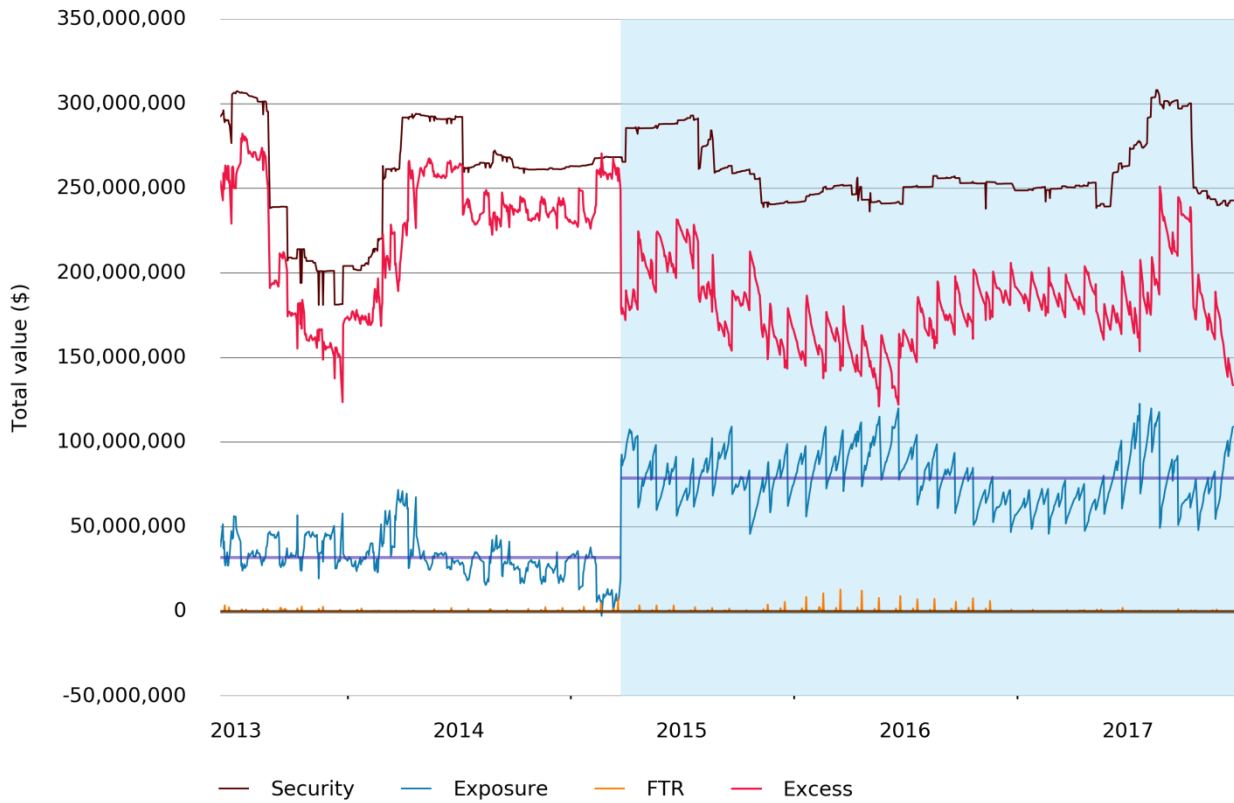
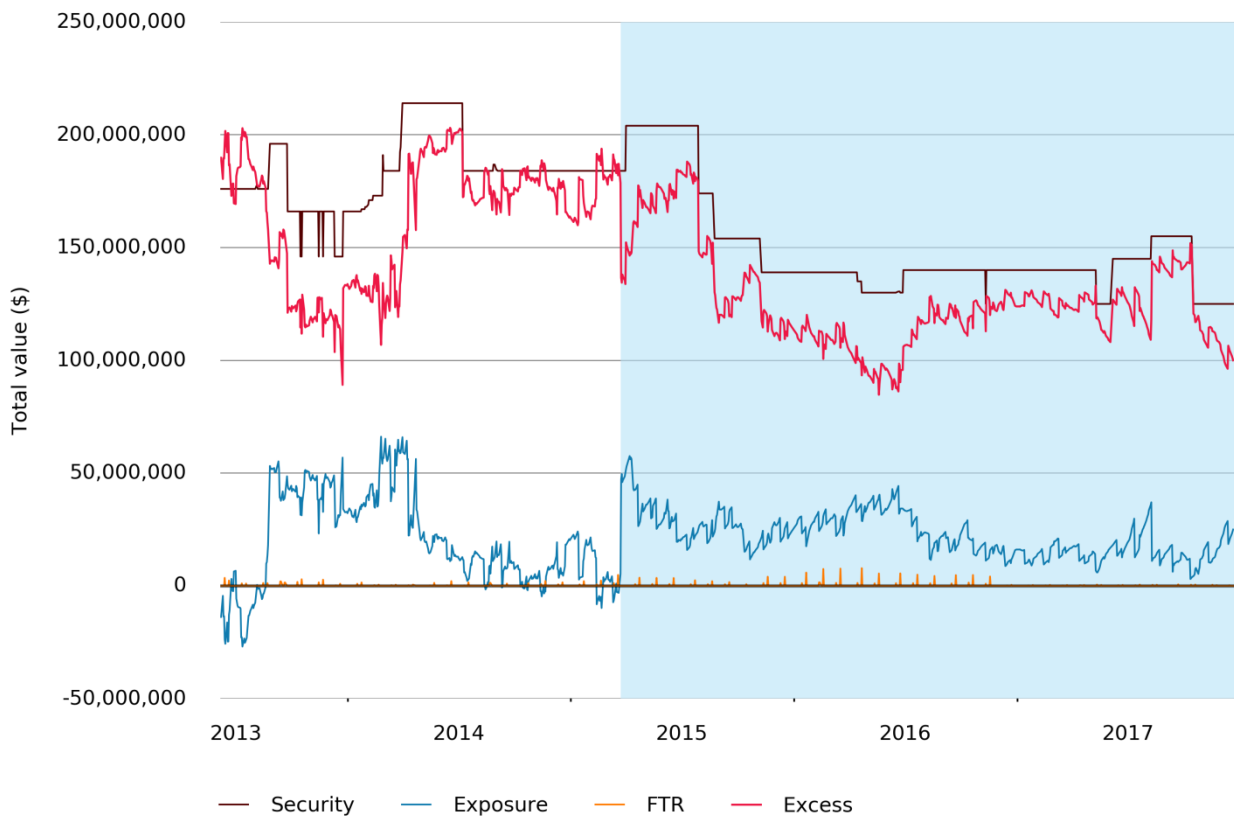
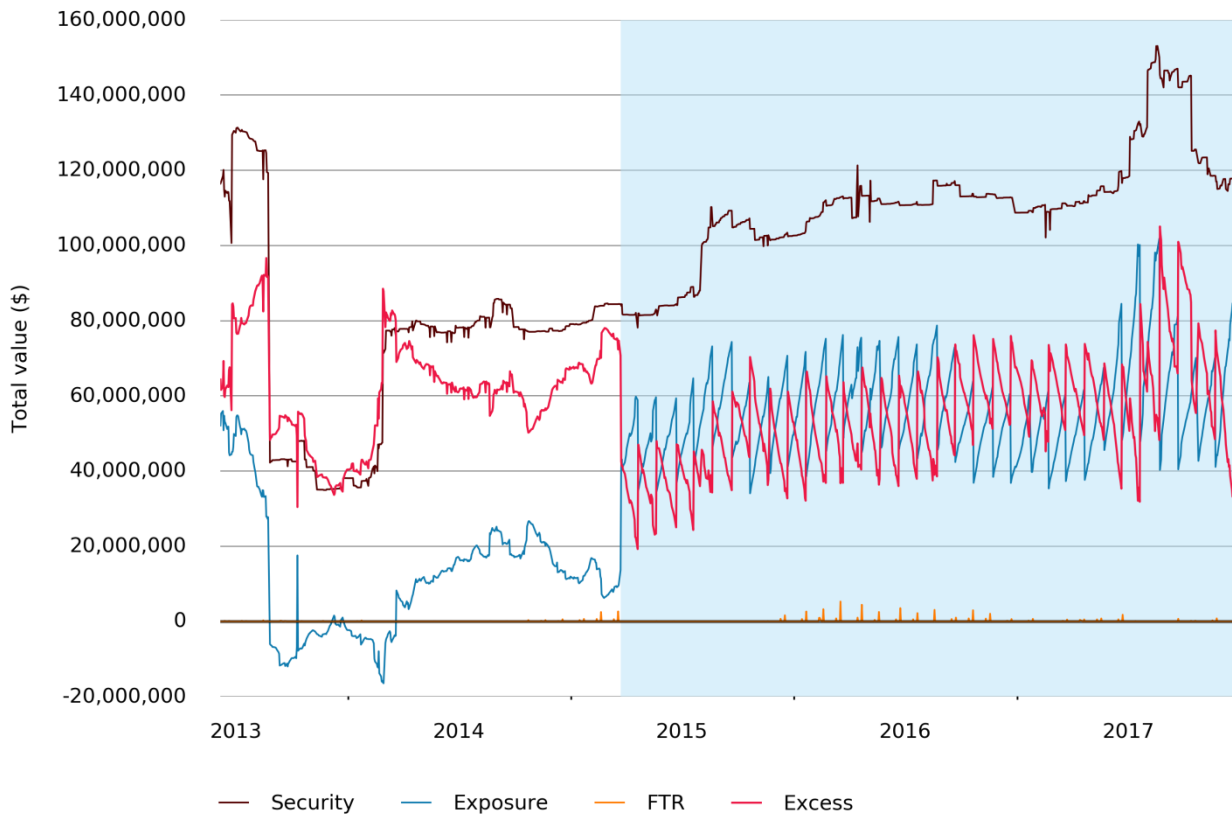


Figure 4: Prudential security positions for the five largest gentailers



6.13 Figure 4 shows the total daily prudential security positions for the five largest gentailers. The prudential security lodged (Security) by these gentailers increased after the new arrangements were introduced, dropped to below \$150 million (having averaged \$184 million before the new arrangements). Gentailers' minimum security required (Exposure) increased initially then stayed under \$50 million for the rest of the study period.

Figure 5: Prudential security position for participants excluding the five largest gentailers



6.14 Figure 5 shows the total daily prudential security positions for participants excluding the five largest gentailers. Prudential security lodged slightly decreased when the new arrangements were introduced, then increased afterwards. Minimum security required increased after the new arrangements were introduced and stayed between \$35 million and \$75 million until early 2017. Minimum security required increased from mid-2017 as spot prices increased due to dry hydro conditions.

6.15 The saw tooth pattern shown in the exposure and excess lines in Figure 5 occurs when the spot market is settled. When participants pay the clearing manager, the outstanding financial amount falls which means exposure falls and excess increases as a result.

6.16 Appendix B shows a scatter plot based on individual participants for comparison. The graph shows that some participants had negative minimum security required under the old arrangements but this does not occur under the new arrangements. This same effect is shown in Figure 5, which shows the aggregate position.

6.17 Figure 6 shows a scatter plot of daily average spot prices against exposure for net purchasers. It shows the old and new arrangements with different colours and thereby shows the relationship between exposure and spot price. Exposure is related to high

spot prices; for example, when dry hydro conditions resulted in the high spot prices in mid-2017, exposure increased as shown in Figure 5 above. This is expected as higher prices mean that purchasers need to lodge more security to cover their liabilities. Figure 6 shows that, for a given spot price, exposure is higher under the new arrangements than the old arrangements.

Figure 6: Scatter plot spot prices against minimum security required by net purchasers

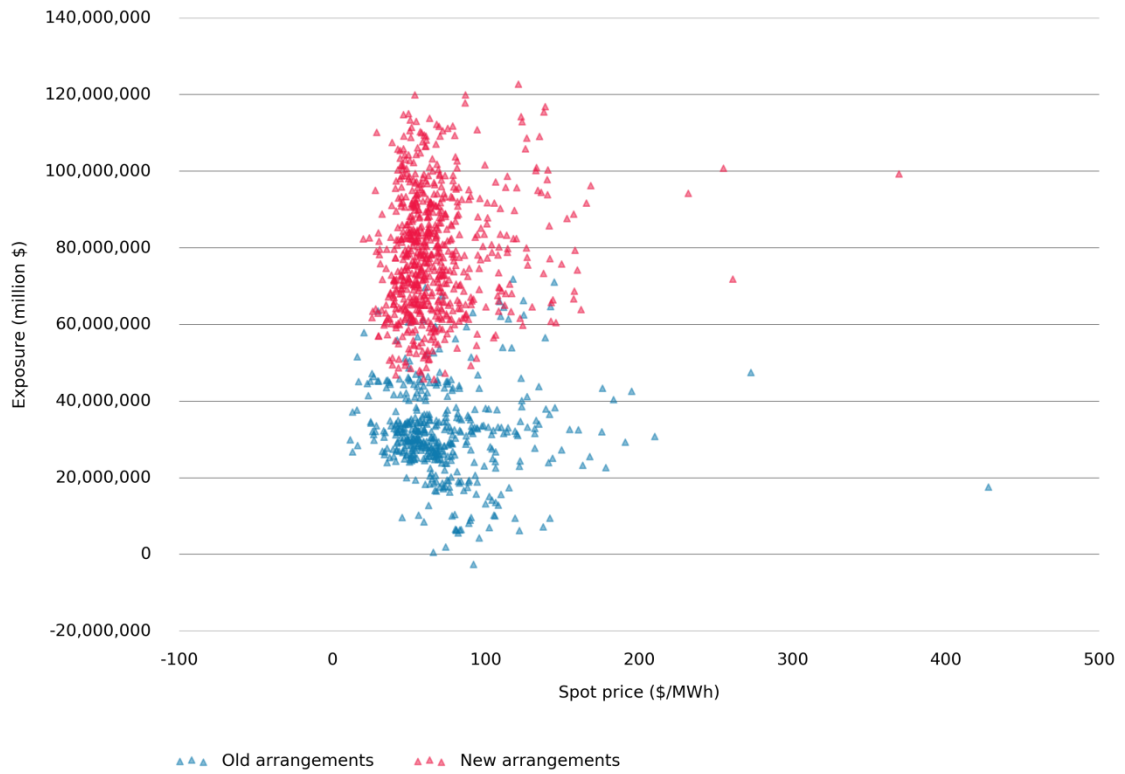
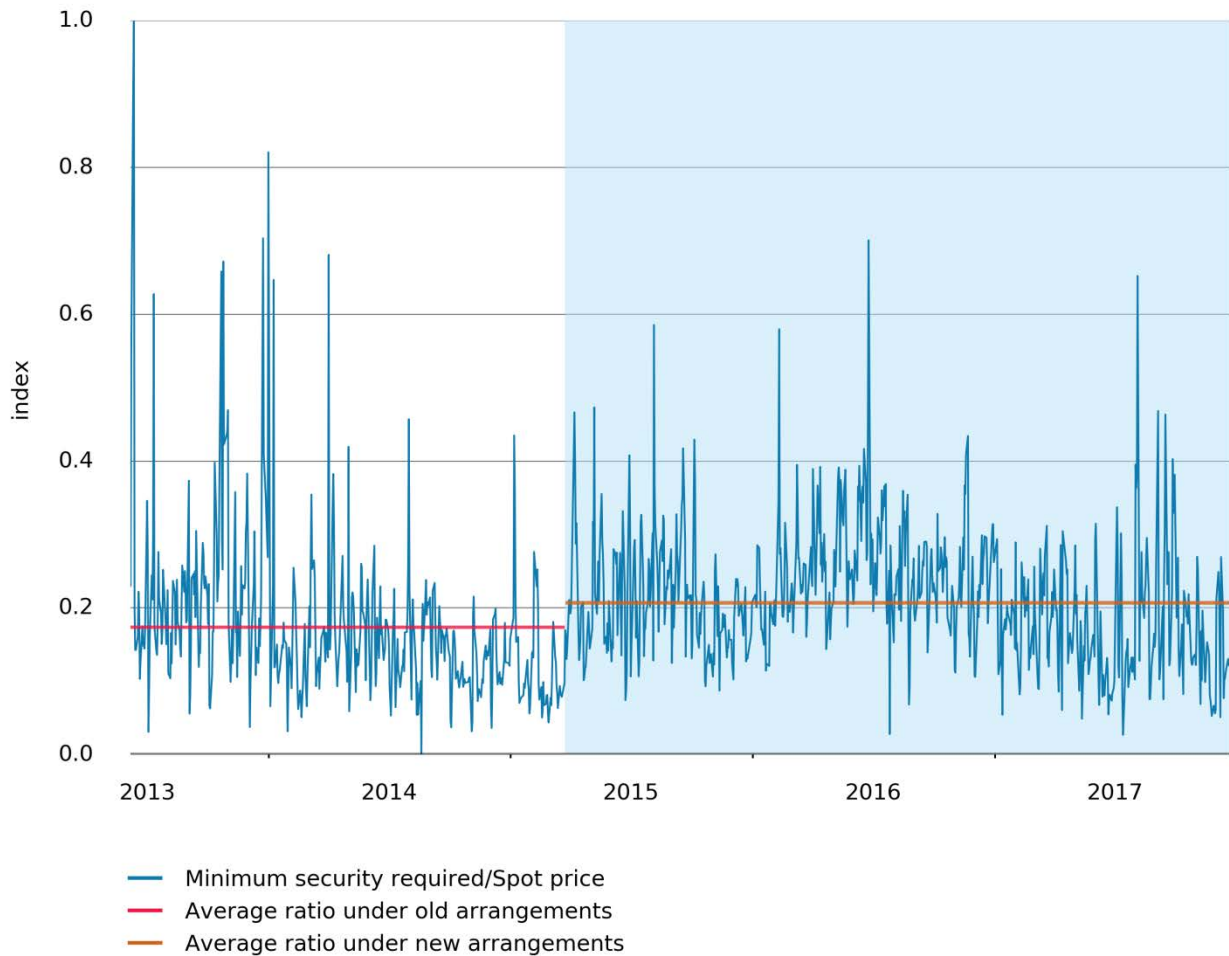


Figure 7: Normalised minimum security required divided by normalised spot price by net purchasers



- 6.18 Figure 7 shows normalised minimum security required divided by normalised spot price. We do this to remove the effect of the spot price on exposure, which can be volatile as hydro conditions vary so much from year to year. The average ratio under the old arrangements is 0.17, and the average ratio under the new arrangements is similar, at 0.21.
- 6.19 This means the minimum security required increases as spot prices increase as expected. The higher ratio after the change means that minimum security required increases more quickly with spot price under the new arrangements. However, the relatively flat trend in this chart indicates that exposure relative to spot price didn't change materially under the new arrangements. Below we check whether this difference is statistically significant.
- 6.20 Table 1 shows the linear regression results for testing if the new arrangements had a statistically significant effect on the ratio graphed in Figure 7. In other words the regression test demonstrates whether the difference between the ratio before and after the new arrangements were introduced is statistically significant. The p-value is small implying the change in the ratio is statistically different under the new arrangements.
- 6.21 However, the ratio is only slightly higher—about 4 per cent—under the new arrangements because the estimated coefficient is small. This means that minimum security required increases slightly faster than spot prices under the new arrangements.

This reduces the risk of non-payment that sellers face under the new arrangements because purchasers are more likely to default when spot prices are high.

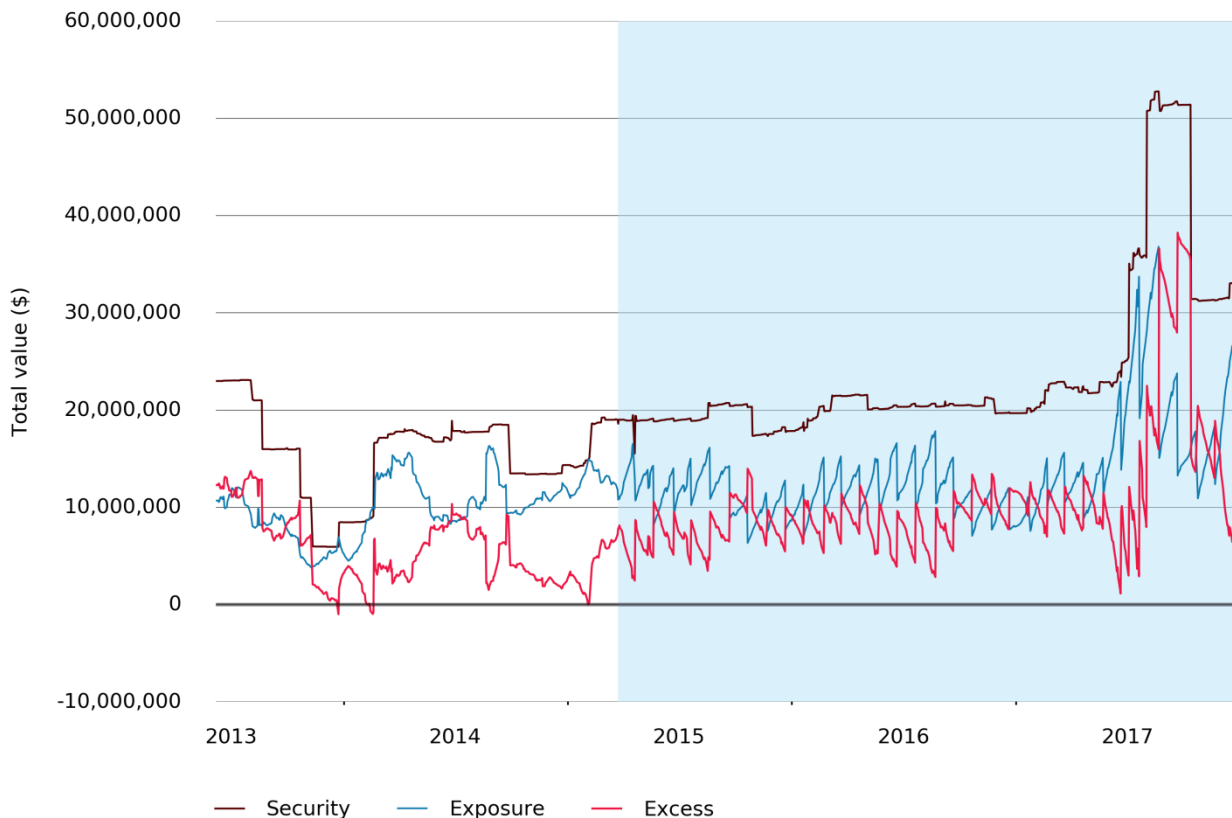
Table 1: Linear regression results for arrangements change on the rate exposure/spot price

	Estimated coefficient	p-value
Arrangements change	0.037	<2.2e-16***

Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

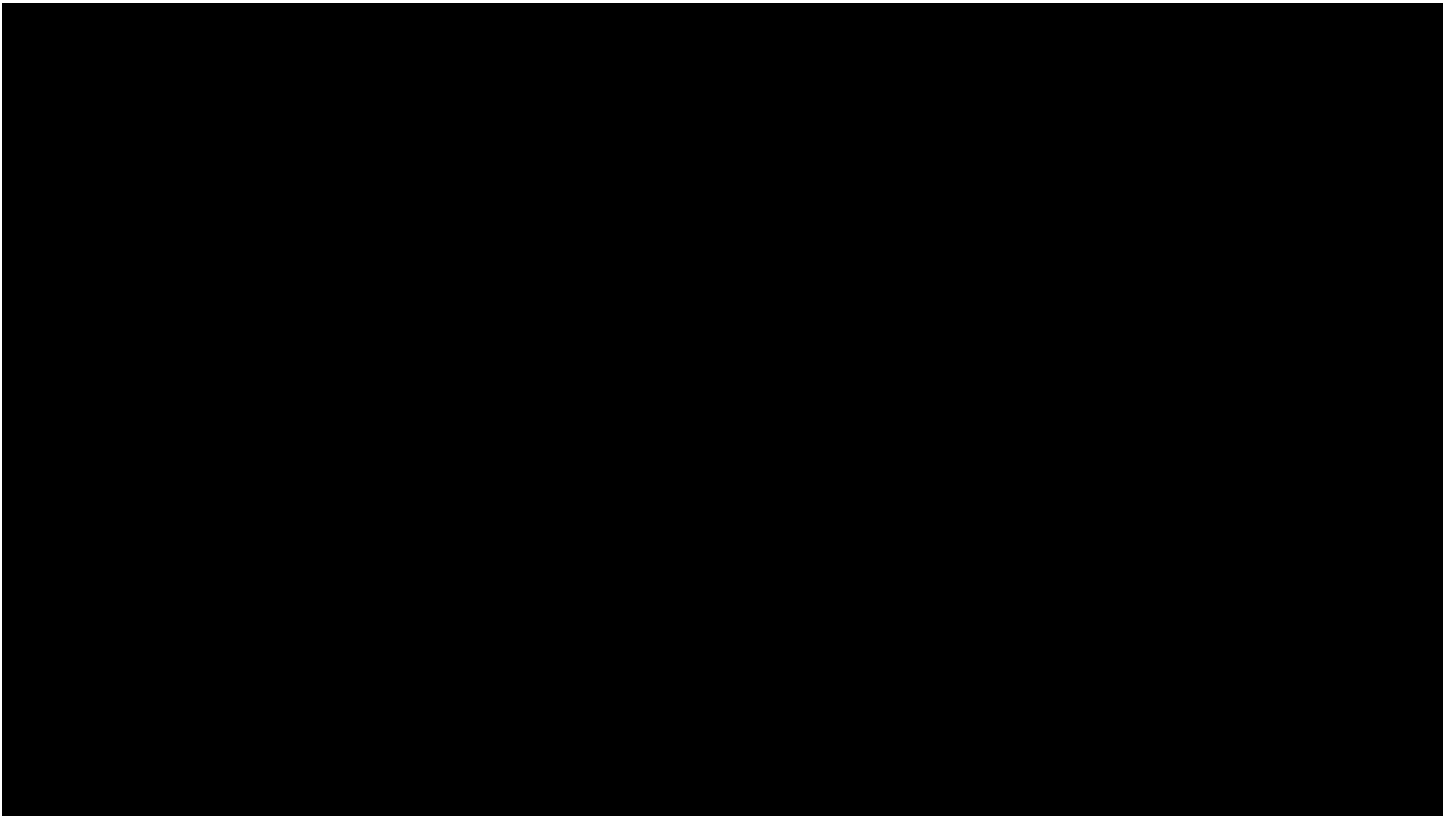
6.22 Figure 8 shows the total daily prudential security positions by retailers (rather than gentailers). Prudential security lodged increased significantly in early 2014. This was because of new retailers entering the electricity market. Prudential security lodged by retailers was steady until mid-2017, then increased in mid and late 2017 as spot prices increased due to hydro conditions.

Figure 8: Prudential security position by retailers



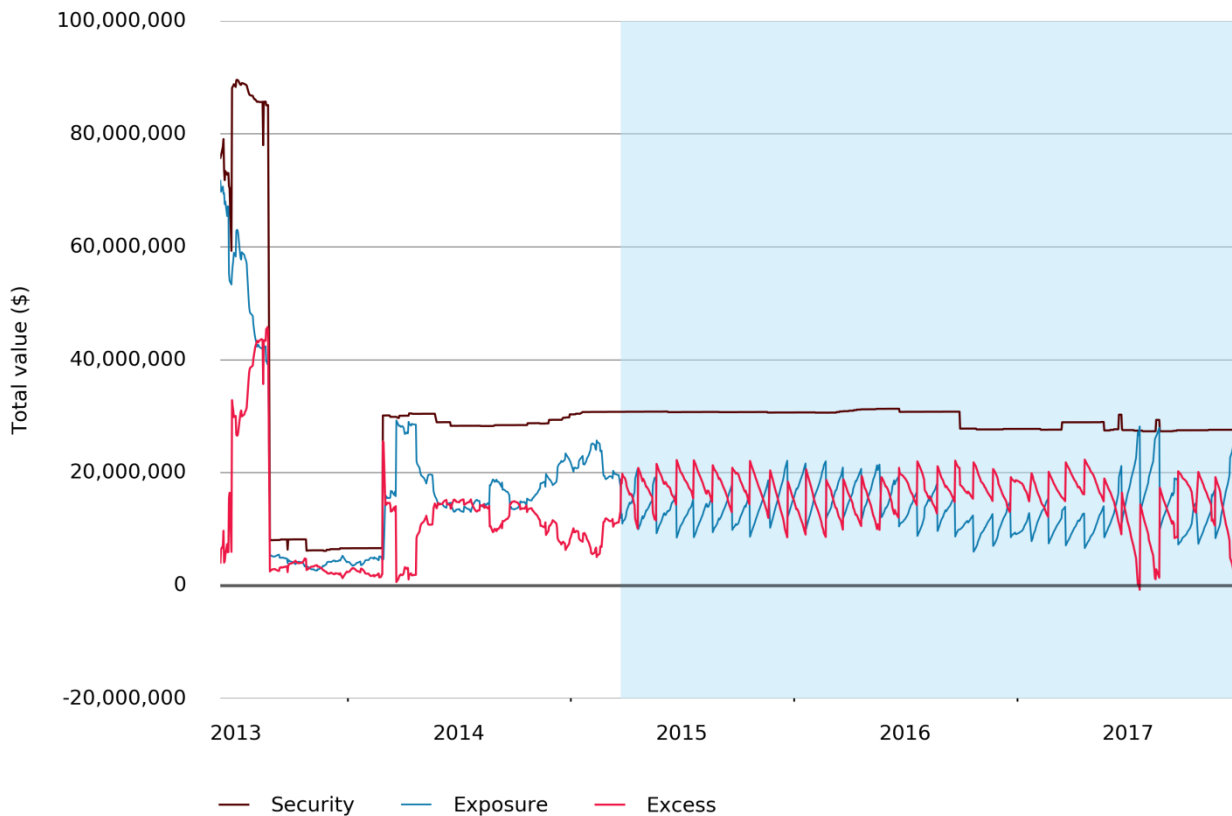
6.23 One of the goals of the new arrangements was to reduce direct purchasers' costs. Direct purchasers are either grid-connected consumers or direct purchasers that are connected at an ICP that is either a local or embedded network connection. Figure 9 shows the total prudential security positions for the five direct purchasers. One individual direct purchaser changed its behaviour in 2013—it lodged very low prudential security from September 2013 compared to the period prior to this. This is why total prudential security lodged dropped sharply in late 2013.

Figure 9: Prudential security positions by direct purchasers



6.24 There were only three direct purchasers in 2013. These were joined by a new direct purchaser in 2014 and another in 2015. Figure 10 excludes these two entrants to get a consistent sample throughout the study period. Without the two entrants, prudential security lodged was flat from about a year before the new arrangements came into force to the end of the study period.

Figure 10: Prudential security positions by direct users excluding two new participants



- 6.25 Prudential security requires either an acceptable credit rating or an acceptable form of security. There are different forms of acceptable security. Figure 11 shows the different forms of security lodged. Note the data on which our analysis is based is incomplete, because there were many instances of missing security type data. The most common security type is a letter of credit which increased when the new arrangements were introduced then decreased through mid-2015 to mid-2017. Cash deposits increased slightly under the new arrangements.
- 6.26 Figure 11 shows that having bank guarantees as a form of security increased significantly when the new arrangements were introduced, then dropped back after one week. This was because of an error in the Clearing and Settlement system which meant the clearing manager couldn't classify any security type as a letter of credit. The clearing manager classified all letters of credit as bank guarantees to allow participants' net exposure to be estimated that week.
- 6.27 The overall prudential security lodged decreased when the new arrangements came into force. However, the prudential security lodged by security types increased for most security types. This is because of the missing security types in our data—there was far more missing data before the new arrangements came into force. As set out above, we got our data from prudential statements an example of which is given in Figure 2. At times—particularly before the new arrangements came into force—these statements omitted the security type. We reproduce Figure 11 for all security types—including the missing security types—in Appendix C.

Figure 11: Prudential security lodged by security types

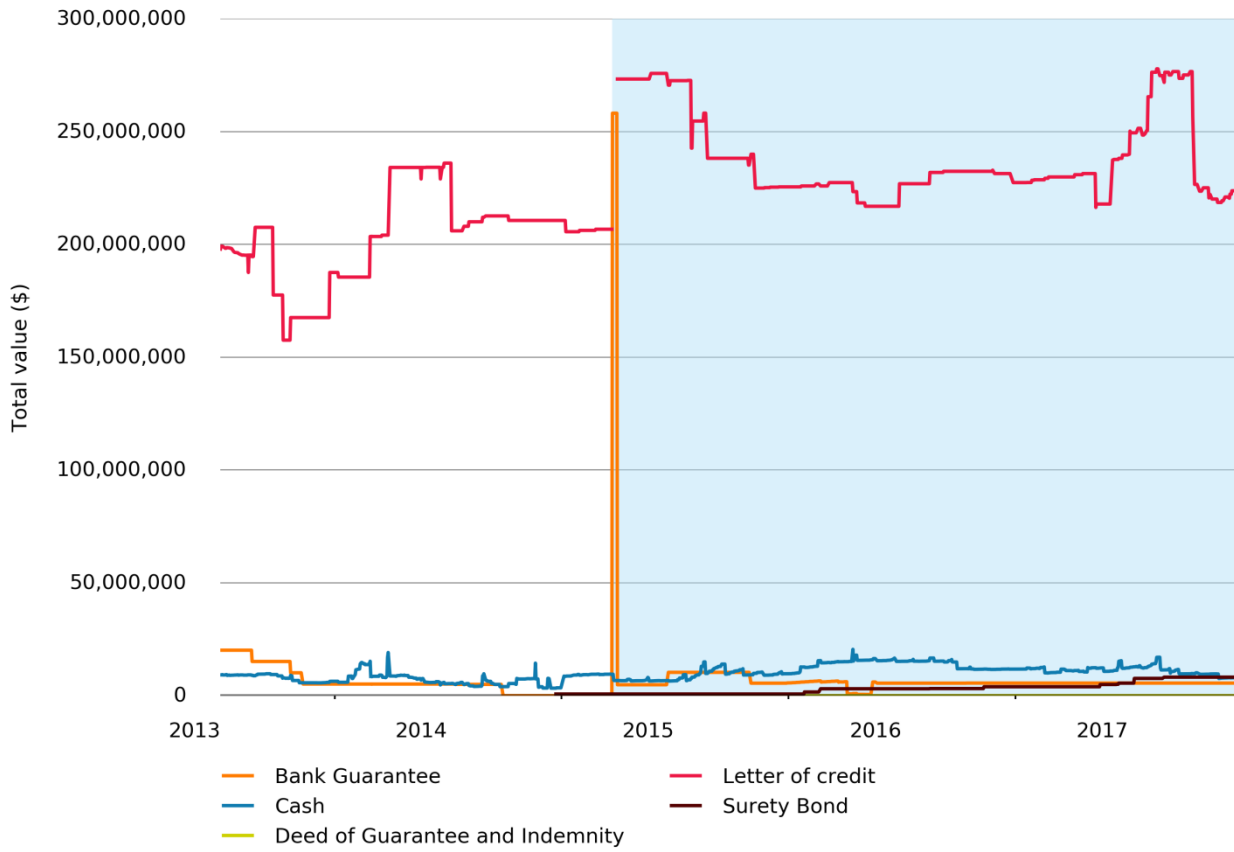


Figure 12: Prudential security lodged by security types by five largest gentailers

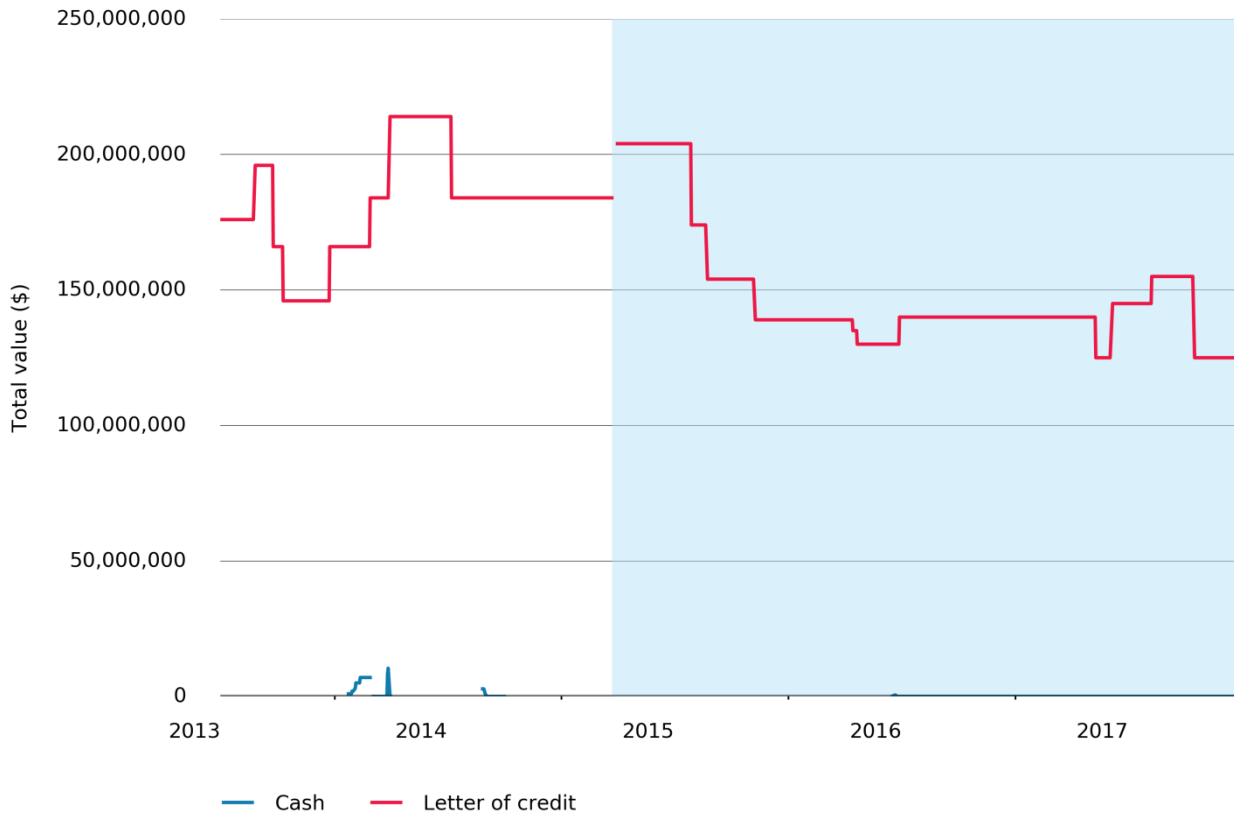
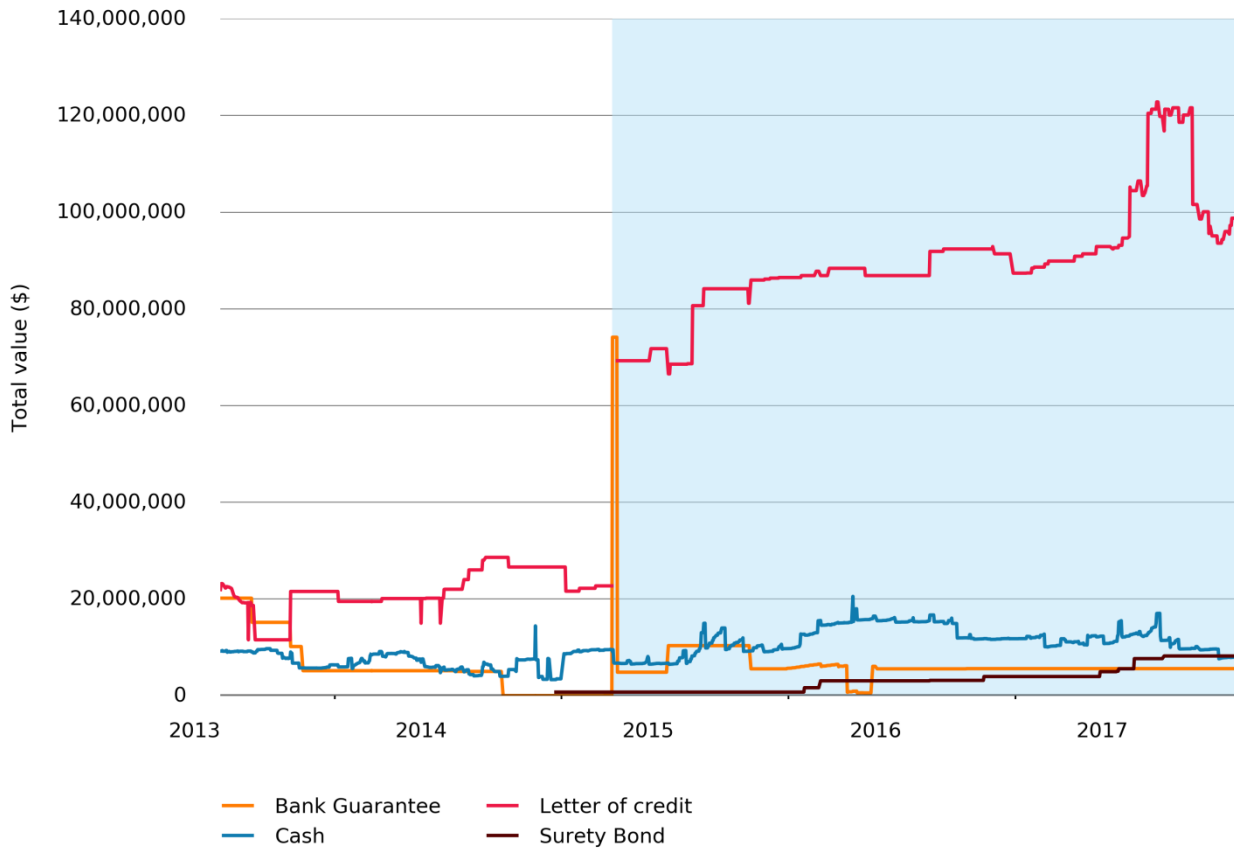


Figure 13: Prudential security lodged by security types excluding five largest gentailers



- 6.28 Figure 12 shows the prudential security types lodged by the five largest gentailers. The most common security lodged by gentailers is a letter of credit, which increased when the new arrangements were introduced then decreased through 2015.
- 6.29 Figure 13 shows prudential security lodged by type for all participants excluding the five largest gentailers. Letter of credit, cash, and surety bond increased when the new arrangements were introduced.

Excess decreased when the new arrangements came into force

- 6.30 This section is technical, but the idea is simple. We are testing whether the new arrangements lowered excess. We are doing this using statistical techniques to provide rigour to our analysis. The result is that the new arrangements did lower excess. The rest of this section explains how we come to this conclusion.
- 6.31 This section uses statistical analysis to determine what effect the new arrangements had on excess when they came into force. This analysis requires that we use the data in a panel. Panel data is a cross-sectional time series dataset that allows repeated measurements on the same individual over time—in other words, it includes data for all participants through time.
- 6.32 We use excess as response variable and dummy variable for arrangements change, log price, load, prudential security lodged, participants' roles and dummy variable for security types as predictors. We use excess because this is a measure of prudential security lodged over and above the calculated liability and indicates a cost that purchasers do not have to incur.

- 6.33 Definition of dummy variables:
- (a) Arrangements change dummy variable: This is a variable that has a value of 1 from 24 March 2015 when the arrangements changed and 0 otherwise. The coefficient of this variable represents the average change in the excess for each participant after the new arrangements were introduced.
 - (b) Security type dummy variables: we also represent security types using dummy variables in the model. The dummy variables represent each security type and are set to 1 for that security type and 0 otherwise. Participants may have multiple security types lodged simultaneously with the clearing manager.
- 6.34 First we need to determine if there is a random individual effect. If there is a random effect, we need to apply Generalised Least Squares Estimation (GLS) to the data. We use the Hausman test to determine if there is a random effect in the model. The p-value from the test is 0.5, implying there is a random effect. This means that participant differences affect the response variable—which is excess. Therefore, we need to account for the participant roles as the random effect in the regression.
- 6.35 Table 2 shows the coefficient estimates and the p-values for the variables. The p-value is approximately zero for the arrangements dummy variable, implying the new arrangements had a statistically significant effect on the excess.
- 6.36 The coefficient on the dummy variable suggests that excess decreased by an estimated mean of \$1.7 million per participant in Table 2 after the new arrangements came into force. This implies the participants have reduced costs of prudential security requirements after the new arrangements came into force.
- 6.37 The consultation paper estimated the total costs of implementing new arrangements would have a present value of \$1.56 million. If the average cost of security is 6 per cent then the new arrangements save each participant about \$100,000 per year on average in financing costs. This means the new arrangements could save participants between \$3.6 million and \$5.8 million in total per year.
- 6.38 We use 6% as an estimate for the cost of capital. This is indicative only. Obviously for letters of credit, the cash cost can be far below 1 per cent. However, a participant needs a strong balance sheet to access this sort of rate, and a strong balance sheet has a cost. Ideally we would use a weighted average of security cost for this sort of analysis, but the large amount of missing security type data makes this difficult even if we could get information on security costs from participants. As a consequence we use 6% as an approximation for a cost of capital.
- 6.39 To test this result, we used a 15 year time horizon and calculated the minimum cost of capital necessary for the benefits to outweigh the costs of the new arrangements—0.17 per cent. This is so low that we assert the benefits of the new arrangements outweigh the costs.
- 6.40 The R-squared is 0.357, meaning the model explains 35.7% of the variation of excess. Although the R-squared is not over 50%, the model fits the data reasonably well for this kind of regression. The lower R-squared might be due to the scheme having a varied effect on different participants. With one exception, R-squared are higher in the following tables where we test participant roles separately using subsets of the data.

Table 2: Part of GLS regression results for all participants

Coefficients	Estimate coefficients	p-values
(Intercept)	-1,911,400	0.06
Dummy variable—arrangements change	- 1,702 ,000	<2.2e-16***
R-squared	0.357	

Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

- 6.41 Table 3 shows the numbers of participants who lodged prudential security are increasing. To avoid bias in the regression results caused by the increasing number of participants, we repeat the analysis above using a consistent set of traders over the study period.

Table 3: Numbers of participants lodged prudential security by year

Year	Participant counts
2013	33
2014	41
2015	45
2016	48
2017	57

- 6.42 Table 4 shows the regression results for the consistent set of participants—omitting new entrant participants from the sample. The full results are in Appendix D. The results are similar to the results in Table 2—the new arrangements lower excess by about \$1.85 million. The R-squared remains at 36%, implying the model fits the data reasonably well.

Table 4: Part of the GLS regression results using 2013 participants

Coefficients	Estimate coefficients	p-values
Dummy variable—arrangements change	-1,853 ,300	<2.2e-16***
R-squared	0.36	

Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

Table 5: Part of the GLS regression results for five direct purchasers

Coefficients	Estimate coefficients	p-values
Dummy variable—arrangements change	1,638,700	<2.2e-16***
R-squared	0.840	

Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

- 6.43 Figure 9 shows that prudential security lodged by the five direct purchasers increased when the new arrangements were introduced. We use the same test to determine if the new arrangements have an effect on the excess for these five direct purchasers. The p-value in Table 5 for the dummy variable for the arrangements changing is approximately

equal to zero, implying the new arrangements cause excess to increase. The estimated mean increase in excess is \$1.64 million per participant under the new arrangements—so direct purchasers’ excess increased under the new arrangements. The R-squared is high at 84.02%, implying the model fits the data well.

- 6.44 Among five direct purchasers, two direct purchasers lodged security for the first time in 2014 and 2015. We remove these two participants from the data and repeat the regression to avoid bias and report the results in Table 6 below. The p-value for the dummy variable for the new arrangements changing is approximately equal to zero, implying the new arrangements caused excess to increase for the remaining three direct purchasers. The estimated increase in excess is \$1.65 million for each participant under the new arrangements. The R-squared is high at 80.7%, implying the model fits the data well. Figure 10 above presents this data graphically.

Table 6: Part of GLS regression results for three direct purchasers

Coefficients	Estimate coefficients	p-values
Dummy variable—arrangements change	1,650,000	<2.2e-16***
R-squared	0.807	

Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

- 6.45 Table 8 shows the same regression results for the five largest gentailers and retailers respectively as Table 6 shows for direct purchasers—that is, they use a consistent set of participants over the study period. The new arrangements affect the excess of both types of participants. The estimated mean excess for the five largest gentailers decreased by about \$3.27 million under the new arrangements. In contrast, the estimated mean excess for retailers increased by about \$0.1 million. However, the R-squared for the gentailer regression is small, only 35%, implying the model fits the data roughly well. The R-squared for the retailer regression is 77.75%, indicating the model fits the data well.

Table 7: Part of GLS regression results for five largest gentailers

Coefficients	Estimate coefficients	p-values
Dummy variable—arrangements change	-3,268,500	<2.2e-16***
R-squared	0.35	

Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

Table 8: Part of GLS regression results for retailers

Coefficients	Estimate coefficients	p-values
Dummy variable—arrangements change	105,690	<2.2e-16***
R-squared	0.7775	

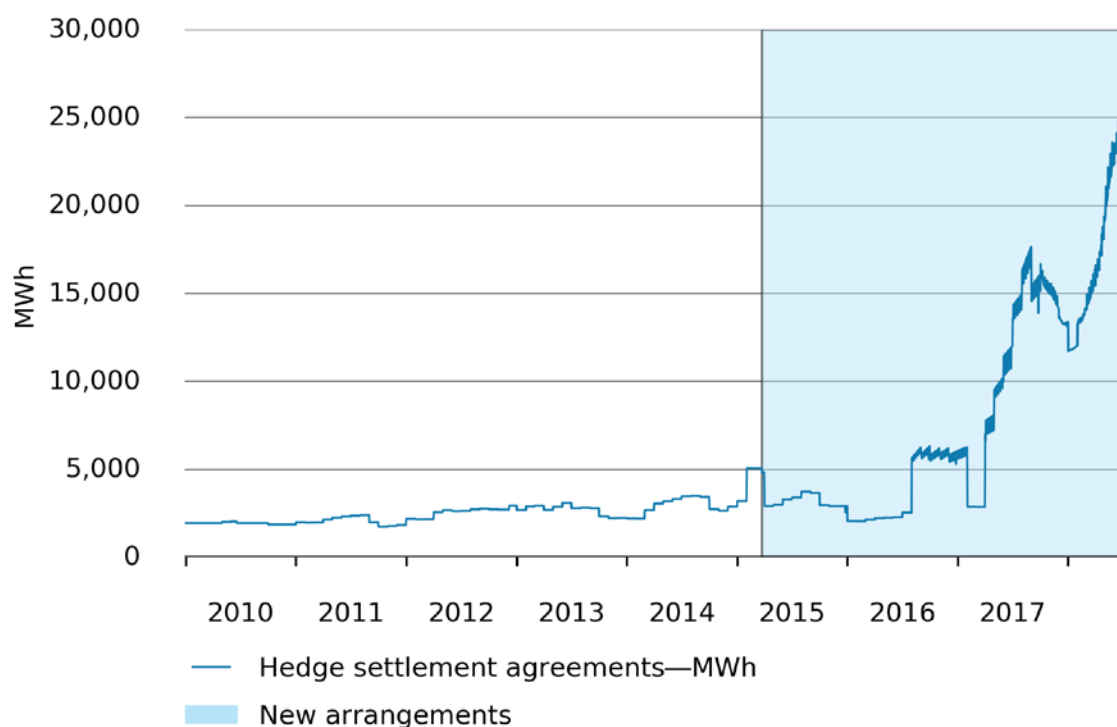
Regarding the p-values, *** means the coefficient is significant at less than 1%, ** means the coefficient significant at 1%, * means the coefficient significant at 5%.

- 6.46 Overall, the evidence shows the excess decreased for the five largest gentailers under the new arrangements, while the excess increased for direct purchasers and slightly increased for retailers under the new arrangements. Figure 3 suggests that this occurred because exposure increased while security lodged remained relatively static. This in turn suggests the new arrangements lowered the amount of security lodged that would have occurred with increased exposure.
- 6.47 Overall we conclude the new arrangements reduced excess and therefore cost for the industry. The trade-off is the possible increase in risk to sellers of non-payment. This is addressed as part of the next section.

Other changes

- 6.48 The new arrangements allowed purchasers to use prudential security for settlement. While we are not able to measure the benefit of this, anecdotally we understand it is a positive change.
- 6.49 Another change made was to allow hedge settlement agreements to be used to offset exposure. As a consequence there was a sharp increase in hedge settlement agreements lodged with the clearing manager.

Figure 14: Hedge settlement agreements



- 6.50 Figure 14 shows hedge settlement agreements in MWh from January 2010 to June 2018. Quantities have been climbing since mid-2016 with the steepest increases during 2017 and early 2018. The settlement quantity was over 25,000 MWh in June 2018, more than double the settlement quantity at the time the new arrangements came into force.

7 Assessment of the benefits of the new arrangements: Approach and methodology

7.1 Our approach was to estimate the benefits and costs—as specified in the cost benefit analysis (CBA) presented in the decision paper—achieved by the new arrangements.

Cost benefit analysis

7.2 Table 9 provides an overview of the predicted changes from the new arrangements, the expected result and an assessment of our ability to measure these. This is set out in Appendix J of the consultation paper.

Table 9: CBA of the major changes of prudential arrangements

Note	Objective	Direct assessment made in CBA?	Expected result	Ability to measure	Captured in this review
1	Increased retail competition and new entry	N	Increase	Medium	Y
2	Improved productive efficiency from reduced costs for generators	N	Increase	Low	Y
3	Improve productive efficiency from reduced costs for direct purchasers	N	Increase	Medium	Y

Summary of our assessment against the CBA

7.3 This study finds that:

- (a) Costs for purchasers have fallen and become less volatile. Retail competition has continued to strengthen.
- (b) The credit risk for generators has fallen because under-procurement of prudential security has fallen, and the overall risk remains low.
- (c) The costs faced by direct purchasers have remained the same under the new arrangements.

Costs have fallen and retail competition has continued to grow

7.4 The CBA in the consultation paper stated that retailer costs would fall because of:

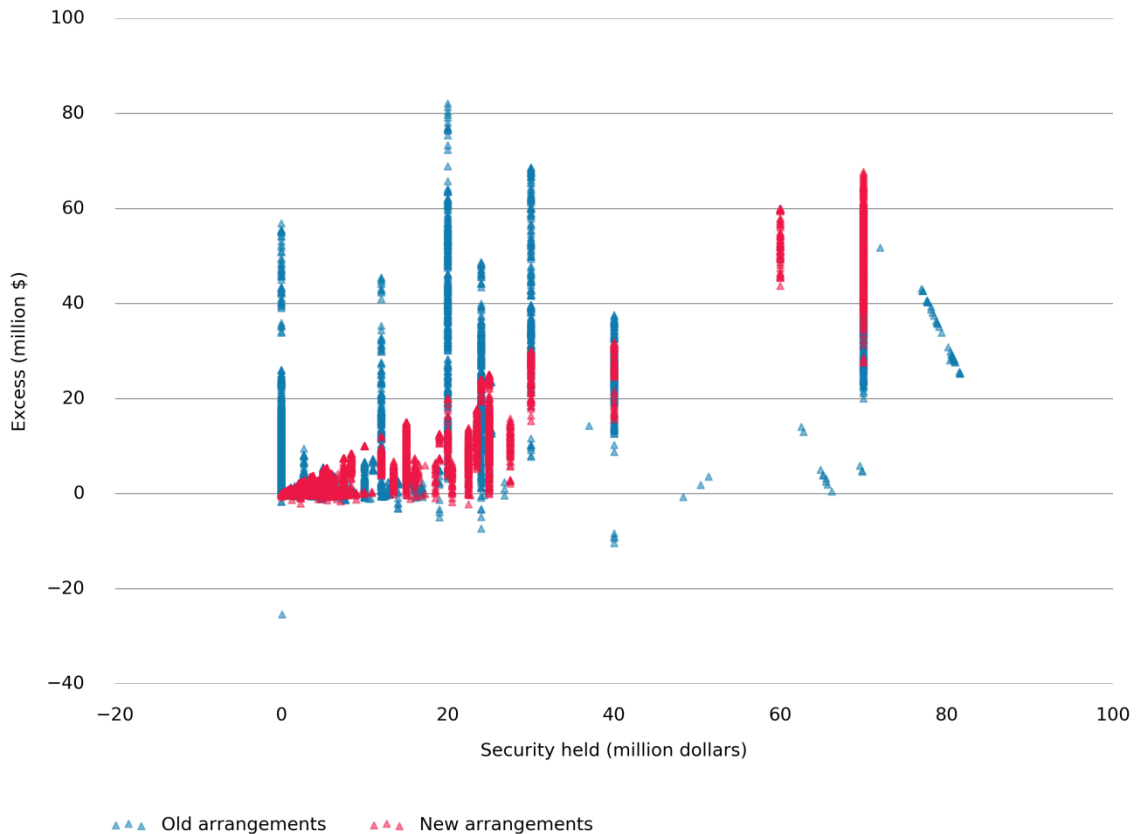
- (a) reduced over-procurement of prudential security

- (b) reduced volatility of prudential security requirements
 - (c) more options for retailers to meet prudential requirements.
- 7.5 The aim of reducing costs was to improve retail competition by reducing retailers' cost to serve. The assumption was that prudential requirements—and therefore costs—could be reduced without increasing the probability of default. This section looks at these three cost reductions then looks at retail competition.

Costs have fallen and become less volatile

- 7.6 The analysis in section 6 above shows that excess has fallen. This means that costs incurred unnecessarily have fallen.
- 7.7 Figure 15 shows a scatter plot of excess against security lodged. It shows that under the new arrangements there are fewer incidents of very high excess, and excess below zero. Also, the range of excess under the new regime is smaller (the red markers are more concentrated) which suggests excess is less volatile under the new arrangements.
- 7.8 We can also measure volatility using the standard deviation—the higher the standard deviation, the higher the volatility. The standard deviation of security lodged is 21.24 under the old arrangements, and 12.63 under the new arrangements. The standard deviation of excess is 17.48 under the old arrangements, and 9.79 under the new arrangements. The standard deviations in security lodged and excess under the new arrangements decreased, suggesting the security lodged and excess are less volatile under the new arrangements than the old arrangements.
- 7.9 Figure 11, Figure 12, and Figure 13 show the changes in security types for different participant types. The proportions of different security types changed under the new arrangements. However, it is difficult to determine the cause of this, or quantify its effect.
- 7.10 Overall we are confident the total cost prudential security has fallen and become less volatile. These lower costs should flow through to the retail market, making it more competitive. The next section looks at the retail market.

Figure 15: Scatter plot of excess against security held for individual participants



Retail competition has continued to improve

7.11 Our view is that overall retailer competition and new entry retailers are measurable by looking at a range of measures, but it is not possible to measure the incremental increase that is due to the new arrangements. In what follows we simply check that all our indicators are showing increased competition—in other words, instead of trying to identify the incremental effect of the new arrangements, we look for the absence of a detrimental effect.

7.12 In the consultation paper, it states that:

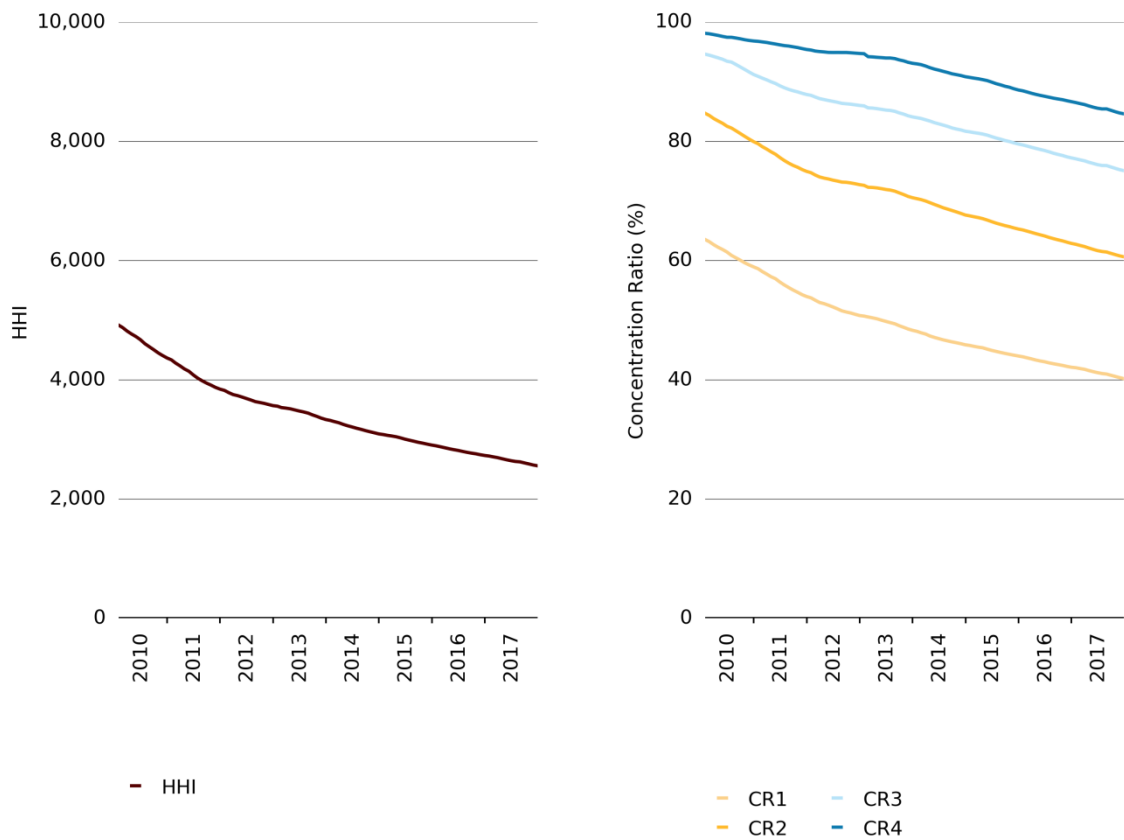
(a) *one of the Authority’s objectives for prudential security arrangements is to achieve a balance between encouraging retail competition and market entry by retailers (purchasers) by making sure that prudential arrangements do not impose an unnecessary barrier to entry. The new settlement and prudential security arrangements would allow new entrant retailers to enter the market with confidence about future prudential requirements.*

7.13 We use the HHI and CRX² to measure concentration in the retail market as it is generally accepted that a less concentrated industry will be more competitive. We also look at the market sizes of incumbents versus smaller retailers, and the recent market

² HHI is the sum of squares of the percentage market shares in a particular market—this calculation gives more weight to players with large market shares. CRX is the sum of the market shares for X players (for example, CR4 is the sum of market shares for four players). As New Zealand is split into regional markets, we calculate national figures using customer weighted averages of the regional HHIs and CRXs.

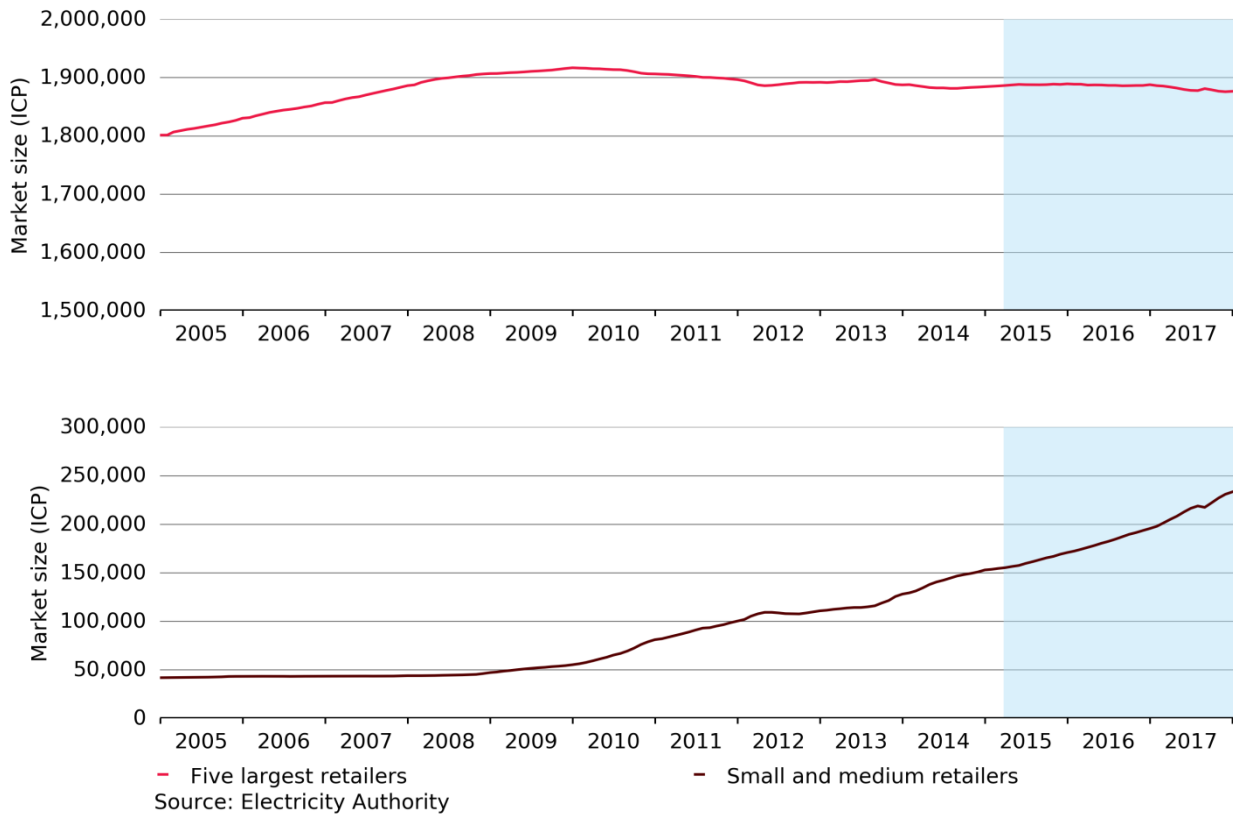
entry. We cannot see any detrimental effect of the prudential arrangements on retail competition, which continues to improve.

Figure 16: HHI and CRX for the retailer market (all sectors)



7.14 Figure 16 shows the national HHI and concentration ratio (CR) 1–4 for all sectors of the market. The HHI value is decreasing and has been below 3,000 since July 2015. The reduction in concentration is an indication of the increased competitiveness of the retail market.

Figure 17: Large and small retailers



- 7.15 Figure 17 shows the market size for the five largest retailers, and all the other retailers, from 2010 to 31 December 2017. The lower chart shows that smaller retailers have continued to grow after the new arrangements were introduced. Note the scales on these charts are very different from each other.
- 7.16 Both Figure 16 and Figure 17 show no obvious signs that retail competition was either positively or negatively affected by the new settlement and prudential security arrangements.

Table 10: The number of retail brands by regional council in 2014 and 2017

Regional Council	2017	2014	increase
Auckland	25	17	▲ 8
Bay of Plenty	22	12	▲ 10
Canterbury	22	11	▲ 11
Gisborne	14	9	▲ 5
Hawke's Bay	17	11	▲ 6
Manawatu-Wanganui	19	12	▲ 7
Marlborough	15	8	▲ 7
Nelson	17	9	▲ 8
Northland	17	9	▲ 8
Otago	18	9	▲ 9
Southland	16	9	▲ 7
Taranaki	16	11	▲ 5
Tasman	16	7	▲ 9
Waikato	22	13	▲ 9
Wellington	19	11	▲ 8
West Coast	13	7	▲ 6

- 7.17 Table 10 shows the number of retail brands increased at the end of 2017 compared with the number of retail brands at the end of 2014 across all regional council areas. The fall in national retail concentration is consistent with the entry shown in Figure 16.

Credit risk for sellers has fallen and overall risk is low

- 7.18 One objective of the new arrangements was to reduce occurrences of participants under-procuring prudential security. To accomplish this, the Authority introduced an 'addor' to reduce the probability of loss given default from around 50% to 25%. In the consultation paper, it states that:

A reduction in under-procurement means generators bear less residual credit risk and may increase investment by generators, which may flow through to lower wholesale prices, lower consumer prices and/or improved reliability of supply.

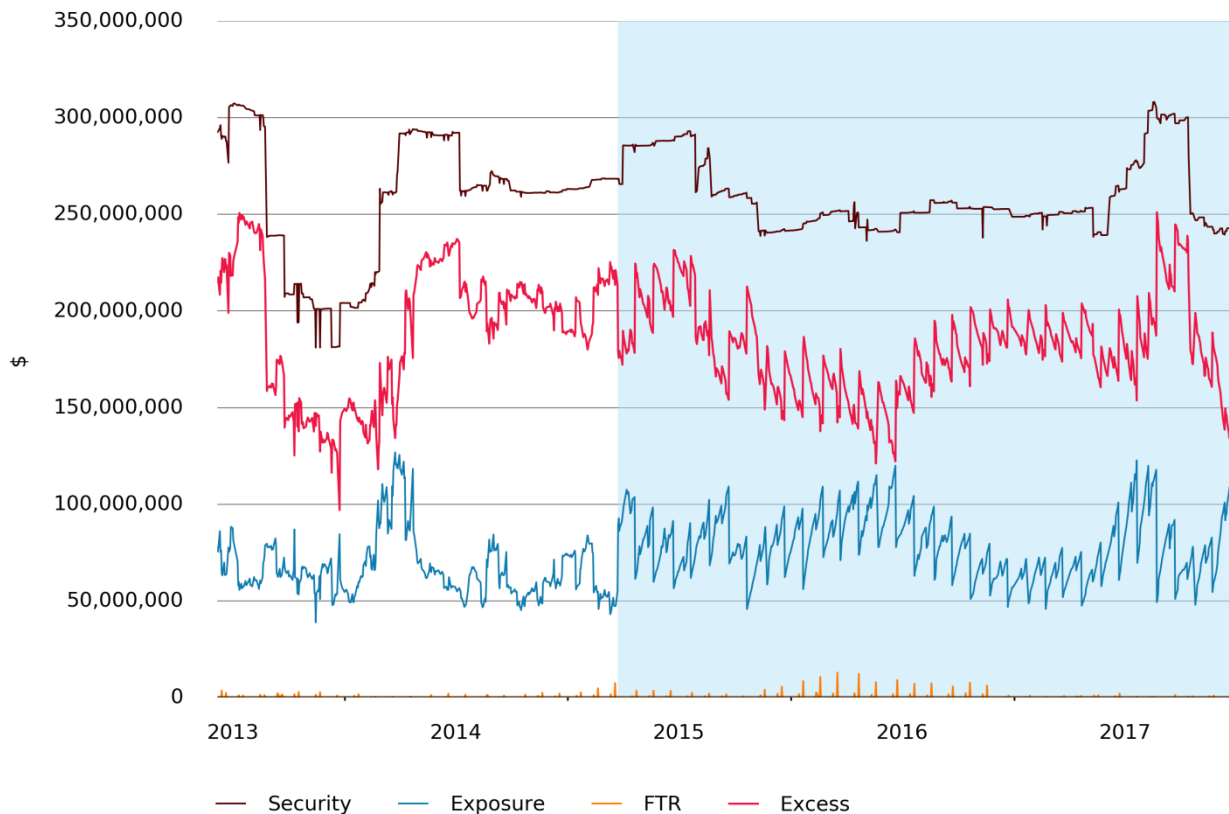
The adder would be determined by creating a hypothetical purchaser purchasing a fixed proportion of national load. The adder would be chosen measured over an historical period of three to ten years, the exit period prudential requirement will be greater than the clearing manager's actual exposure to the participant on 75% of days.

- 7.19 The adder is calculated to ensure that, for 75% of days, the prudential requirement is greater than the exposure. The exit period margin is a forecast that estimates the minimum prudential requirement or exposure. The adder is a price applied to the net

purchase quantity which effectively increases exposure when the exit period margin is calculated according to the formula:

$$\text{Exit Period Base Price} \times \text{Net Purchase Quantity} + \text{Adder} \times \text{Net Purchase Quantity} + \text{Ancillary Services Amount} + \text{Hedge Settlement Amount}$$

Figure 18: Prudential security requirements by net purchasers



- 7.20 The effect of the adder can be seen in an increase in exposure in Figure 3 and to a lesser extent Figure 18.
- 7.21 Excess has remained above \$100 million for net purchasers throughout the study period as shown in Figure 18. We use net purchasers—those that purchase more energy than they generate—because these are the participants that are likely to be most exposed to the spot price, and therefore most at risk of default.
- 7.22 When considering default, what matters is the risk of individual purchasers rather than the total risk of the market. So, as well as establishing that excess remained high for purchasers as a whole, Figure 15 shows fewer incidents of negative excess for individual participants, and the size of negative excess occurrences has fallen. This suggests the risk of non-payment by individual participants has fallen.
- 7.23 Figure 18 shows security and exposure for net purchasers. The prudential security lodged decreased after the new arrangements came into force, the exposure remained at similar levels and the excess fell. Average prudential security lodged is still around 3.3 times the average exposure. This means that prices would have to be at least 3.3 times higher than anticipated when exposure was calculated for the purchaser's security not to cover their excess. This suggests the possibility of a defaulting purchaser's prudential not covering its liabilities is very low.

7.24 Before the change the corresponding number to average prudential security lodged was around 5.3 times the average exposure. So while the credit risk for generators has increased in the sense there is less room for price error, the overall risk remains low. There are also fewer periods where participants have negative excess, which suggests a reduction in under-procurement of prudential security and a reduction in risk to sellers.

Costs for direct purchasers remain the same

7.25 We cannot measure (3) *Improve productive efficiency from reduced costs for direct purchasers* in Table 9 directly. The consultation paper states that *large industrial purchasers should see a reduction in the cost of meeting settlement and prudential security obligations*. However, if we assume that \$1 of security costs the same before and after the change, we can assess the costs for direct purchasers by assessing the amount of prudential security lodged.

7.26 Figure 10 shows the security lodged by direct purchasers is similar before and after the new arrangements, although Figure 10, Table 5, and Table 6 show that security lodged by direct purchasers was slightly higher after the new arrangements came into force. Overall, we think the costs for direct purchasers have remained the same. However as noted above, excess did increase for direct purchasers, which means they lodged more prudential security compared to their exposure.

8 Conclusion

8.1 Overall, we find the benefits of the new arrangements outweighed the costs for any reasonable discount rate with participants needing to finance on average around \$1.6 million less in prudential security. The possibility of a defaulting purchaser's prudential not covering its liabilities is low and has fallen, suggesting that generators face lower credit risk under the new arrangements. Overall, we conclude the new arrangements were a positive change and provided substantial benefit to the industry.

Appendix A A description of the new prudential security arrangements from the decision paper

A.1 The details of comparing the proposed changes of settlement and prudential security arrangements in the consultation paper to the changes in the decision paper

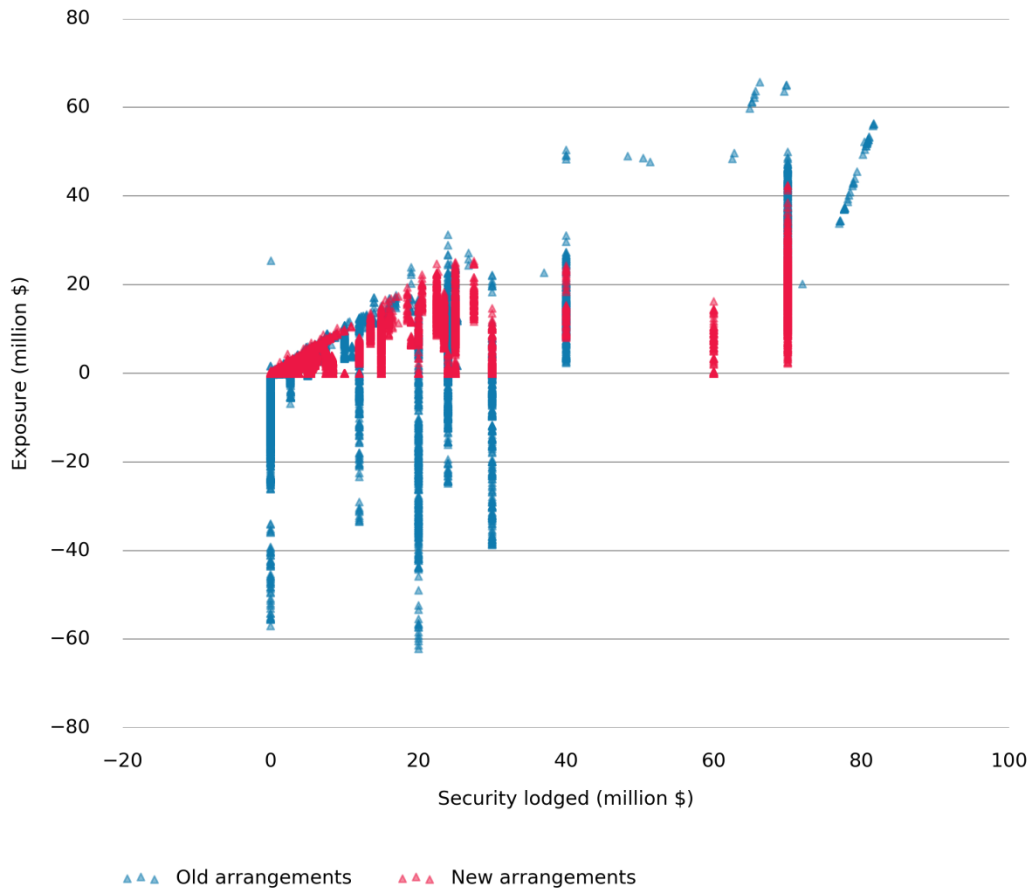
The Code before amendment	Proposal	Decision	Reasons/benefits
<i>Monthly settlement</i>	<i>Weekly settlement</i>	<i>Retain monthly settlement</i>	<p><i>The key reasons the Authority has decided to retain monthly settlement are that:</i></p> <ul style="list-style-type: none"> <i>a) a move to weekly settlement would result in substantially higher costs than the monthly settlement option</i> <i>b) the additional benefits of weekly settlement are unlikely to be significant.</i>
<i>The Code did not include an adder</i>	<i>The Wholesale Advisory Group (WAG) proposed an approach that would set a participant's required prudential security level conservatively high so that it would be expected to be sufficient 75% of the time, or equivalent to a probability of loss given default (PLGD) of 25%.</i>	<i>The Authority decided to retain a mildly conservative adder based on a targeted PLGD of 25%, which is around \$10 to \$20/MWh.</i>	<i>The conservative adder increases assessment and monitoring costs by a small amount but decreases risk aversion costs and exit administration costs significantly.</i>
	<i>The WAG recommend a static approach rather than a dynamic approach</i>	<i>The Authority decided to retain the static approach rather than a</i>	<p><i>The main reasons for retaining the static approach are:</i></p> <ul style="list-style-type: none"> <i>(a) the static approach could lead</i>

The Code before amendment	Proposal	Decision	Reasons/benefits
	<i>to calculating the exit period prudential margin.</i>	<i>dynamic approach to calculating the exit period prudential margin.</i>	<p><i>to greater retail competition because a retailer can enter the market with more confidence regarding its likely future prudential security requirements, as under a static approach the exit period price is set in advance, and not impacted by short-term changes in wholesale market spot prices</i></p> <p><i>(b) the static approach's benefits in terms of encouraging retail competition were expected to outweigh any efficiency concerns arising from the fact that purchasers will not always face the full cost of their business risks</i></p>
<i>There may already be contractual provisions between the direct purchaser and the distributor or grid owner was allowing the distributor or grid owner to disconnect the consumer. In other cases, the contracts for supply to direct purchasers may provide for disconnection if the</i>	<i>The WAG proposed that the clearing manager would direct disconnections.</i>	<i>The Authority decided to modify the proposal so that the Authority rather than the clearing manager would issue a direction to the relevant distributor or grid owner to disconnect the defaulting direct purchaser.</i>	<i>The Code amendments adequately provide for the exit of a direct purchaser within a reasonably short time period so that required prudential security levels can be correspondingly low.</i>

The Code before amendment	Proposal	Decision	Reasons/benefits
<p><i>consumer does not pay the distributor or grid owner, and these provisions could be extended to cover situations where the Authority instructs disconnection under the Code.</i></p>			
<p><i>HSA was non-symmetrical. The general shortfall was essentially allocated pro rata to generation amounts and to HAS amounts associated with the payee invoice. HAS amounts associated with the payer invoice are not relevant for the allocation of the shortfall.</i></p>	<p><i>The WAG proposed symmetrical pooling of physical and HAS credit risk. Partial net settlement means that HSAs are not associated with either the payer or payee invoice. It is only the direction of the HAS payment that is relevant. Any participant who receives an amount under an HAS will share pro rata in any shortfall. Where a participant's HAS results in the participant having to pay an amount under the HAS, that amount will not contribute to the calculation of the shortfall to be borne by that participant.</i></p>	<p><i>The Authority decided to retain the proposed approach to risk pooling outlined in the consultation paper.</i></p>	<p><i>The approach can be implemented in practice because:</i></p> <ul style="list-style-type: none"> <i>(a) it is internally consistent</i> <i>(b) it is consistent with the principle that the Authority should aim to make HSAs a useful product for participants, to educate participants in their use and to remove any unnecessary barriers to their uptake, but should not provide financial incentives to lodge HSAs.</i>

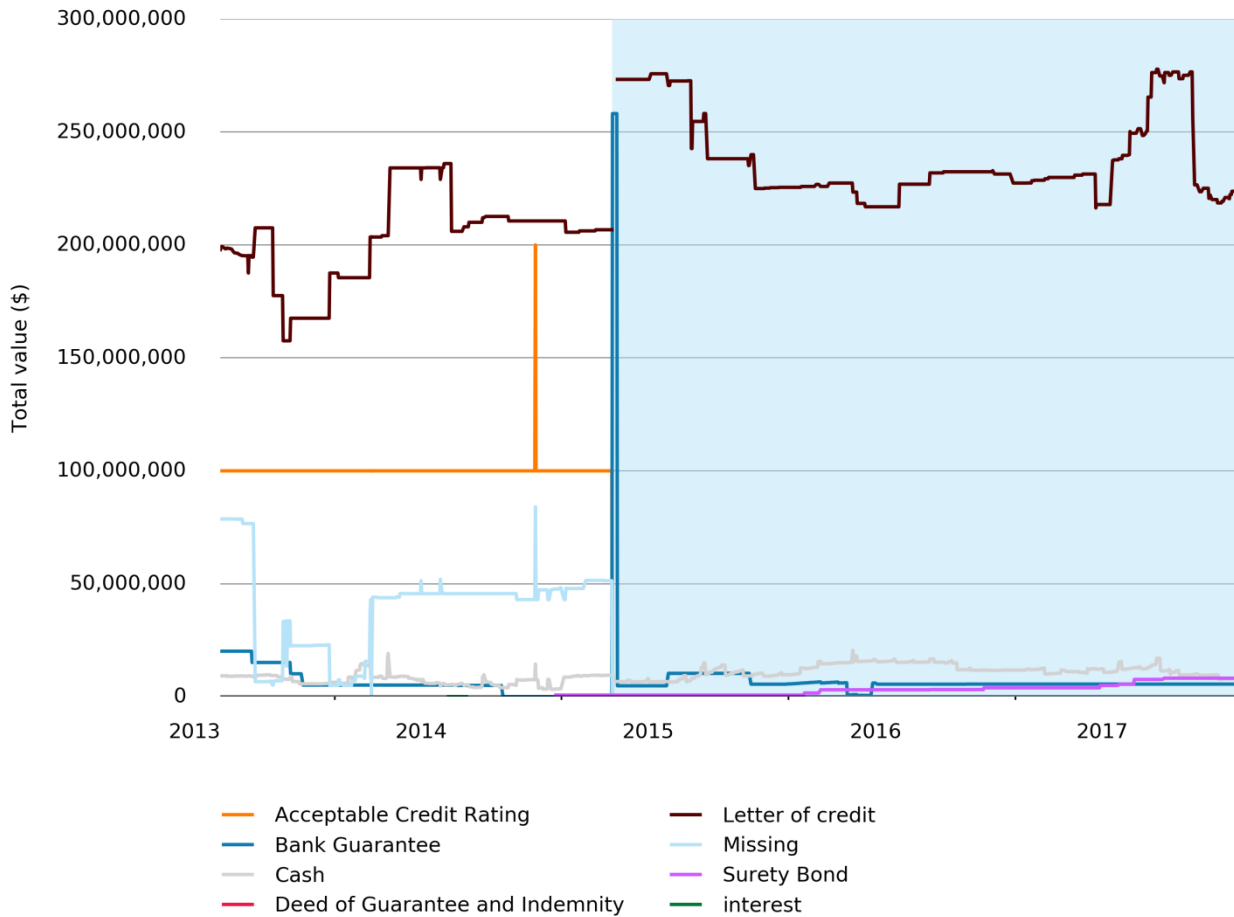
Appendix B Scatter plot minimum security required against prudential security lodged by participants

B.1 Appendix B shows a scatter plot of exposure against security lodged before and after new settlement and prudential security arrangements has been commenced. Less security was lodged after the new regime commenced. Some participants had negative exposure before the new regime commenced, but this hasn't occurred since. This is due to the change in methodology for calculating exposure.



Appendix C Prudential security requirements by security types

C.1 Appendix C shows the security types of prudential security lodged that include missing and interest types. The most common security type is letter of credit. It increased when the arrangements commenced in March 2015 but then decreased through mid-2015 to mid-2017



Appendix D Regression results for a consistent set of participants

D.1 Appendix D shows the full regression results for the whole dataset, using 2013's participants and five direct purchasers respectively. The p-values in three tables are all approximately zero for the arrangements dummy variable, implying the new arrangements had a statistically significant effect on the excess. The p-values for the coefficients are significant at 5% except log price in all three regressions. However, we cannot exclude the variable of log price, because it is a part of the regression.

Table 11: GLS regression results

Coefficients	Estimate coefficients	p-values
(Intercept)	- 1,911,400	0.06
Dummy variable—arrangements change	- 1,702,000	<2.2e-16***
Log(price)	7,906	0.87
Load	9948	0.0007396***
Security lodged	0.565	<2.2e-16***
Role distributor	1,422,900	0.2579431
Role generator	4,682,800	0.0028321**
Role generator distributor	6,762,400	0.0040333**
Role gentailer	3,482,500	0.0023202**
Role retailer	1,113,300	0.2848075
Role trader	2,198,700	0.1621013
Dummy variable cash	381,220	<2.2e-16***
Dummy variable letter of credit	2, 677,400	<2.2e-16***
Dummy variable bank guarantee	1,195,400	<2.2e-16***
Dummy variable deed of guarantee	- 3,166,700	<2.2e-16***
Dummy variable interest	-2,714,100	0.0001287 ***
Dummy variable surety bond	1,542,800	<2.2e-16***
R-squared	0.357	

Table 12: GLS regression full results of using 2013's participants

Coefficients	Estimate coefficients	p-values
(Intercept)	- 2,223,200	0.1156382
Dummy variable—arrangements change	- 1,853,300	<2.2e-16***
Log(price)	6,086	0.3204873
Load	11,564	0.0021166**
Security lodged	0.56	<2.2e-16***
Role distributor	1,325,200	0.4045103
Role generator	4,612,700	0.0142111*
Role generator distributor	6,692,300	0.0118462*
Role gentailer	3,641,600	0.0152472*

Coefficients	Estimate coefficients	p-values
Role retailer	-1,609,700	0.9177823
Role trader	2,333,700	0.3800113
Dummy variable cash	349,620	<2.2e-16***
Dummy variable letter of credit	3,0058,400	<2.2e-16***
Dummy variable bank guarantee	1,159,500	<2.2e-16***
Dummy variable deed of guarantee	-3,008,500	<2.2e-16***
Dummy variable surety bond	1,704,500	<2.2e-16***
R-squared	0.36	

Table 13: GLS regression full results of five direct purchasers

Coefficients	Estimate coefficients	p-values
(Intercept)	1,801,400	0.004**
Dummy variable— arrangements change	1,638,700	<2.2e-16***
Log(price)	- 420,810	<2.2e-16***
Load	- 6,608	0.177
Security lodged	0.44499	< 2.2e-16***
R-squared	0.8402	