Wholesale Advisory Group

Hedge Market Development Project

Metrics

1 May 2014

Note: This paper has been prepared for the purpose of discussion within the Wholesale Advisory Group (WAG). Content should not be interpreted as representing the views or policy of either the Electricity Authority or the WAG.

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Executive summary

At the request of the Electricity Authority, the Wholesale Advisory Group (WAG) is undertaking a project to consider opportunities to further develop the New Zealand electricity hedge market in order to maintain its current forward momentum and develop its value to the wholesale and retail markets.

This paper is intended as an internal discussion paper within the WAG. The purpose of this paper is to:

- provide the WAG with metrics that may assist it to form a view on the nature and materiality of potential problems with the hedge market;
- seek feedback from the WAG on any further metrics that would assist it to form a view; and
- define measures of hedge market performance that the Electricity Authority's Market Monitoring team may consider using on an ongoing basis.

The metrics set out in this paper can be divided into four groups – those relating to:

- volume;
- price;
- depth and liquidity; and
- non-price barriers.

Some key observations are listed below.

<u>Volume</u>

- The ASX futures market is growing, but is still much smaller in relative terms than the NEM equivalent. Further growth in the market has the potential to bring increased depth and liquidity and more competitive pricing.
- While it is possible to obtain hedge cover more than a year into the future on the ASX, traded volumes for long lead times are still relatively light and it may be difficult for parties to establish a long term position.
- There may be scope to support the further growth of the ASX market. In developing any such initiatives, liquidity on longer time frames may warrant particular consideration.
- The OTC CfD market has shrunk relative to the ASX but still remains important.
- A significant proportion of OTC CfDs extend two years or more into the future.
- Based on hedge disclosure data, the OTC FPVV market appears to be growing. The FPVV market forms an important part of the hedge market.
- Participation in the hedge market by financial institutions still appears to be relatively light, and encouraging such participation may be an important part of growing the hedge market.

<u>Price</u>

- It appears that ASX futures trade at a significant premium relative to the underlying spot price– particularly for products with lead time of a year or more.. It remains unclear whether these margins reflect real risks (or perceptions of risk), or otherwise suggest some inefficiency in ASX prices.
- Average ASX prices have been higher at Benmore than at Otahuhu, relative to the underlying spot price – but this difference may be arbitraged away to some extent in the future by trading in FTRs.
- OTC CfDs that are directly comparable to ASX futures appear to be priced only slightly above the ASX price.
- OTC FPVVs may be priced at a reasonable margin above OTC CfDs and futures.
- Among OTC CfDs, margins appear higher for contracts with long lead times.
- In contrast, long-term FPVV contracts do not appear to have higher margins than short-term FPVV contracts.
- Both for CfDs and FPVVs, it appears that margins in the South Island market may be higher than the North Island market. OTC CfD margins in Canterbury seem unusually high (although this is based on a relatively small number of contracts).

Depth and liquidity

- The level of participation in the ASX and OTC CfD markets has increased over the last few years, and the depth and liquidity of the ASX market has improved since market-maker agreements were put in place.
- Data limitations make it difficult to assess the current levels of depth and liquidity of the ASX market – nevertheless, on the basis of available data, it appears that there may be room for improvement. There can be significant price movements from one trade to the next and it may sometimes be difficult for a participant to make substantial changes to their position in a short time, and at a competitive price.
- There may be scope to improve the depth and liquidity of the ASX market. One possible avenue may be through encouraging broader participation. Another possible option may be moving to a smaller unit size.

Non-price barriers

- HSAs are being used intermittently by some participants to manage prudential requirements and credit risk.
- It is not clear whether the initial margins charged by ASX accurately reflect the level of price risk on various time scales. It may be the case that traders in New Zealand electricity futures are paying unnecessarily high initial margins.
- Many OTC contracts still employ force majeure and/or suspension clauses, which may reduce their value to the buyer and potentially limit the range of hedging strategies buyers may employ.
- It is possible that moving to a smaller unit size might support participation, depth and liquidity in the ASX market.

The paper seeks the WAG's views on findings, and asks what further quantitative analysis could assist WAG to reach conclusions on the efficiency or competitiveness of the hedge market.

1 Introduction

1.1 The hedge market development project

1.1.1 The purpose of the hedge market development project is to examine opportunities to further develop the New Zealand electricity hedge market, in order to maintain its current forward momentum and develop its value to the wholesale and retail markets.

1.1.2 The WAG took on the project in September 2013. At its 28 November 2013 meeting, the WAG was presented with a paper that proposed an approach to the initial "fact-finding phase" of the Hedge Market Development project. Under this proposed approach, the fact-finding phase includes three broad approaches to gathering information on the hedge market:

a) presentations from stakeholders to provide a number of different perspectives;

b) quantitative metrics to help objectively measure performance and the magnitude of any issues, and monitor the market's progress; and

c) a survey on the hedge market to determine the areas of concern.

1.1.3 .

1.1.4 This paper relates to point 1.1.2b), and seeks to:

a) provide the WAG with metrics that may assist it to form a view on the nature and materiality of potential problems with the hedge market (in combination with other sources of information available to WAG members, such as the hedge market survey, first principles analysis, and commercial experience);

b) seek feedback from the WAG on any further quantitative information that would assist it to form a view; and

c) define measures of hedge market performance that the Electricity Authority's Market Monitoring team may consider using on an ongoing basis.

1.2 Key questions

1.2.1 The focus of the metrics in this paper is on:

a) whether hedge prices are efficient;

b) whether hedge markets provide a level playing field for competition; and

c) whether there are (avoidable) non-price barriers that prevent participants from meeting their risk management needs through hedge markets.

1.3 Previous WAG discussion on metrics

1.3.1 At its 20 February 2014 meeting, the WAG discussed the role of quantitative metrics in the fact-finding phase and the kinds of metrics that may be useful. A paper presented to the WAG suggested that:

a) metrics should refer to the characteristics of a high-performing hedge market, and should allow for progress towards such a market to be measured and tracked;

b) hedge market metrics can be divided into four categories: price, volume, liquidity, and barriers to trading. All of these are important in assessing the performance of the hedge market;

c) it may be that no single metric adequately captures performance in a particular area – a range of metrics may be required; and

d) while data limitations should be considered, the WAG should not feel restricted to drawing on information that is already available.

1.3.2 Key WAG comments included that:

a) the analysis should include the FPVV market;

b) the analysis should consider credit issues – particularly with regard to options to reduce cash flow requirements;

c) the features of a high-performing market include confidence in the forward price curve and liquidity; and

d) it is challenging to compare prices between ASX, OTCs and spot, and results will depend on the time horizons used.

1.3.3 In the context of a Pulse Energy presentation, the WAG also commented that:

a) the existence of a significant premium in ASX prices above forecast spot is speculative;

b) it is not clear whether any premiums are inappropriate relative to the risks in the market;

c) ASX liquidity may already be adequate, and sufficient for the needs of small retailers;

d) work should be done to identify what risks are being priced into hedge contracts (hydrology is a primary source of risk); and

e) work should be done to quantify the unhedged portion within the market.

2 Overall approach to metrics

2.1 Terminology

2.1.1 In order to avoid confusion, it is important to establish a common language for describing the hedge market.

2.1.2 The WAG has already established key terms to describe the various parts of the hedge market (see Glossary). This paper adds a selection of new terms that are used in defining and discussing hedge market metrics, which are listed below.

Time:	
Trading date	The date on which a hedge product is contracted (similarly "trading month", "trading year")
Hedged period	The period for which hedge payments are made (for instance, a quarterly future might have a hedged period of January-March 2015)
Duration	The length of the hedged period
Expiry	The end of the hedged period
Advance period	The period from the trading date to the beginning of the hedged period
Lead time	The length of the advance period
Product	In a market for CfDs, a combination of location and hedged period (e.g. OTA 2014 Q1)
Price:	
Traded price	The strike price of a CfD, or the price(s) at which power is sold in a FPVV contract
Market price	The price at which the market for a CfD product sits at a point in time. Can be established either as (bid + ask)/2, or with reference to traded prices
Settlement price	The price against which a CfD is settled, i.e. the time-weighted average of spot prices during the hedged period
Margin	The difference between two prices
Percentage margin	The difference between two prices, as a percentage of the second price
Quantum:	
Quantity	The size of a CfD, in MW (= volume / duration)
Volume	The size of a CfD, in GWh (= quantity x 1000 x duration)
Open volume / traded volume	The open volume is the sum of the volumes of all contracts that are still open at a given point in time. Can be further restricted, e.g. the open volume for a particular settlement period, or for a range of lead times. The traded volume is the sum of the volumes of all contracts for which the trading date falls within a particular period. Again this can be further restricted

Open quantity / traded quantity	The equivalent of open volume / traded volume, in MW terms
Liquidity / depth:	
Spread	Ask minus bid, sometimes expressed as a percentage of bid
Depth	Depth refers to the trade-off between the *quantity to be sold* and the price it can be sold for (c.f. liquidity below). It can be measured in various different ways
Liquidity	Liquidity refers to the trade-off between the *speed of the sale* and the price that can be obtained (c.f. depth above). It can be measured in various different ways

2.2 Four groups of metrics

2.2.1 The metrics set out in this paper can be divided into four groups – those relating to:

a) volume;

b) price;

c) depth and liquidity; and

d) non-price barriers.

2.2.2 The **volume** metrics seek to describe the extent to which the various parts of the hedge market are being used. The primary focus is on ASX futures, OTC CfDs and OTC FPVVs. Volume metrics are benchmarked against other key quantities where possible.

2.2.3 Where the amount of trading in a particular part of the market is increasing, this may suggest that the market is getting healthier and prices should be becoming more competitive. Increasing traded volumes may also be associated with an increase in depth and liquidity.

2.2.4 The volume metrics have a focus on hedges that have a distant expiry date (i.e. extend at least a year into the future). Such hedges help to flesh out the far end of the forward price curve. OFGEM in the UK identified hedges on longer lead-times as being particularly important in supporting retail competition.[1]

2.2.5 The volume metrics also focus on the amount of trading carried out by financial institutions such as banks. The involvement of these parties may bring increased liquidity and lead to a wider range of OTC products becoming available.

2.2.6 The **price** metrics seek to investigate (to the extent possible) the relationship between hedge prices and the underlying spot price. Hedge prices would be expected to reflect cost plus a reasonable premium for risk.

2.2.7 The price metrics also seek to assess whether hedge markets are competitive – with a level playing field across parties, hedging timeframes, geographical regions, etc.

2.2.8 Key comparisons are between:

[1] As explained in the OFGEM retail market review: "Of direct relevance to our liquidity objectives is the proportion of the [hedge] market that is traded months or years ahead of delivery. In order to compete, market participants require products that enable them to hedge against the risk of future movements in the wholesale price…" The OFGEM review places particular focus on products extending at least a year, and preferably more than two years, into the future.

a) ASX prices and spot prices;

b) ASX prices at Otahuhu and ASX prices at Benmore;

c) margins on the ASX and margins on futures exchanges in other jurisdictions;

d) OTC CfD prices and ASX prices where possible;

e) OTC CfD prices and spot prices; and

f) OTC FPVV prices and profiled spot prices.

2.2.9 The **depth and liquidity** metrics seek to assess the extent to which participants can trade hedges without altering the market price. To the extent that depth and liquidity are limited, participants may find it difficult to obtain a competitive price for a large trade or multiple trades.

2.2.10 Key issues include:

a) the extent of participation in the various parts of the hedge market – as broad participation is one sign of a deep and liquid market;

b) the size of spreads on the ASX, and how these compare with other exchange-traded futures; and

c) the change in market prices as volumes are traded on the ASX.

2.2.11 Finally, this paper lists some **non-price barriers** to use in evaluation of hedge markets. The majority of these cannot readily be assessed quantitatively, and would need to be tackled on a qualitative basis. In some cases, however, metrics are shown to be helpful.

2.3 Caveats

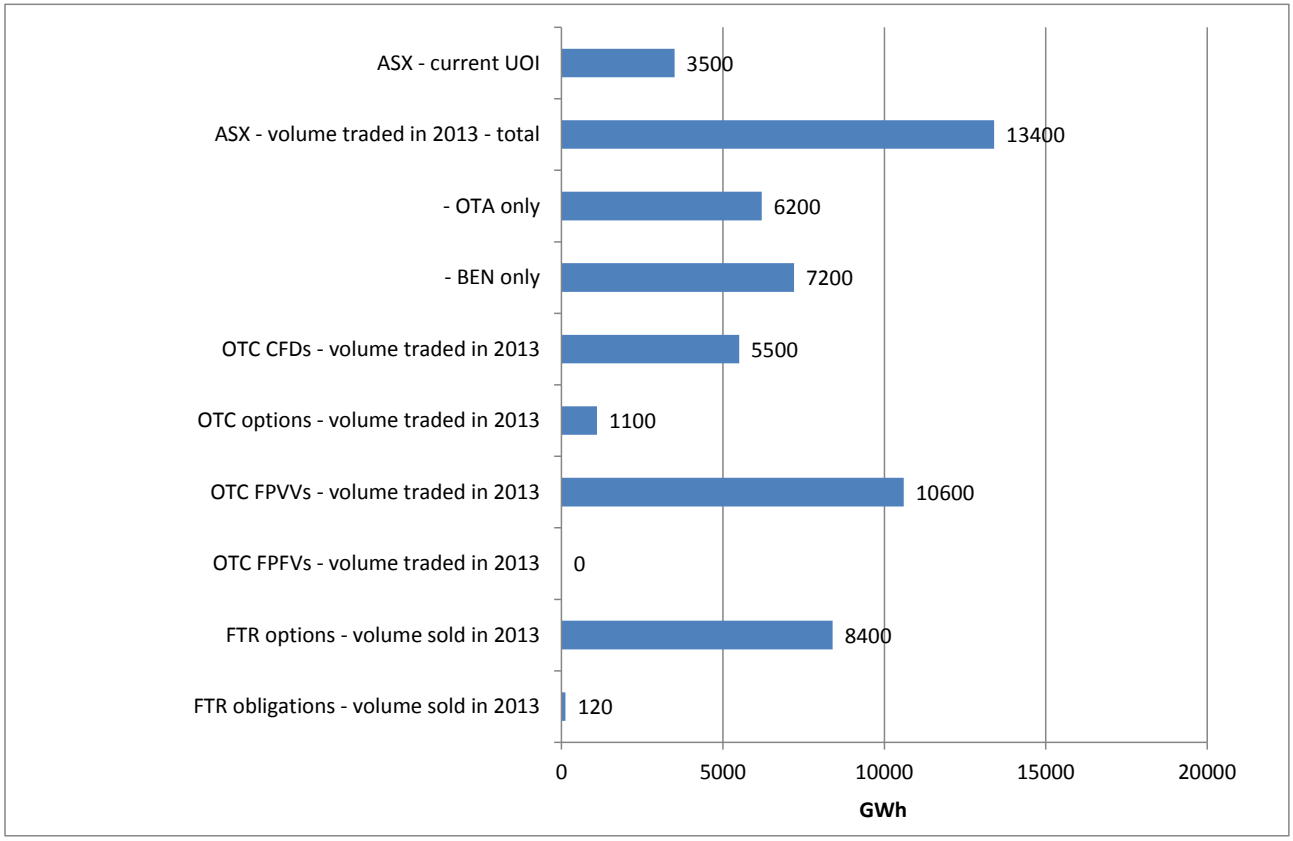
2.3.1 Much of the analysis in this paper is based on hedge disclosure data. This data is indispensable for any quantitative analysis of OTC contracts – however, it is known to be neither 100% complete nor 100% correct. For instance, some large hedges (such as the NZAS Tiwai contract) are not included in the disclosure dataset. There are obvious examples of incorrect data (such as a participant listing the size of a contract in MW instead of GWh), and this suggests there may be other more subtle errors.

3 Volume

3.1.1 Figure 1 puts the scales of various parts of the hedge market in context.

3.1.2 Note that this graph, like most of the other graphs in this section, is based on hedge disclosure data that does not include some large hedges such as the NZAS Tiwai contract.

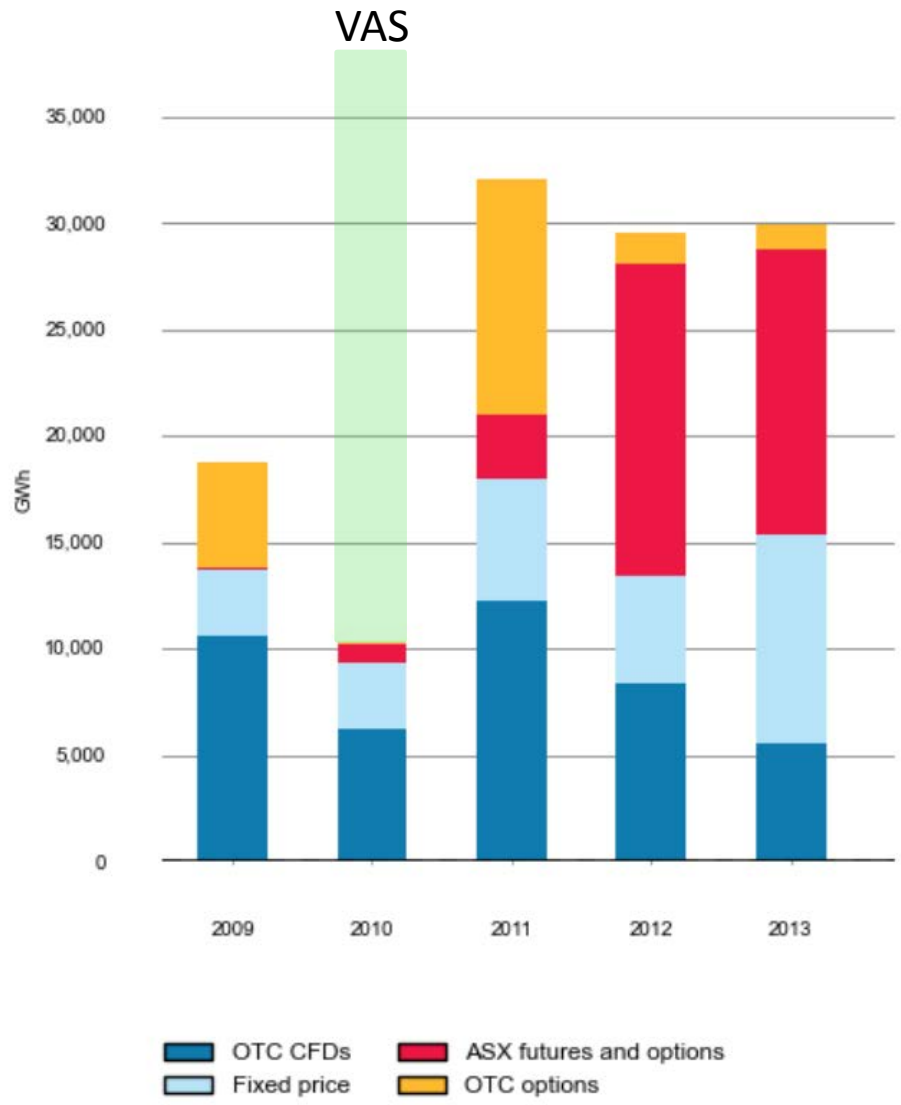
Figure 1: Relative scales of various parts of the hedge market, in 2013



3.1.3 Figure 1 highlights that the key parts of the energy hedge market are the ASX futures market, the OTC CfDs market, the OTC FPVVs market, and the OTC options market. (The FTR market is excluded from this list, and is not discussed further in this section of the paper, because it is a market for hedging locational price risk rather than an energy hedge market.)

3.1.4 The breakdown of trading across these markets has changed considerably over the last few years (Figure 2).

Figure 2: Breakdown of hedge traded volumes over the last few years



3.1.5 Traded volumes on the ASX have greatly increased since market-maker spreads were reduced from 10% to 5%, and market-maker quantities increased to 3 MW on each side, in October 2011. Traded volumes of OTC CfDs have now been overtaken by the ASX, but still remain significant.

3.1.6 Traded volumes of OTC FPVVs have increased considerably since 2010 and, in 2013, exceeded traded volumes of OTC CfDs. This is consistent with anecdotal information about the currently high level of competiveness of the OTC FPVV market.

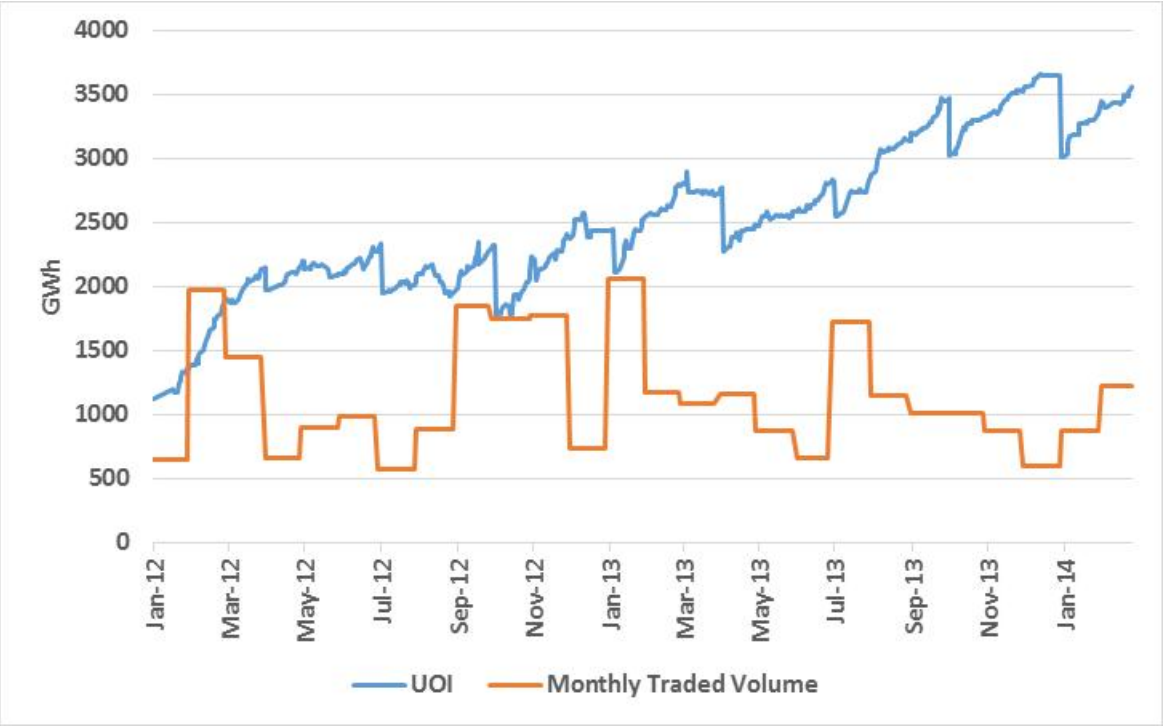
3.1.7 There has been relatively little trading in OTC options over the last four years, apart from trades associated with the electricity industry reforms of 2010 (e.g. the virtual asset swaps).

3.1.8 The following subsections drill down into volumes in the ASX, OTC CfD and OTC FPVV markets.

3.2 ASX futures volumes

3.2.1 Since the beginning of 2012, traded volume on the ASX has remained reasonably steady, but unmatched open interest (UOI) has increased substantially (Figure 3).

Figure 3: Growth in ASX UOI



3.2.2 The ASX market for NZ electricity futures is still a young market and annual traded volumes are still low relative to total system load. By contrast, in the Australian NEM, where the futures exchange has been operating since 2002, the annual traded volume of exchange-traded futures and options exceeds total system load (Figure 4) – and has done so for some years (Figure 5).

Figure 4: Putting ASX traded volumes in context

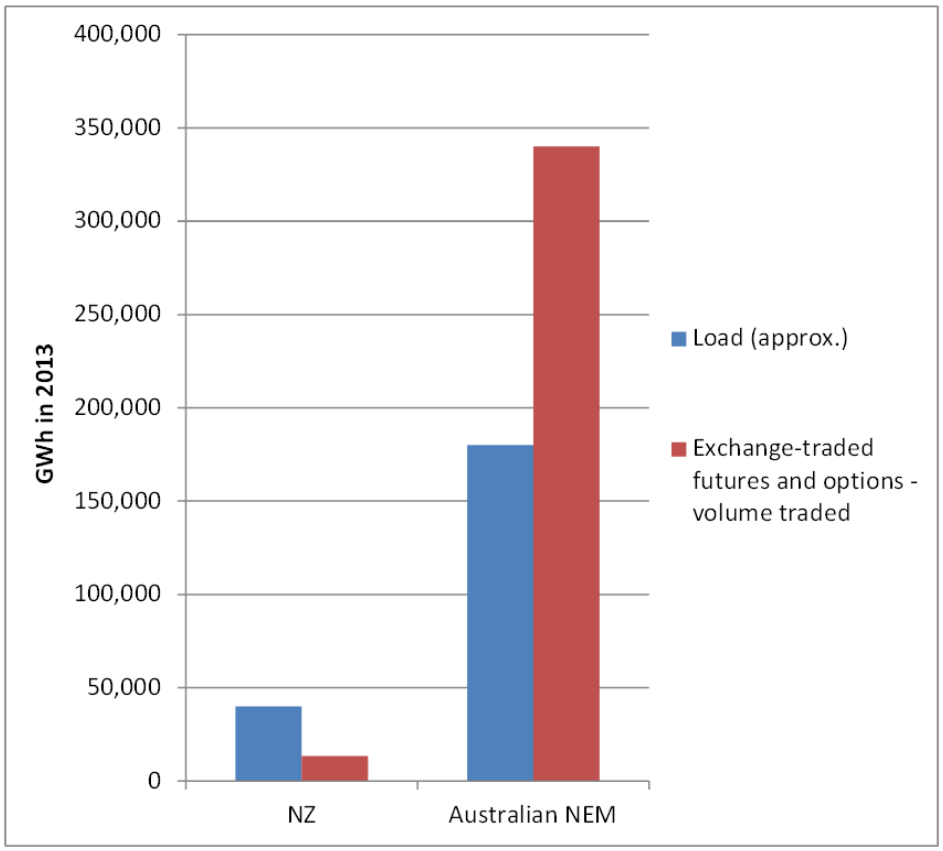
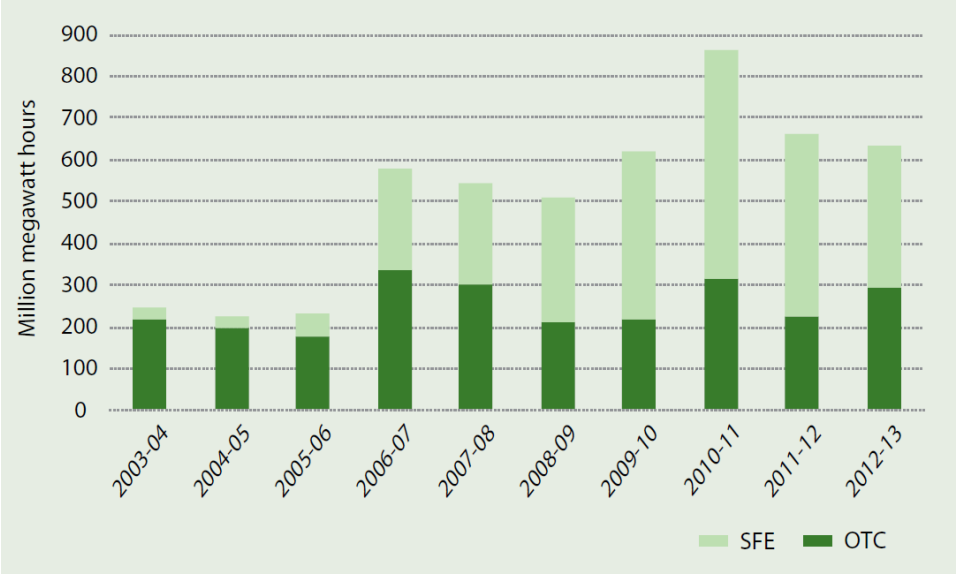


Figure 5: Annual traded volumes of Australian electricity hedges *(reproduced from the Australian Financial Markets Report 2013)*



Note: SFE = exchange-traded products – equivalent to the red bar in Figure 4.

OTC = over-the-counter hedges – not shown in Figure 4.

3.2.3 In its review of the hedge market in the UK, OFGEM identified that a key issue is whether parties can obtain hedge cover for a year or more into the future. They suggested that hedges with long lead times:

a) may be particularly important in supporting retail competition; and

b) help to flesh out the far end of the forward price curve.

3.2.4 The WAG may also want to consider whether this is a concern for the New Zealand hedge market. Disclosure data shows that:

a) in recent years, 14% of traded volumes on the ASX have been for a lead time of two years or more (Figure 6);

b) as of end of February 2014, 14% of UOI on the ASX was for a lead time of two years or more (Figure 7); and

c) there is relatively little UOI for a lead time of three years or more (Figure 8). What open interest there is on this long time frame is made up of a small number of trades.

Figure 6: ASX traded volumes by lead time

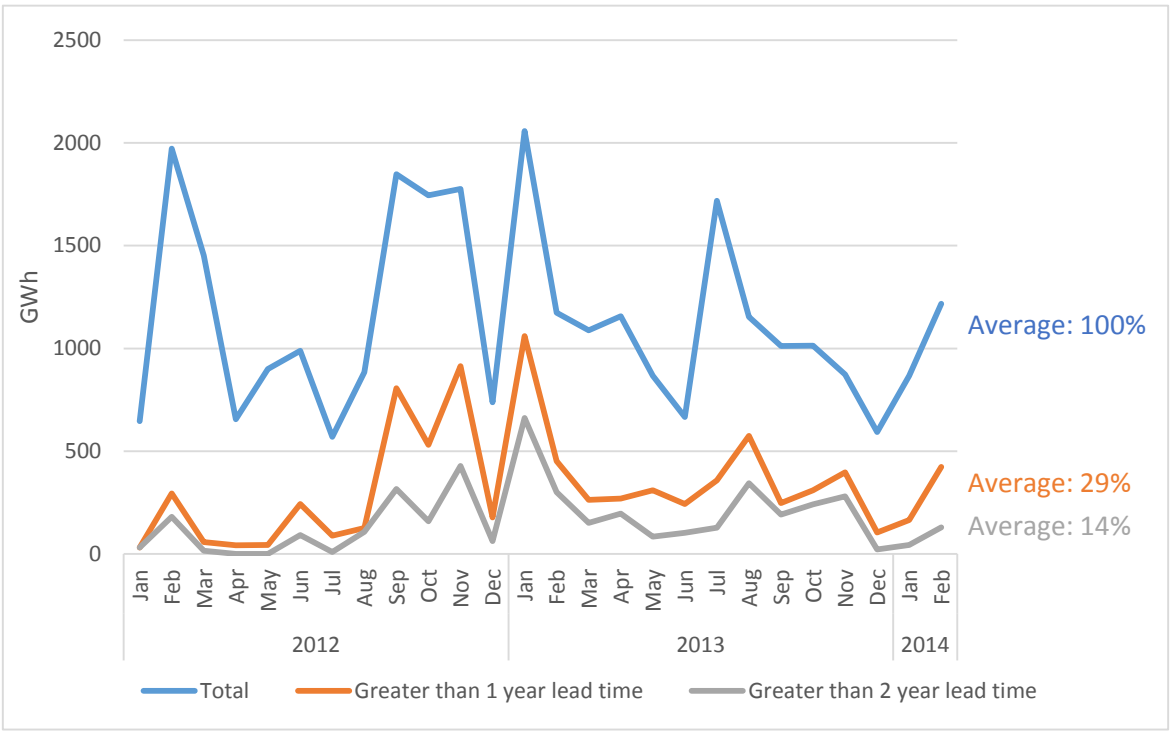


Figure 7: ASX UOI by lead time

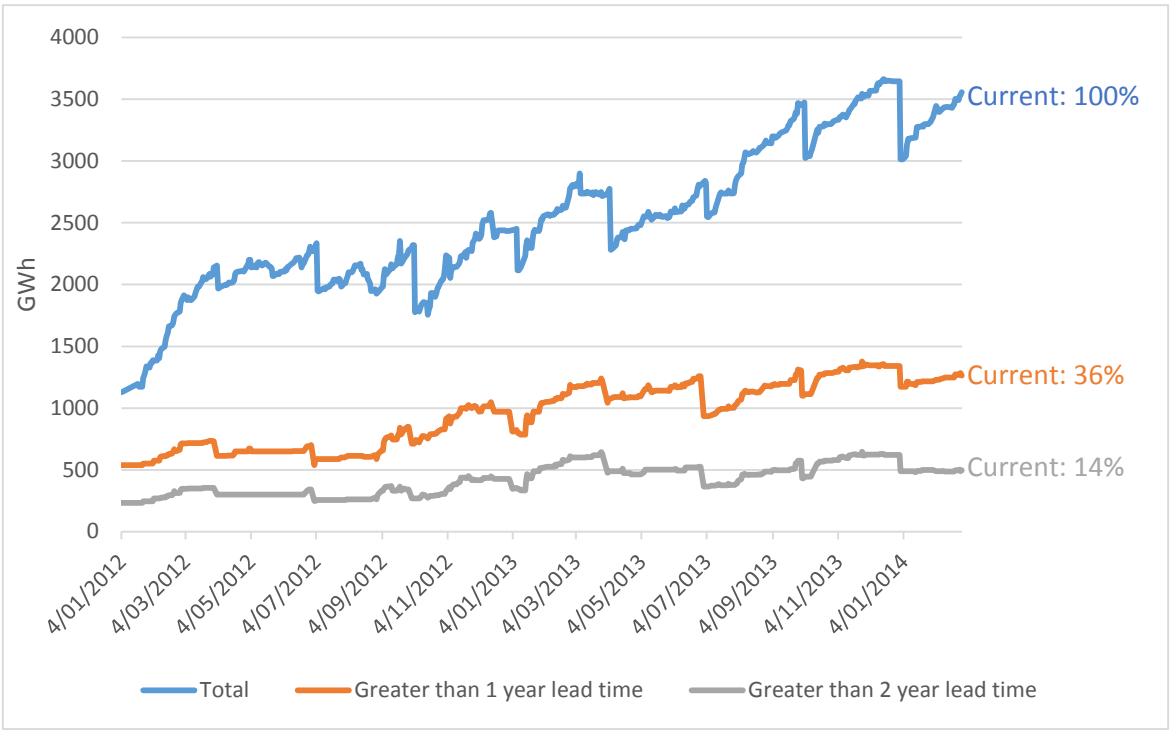
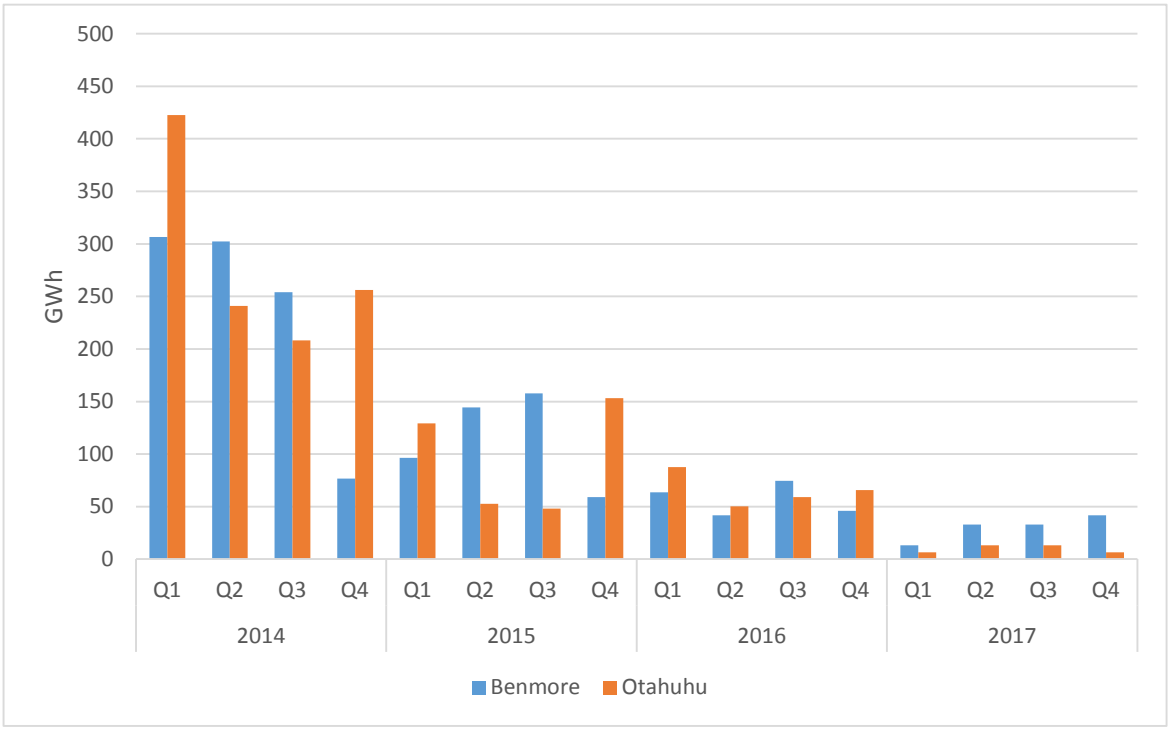


Figure 8: Breakdown of current ASX UOI by lead time



3.2.5 A key consideration for the NZ hedge market is the amount of trading carried out by financial institutions such as banks. The involvement of these parties may bring increased liquidity and lead to a wider range of OTC products becoming available.

3.2.6 One way to look at this issue is by breaking down hedge disclosure data on ASX trades by the identity of the buyer or seller (i.e. whichever of the parties to the hedge is *not* the ASX).

This analysis appears to show that the majority of traded volume on the ASX is confined to the four market makers

3.2.7 It appears that financial institutions have contributed only 10% of the traded volume logged on the Electricity Contracts website since the beginning of 2012

Figure 9: ASX traded volumes by trader (based on hedge disclosure data)

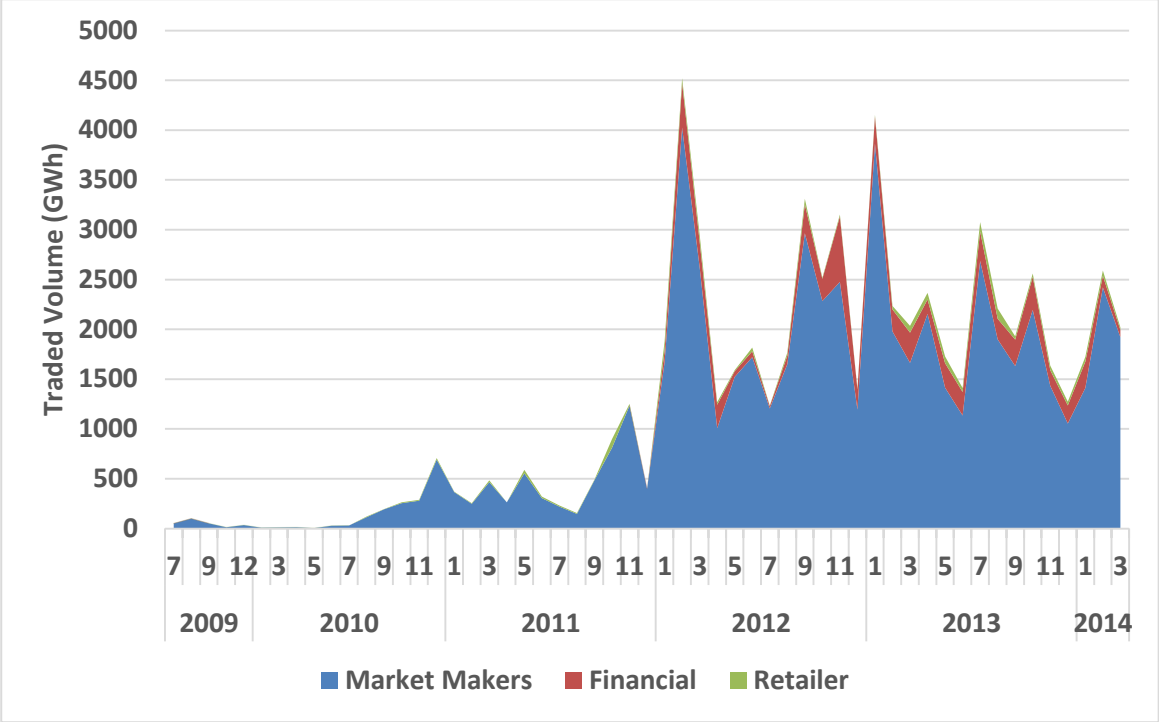
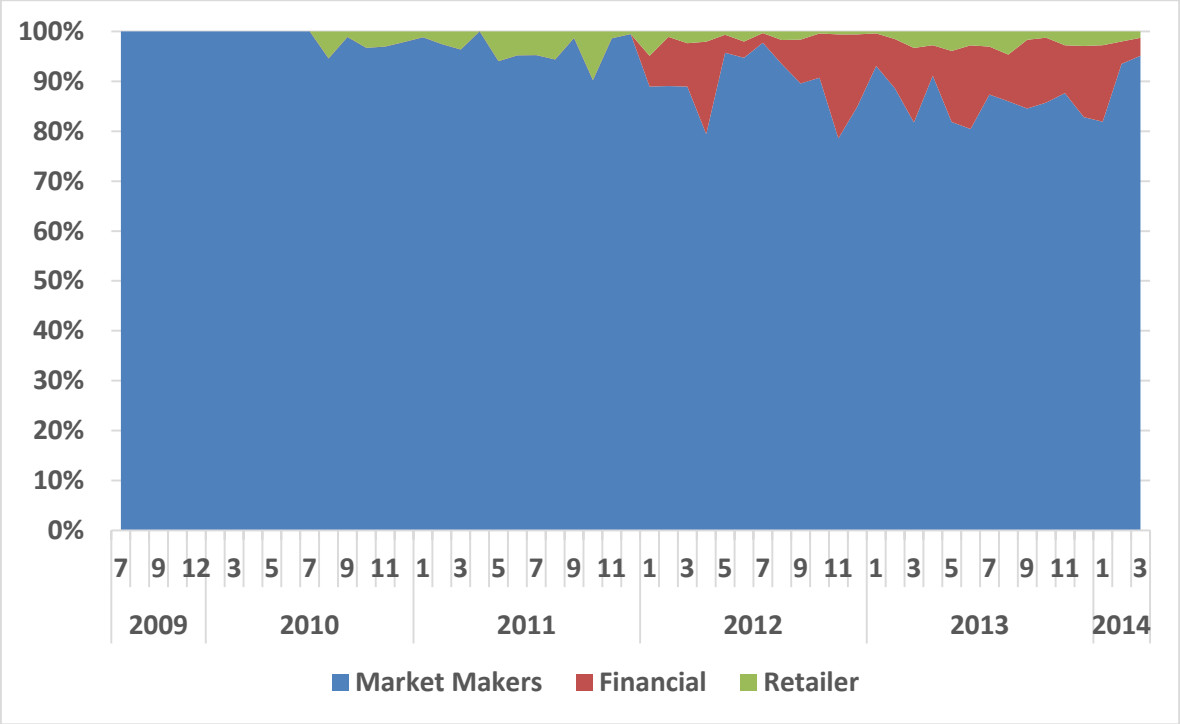


Figure 10: ASX traded volumes by trader (in percentage terms)



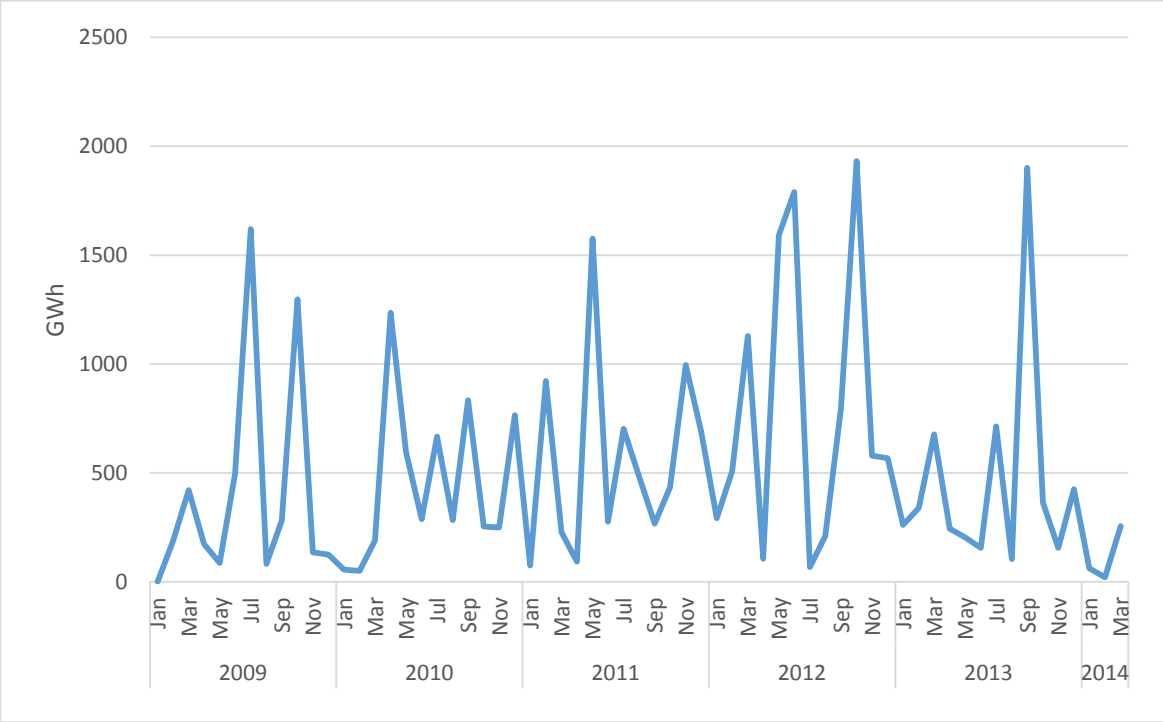
3.2.8 However, the analysis above may be misleading as the hedge disclosure for ASX is known to be incomplete. In particular, some financial institutions do not, or have not previously, disclosed all their ASX trades. .

3.2.9 It is clear that not all of the ASX transactions are being recorded on the Electricity Hedge Disclosure System website. In the 12 months ending 31 March 2014, 87%of ASX Sells and 88% of ASX Buys were logged on the website. Transactions entered into by parties with no office in New Zealand are not required to be logged on the website. In addition it is probable that a number of market participants within New Zealand are not meeting their obligation to record such transactions.

3.3 OTC CfD volumes

3.3.1 Traded volumes of OTC CfDs, according to the hedge disclosure data, are shown in Figure 11.

Figure 11: OTC CfD traded volumes



Hedge disclosure data is known to exclude some large trades. Trades with key fields missing, anomalous trades and arrangements associated with the 2010 industry reforms have also been excluded from this graph

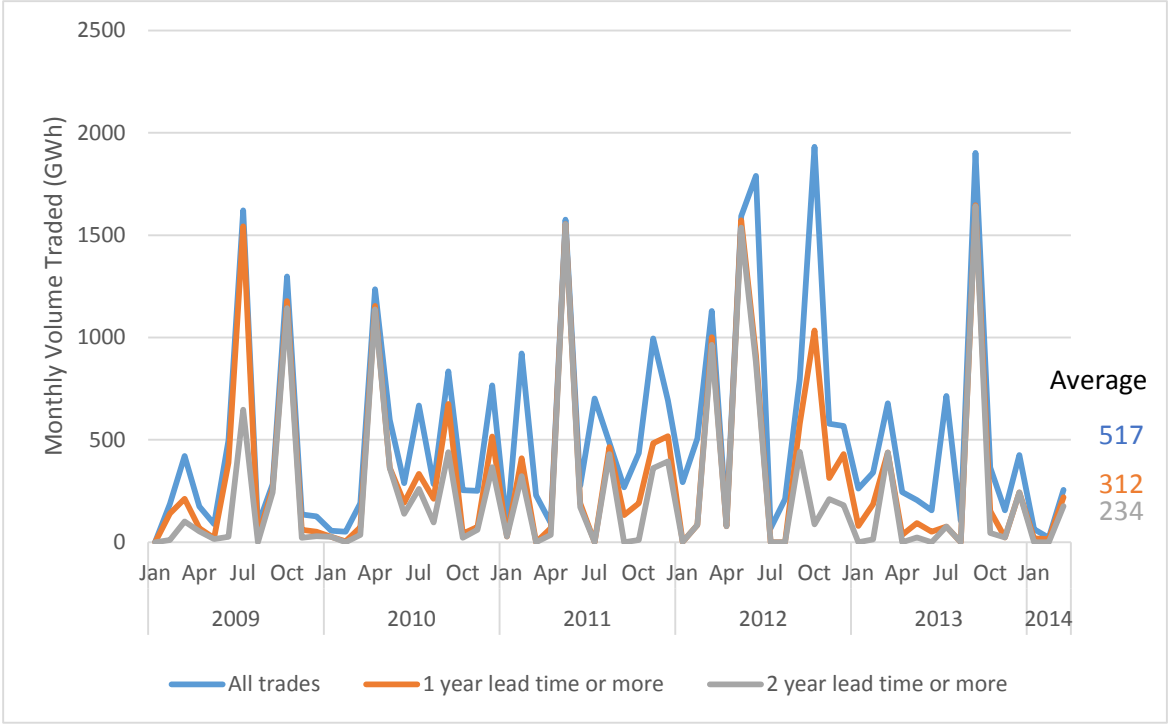
3.3.2 CfD trading volumes have varied substantially from month to month, but there has been no clear trend over the last five years.

3.3.3 As with the ASX, a key issue may be whether parties can obtain hedge cover for a year or more into the future. Disclosure data shows that, in recent years:

a) 60% of OTC CfDs (by volume) have had an expiry date at least a year into the future; and

b) 45% have had an expiry date at least two years in the future (Figure 12).

Figure 12: OTC CfD traded volumes by expiry date



This graph excludes some large trades – see notes below Figure 11.

3.3.4 These results suggest that there is substantial trading involving contracts two or more years into the future. This suggests that purchasers are able to access long term cover.

3.3.5 As with the ASX, a key issue is the amount of trading carried out by financial institutions such as banks. This issue can be assessed by using hedge disclosure data to break down traded volumes by the identities of the buyer and seller.

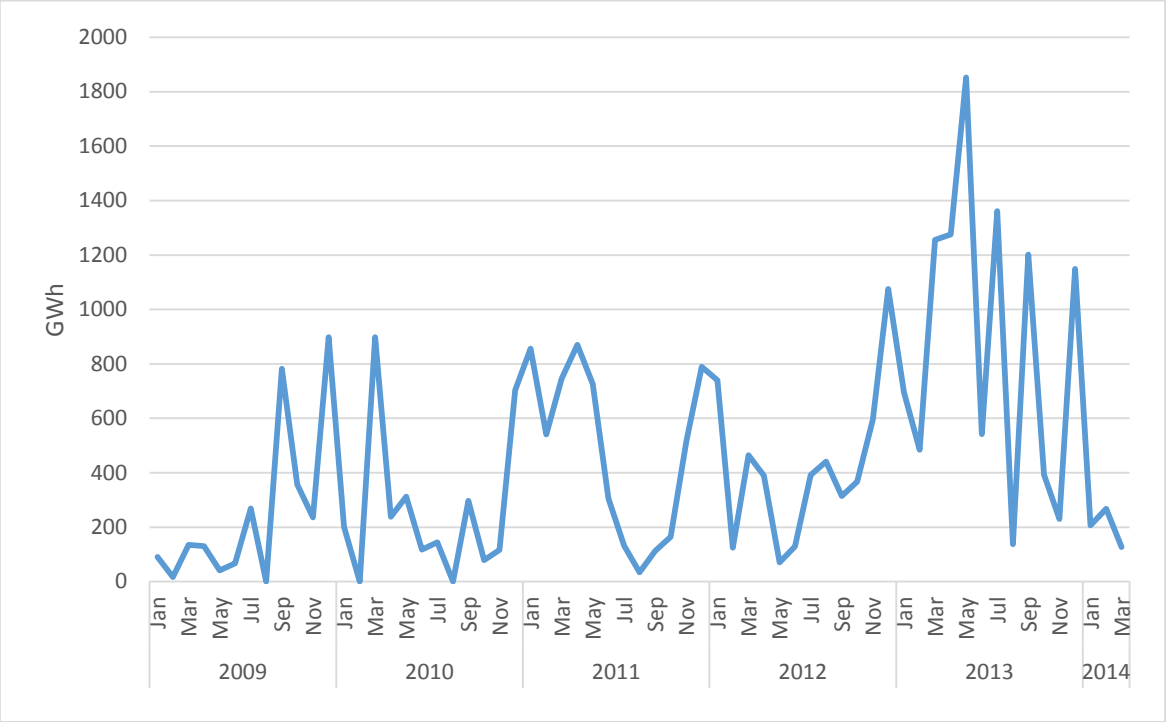
3.3.6 Most OTC CfDs (by volume) are sold by the "big 5" generator-retailers, but there is much more diversity amongst buyers.

3.3.7 Financial institutions appear to contribute only a small proportion of traded volume, both on the buying and the selling side.

3.4 OTC FPVV volumes

3.4.1 Traded volumes of OTC FPVVs, according to the hedge disclosure data, are shown in Figure 13.

Figure 13: OTC FPVV traded volumes



3.4.2 Trading volumes have varied from month to month, but were substantially higher in 2013 than in previous years.

3.5 Summary observations on volume

3.5.1 The ASX futures market is growing, but is still much smaller in relative terms than the NEM equivalent. Further growth in the market has the potential to bring increased depth and liquidity and more competitive pricing.

3.5.2 While it *is* possible to obtain hedge cover more than a year into the future on the ASX, traded volumes for long lead times are still relatively light and it may be difficult for parties to establish a long term position.

3.5.3 There may be scope to support the further growth of the ASX market. In developing any such initiatives, liquidity on longer time frames may warrant particular consideration.

3.5.4 The OTC CfD market has shrunk relative to the ASX but still remains important.

3.5.5 A significant proportion of OTC CfDs extend two years or more into the future.

3.5.6 Based on hedge disclosure data, the OTC FPVV market appears to be growing. The FPVV market forms an important part of the hedge market.

3.5.7 Participation in the hedge market by financial institutions still appears to be relatively light, and encouraging such participation may be an important part of growing the hedge market.

3.5.8 There is still more work to be done on quantifying un-hedged positions within the market. At the previous WAG it was suggested that “many of the generator-retailers may already be close to

having 20% of their position open or contracted with non-affiliates, particularly when the VAS contracts were considered". It may be possible to quantify this further based on publicly available information.

Question 1.	Does the WAG agree that there is scope for further growth in the ASX futures market, and that such growth could bring market benefits?
Question 2.	Does the WAG agree that OTC markets remain important, and that growth in the ASX futures market has the potential to drive improvements in the OTC markets?
Question 3.	Does the WAG consider that liquidity on longer time frames is important? If so, why is it important, and what could be done to support liquidity on longer time frames?
Question 4.	Does the WAG consider that hedge market participation by financial institutions is important? If so, why is it important, and what could be done to support participation by financial institutions?
Question 5.	What further analysis of hedge volumes could assist the WAG to reach conclusions about the efficiency or competitiveness of the hedge market?

4 Price

4.1 ASX vs spot

4.1.1 In investigating ASX prices, we define the "margin over spot" as the difference between:

a) the price of an ASX future at a given lead time (or averaged over a range of lead times); and

b) the mean spot price during the hedged period at the relevant location (Otahuhu or Benmore) – which is the price at which the future settles,

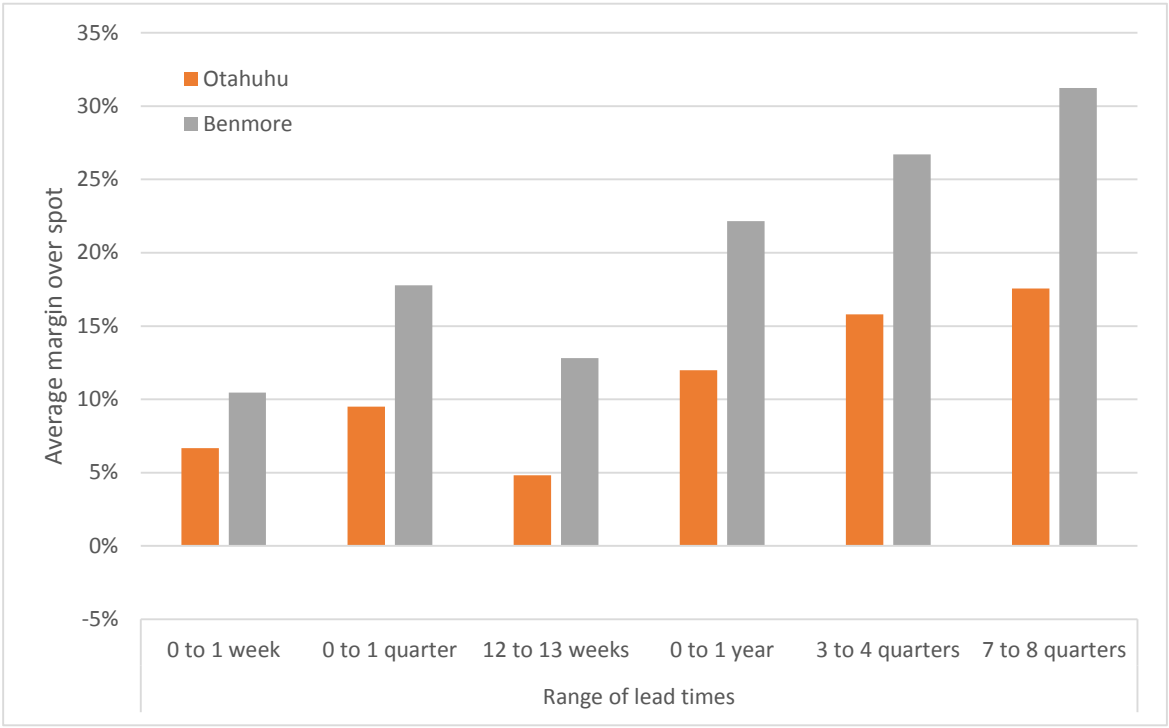
expressed as a percentage of (b) above.

4.1.2 The margin over spot is not known until the hedged period is complete.

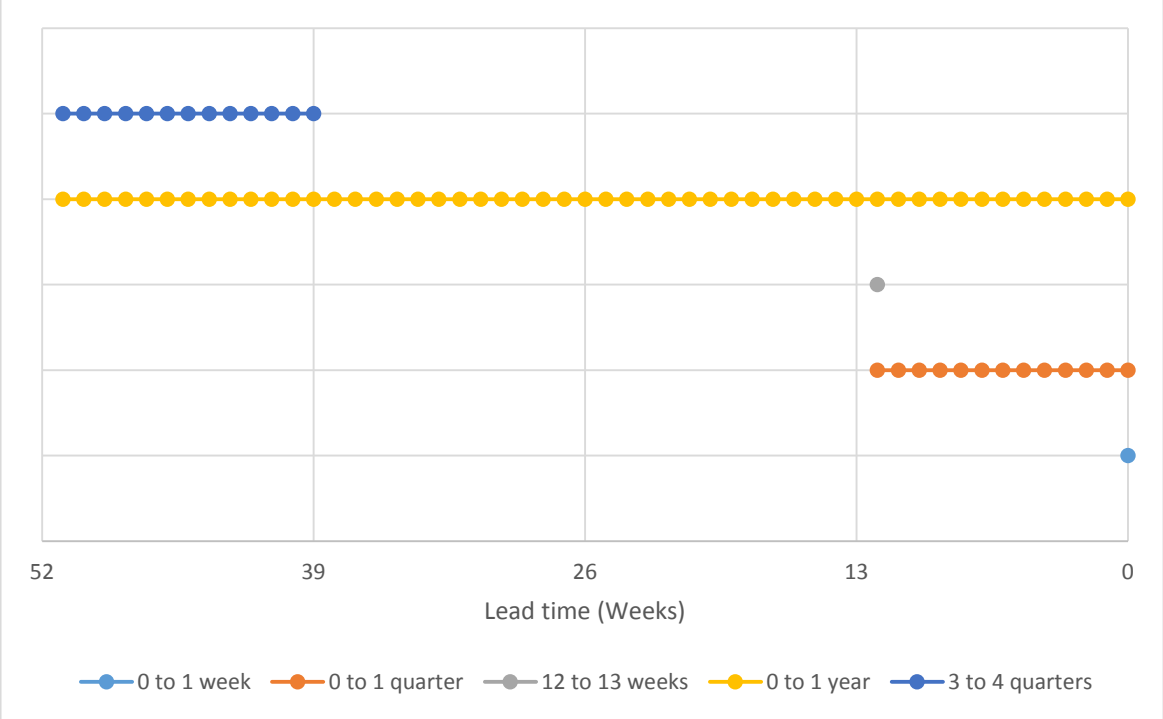
4.1.3 In a competitive futures market, it might be expected that the long-term average margin over spot would be driven by the cost of risk and the cost of providing prudentials. It might also include a risk premium reflective of the asymmetric price risk in the market. In a less competitive futures market, it might also include an additional premium, which would be profit for the seller.

4.1.4 Figure 14 shows ASX margins over spot, for hedged periods from 2010 to 2013, for various lead times.

Figure 14: ASX margins over spot for various lead times



The lead time ranges shown on the x-axis are illustrated graphically below. For instance, the pair of bars for '3 to 4 quarters' above are based on hedge prices at Otahuhu and Benmore, averaged over times between 3 and 4 quarters before the beginning of the hedge period (blue dots below).



4.1.5 For instance, over the period studied (the "ASX period"), the mean margin over spot at Otahuhu, for lead times between 3 and 4 quarters, was just over 15%.

4.1.6 It may be misleading to draw conclusions about the competitiveness of ASX pricing from such a short study period (four years) as:

a) the ASX market and the New Zealand wholesale market have both undergone significant change over that time; and

b) the four-year ASX period includes only a limited sample of hydrological conditions – which are a key driver of spot prices and hence of margins over spot. In dry conditions, spot prices are typically higher than average and (except for short lead times) margins over spot can be expected to be low.

4.1.7 In fact, the four-year ASX period appears to have been drier than average, as it included the dry summer/autumn of 2012 and no particularly wet years. As a rule of thumb, total hydrological inflows in the first six months of the calendar year can be used as a reasonable measure of hydrological conditions as they affect spot prices for the year. Over the four years in the ASX period, mean January-June inflows were approximately 12.2 TWh – 3% less than the long-term average which is approximately 12.6 TWh.

4.1.8 This suggests that in the long term, the average margin over spot could be expected to be *higher* than the 15% observed so far – all else being equal.

4.1.9 In the above analysis, the "price of an ASX future" at any given time is taken to be the "previous settlement" figure published by ASX. An alternative approach is to base the analysis on actual trade prices. Prices are only used from days on which there are trades. Under this approach,

margins over spot appear to be higher (Appendix B). This may be more reflective of the actual margins that participants experience.

4.1.10 In summary, it is apparent that ASX trades at a significant margin over spot – particularly for products with lead time of a year or more. These products have been observed to be at an average margin over spot of about 15%, and the long-term average could potentially be higher. It remains unclear whether these margins reflect real risks (or perceptions of risk), or otherwise suggest some inefficiency in ASX prices.

4.2 ASX at Otahuhu vs ASX vs Benmore

4.2.1 Figure 14 shows substantially higher average margins over spot at Benmore than Otahuhu, over the four-year "ASX period" studied – even though the ASX period included one unusually dry year (2012), in which it might be expected that margins over spot would have been lower at Benmore than at Otahuhu.

4.2.2 This section focuses on the difference in ASX prices between Otahuhu and Benmore.

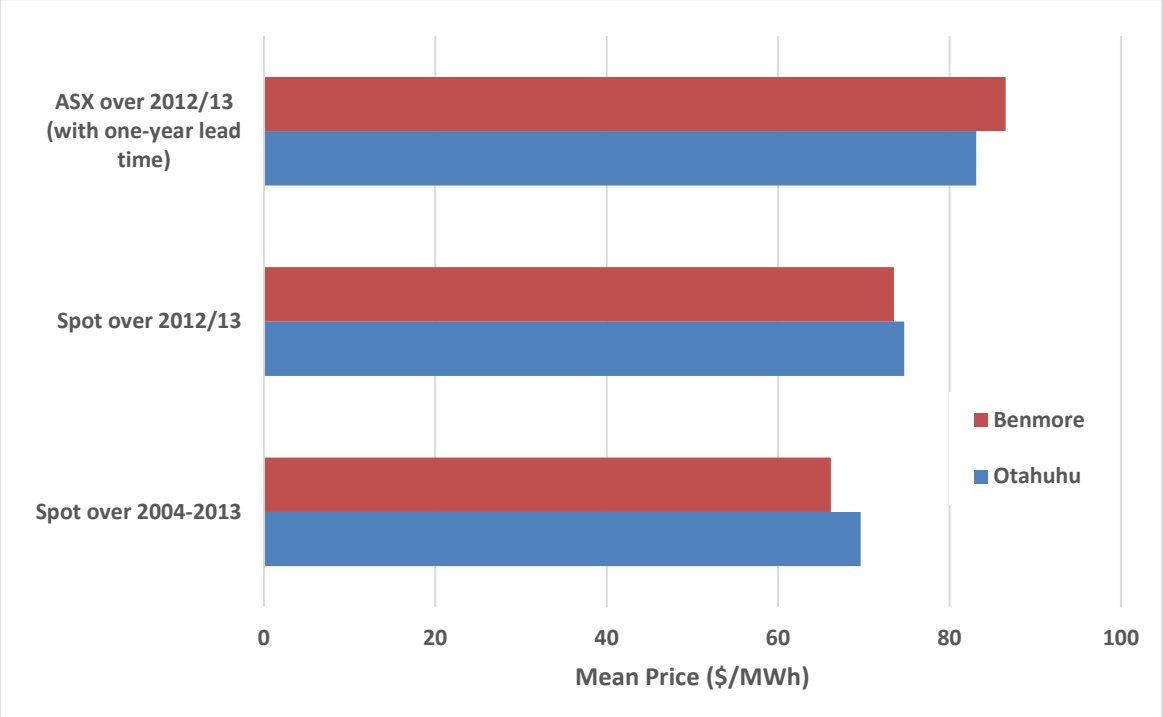
4.2.3 As shown in Figure 15:

a) over 2012-13, the mean ASX price at Otahuhu (for a one-year lead time, and using the "previous settlement" index) was $83.1/MWh and the mean ASX price at Benmore was $3.4/MWh higher at $86.5/MWh.

b) in contrast, over the same period, the mean spot price at Otahuhu was $74.3/MWh and the mean spot price at Benmore was $1/MWh *lower* at $73.3/MWh and

c) further, over the decade ending December 2013, the mean spot price at Otahuhu was $68.7/MWh and the mean spot price at Benmore was $3.7/MWh *lower* at $65.0/MWh.

Figure 15: Comparison of prices between Otahuhu and Benmore



4.2.4 Several factors may contribute to the higher average margins over spot observed at Benmore, including:

a) higher dry-year price risk at Benmore,

b) narrower participation, and hence less competition, in the Benmore ASX market.

4.2.5 The availability of FTRs may lead to much of the difference in price between ASX products at Otahuhu and Benmore being arbitraged away – it is probably still too early to tell.

4.3 ASX vs its predecessor, EnergyHedge

4.3.1 Appendix A compares ASX with its predecessor, EnergyHedge, and concludes that:

a) ASX margins over spot at Otahuhu may be lower than EnergyHedge margins over spot were, for short lead times; but

b) ASX margins over spot at Otahuhu may be several percentage points higher than EnergyHedge margins over spot, for lead times of a year or more.

4.3.2 Caution should be applied in drawing any conclusions from this analysis – it is not clear whether the results are an accurate reflection of the true underlying differences between the two markets.

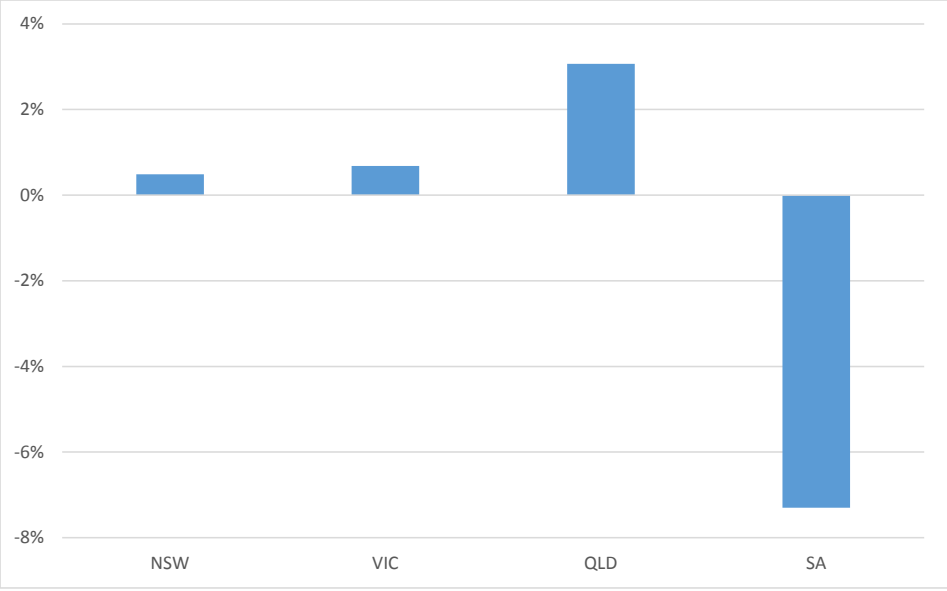
4.4 ASX vs other jurisdictions

4.4.1 It would seem useful to compare margins over spot between ASX and other exchange-traded futures markets in other jurisdictions.

4.4.2 It can be difficult to access historical price data for most other futures markets. However, just over a year's worth of Australian electricity futures prices has been obtained. Expectations are that a longer record will be obtained in due course.

4.4.3 Figure 16 shows margins over spot in the Australian electricity futures market, for the year to end Mar 2014, for monthly products at a one-month lead time.

Figure 16: Australian electricity futures - average margins over spot, for a one-year period

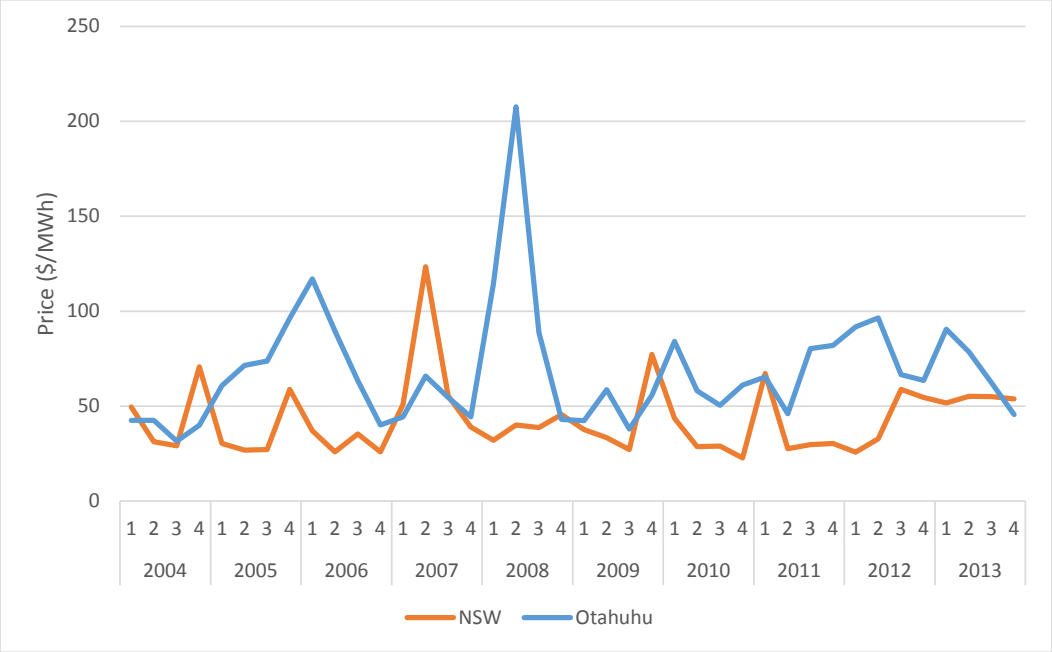


4.4.4 It is hard to draw any conclusions from such a short study period. In particular, the figure for South Australia appears to be an outlier driven by unexpected spot price variation. New South

Wales and Victoria had extremely modest margins over spot (but could potentially have turned out differently if spot prices had been different). Queensland had a slightly higher margin over spot.

4.4.5 In comparing hedge market pricing between the NEM and New Zealand, it is important to bear in mind that the two markets experience different levels of spot price volatility (Figure 17).

Figure 17: Quarterly mean spot prices - comparison between the NEM and New Zealand



4.4.6 Quarterly mean spot prices for New South Wales include occasional single-quarter spikes, while New Zealand spot prices include occasional longer peaks brought about by hydrology (most notably Q1/Q2 2008).

4.4.7 Ideally it would be possible to compare with other jurisdictions as well.

4.5 OTC CfDs vs ASX: like-for-like comparisons

4.5.1 In a fully competitive hedge market, it might be expected that OTC CfD prices would be similar to the prices of equivalent ASX products, with an additional premium for credit risk and/or search costs. Exceptions to this rule would be OTC contracts that are not straightforward CfDs – for instance, having force majeure clauses or suspension clauses.

4.5.2 For the purpose of this paper, we say an OTC CfD is "directly comparable" with the ASX if it:

a) was traded after New Zealand electricity futures began trading on ASX;

b) was not traded on ASX or EnergyHedge;

c) had a hedged period that consists of one calendar quarter or one calendar year;

d) covered all trading periods; and

e) did not include any trades with special clauses.

4.5.3 The hedge disclosure database includes 139 OTC CfDs that appear to be directly comparable with the ASX. We can compare the prices of these OTC contracts with prices for the equivalent ASX

products on the same lead times. This may be informative as to whether OTC CfDs have been priced at a reasonable margin over ASX – though it may not be valid to extrapolate the conclusions to OTC CfDs that are *not* directly comparable with the ASX.

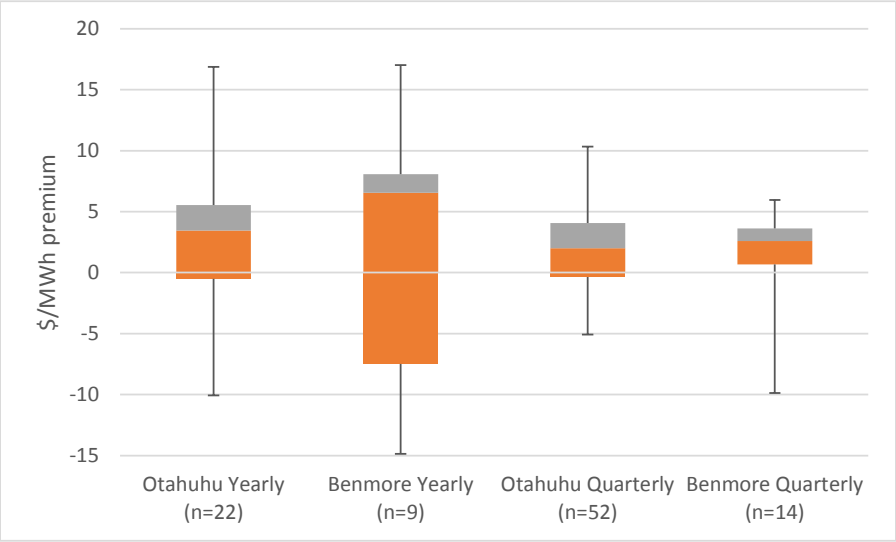
4.5.4 Figure 18 shows the distribution of differences in price between OTC CfDs and directly comparable ASX products with the same lead time. This analysis includes:

a) OTC CfDs in Grid Zone Area A, which are compared with ASX products at Otahuhu *(note that Grid Zone Area A includes Auckland, and all contracts in this area are converted to an equivalent Otahuhu price);*

b) similarly Grid Zone Area E and Benmore; and

c) OTC CfDs in other areas, which are "price-converted" to Benmore for South Island regions and Otahuhu for North Island regions, by using the average location factor for the year of the OTC CfD's trade date.

Figure 18: Differences in price between OTC CfDs and directly comparable ASX products



4.5.5 For OTC CfDs that are directly comparable with ASX, the median difference in price between the OTC and ASX appears to be about $3/MWh. This seems to suggest that OTC CfDs are priced at a reasonable margin above ASX. However, the sample size is small and there is considerable volatility about the median (some of which may be driven by inaccuracies in the hedge disclosure data).

4.6 OTC CfDs vs spot

4.6.1 This subsection attempts to compare OTC CfD prices with spot prices, in order to form conclusions about how competitively OTC CfDs have been priced. The analysis is based on hedge disclosure data, and the WAG should bear in mind the caveats about the accuracy of the disclosure data.

4.6.2 Some OTC CfDs are not informative about the competitiveness of pricing, for various reasons. The analysis below is restricted to a subset of "pricing-informative" OTC CfDs – defined as all CfDs in the hedge disclosure database, *except*:

a) those that were traded on the ASX or EnergyHedge;

b) those without a valid price, or with a quantity less than 0.1 MW;

c) those that have a hedged period shorter than a month;

d) those for which the lead time is less than zero (i.e. the trading date falls after the start of the hedged period);

e) those for which the gap between the trading date and the *midpoint* of the hedged period is less than 60 days (as empirical analysis shows that the pricing of such hedges is heavily influenced by expected hydrology);

f) those for which the hedged period does not have final prices (i.e. those in the future).

g) those that only cover a subset of trading periods;

h) those shown as having adjustment clauses, special credit clauses or "other clauses";

i) those with status of "long term dispute"; and

j) some specific trades that appear to have been at non-standard prices.

4.6.3 On this basis, the hedge disclosure database includes 344 pricing-informative CfD contracts.

4.6.4 When examining the pricing of OTC CfDs, it is important to take account of seasonality and location factors. We do this by calculating a measure of price that is corrected for seasonal and locational differences, and proceeding to investigate these corrected prices instead of raw prices.

4.6.5 For the purpose of this paper, we define "margin over seasonality" as the difference between:

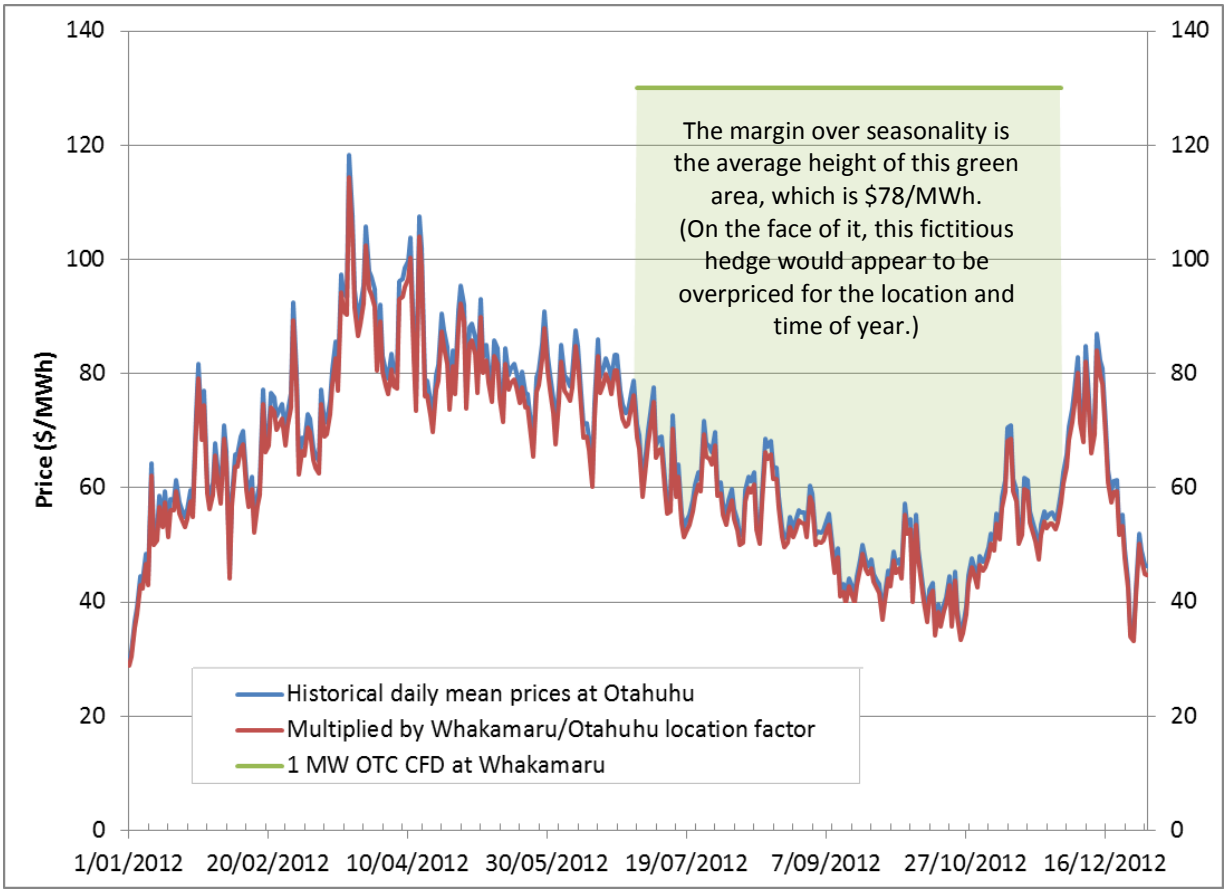
a) the price of a pricing-informative OTC CfD; and

b) the mean spot price over the same times of year during 2002-2011 at the island reference node, multiplied by a long-term location factor for the reference node of the grid zone area in which the hedge is located.

4.6.6 For instance, the margin over seasonality of a {1 MW OTC CfD at Whakamaru covering 1 Jul 2012 – 30 Nov 2012} would be the CfD price minus [the mean price at Otahuhu in the months of July-November for 2002-2011, multiplied by a long-term location factor for Whakamaru relative to Otahuhu].

4.6.7 This calculation is illustrated in Figure 19.

Figure 19: Illustration of the "margin over seasonality" calculation



4.6.8 It does not seem appropriate to interpret the margin over seasonality in absolute terms, because the historical mean spot price may not be a good guide to the true cost of energy to the seller.

4.6.9 For instance, just because a CfD has a margin over seasonality of $30/MWh need not mean that the seller makes a net return of $30/MWh – let alone that the trade is uncompetitively priced; in fact, even if the seller *was* making a return of $30/MWh, this might be appropriate given the cost of risk and other transactional costs.

4.6.10 However, the margin over seasonality may be useful in *relative* terms, when comparing the pricing of different groups of CfDs. If one group of CfD typically has a higher margin over seasonality than another, this may suggest either that:

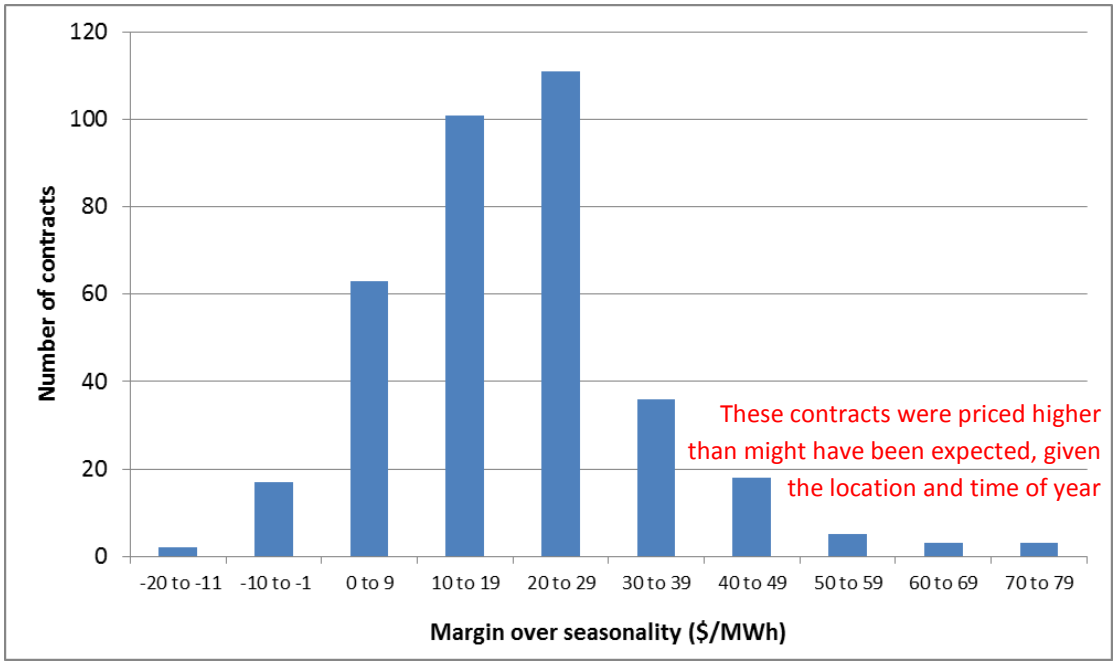
a) CfDs in the former group are less competitively priced;

b) CfDs in the former group come at some additional cost to the seller, or those in the latter group come at some additional cost to the buyer; or

c) CfDs in the former group are, for some other reason, more attractive to the seller or less attractive to the buyer.

4.6.11 Unfortunately it is difficult to draw firm conclusions from such comparisons, because of the level of variability in the data. The hedge disclosure data shows considerable variation in margin over seasonality, even among pricing-informative OTC CfDs (Figure 20). Some of this variation may result from data errors.

Figure 20: Variability in "margin over seasonality" for pricing-informative OTC CfDs



4.6.12 Nevertheless, we proceed to run some comparisons between different groups of CfDs, in the hope that it may be informative.

4.6.13 For pricing-informative OTC CfDs, the average margin over seasonality is compared:

a) between the five grid zone areas in the disclosure database – which are referenced to Otahuhu, Whakamaru, Haywards, Islington and Benmore – in Figure 21 (note that the margin over seasonality already takes into account long-term location factors);

b) between small, medium and large hedge quantities (in MW), in Figure 22;

c) between small, medium and large hedge volumes (in GWh), in Figure 23;

d) between short, medium, and long hedged periods, in Figure 24 (though note that hedged periods less than one month are excluded);

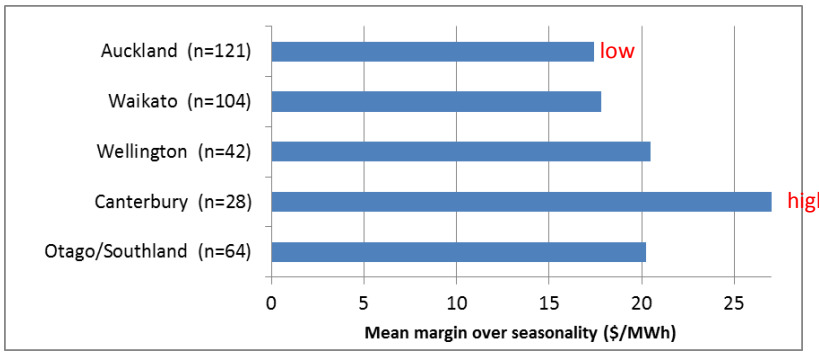
e) between short, medium and long lead times, in Figure 25 (though note that hedges with a gap of less than 60 days between the trading date and the midpoint of the hedged period, which make up the majority of hedges with short lead times, have been excluded);

f) between key groups of sellers and buyers, in Figure 26 and Figure 27; and

g) between contracts with and without force majeure clauses or suspension clauses, in Figure 28.

4.6.14 For instance, Figure 28 shows that OTC CfDs tend to have a lower price if they have force majeure clauses (relative to the average spot price at the relevant location and time of year). The suggestion is that such clauses make the contract less appealing to the buyer.

Figure 21: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by grid zone area



Note: grid zone areas are labelled in terms of the GXP to which the area is referenced

Figure 22: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by hedge quantity (in MW)

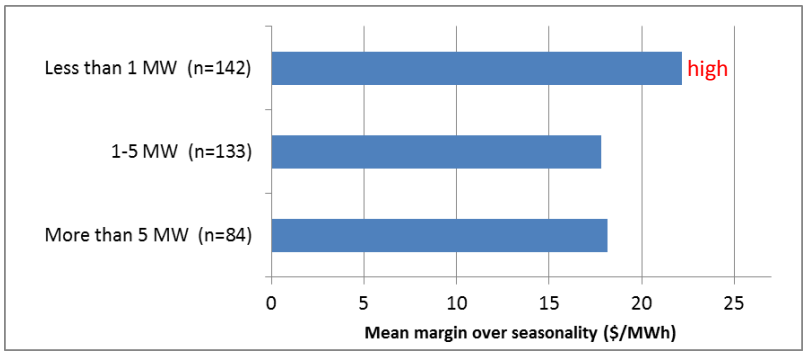


Figure 23: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by hedge volume (in GWh)

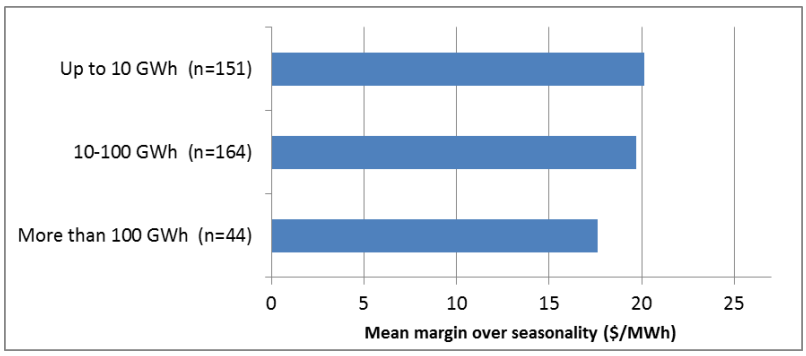


Figure 24: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by duration (i.e. the length of the hedged period)

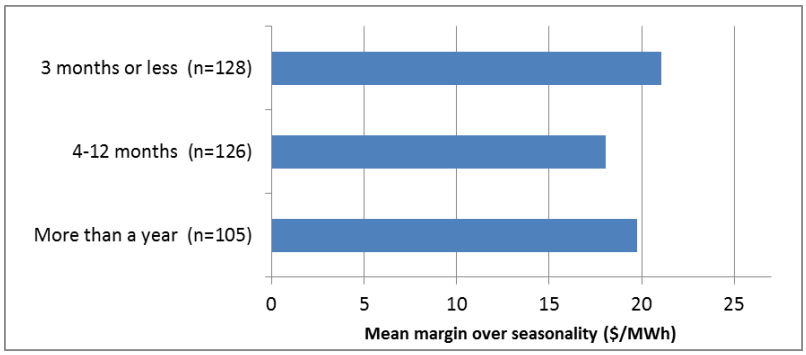


Figure 25: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by lead time

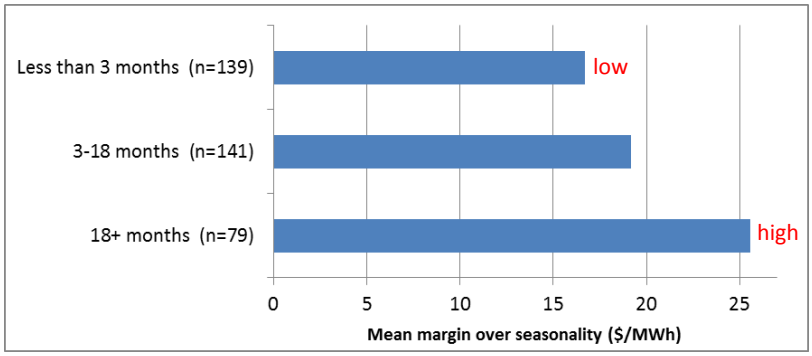
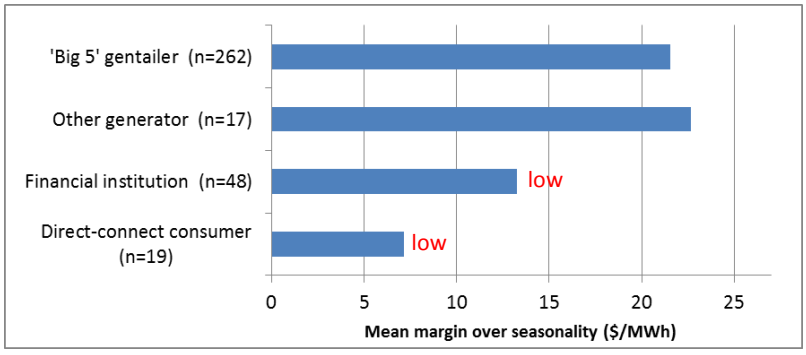
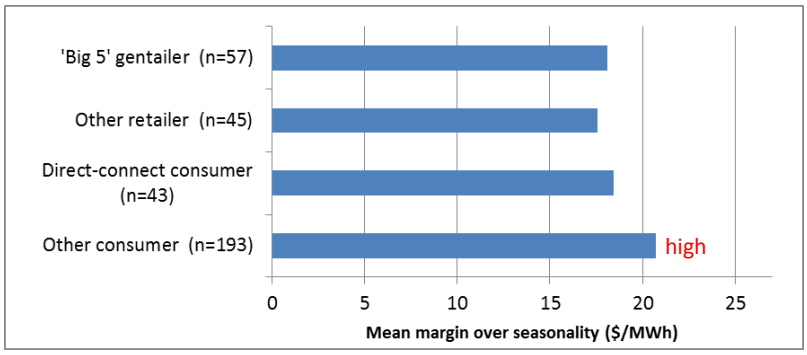


Figure 26: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by the identity of the seller



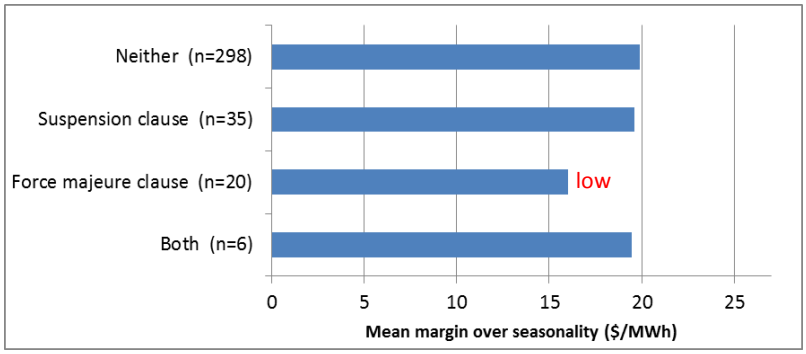
Other groups of participants are not shown due to insufficient sample size.

Figure 27: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by the identity of the buyer



Other groups of participants are not shown due to insufficient sample size

Figure 28: Average "margin over seasonality" for pricing-informative OTC CfDs, broken down by whether the CfD has force majeure clauses and/or suspension clauses



4.6.15 Bearing in mind the caveats above – in particular, that there is a high level of variability around the data shown, so that trends that hold on average may not hold in all cases – these graphs suggest that (on average) OTC CfDs have been priced:

a) higher in the South Island than the North Island (relative to mean spot prices);

b) considerably higher in the Canterbury region than in other areas *(although the sample size for Canterbury is quite small)*;

c) higher for quantities under 1 MW than for larger quantities *(although this may have been driven in large part by the nature of these small hedges and the parties involved, rather than because the quantities were small);*

d) lower for short lead times (i.e. less than a quarter) and higher for long lead times (i.e. over 18 months) *(bearing in mind that contracts with a negative lead time, or with a gap of less than 60 days between the traded date and halfway through the hedged period, were excluded from the analysis);*

e) slightly higher when the buyer was a non-direct-connect consumer; and

f) lower when the contract included force majeure clauses.

4.7 OTC FPVVs vs spot

4.7.1 This subsection attempts to compare OTC FPVV prices with spot prices, in order to form conclusions about how competitively OTC FPVVs have been priced. Again, the analysis is based on

hedge disclosure data, and the WAG should bear in mind the caveats about the accuracy of the disclosure data.

4.7.2 The analysis below is restricted to a subset of "pricing-informative" OTC FPVVs – defined as all FPVVs in the hedge disclosure database, *except*:

a) those without a valid price;

b) those that have a hedged period shorter than a month; and

c) those for which the lead time is less than zero (i.e. the trading date falls after the start of the hedged period – this is quite frequent), or the gap between the trading date and the *midpoint* of the hedged period is less than 60 days.

4.7.3 The hedge disclosure database includes 533 "pricing-informative" FPVV contracts.

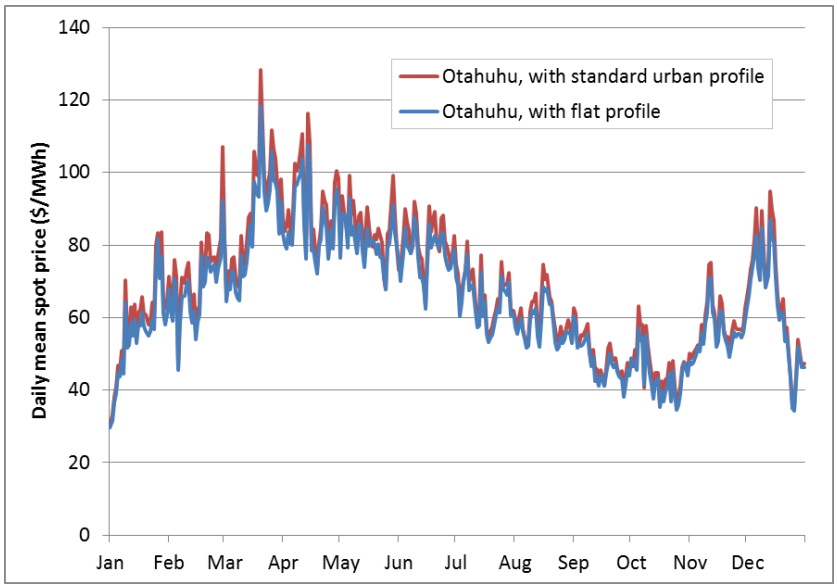
4.7.4 When examining the pricing of OTC FPVVs, it is important to take account of seasonality, location factors, and (to the extent possible) the customer's profile. We define "margin over seasonality *with flat profile*" in the same way as we defined "margin over seasonality" for OTC CfDs, and "margin over seasonality *with shaped profile*" as the difference between:

a) the price of a pricing-informative OTC FPVV; and

b) the mean spot price over the same times of year during 2002-2011 at the island reference node, *applying a standard urban weekly profile,* multiplied by a long-term location factor for the reference node of the grid zone area in which the hedge is located.

4.7.5 Figure 29 shows daily average spot prices at Otahuhu over the last few years, using a flat profile (red line) and a standard urban weekly profile (blue line). It can be seen that the profiled price is higher – the average difference between the two lines is about $3/MWh. This is just one of the reasons why FPVVs for profiled loads may be priced higher than CfDs.

Figure 29: Effect of applying a profile to daily mean spot prices

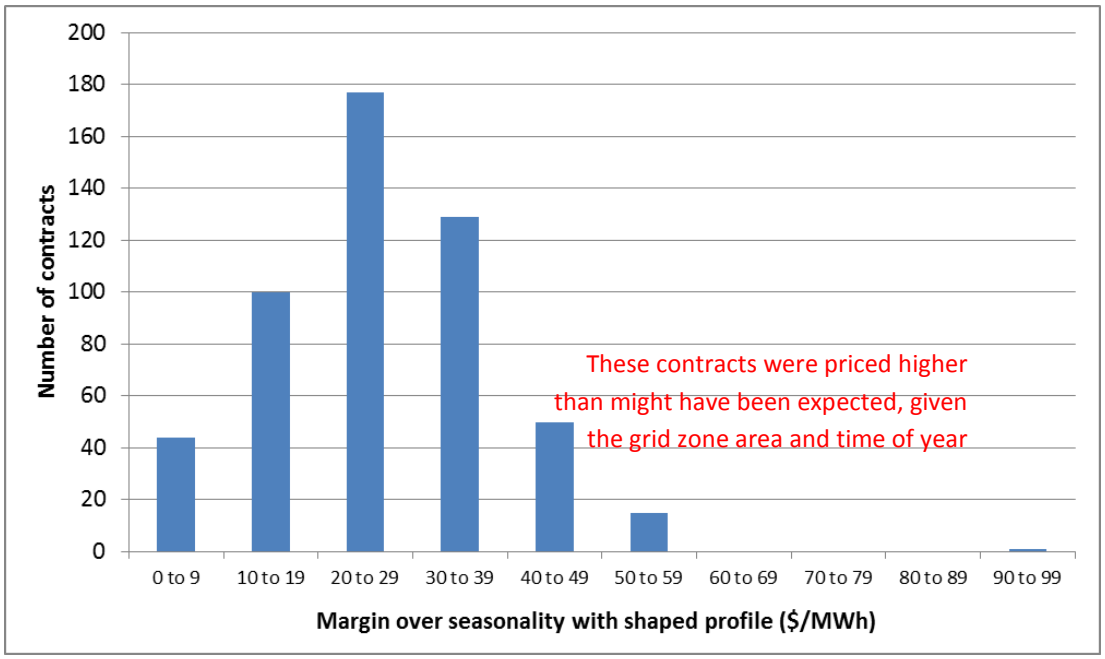


4.7.6 As with CfDs, it does not seem appropriate to interpret the margin over seasonality in absolute terms. However, the margin over seasonality may be useful in *relative* terms, when comparing the pricing of different groups of FPVVs.[2]

4.7.7 It may also be useful to compare "margin over seasonality" between OTC CfDs and OTC FPVVs. On first principles one would expect that the margin over seasonality would typically be higher for FPVVs, which expose the seller to volume risk and profile risk.

4.7.8 As with CfDs, the analysis of FPVVs is made more difficult by the presence of considerable variability in the data (Figure 30). Some of this variability may result from data errors.

Figure 30: Variability in "margin over seasonality with shaped profile" for pricing-informative OTC FPVVs



4.7.9 Nevertheless, we proceed to run some comparisons between different groups of FPVVs, in the hope that it may be informative.

4.7.10 For pricing-informative OTC FPVVs, the average margin over seasonality *with shaped profile* is compared:

a) between the five grid zone areas included in the disclosure database, in Figure 31 (note that the margin over seasonality already takes into account long-term location factors);

b) between short, medium, and long hedged periods, in Figure 32;

c) between short, medium and long lead times, in Figure 33; and

d) between contracts with and without force majeure clauses or suspension clauses, in Figure 34.

[2] It may also be useful to compare "margin over seasonality" between OTC CFDs and OTC FPVVs (for which, see next section). On first principles one would expect that the margin over seasonality would typically be higher for FPVVs, which expose the seller to volume risk and profile risk.

4.7.11 For instance, Figure 31 shows that FPVV contracts in the South Island are usually priced higher than those in the North Island, relative to profiled mean spot prices in the area and at the time of year. This may suggest that there is more competition in the North Island FPVV market.

4.7.12 No comparisons between groups of buyers or sellers have been attempted for FPVVs, as almost all those in the database were sold by a "big 5" generator-retailer to a non-direct-connect consumer.

Figure 31: Average "margin over seasonality with shaped profile" for pricing-informative OTC FPVVs, broken down by region

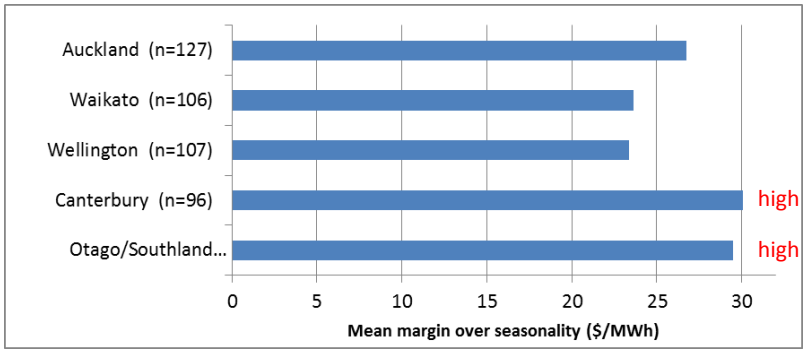


Figure 32: Average "margin over seasonality with shaped profile" for pricing-informative OTC FPVVs, broken down by hedged period

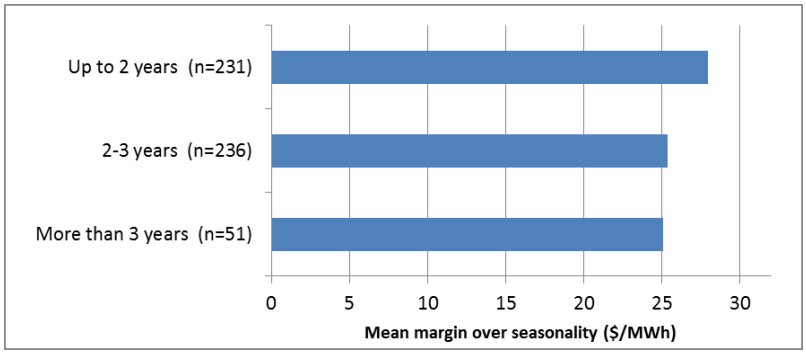


Figure 33: Average "margin over seasonality with shaped profile" for pricing-informative OTC FPVVs, broken down by lead time

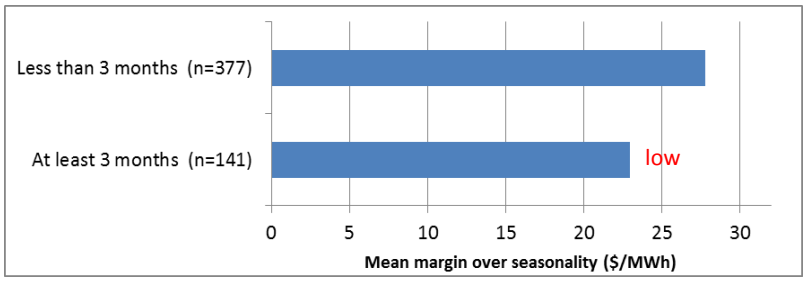
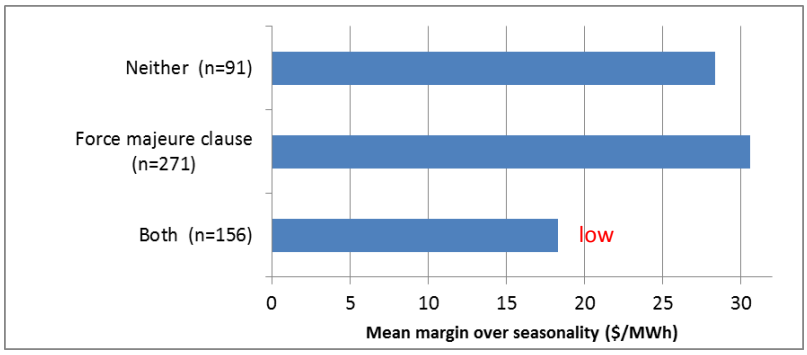


Figure 34: Average "margin over seasonality with shaped profile" for pricing-informative OTC FPVVs, broken down by whether the contract has force majeure clauses and/or suspension clauses



4.7.13 Bearing in mind the caveats above – in particular, that there is a high level of variability around the data shown, so that trends that hold on average may not hold in all cases – these graphs suggest that (on average) OTC FPVVs have been priced:

a) higher in the South Island than the North Island (relative to mean spot prices);

b) slightly higher in the Auckland region than elsewhere in the North Island;

c) lower for longer lead times (i.e. at least a quarter) *(note, this is the opposite to the trend observed for CfDs, where the margin over seasonality tended to be lower for short lead times)*; and

d) lower when the contract included suspension clauses.

4.8 Summary observations on price

4.8.1 It is apparent that ASX trades at a significant margin over spot. It remains unclear whether these margins reflect real risks (or perceptions of risk), or otherwise suggest some inefficiency in ASX prices.

4.8.2 The size of the margin in ASX compared to spot is particularly significant for products with lead time of a year or more. These products have been observed to be at an average margin over spot of about 15%, and the long-term average could potentially be higher.

4.8.3 Average ASX margins over spot have been higher at Benmore than at Otahuhu – but this difference may be arbitraged away to some extent in the future by trading in FTRs.

4.8.4 It should be possible to compare ASX margins over spot with those of Australian electricity futures, once the relevant data is obtained. Care should be taken in doing so, as the underlying volatility of spot prices is quite different in Australia.

4.8.5 OTC CfDs that are directly comparable to ASX futures appear to be priced only slightly above the ASX price.

4.8.6 For pricing-informative OTC FPVVs, the average "margin over seasonality with shaped profile" is estimated to be about $26/MWh. This is only $7/MWh greater than for OTC CfDs – arguably not a large premium, considering the additional profile risk and volume risk associated with FPVVs. The suggestion may be that FPVVs are at a reasonable margin above CfDs and futures.

4.8.7 Margins appear higher for CfDs with long lead times.

4.8.8 In contrast, long-term FPVV contracts do not have higher margins than short-term FPVV contracts.

4.8.9 Both for CfDs and FPVVs, it appears that margins in the South Island market may be higher than the North Island market. OTC CfD margins in Canterbury seem unusually high (although this is based on a relatively small number of contracts).

4.8.10 It appears that consumers may pay an additional premium for small CfDs (under 1 MW) – although closer examination of the data shows that part of the observed difference in prices is driven by the other characteristics of these small contracts, rather than by the smaller size alone. Contracts of this size are not available on the ASX.

4.8.11 Contracts with force majeure and/or suspension clauses appear to be priced at a discount, though it is not clear whether the discount adequately reflects the additional risk to the buyer.

4.8.12 Hedge disclosure data are indispensable if analysis of OTC prices is to be carried out. However, the existing disclosure data are known to have some omissions and inaccuracies – all the above conclusions with regards to OTC contracts should be caveated accordingly.

Question 6.	Does the WAG have views on the extent to which the ASX is competitively priced?
Question 7.	Does the WAG have views on the extent to which OTC CfDs are competitively priced?
Question 8.	Does the WAG have views on the extent to which OTC FPVVs are competitively priced?
Question 9.	In the part(s) of the hedge market where prices are less competitive, what should be done to support competition?
Question 10.	What further analysis of hedge prices could assist the WAG to reach conclusions about the efficiency or competitiveness of the hedge market?

5 Depth and liquidity

5.1 Participation

5.1.1 One sign of a liquid market is usually considered to be broad participation.

5.1.2 Figure 35 shows how the number of active participants in the ASX market has increased over time, and Figure 36 shows the equivalent for the OTC CfD market. Both graphs are based on hedge disclosure data – the caveats about data completeness apply.

Figure 35: Number of participants in the ASX market

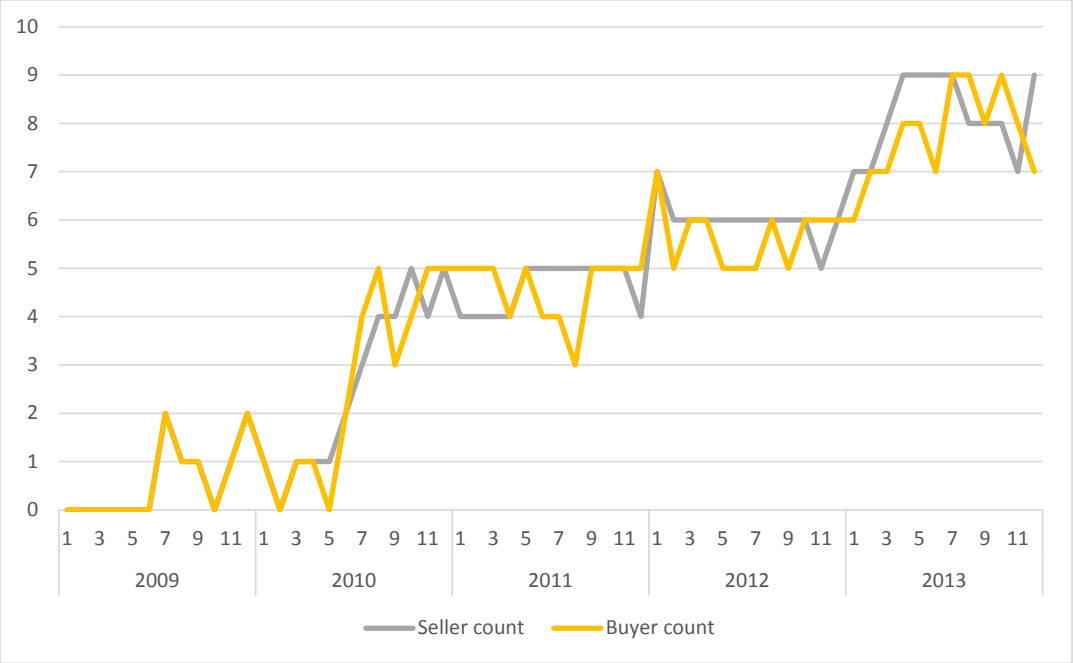
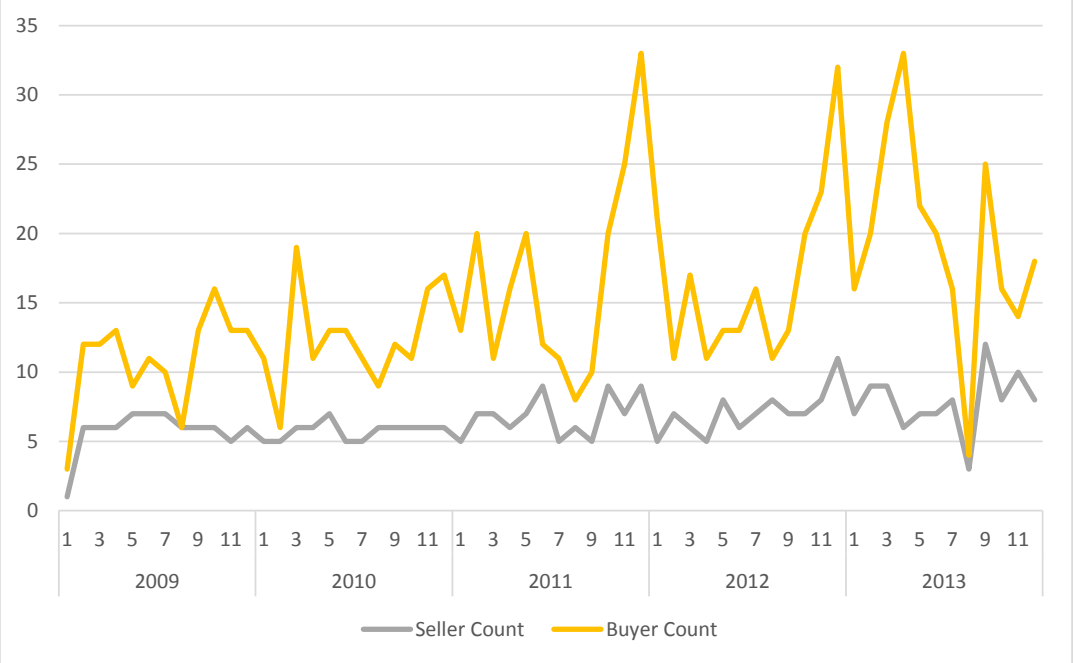


Figure 36: Number of participants in the OTC CfD market



5.1.3 Figure 37 and Figure 38 show concentration in the ASX and OTC CfD markets, using the Herfindahl–Hirschman Index (HHI) metric. HHI is a way of measuring diversity in a market. It is more informative than just using number of participants, as it takes account of the market share of each participant. A HHI of 10,000 is a perfect monopoly, and some consider that an HHI of 2,500 or lower represents a competitive market.

Figure 37: Level of concentration of the ASX market

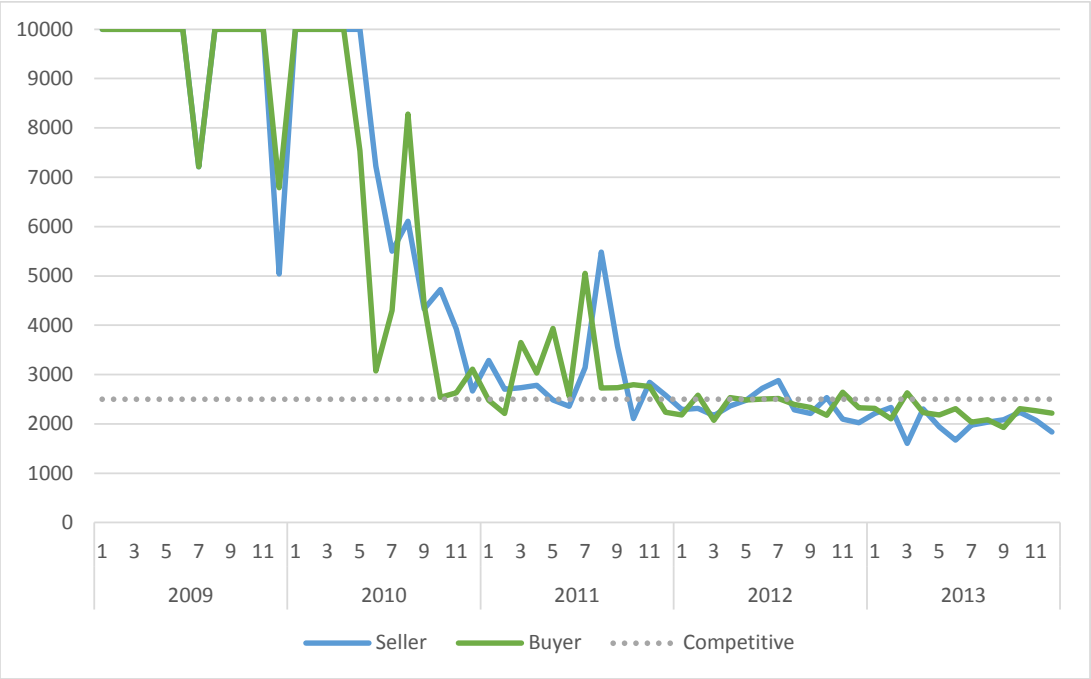
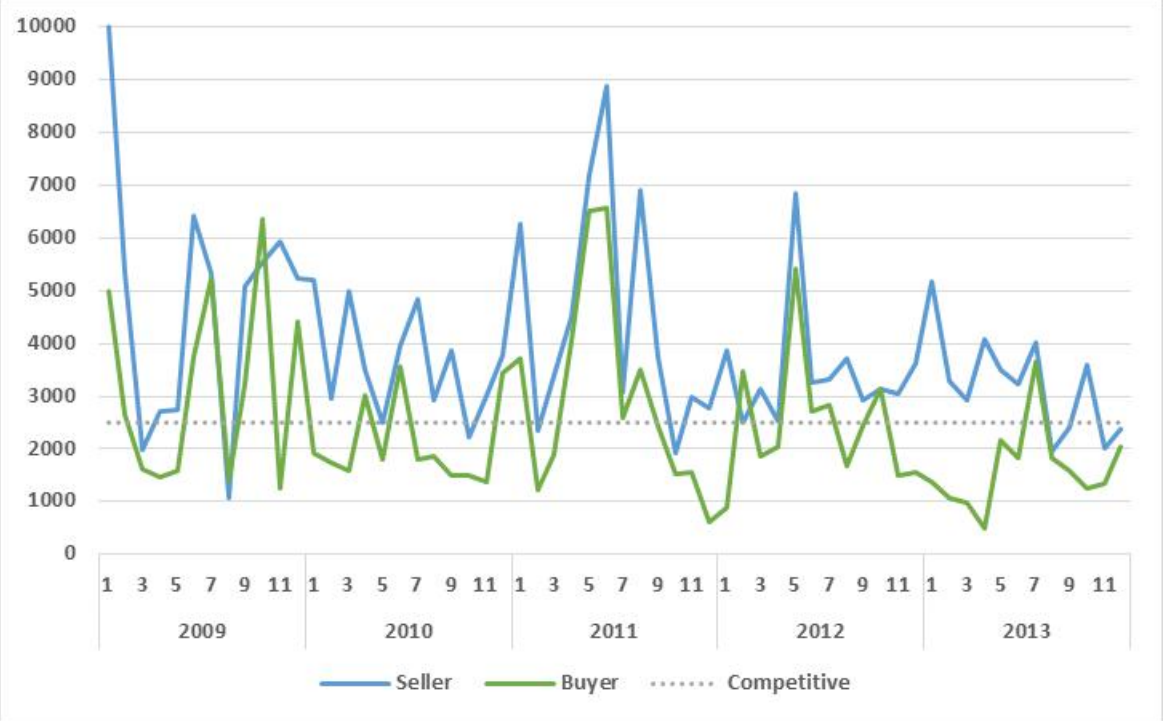


Figure 38: Level of concentration of the OTC CfD market

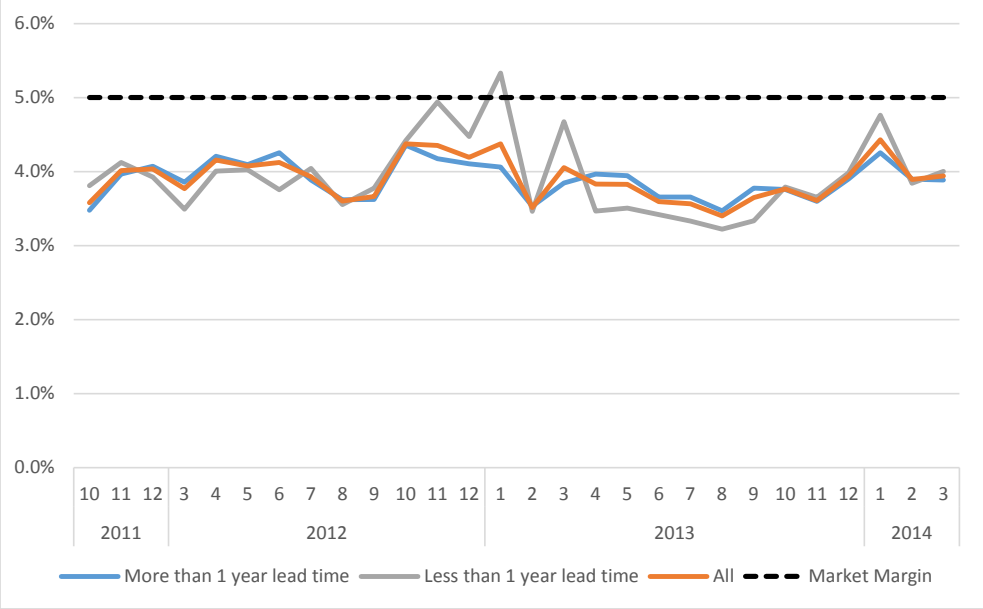


5.1.4 Participation in both markets is growing. Unsurprisingly, there is most participation on the buyer side of the OTC CfD market, with a considerably lower level of participation on the seller side of the OTC CfD market and on both sides of the ASX market.

5.2 Spreads

5.2.1 Narrow spreads contribute to the liquidity of a hedge market. The spreads on the ASX are driven by market maker requirements (Figure 39).

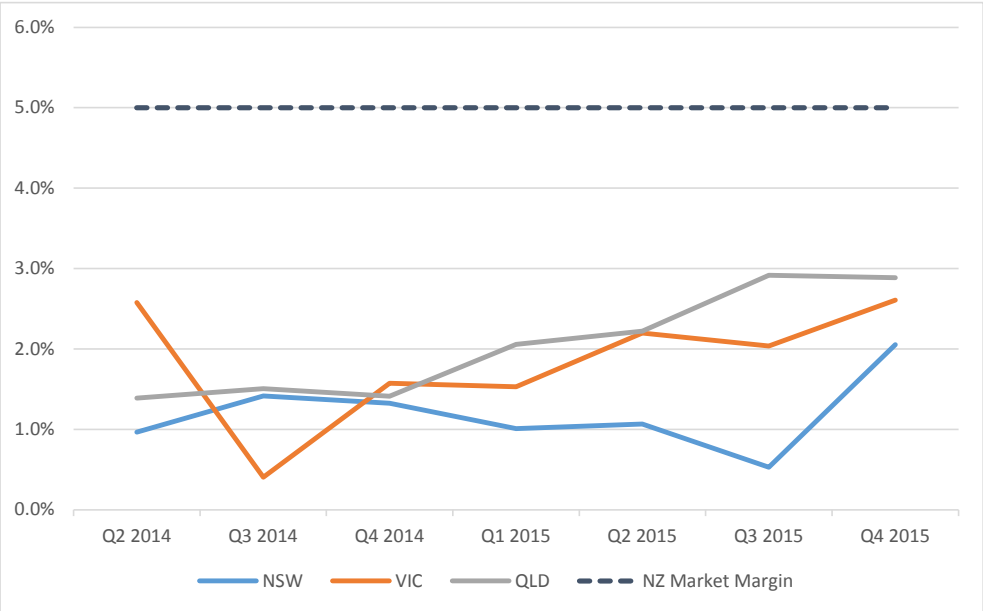
Figure 39: Monthly average spreads on the ASX



Note: this graph shows the average of the daily spread of products offered during each month. The 5% minimum spread required of market makers is shown for comparison.

5.2.2 It is interesting to compare these with current spreads on the Australian electricity futures market, which does not have market maker requirements (Figure 40).

Figure 40: Snapshot of spreads on the Australian electricity futures market



Note: this graph shows the market spreads for different products on a particular date. It is different from Figure 39, which averages spreads across a range of dates. The 5% market maker line is shown for reference, although the Australian futures market does not have market maker requirements.

5.3 Depth metrics for the ASX

5.3.1 This subsection investigates how ASX prices change following trading activity. It is motivated by anecdotal reports that ASX prices can increase after a party has carried out a trade – which makes it hard to establish a position.

5.3.2 The ability to investigate price movements on the ASX is somewhat limited at present, because its access to ASX trading information is limited to summary data sampled from the Web at a ten-minute resolution. This limits the accuracy of some of the analyses shown below. A better source of data is currently being sought.

5.3.3 One way to assess market depth is to observe how prices of ASX products change on days where substantial quantities of that product are traded. If high trading volumes were found to coincide with large price changes, then this:

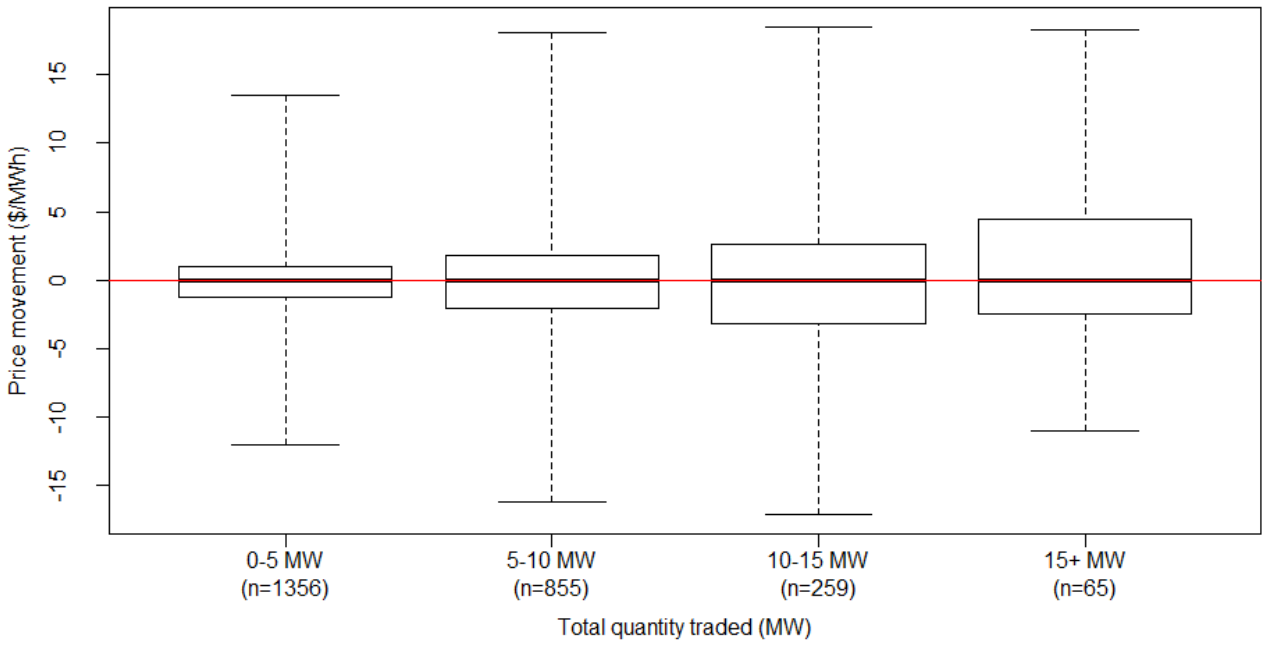
a) might simply be an indication that external events can lead both to a reassessment of the price of a futures product, and to an increased volume of trading in that product;

b) but might also be a sign of limited market depth.

5.3.4 In particular, if high trading volumes often coincided with large *upwards* price movements, then this might be seen to support the anecdotal evidence that it can be hard for a buyer to establish a position on the ASX.

5.3.5 Figure 41 shows the relationship between daily traded quantities of an ASX product and the daily price movement for the same product.

Figure 41: Daily price/quantity outcomes for ASX products over 2010-2014



5.3.6 The analysis shows that:

a) there is a moderate degree of volatility from day to day, with price movements in excess of $10/MWh (in either direction) not uncommon;

b) in 10% of cases, daily traded quantities in excess of 5 MW are associated with daily price movements in excess of $7/MWh;

c) in general, daily price movements are as likely to be upwards as downwards; but

d) when the daily traded quantity is in excess of 15 MW, the price movement is 20% likely to be upwards by $5/MWh, but only 10% likely to be downwards by at least $5/MWh.

5.3.7 Another approach is to observe how prices of ASX products change following a single trade. The ability to do so is currently limited, because:

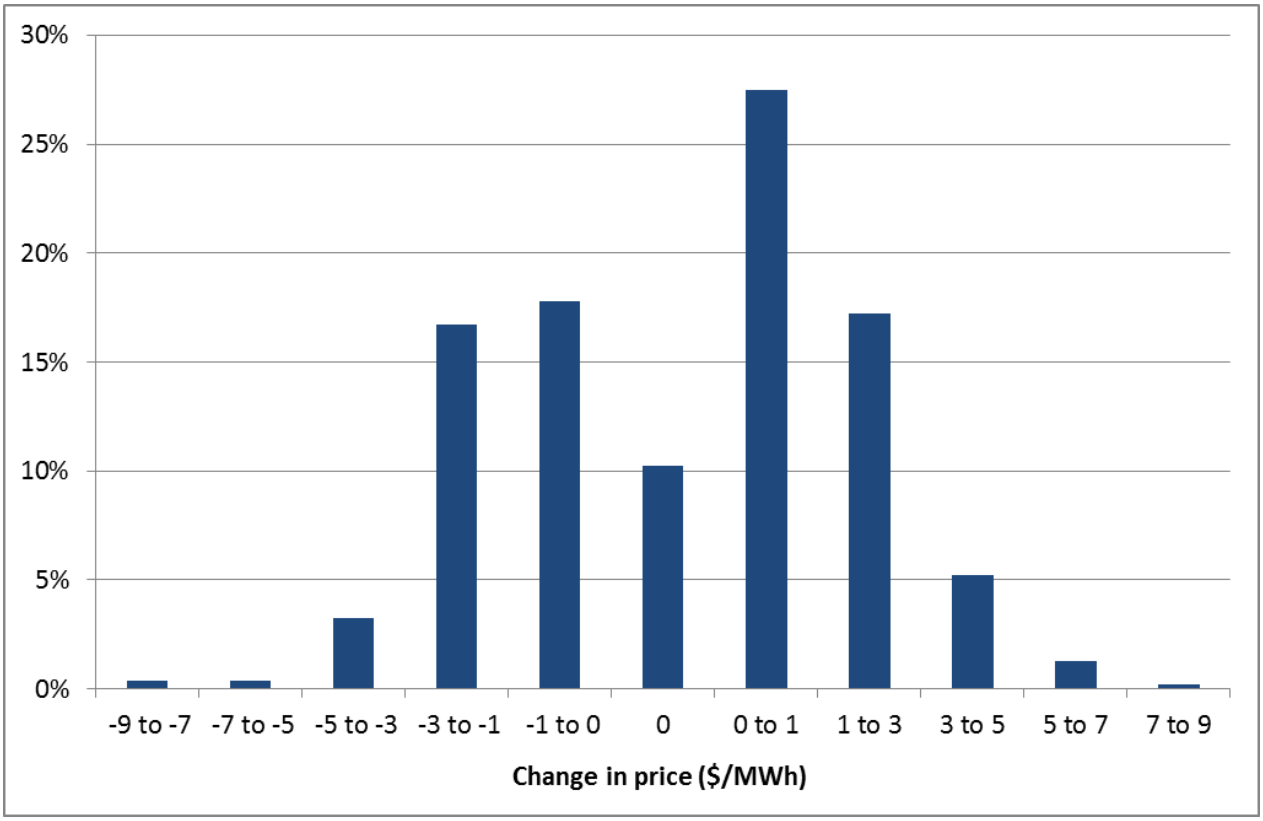
a) ASX trading data is only available for a one-year period;

b) the data does not distinguish between multiple trades of the same product by separate parties within a ten-minute interval; and

c) the data only observes one tranche of a trade carried out in multiple tranches.

5.3.8 Nevertheless, the issue has been investigated to the extent possible using the available data. Figure 42 shows the distribution of price movements between one trade in an ASX product and the next, providing both trades take place within 24 hours.

Figure 42: Distribution of changes in price from one ASX trade to the next, within 24 hours



5.3.9 Subject to the above caveats, this analysis shows that:

a) there is a moderate degree of volatility from trade to trade (within 24 hours), with some price movements exceeding $5/MWh (in either direction); and

b) price movements from one trade to the next (within 24 hours) are 51% likely to be upwards, but just 38% likely to be downwards (with the balance being a nil price change).

5.3.10 Ideally it would be possible to benchmark these depth metrics against other exchange-traded electricity futures markets, or even other types of market entirely – but at present the relevant data is not available.

5.4 Summary observations on depth and liquidity

5.4.1 The level of participation in the ASX and OTC CfD markets has increased over the last few years and the depth and liquidity of the ASX market has improved since market-maker agreements were put in place.

5.4.2 Data limitations make it difficult to assess the current levels of depth and liquidity of the ASX market – nevertheless, on the basis of available data, it appears that there may be room for improvement. There can be significant price movements from one trade to the next and it may sometimes be difficult for a participant to make substantial changes to their position in a short time, and at a competitive price.

5.4.3 There is scope for initiatives to support the depth and liquidity of the ASX market. One possible avenue may be through encouraging broader participation. Another possible option may be moving to a smaller unit size (see next section).

Question 11.	Does the WAG consider that there is scope for greater depth and liquidity in the ASX market, and that this would be beneficial? If so, what could be done to support depth and liquidity?
Question 12.	What further analysis of hedge depth or liquidity could assist the WAG to reach conclusions about the efficiency or competitiveness of the hedge market?

6 Non-price barriers

6.1 List of some potential non-price barriers

6.1.1 Competitive pricing, depth and liquidity are key issues that may drive the extent to which parties are able and willing to use the hedge market. But other barriers can also limit use of the hedge market.

6.1.2 Table 1 provides a non-exhaustive list of non-price barriers that may prevent, discourage or disincentivise the use of some hedge products.

Table 1: Some non-price barriers that may limit use of the hedge market

Type of barrier	ASX	OTC
Range of products	Limited, but has considerably improved with the introduction of monthly products, peak products and options	Broad
Unit size	1 MW (which may be too large to suit some traders' requirements, and may also tend to reduce liquidity and depth – see Section 6.5)	N/A
Ability to offset hedges against physical market prudential requirements	ASX futures cannot be used to reduce physical market prudentials	OTC CfDs can be used to reduce physical market prudentials if a hedge settlement agreement (HSA) is in place (see Section 6.2)
Financial market prudential arrangements	Prudential requirements may be onerous for some (see Section 6.3)	Parties are commonly required to put credit support arrangements in place when entering into OTC CfDs – in some cases this may be mitigated by the use of HSAs (see Section 6.2) or by moving to the ASX
Access to capital	Considerable capital required. As was noted at the most recent meeting of the WAG? – "there is a need to educate banks and insurance companies on the industry and level of risk involved in order to encourage … them to provide credit intermediation. There may be benefit in incentivising banks and insurance companies to identify an approach to overcoming the issues associated with accessing credit…	
Search costs	N/A	Search costs are an impediment to OTC trading, but may in some cases be reduced by the use of third party platforms such as Commtrade[3]

[3] https://www.commtrade.co.nz/electricity/

Type of barrier	ASX	OTC
Requirements of participation	Technical requirements are significant – participants face compliance costs and day-to-day trading costs	Technical requirements are significant, but buyers can reduce their costs by trading infrequently
Exclusions	N/A	Counterparties may attempt to insert force majeure and/or suspension clauses (see Section 6.4)
Volatility of spot prices	May discourage use of fixed-volume futures, as they do not eliminate price risk at times when physical quantity differs from hedge quantity	May encourage parties to prefer FPVV products over futures
Locational price risk	May discourage parties from using the ASX if they are not located near Otahuhu or Benmore	May reduce the level of competition at locations that are not near Otahuhu or Benmore
Internal approval	May be difficult for participants to obtain internal approval to trade in derivatives	May be difficult for participants to obtain internal approval to trade in derivatives – which may encourage the use of FPVVs
Level of industry knowledge and understanding of hedge market	Lack of knowledge may be a barrier for some parties	For many parties, these instruments will be more familiar than ASX futures

6.1.3 Many of these issues cannot readily be assessed through market metrics, and need to be tackled in other ways (for instance, through the hedge market survey). In some cases, however, metrics may be helpful:

a) Section 6.2 demonstrates the use of HSAs as a tool to manage prudential and credit risk issues;

b) Section 6.3 shows initial margins for New Zealand electricity futures on the ASX;

c) Section 6.4 shows how the proportion of OTC contracts that include force majeure and/or suspension clauses has changed over time; and

d) Section 6.5 discusses the consequences of the ASX unit size of 1 MW.

6.2 HSAs as a tool to manage prudential and credit risk issues

6.2.1 A Hedge Settlement Agreement (HSA) is an agreement between two market participants in favour of the Clearing Manager. It relates to an underlying hedging arrangement between the two participants. When an HSA is lodged with the Clearing Manager, its effect is that:

a) any amount that one participant must pay to a second participant under the hedging arrangement must instead be paid to the Clearing Manager by 2pm on settlement day, and

b) the Clearing Manager must then pay that amount to the second participant by 4:30pm on settlement day; and

c) the Clearing Manager will take into account the expected payments under the hedge arrangement when determining the required prudential levels for each participant.

6.2.2 Every HSA must be approved by the Electricity Authority before it is lodged with the Clearing Manager.

6.2.3 The level of use of HSAs over the last few years is shown in Figure 43 and Figure 44.

Figure 43: Number of HSAs by trading year

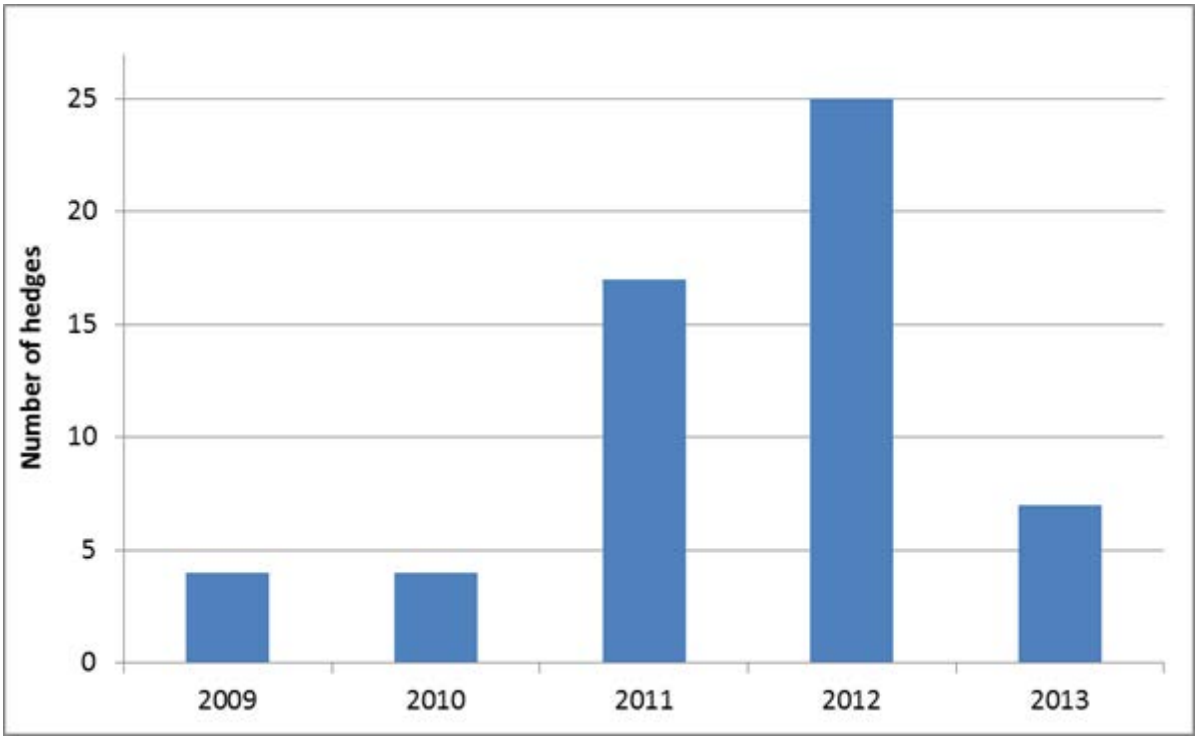
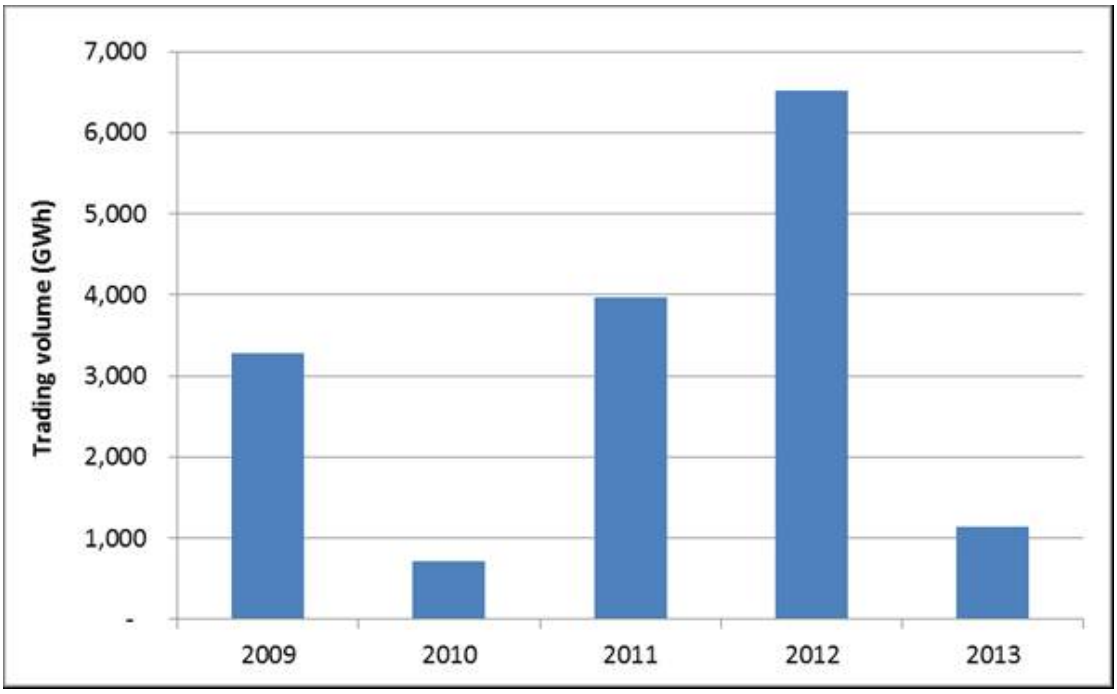


Figure 44: Traded volume of HSAs by hedged period



6.2.4 Closer examination of the data shows that a reasonable number of participants have used HSAs, but they have typically done so sporadically – rather than consistently lodging hedges over an extended period.

6.3 Initial margins on the ASX

6.3.1 Participants in the ASX futures market must provide margins. The ASX website sets out that *"margins are designed to protect the financial security of the market by ensuring that you can meet your obligations. If you trade an ASX-listed CfD, you have a potential obligation to the market because the position may move against you. The total margin for ASX-listed CfDs is made up of two components:*

a) Initial margins - initial margins protect the Clearing House from risk resulting from a negative movement in the value of a position as a result of a change in overnight market prices. The Initial Margin is typically set at a level designed to cover reasonably foreseeable losses on a position between the close of business on one day and the next.

b) *Variation margins - in addition to the Initial Margins required to open contracts, any adverse price movements in the market must be covered by further payments, known as Variation Margins. The variation margin is based on the end of day marked to market revaluation of an ASX-listed CfD position."*

6.3.2 For electricity futures on the ASX, the initial margin for a contract is expressed as a percentage of the future's price.

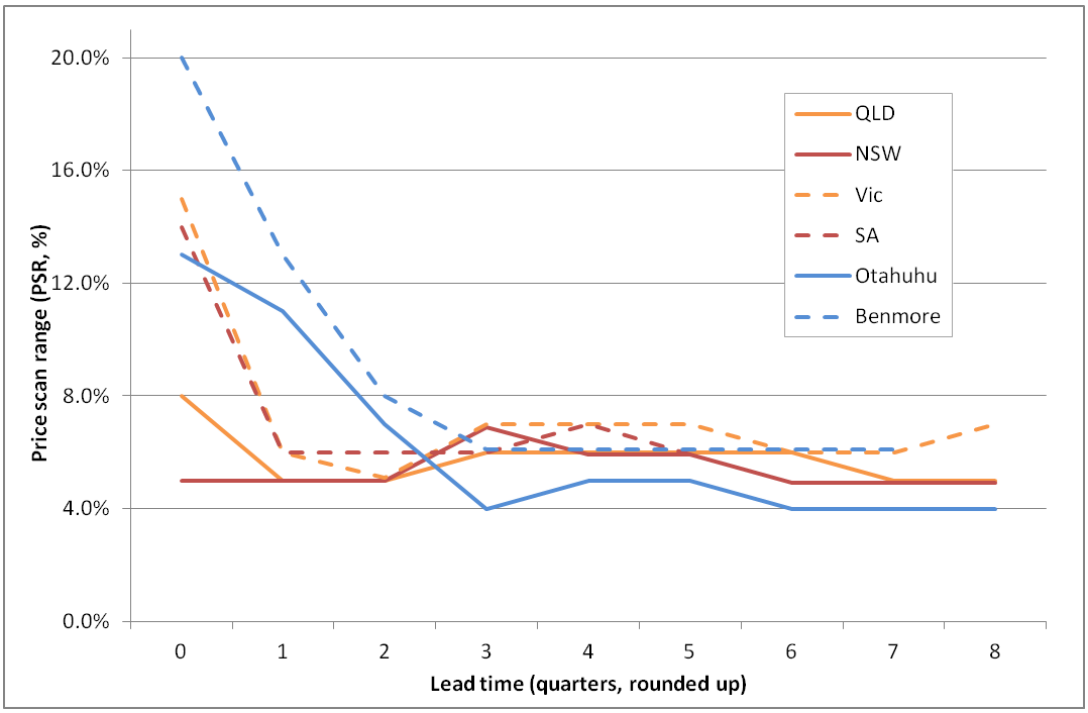
6.3.3 The ASX website sets out that *"the amount of initial margin for each contract varies according to the price volatility of the underlying [spot price]"* – I.e. a relatively high initial margin is required at locations and lead times where it is anticipated that futures may be more volatile.

6.3.4 Initial margins are recalculated over time, typically increasing in the lead up to the hedged period. The initial margin is not recovered until the hedged period is over. No interest is earned by the participant on the margin funds held by the ASX.

6.3.5 Initial margins required for one product can partly offset initial margins for other products if holdings in the two products are deemed to be negatively correlated. For instance, if a party is short at Benmore and long at Otahuhu, they can offset one against the other. Similarly, if a party is long for one quarter and short for the next quarter, they can offset one against the other.

6.3.6 Figure 45 shows the level of initial margin required for Australian and New Zealand quarterly electricity futures. For instance, a party that purchases quarterly futures at Benmore for a lead time of a year or more must directly pay the ASX an initial margin of 6% of the strike price. This margin will increase further over time, and the money is not recovered until after the hedge expires.

Figure 45: Initial margins required for Australian and New Zealand quarterly electricity futures on the ASX, as a % of the underlying



6.3.7 Key points are that (all else being equal):

a) for the current quarter, Benmore futures attract a higher margin than Australian futures; and

b) one to two quarters out, both Otahuhu and Benmore futures attract a higher margin than Australian futures.

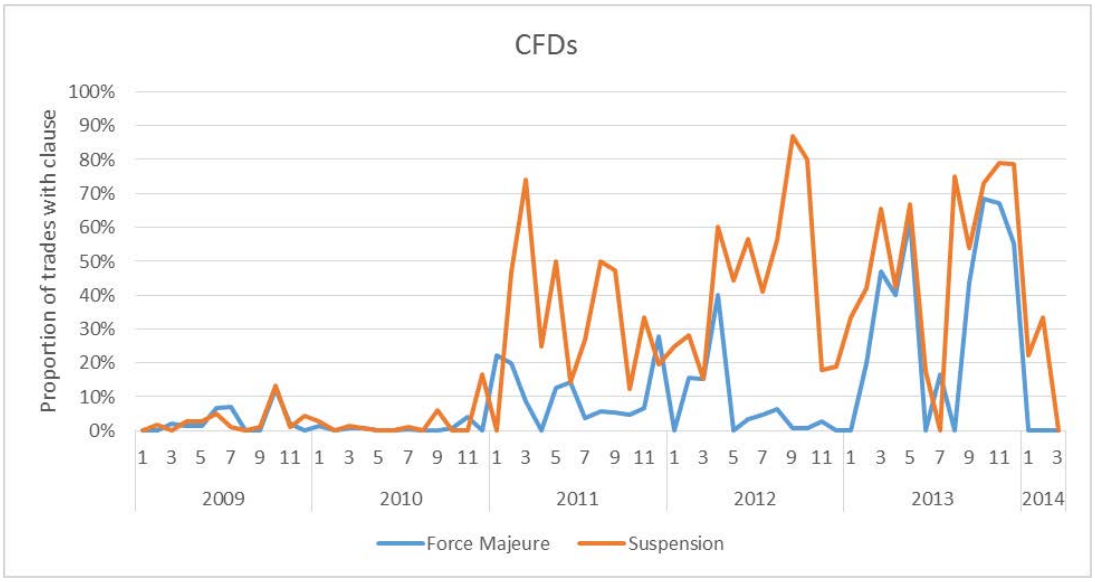
6.3.8 Presumably both differences are due to hydrological risk.

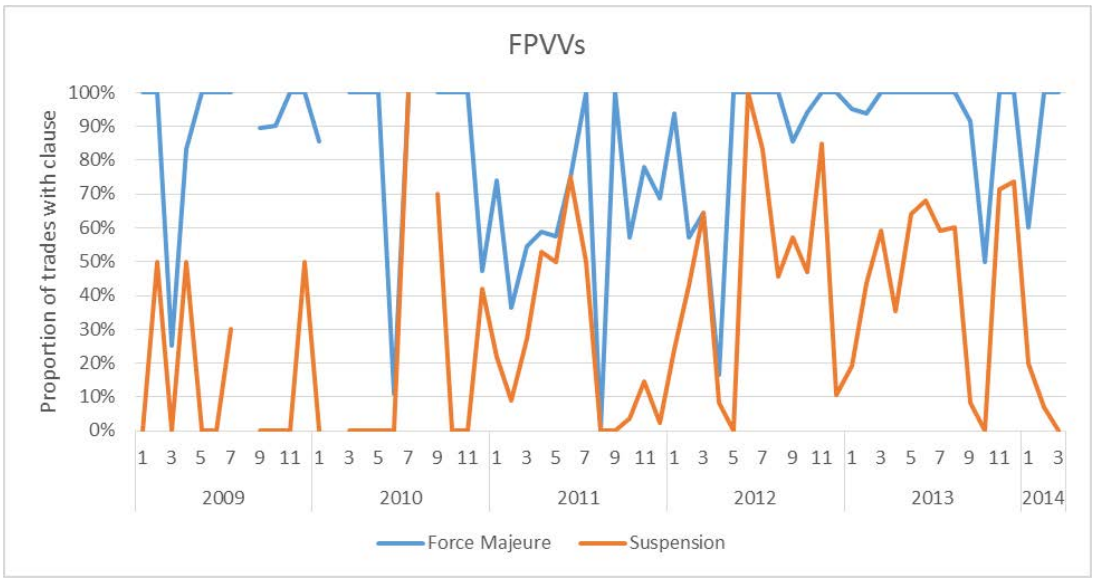
6.3.9 It is not clear whether the margins charged by ASX accurately reflect the level of price risk on various time scales. It may be the case that traders in New Zealand electricity futures are paying unnecessarily high initial margins.

6.4 Use of force majeure and suspension clauses

6.4.1 The practice among OTC sellers of requiring force majeure or suspension clauses may be a barrier to some buyers. Figure 46 shows how the proportion of OTC contracts that include force majeure and/or suspension clauses has changed over time, based on hedge disclosure data.

Figure 46: Proportions of OTC contracts with force majeure or suspension clauses





6.4.2 The proportion of contracts with suspension clauses has not declined appreciably since 2011. The proportion of contracts with force majeure clauses has actually increased over the same period.

6.4.3 The *nature* of these clauses may, however, have changed over time. The disclosure data do not record the terms of a force majeure or suspension clause – only whether one is in place or not.

6.4.4 The hedge market survey may be more informative about this issue.

6.5 ASX unit size

6.5.1 On the ASX, New Zealand electricity futures are traded in units of 1 MW. Among the implications of this are that:

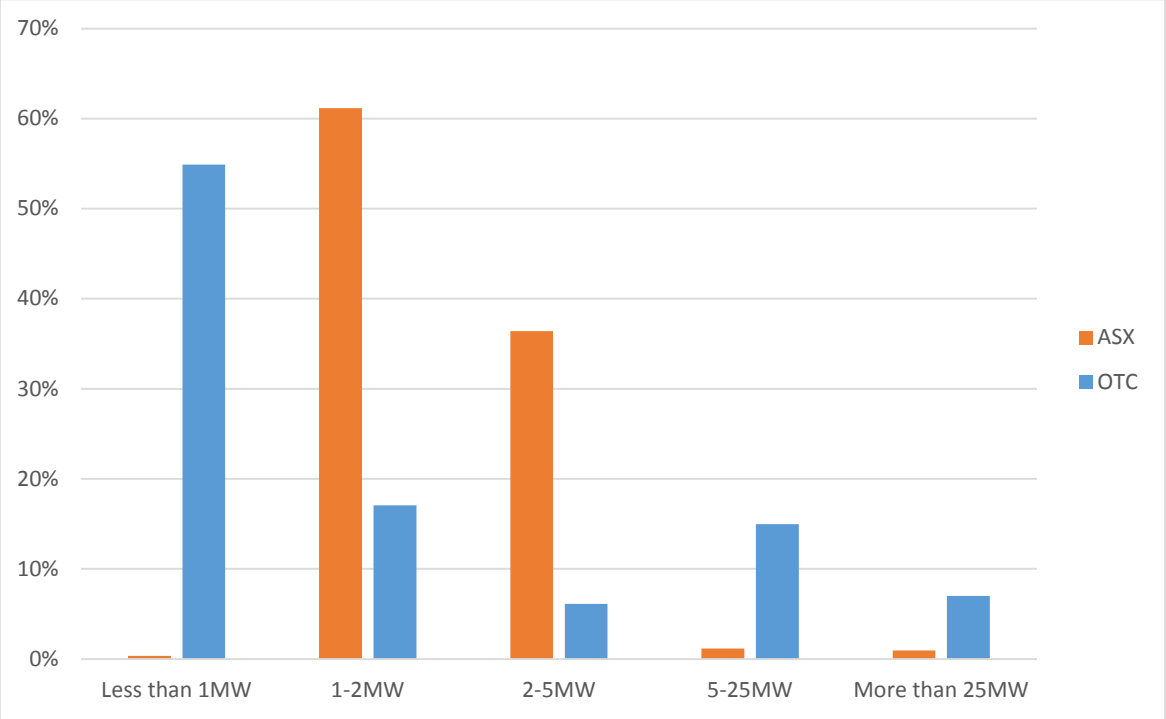
a) parties that want less than 1 MW of cover will not be able to meet their requirements on the ASX;

b) parties that want a non-integer quantity of cover (such as 1.5 MW) will not be able to meet their requirements on the ASX; and

c) parties cannot carry out a large trade in many small increments of less than 1 MW each, which may reduce their ability to obtain a competitive price in a market of limited depth.

6.5.2 In contrast, the majority of OTC CfD trades are for a quantity less than 1 MW (Figure 47).

Figure 47: Distribution of trade quantities since 2009, for ASX and OTC CfD markets



6.5.3 It may be that the 1 MW unit size has deterred some parties from using the ASX – although there are other reasons why smaller traders might not use the ASX.

6.6 Summary observations on non-price barriers

6.6.1 HSAs are being used intermittently by some participants to manage prudential requirements and credit risk.

6.6.2 It is not clear whether the initial margins charged by ASX accurately reflect the level of price risk on various time scales. It may be the case that traders in New Zealand electricity futures are paying unnecessarily high initial margins.

6.6.3 Many OTC contracts still employ force majeure and/or suspension clauses, which may reduce their value to the buyer and potentially limit the range of hedging strategies buyers may employ.

6.6.4 It is possible that moving to a smaller unit size might support participation, depth and liquidity in the ASX market.

6.6.5 The hedge market survey will yield more information about non-price barriers.

Question 13. Does the WAG have a view on the reasons why some participants do not use HSAs, and others only use them sporadically?

Question 14. What value does the WAG see in HSAs?

Question 15. Does the WAG have a view on whether the ASX prudential regime is appropriate? In particular, are initial margins excessive?

Question 16. Does the WAG consider that the ASX unit size of 1 MW is appropriate?

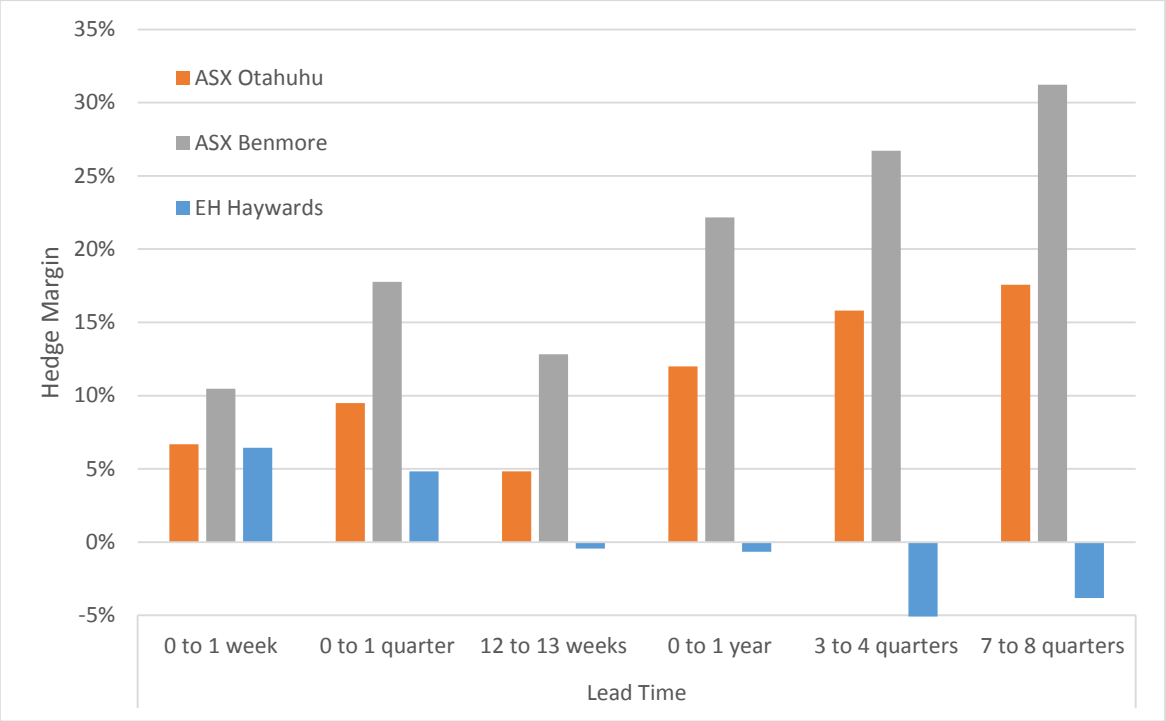
Question 17. What further *quantitative* analysis of non-price barriers could assist the WAG to reach conclusions about the efficiency or competitiveness of the hedge market?

Appendix A Comparison between ASX and EnergyHedge

A.1 EnergyHedge was a trading platform for standardised electricity hedge contracts. It operated from early 2004 to early 2011, at which time it was superseded by futures trading on the ASX. It was intended to provide information on the future price curve as well as providing hedge products. Actual trading activity was limited, and was largely confined to major generator-retailers. However, it may still provide a useful benchmark for the ASX.

A.2 Figure 48 extends the "margin over spot" analysis in Figure 14 to cover the EnergyHedge market.

Figure 48: ASX and EnergyHedge margins over spot for various lead times



A.3 On the face of it, it might appear as if EnergyHedge pricing was substantially more competitive than ASX pricing. However this is misleading. One reason is that the "EnergyHedge period" (from 2005 to 2010) was (on average) exceptionally dry, and much drier than the "ASX period". Over the 6 years in the EnergyHedge period, mean January-June inflows were approximately 11.6 TWh – 5% less than the mean for the ASX period, which was 12.2 TWh. All else being equal, this would tend to lead to lower margins over spot during the EnergyHedge period.

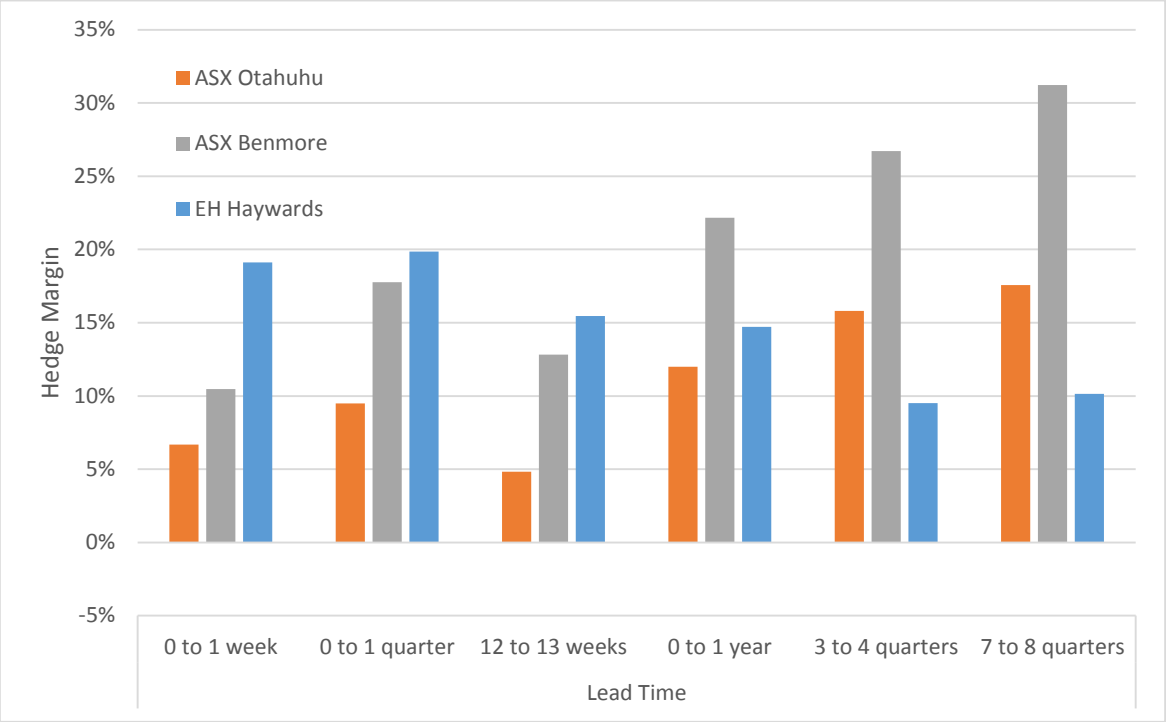
A.4 EnergyHedge margins over spot were particularly low for the first and second quarters of the 2008 calendar year. During these two quarters, the mean spot price at Haywards was approximately $115/MWh and $235/MWh respectively. Over medium to long lead times, EnergyHedge prices for these quarters were much less than actual spot prices.

A.5 If the first two quarters of 2008 were excluded, then:

(a) mean January-June inflows over the remainder of the EnergyHedge period would equal 12.0 TWh – very comparable with the 12.2 TWh over the ASX period; and

(b) average EnergyHedge margins over spot would be more comparable with ASX margins over spot (Figure 49).

Figure 49: ASX and EnergyHedge margins over spot for various lead times - excluding Jan-Jun 2008 from the EnergyHedge analysis



A.6 On this basis, it appears that:

(a) ASX margins over spot at Otahuhu may be lower than EnergyHedge margins over spot were, for short lead times; but

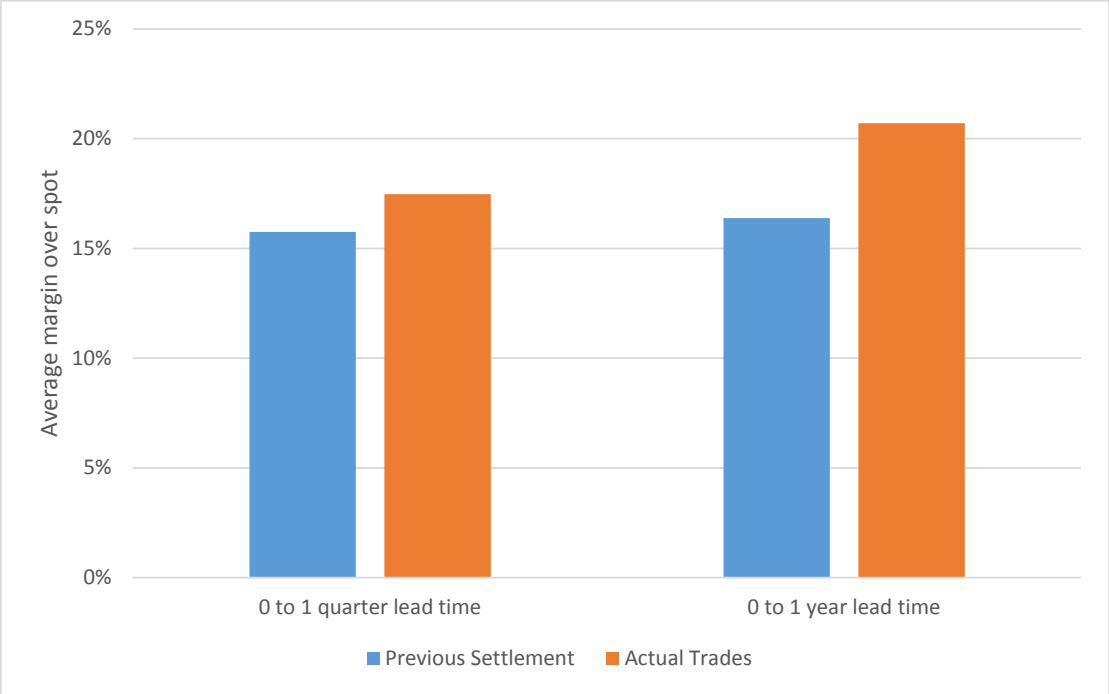
(b) ASX margins over spot at Otahuhu may be several percentage points higher than EnergyHedge margins over spot, for lead times of a year or more.

A.7 Caution should be applied in drawing any conclusions from this analysis – it is not clear whether the results are an accurate reflection of the true underlying differences between the two markets.

Appendix B "Previous settlement" approach vs. "actual trade prices" approach

B.1 In the analysis in Section 4.1, the "price of an ASX future" at any given time is taken to be the "previous settlement" figure published by ASX. An alternative approach is to base the analysis on actual trade prices. Under this approach, margins over spot appear to be higher (Figure 50). This may be more reflective of the actual margins that participants experience.

Figure 50: ASX margins at Otahuhu over spot - previous settlement approach vs actual trade prices approach

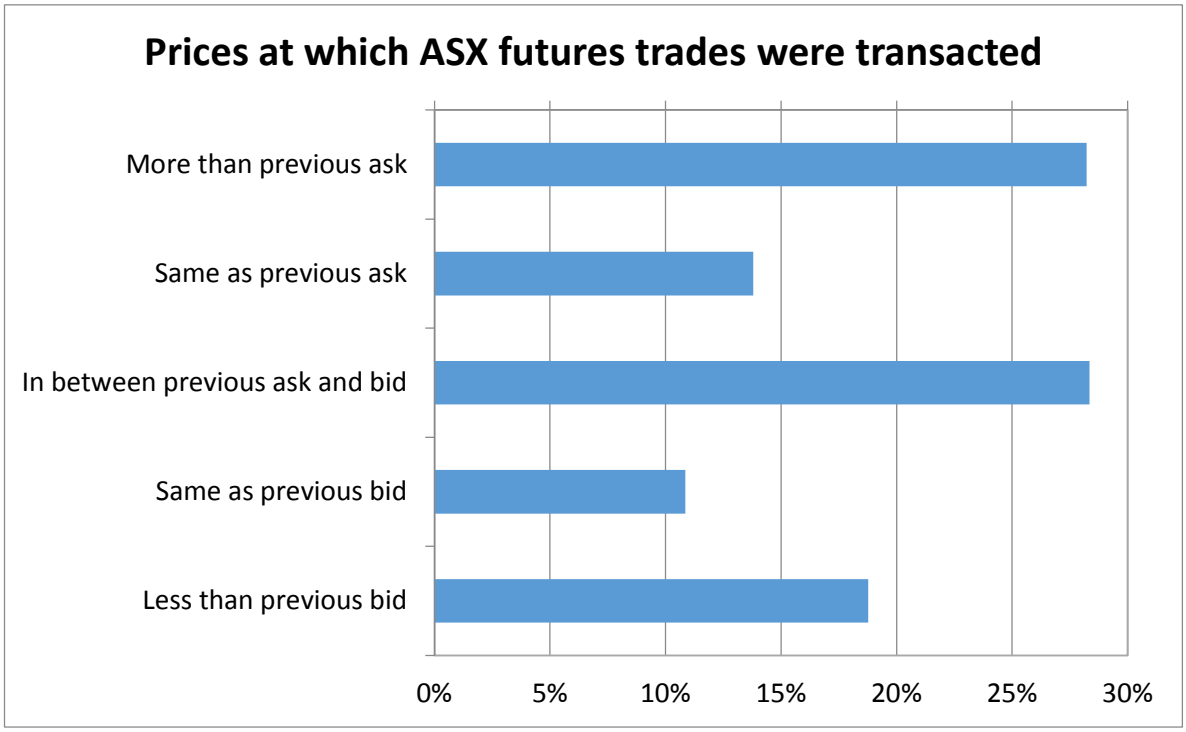


Note: these are the only two lead time ranges for which there is a sufficient number of actual trades to draw a meaningful comparison.

B.2 It may be seen as counter-intuitive that the prices paid by participants are, on average, higher than the mean market price (as measured by "previous settlement", which is influenced both by actual trade prices and by the midpoint of bid and ask). The reason appears to be that ASX trades are made by buyers more often than sellers.

B.3 It is more common for the price to equal or exceed the previous ask, than for it to equal or be less than the previous bid (42% compared to 29%, as shown in Figure 51 – though note that the figures in this graph may not be completely accurate, due to limited access to ASX data).

Figure 51: It appears that ASX trades are made by buyers more often than sellers



Glossary of abbreviations and terms

We have this from last time:

Term	Definition
Market definitions	
Hedge market	The market through which businesses and consumers establish arrangements for managing the risks to their incomes or the costs that they face because electricity prices vary.
Spot market	The wholesale market for electricity where prices are set every half-hour at around 280 locations, as determined by the lowest cost mix of offered generation resources that will satisfy overall demand for each half-hour.
ASX	Australian Securities Exchange – a platform upon which NZ electricity futures are traded.
Types of hedges	
Fixed-price variable-volume (FPVV) contracts	Contracts for physical that include an electricity charge that is set in advance on a price per unit basis. This may be a single price applying to all use, or a more complex pricing structure with separate prices for different times and/or locations.
Fixed-price fixed-volume (FPFV) contracts	Contracts for physical that include an electricity charge that is set in advance on a price per unit basis, for a fixed number of units. This may be a single price applying to the full volume, or a more complex pricing structure with separate prices for different times, quantities and/or locations.
Contract-for-difference (CfD)	A financial contract between two parties, typically described as the "buyer" and "seller", that insulates the parties from spot price volatility for the quantity specified in the contract. The difference between the contract price and the spot price is payable by the buyer to the seller.
Options (incl caps, collars, swaptions)	A financial contract that can be used to insulate the holder from some spot price volatility. Provides the holder with the option to activate the contract on or before an agreed date. Can be traded on an exchange or over-the-counter.
Futures	A form of electricity forward contract traded on an exchange which has standard terms and conditions, a clearing house, and clearing participants who guarantee performance. A buy and sell price for NZ electricity futures contracts is quoted each business day on the ASX.
Financial Transmission Rights (FTRs)	Financial contracts designed to assist wholesale electricity market participants to manage their locational price risk. FTRs allow the holder some protection from price uncertainty caused by losses and constraints between two locations on the national grid.

And this from 2006:

basis risk	The risk that occurs as a result of a mismatch between a particular contract and the underlying risk which the contract is intended to mitigate
commodity market	A market where a product is traded under a standardised contract
counterparty	The other party to a contract
derivative	A financial product with a value derived from an underlying physical product
EnergyHedge	A specific platform used by the five main generator/retailers for trading electricity derivatives in New Zealand
equity market	A market where entities trade company shares, or financial derivatives of these shares (such as options). An equity market is often referred to as a stock market
exchange	A centralised platform used for the trading of specific commodities or derivatives, usually with specific credit requirements
forward price curve	A forward price is the price today at which two parties are willing to settle a transaction at some time in the future. The forward price curve is created from the series of prices for the same product type that commence at the current spot price and continue out into the future
ISDA	International Swaps and Derivatives Association
Nordpool	The electricity market for the Nordic countries of Norway, Sweden, Denmark and Finland
NZEM	The New Zealand Electricity Market, which operated the New Zealand wholesale electricity spot market from 1 October 1996 until 29 February 2004
OTC	Over-the-counter - The term used for bilateral negotiation of the supply of goods and services
physical electricity market	The market for the physical supply and use of electricity
PJM	The Pennsylvania, New Jersey and Maryland electricity market, which is the main electricity market for the North-eastern United States
previous settlement	The market price for a hedge product as calculated by the ASX. It is based on price of the most recent trade when a trade has occurred recently, and the bid/ask spread when this is not the case.
spot market	The wholesale part of the physical market for trading electricity in New Zealand where electricity generators offer electricity to the market and purchasers bid to buy the electricity. This market is also referred to as the

	physical wholesale market

And then this from Section 2 of the paper:

Time:	
Trading date	The date on which a hedge is contracted (similarly "trading month", "trading year")
Hedged period	The period for which hedge payments are made (for instance, a quarterly future might have a hedged period of January-March 2015)
Duration	The length of the hedged period
Expiry	The end of the hedged period
Advance period	The period from the trading date to the beginning of the hedged period
Lead time	The length of the advance period
Product	In a market for CfDs, a combination of location and hedged period (e.g. OTA 2014 Q1)
Price:	
Traded price	The strike price of a CfD, or the price(s) at which power is sold in a FPVV
Market price	The price at which the market for a CfD product sits at a point in time. Can be established either as (bid + ask)/2, or with reference to traded prices
Settlement price	The price against which a CfD is settled, i.e. the time-weighted average of spot prices during the hedged period
Margin	The difference between two prices
Percentage margin	The difference between two prices, as a percentage of the second price
Quantum:	
Quantity	The size of a CfD, in MW (= volume / duration)
Volume	The size of a CfD, in GWh (= quantity x duration)
Open volume / traded volume	The open volume is the sum of the volumes of all contracts that are still open at a given point in time. Can be further restricted, e.g. the open volume for a particular settlement period, or for a range of lead times. The traded volume is the sum of the volumes of all contracts for which the trading date falls within a particular period. Again this can be further restricted
Open quantity / traded quantity	The equivalent of open volume / traded volume, in MW terms
Liquidity / depth:	
Spread	Ask minus bid, sometimes expressed as a percentage of bid

Depth	Depth refers to the trade-off between the *quantity to be sold* and the price it can be sold for (c.f. liquidity below). It can be measured in various different ways
Liquidity	Liquidity refers to the trade-off between the *speed of the sale* and the price that can be obtained (c.f. depth above). It can be measured in various different ways

And new terms introduced in the main text:

- Margin over spot (in the context of ASX)
- Margin over seasonality (in the context of OTC CfDs)
- Previous settlement (ditto)
- ASX period, EnergyHedge period
- Directly comparable (in the context of OTC CfDs being directly comparable to ASX products)
- Pricing-informative (in the context of OTC CfDs)
- UOI
- VAS