DESC: Model Smoothing - Evaluation

13th November 2013

Model Smoothing: Background

- Model smoothing was first undertaken in 1999/00 and has been applied to all subsequent years based on methodology in Spring Approach document

- In January 2006, DESC agreed to move to a biennial assessment of the continued applicability of model smoothing

- The analysis presented today is the first full assessment of model smoothing since Autumn 2011 and has been carried out along the same lines

- Presentation summarises the results and conclusions, however supporting document also available which provides further commentary and detailed analysis

- <u>Objective for DESC</u> is to discuss results and agree on approach / application of model smoothing for Spring 2014

Model Smoothing: Principles

- Model smoothing is the averaging of 3 years of models (including the current and most recent data sets) to derive new parameters

- Introduced to address year on year <u>volatility</u> and provide more <u>stability</u> in EUC models

- Model smoothing will not necessarily improve model predictability, however it may be better than single year models

- Analysis performed considers volatility, predictability and trend analysis

- Model smoothing assessments are undertaken using the CWV intercept differences from the relevant single year or smoothed models

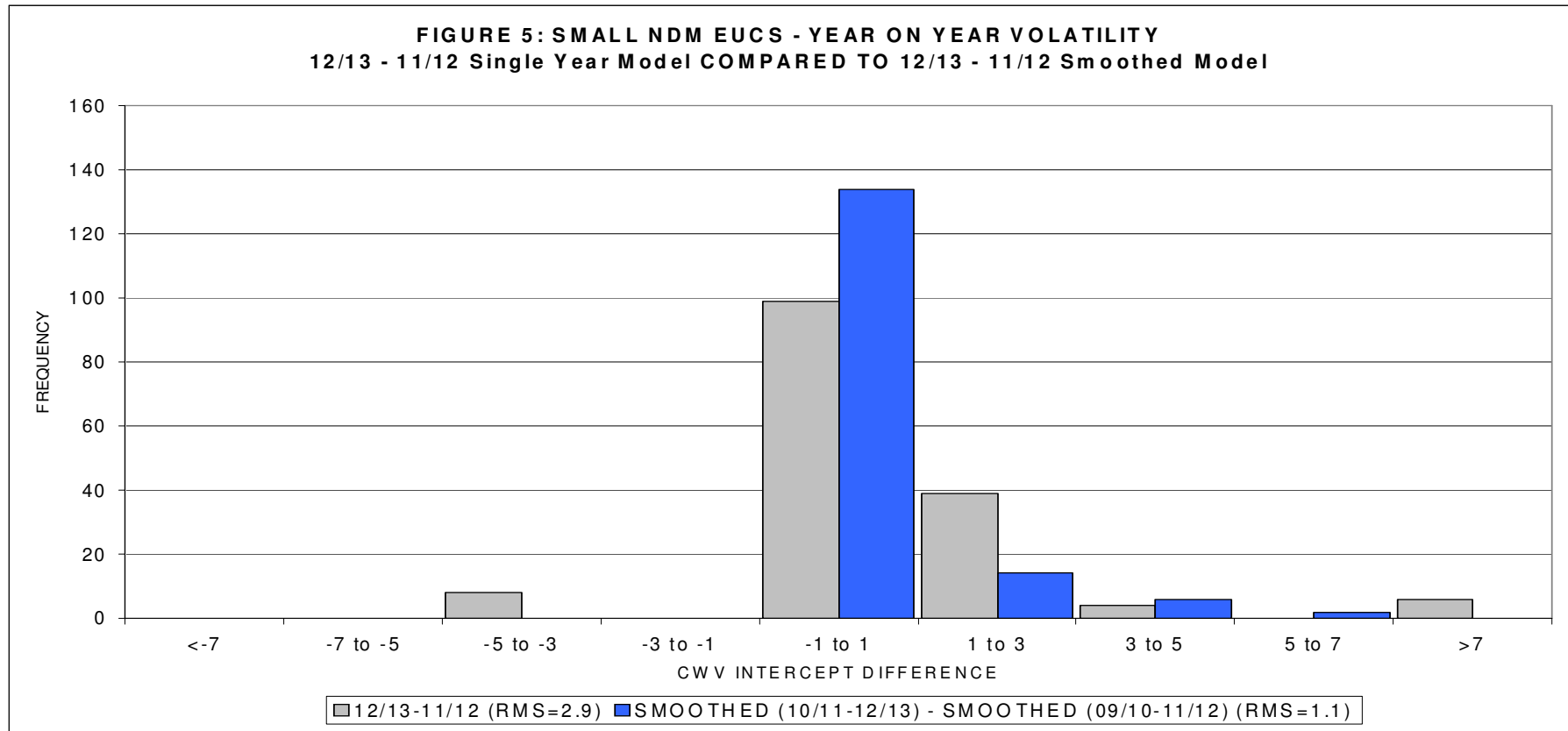# Model Smoothing: CWV Intercepts

- Appendix 6 of annual NDM report contains individual year and smoothed model CWV intercepts
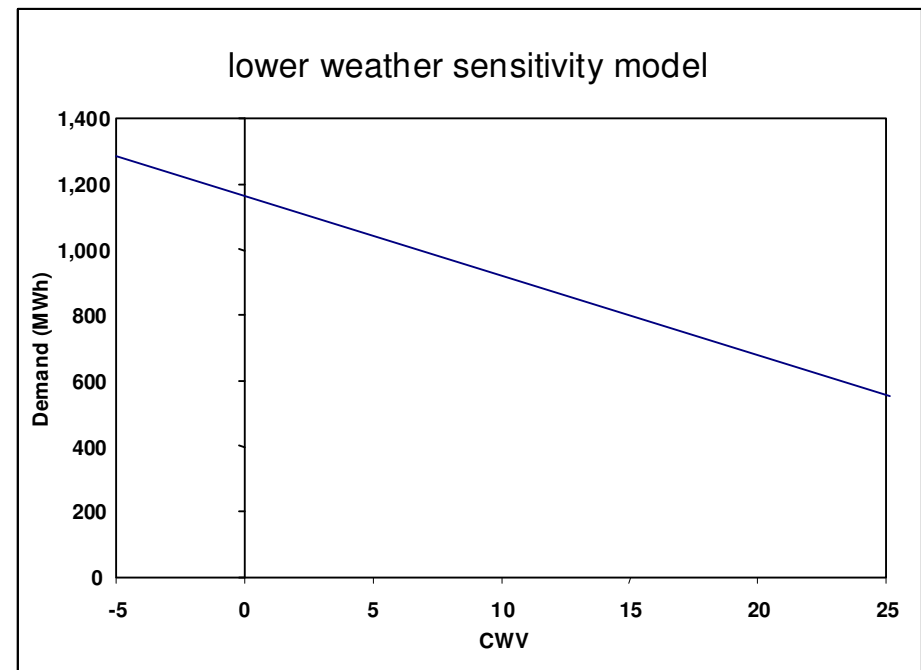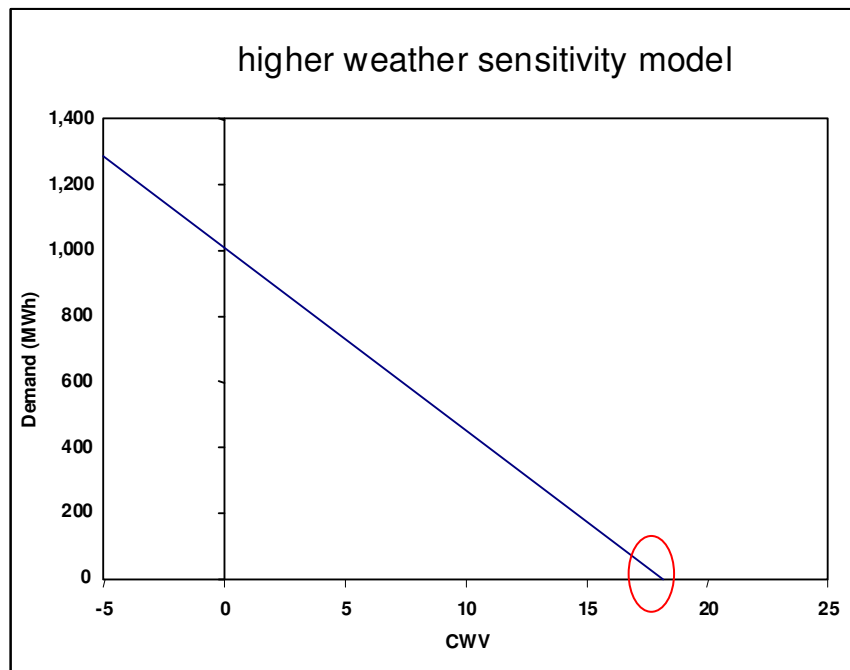
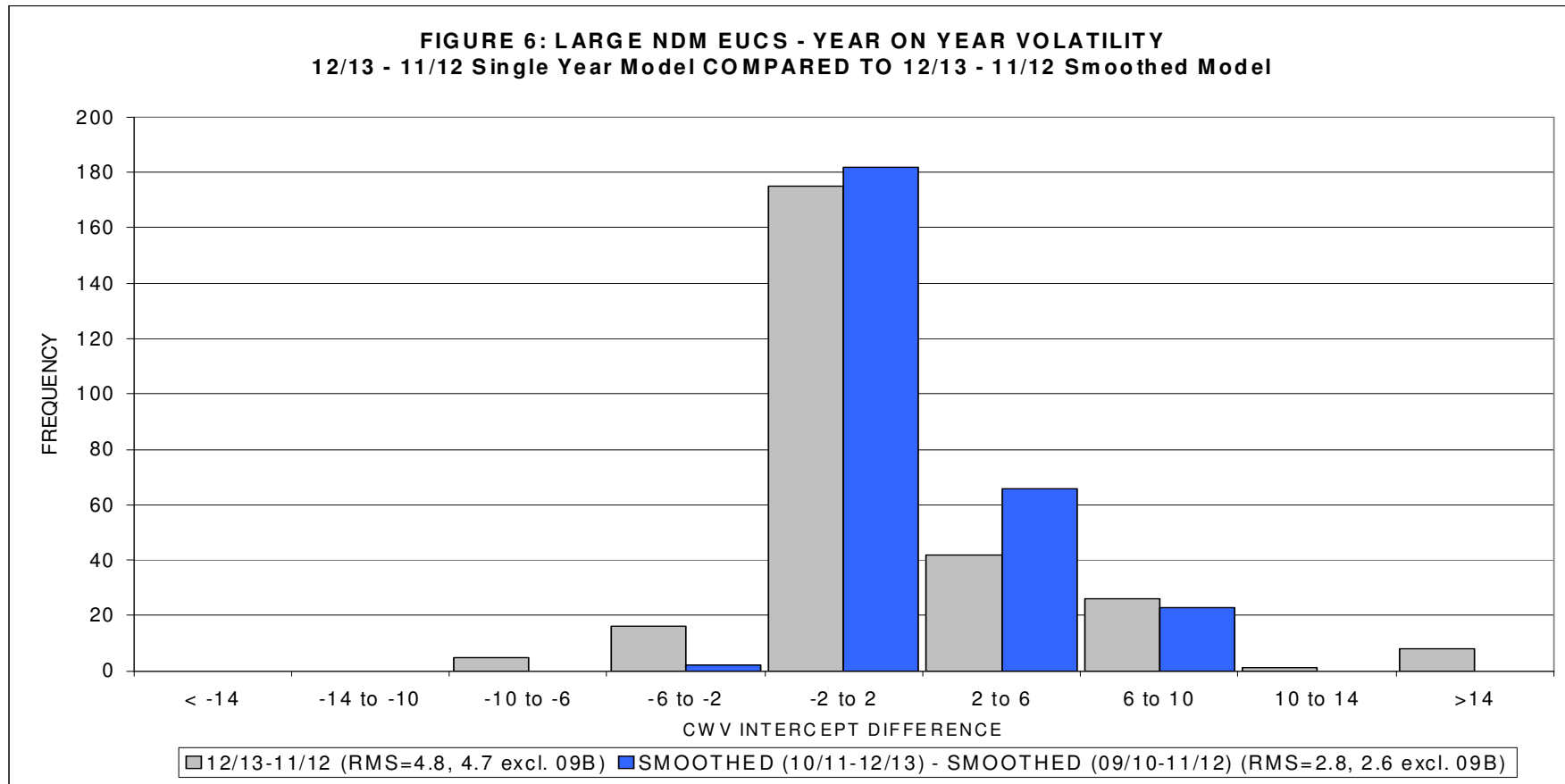# Model Smoothing: Analysis 1 - Volatility Analysis

- Compares year on year volatility reduction of each model type (smoothed and single year).

- <u>AIM</u>: To assess differences in between each year:

  - Compare 12/13 applied smoothed model (10/11, 11/12, 12/13)
    To
  - Applied smoothed for 11/12 (09/10, 10/11, 11/12)

  - Compare 12/13 single year model (that would have been applied to 13/14)
    To
  - Single year model for 11/12 (that would have been applied to 12/13)

- Using variations in CWV intercepts and RMS values to identify level of volatility between model types and years.

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Volatility Analysis: All EUC Bands – Small NDM

FIGURE 5: SMALL NDM EUCS - YEAR ON YEAR VOLATILITY
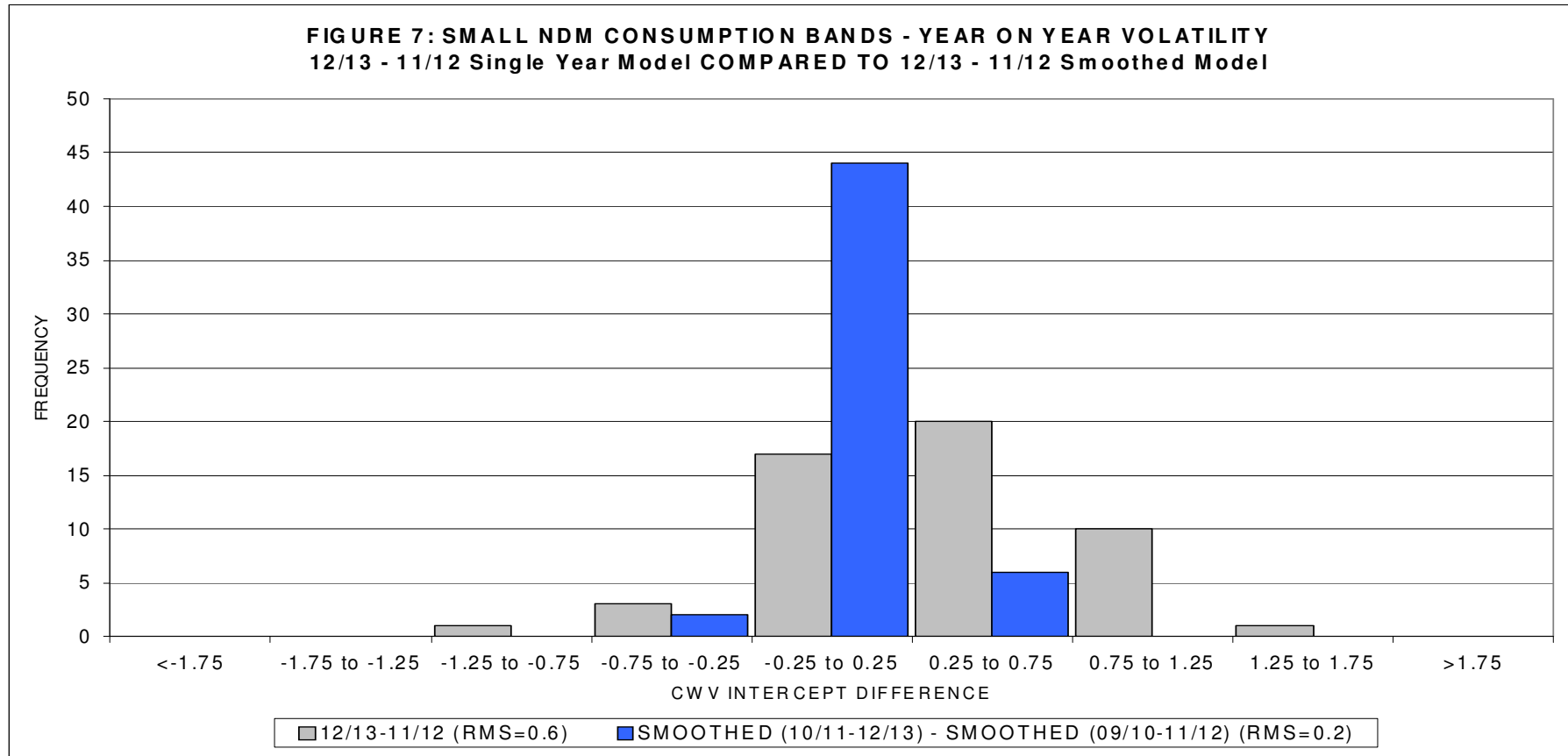12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model

- 156 Small NDM EUCs assessed
- Smoothed Model has smaller CWV Intercept differences and lower RMS values and so overall less volatility

Volatility Analysis: All EUC Bands – Large NDM

FIGURE 6: LARGE NDM EUCS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model

Legend:
- 12/13-11/12 (RMS=4.8, 4.7 excl. 09B)
- SMOOTHED (10/11-12/13) - SMOOTHED (09/10-11/12) (RMS=2.8, 2.6 excl. 09B)

X-axis (CWV INTERCEPT DIFFERENCE): < -14, -14 to -10, -10 to -6, -6 to -2, -2 to 2, 2 to 6, 6 to 10, 10 to 14, >14
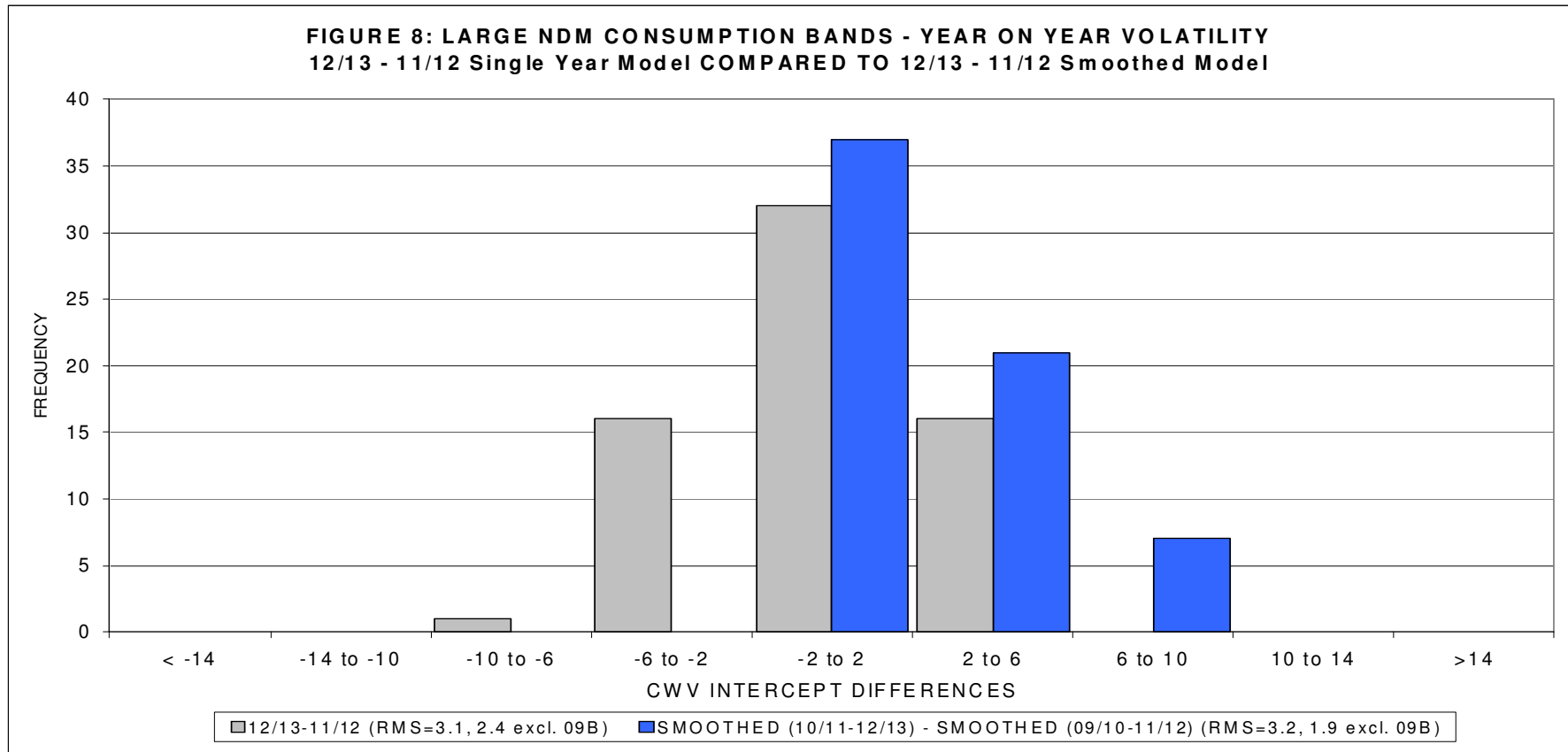
Y-axis: FREQUENCY

- 273 Large NDM EUCs assessed
- Smoothed Model has smaller CWV Intercept differences and lower RMS values and so overall less volatility

Volatility Analysis: Consumption Bands – Small NDM

FIGURE 7: SMALL NDM CONSUMPTION BANDS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model

- 52 Small NDM Consumption Bands assessed
- Smoothed Model has slightly smaller CWV Intercept differences and lower RMS values and so overall less volatility

Volatility Analysis: Consumption Bands – Large NDM

FIGURE 8: LARGE NDM CONSUMPTION BANDS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model

- 65 Large NDM Consumption Bands assessed (includes 09B)
- Smoothed Model has smaller CWV Intercept differences and similar RMS values and so overall less volatility
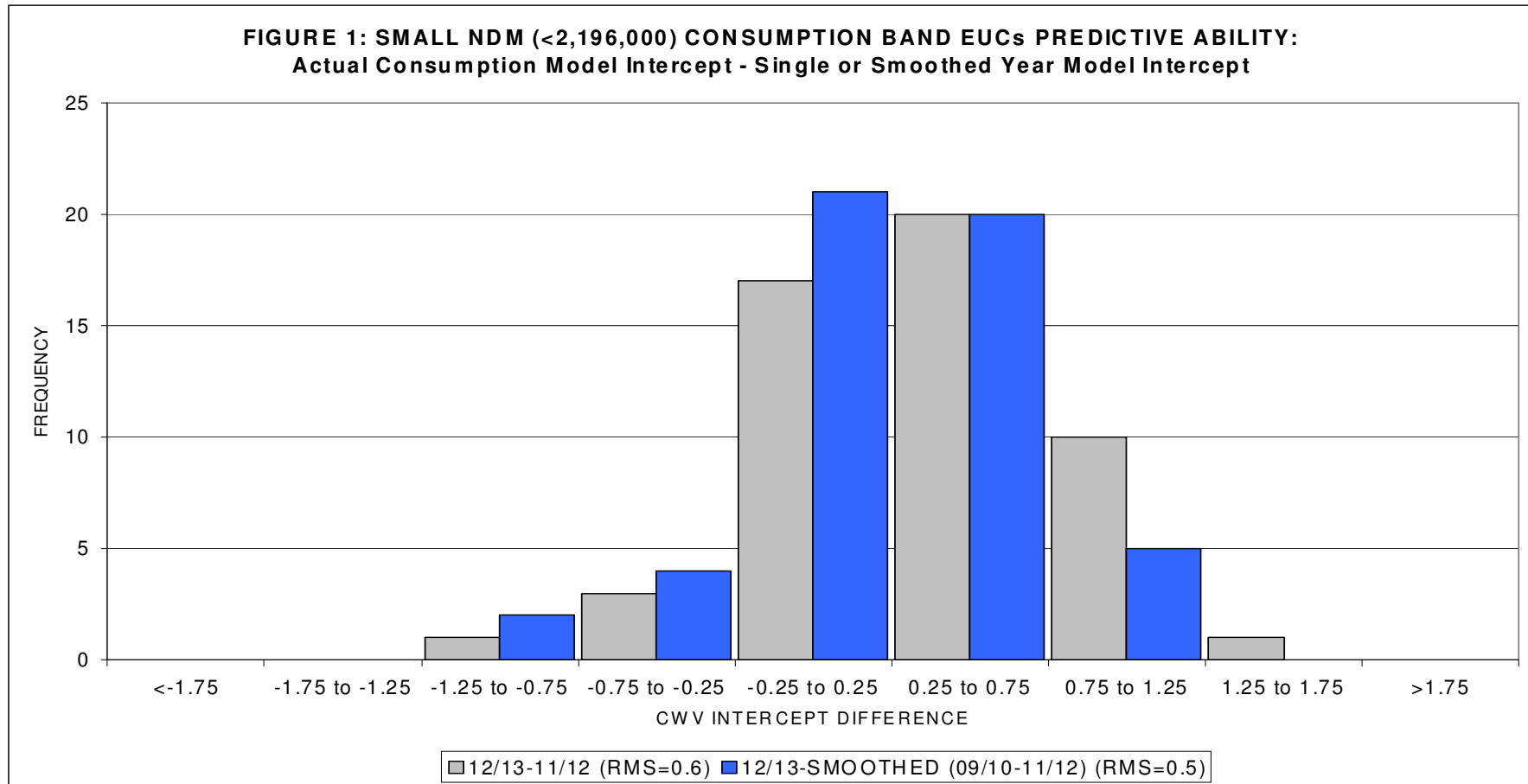
Model Smoothing: Volatility Analysis Assessment

- Analysis shows that the smoothed models for large and small NDM EUCs are associated with significantly lower year on year volatility as shown by:

    – Generally narrower distribution of CWV intercept differences

    – Generally notable reductions in the corresponding RMS values

- Further analysis carried out to assess predictive ability……

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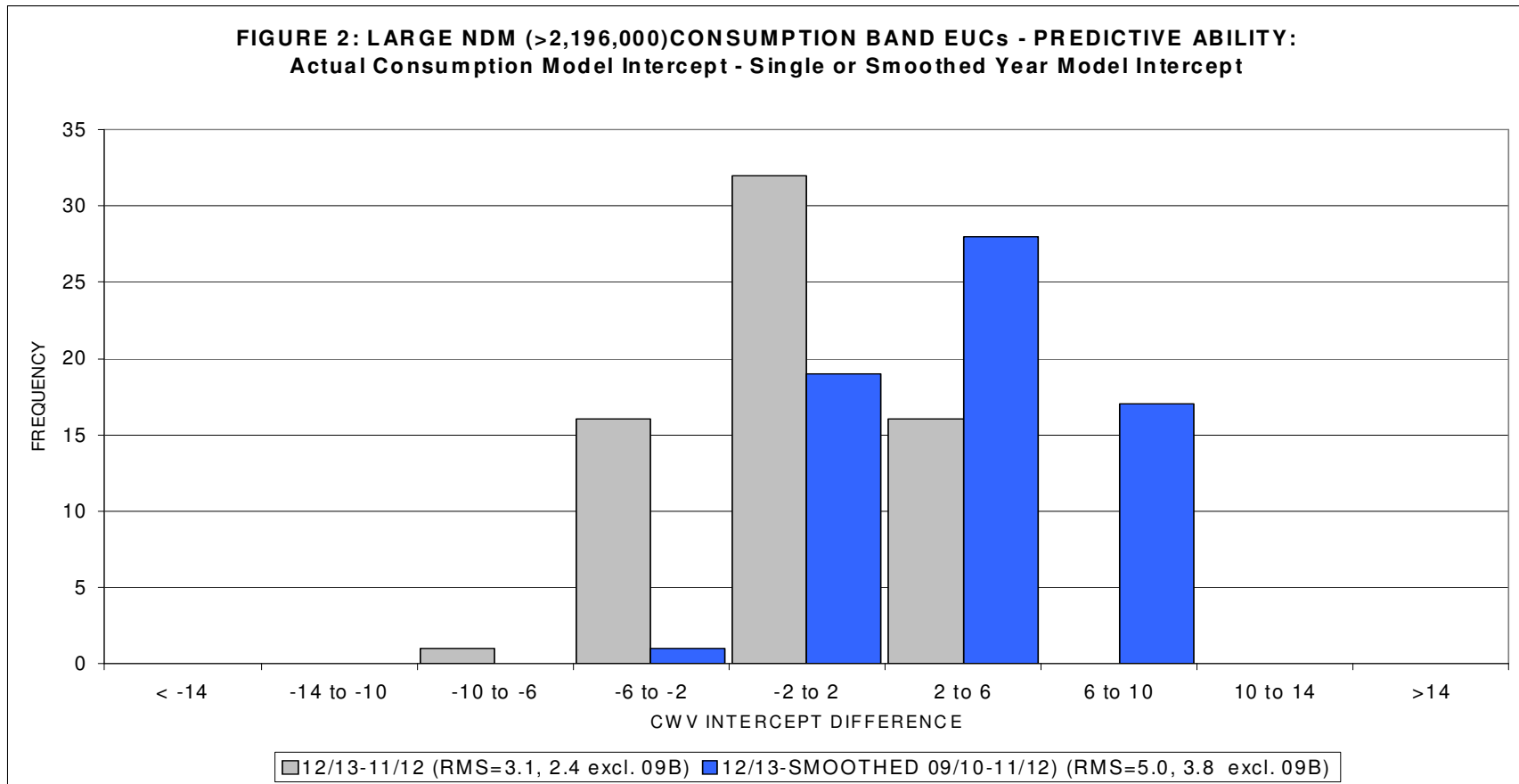# Model Smoothing: Analysis 2 – Predictive Ability

- Compares variance of actual CWV intercept from most recent data set (i.e. 2012/13) to single year model and smoothed model

- AIM: To assess differences in CWV intercepts between each year:

  - Compare 12/13 applied smoothed model (09/10, 10/11, 11/12)
    To
  - Most recent data set for 12/13

  - Compare 11/12 single year model (that would have been applied to 12/13)
    To
  - Most recent data set for 12/13

- Using variations in CWV intercepts and RMS values to identify level of predictability

Predictive Ability Analysis: Consumption Bands – Small NDM

FIGURE 1: SMALL NDM (<2,196,000) CONSUMPTION BAND EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept
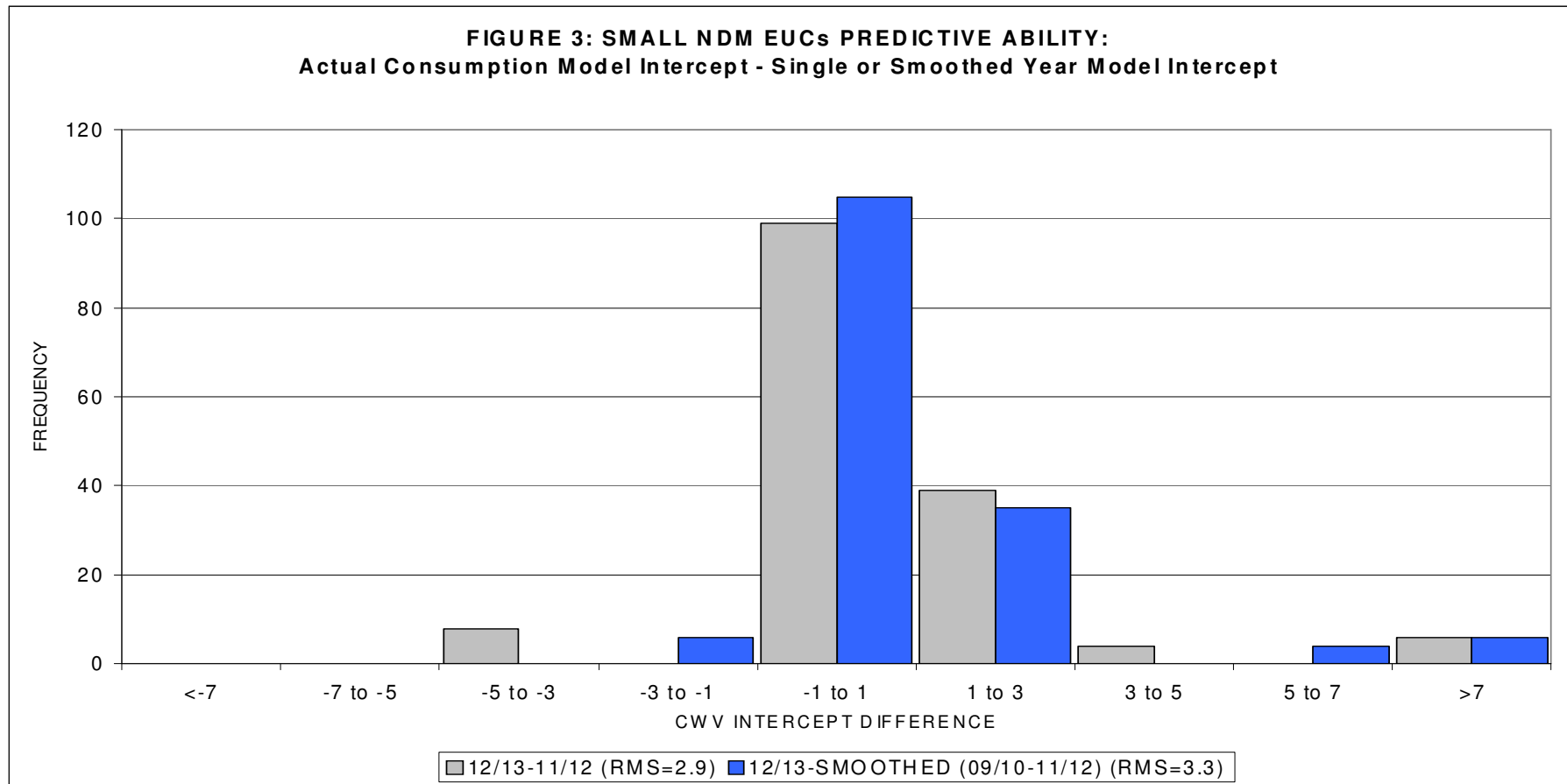

- 52 Small NDM EUCs assessed
- Smoothed model slightly better than single year model at predicting

Predictive Ability Analysis: Consumption Bands – Large NDM

FIGURE 2: LARGE NDM (>2,196,000)CONSUMPTION BAND EUCs - PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

Legend: 12/13-11/12 (RMS=3.1, 2.4 excl. 09B)   12/13-SMOOTHED 09/10-11/12) (RMS=5.0, 3.8 excl. 09B)

X-axis: CWV INTERCEPT DIFFERENCE — < -14, -14 to -10, -10 to -6, -6 to -2, -2 to 2, 2 to 6, 6 to 10, 10 to 14, >14
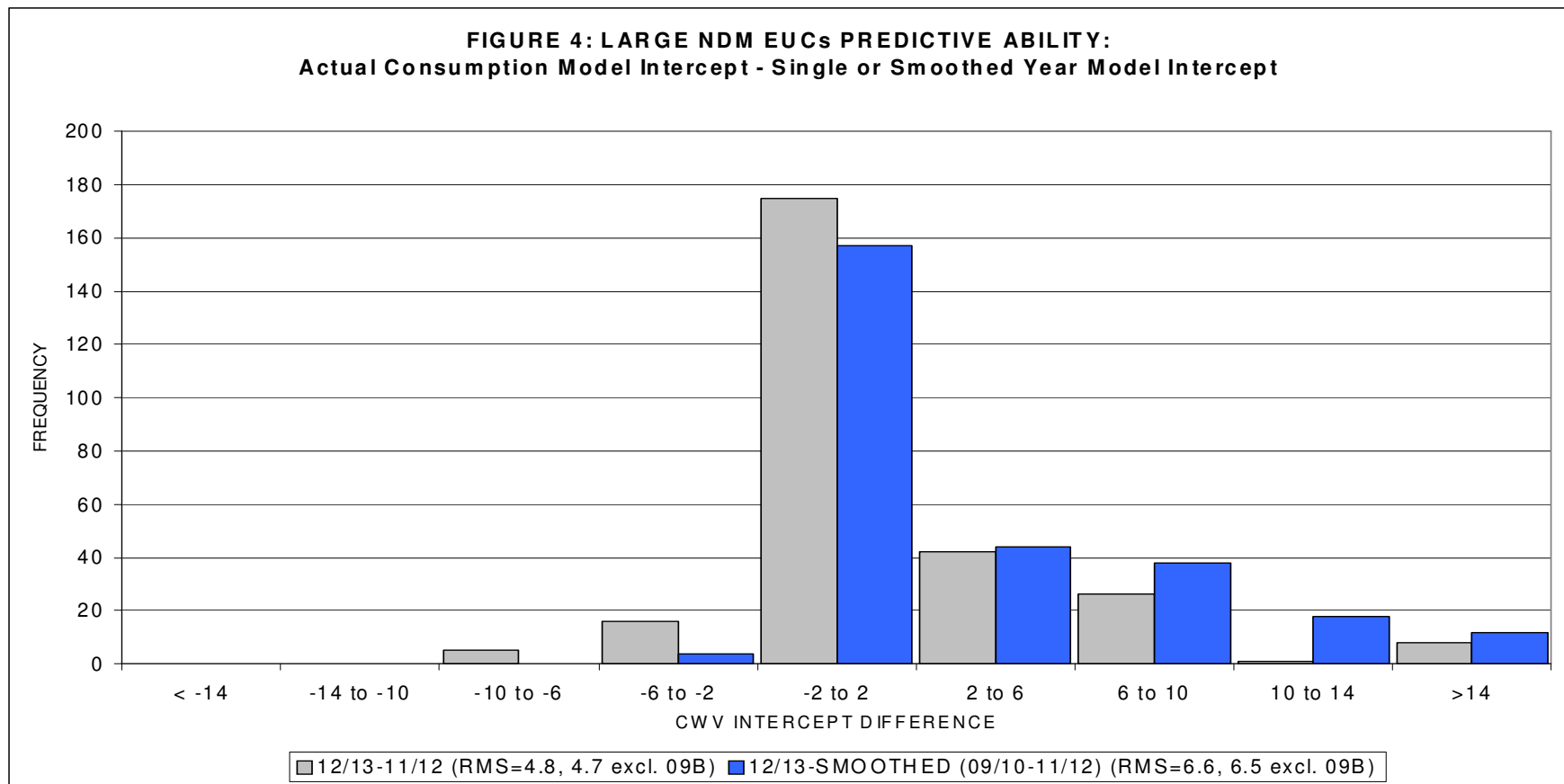
Y-axis: FREQUENCY

- 65 Large NDM EUCs assessed (includes 09B)
- Single year model has smaller CWV Intercept differences and lower RMS values so better at predicting

Predictive Ability Analysis: All EUC Bands – Small NDM

FIGURE 3: SMALL NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

- 156 Small NDM EUCs assessed
- Single year model is marginally better at predicting with lower RMS values

Predictive Ability Analysis: All EUC Bands – Large NDM

FIGURE 4: LARGE NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

Legend: 12/13-11/12 (RMS=4.8, 4.7 excl. 09B) ▪ 12/13-SMOOTHED (09/10-11/12) (RMS=6.6, 6.5 excl. 09B)

- 273 Large NDM EUCs assessed
- Single year model better than smoothed model at predicting

Model Smoothing: Predictive Ability Assessment

- Overall there is evidence on this occasion that the single year models for Large NDM EUCs were better than smoothed models in terms of predictive ability. Significant changes to sample composition probable cause of this.

- No strong evidence for either approach across Small NDM Consumption and EUC bands

- The main driver for using a smoothed model is the mitigation of year on year volatility rather than predictive ability

- Further analysis carried out to assess trends ……

Model Smoothing: Analysis 3 – CWV Intercept Trends

- <u>AIM:</u> To identify any trends occurring in CWV intercepts between each year:

- Compares trends in CWV intercept value for the 3 single year models constituting the 13/14 smoothed model.

  - 2010/11
  - 2011/12
  - 2012/13

- Argument for single year models rather than smoothed could be strengthened if evidence of underlying trends

- 5 possible outcomes when completing this analysis…

Model Smoothing: Analysis 3 – CWV Intercept Trends

UP/UP (UU)

UP/DOWN (UD)

FLAT (F)

DOWN/DOWN (DD)

DOWN/UP (DU)
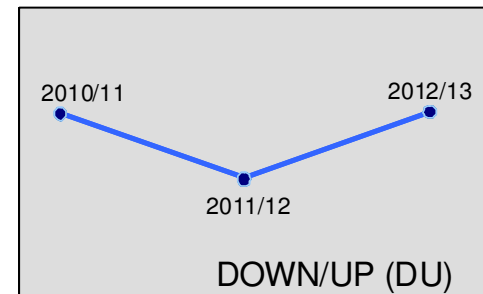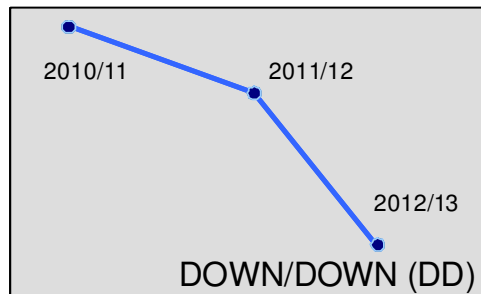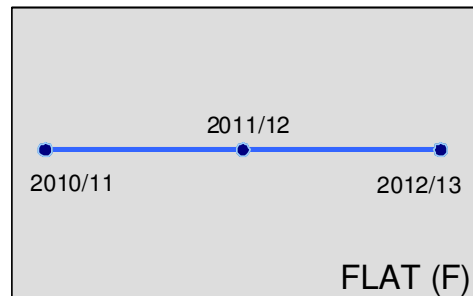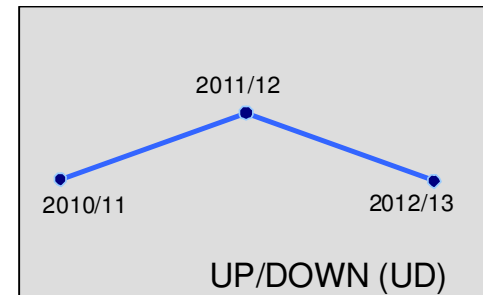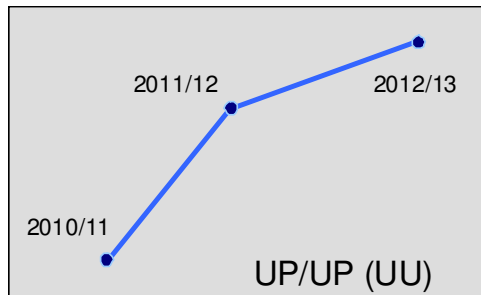
CWV Intercept Trends: Results of Analysis – 3 years

EUC	Type					Total	
	UU	UD	DU	DD	F		
2010/11, 2011/12 and 2012/13 Analysis Years	132	117	115	26	39	429	Autumn 2013
2009/10, 2010/11 and 2011/12 Analysis Years	135	150	74	31	39	429	Autumn 2012
2008/09, 2009/10 and 2010/11 Analysis Years	90	85	161	54	39	429	Autumn 2011
2007/08, 2008/09 and 2009/10 Analysis Years	52	214	91	33	39	429	Autumn 2010
2006/07, 2007/08 and 2008/09 Analysis Years	129	123	101	37	39	429	Autumn 2009
2005/06, 2008/09 and 2009/10 Analysis Years	46	81	173	90	39	429	Autumn 2008
2004/05, 2005/06 and 2008/09 Analysis Years	28	195	68	99	39	429	Autumn 2007

- Table summarises the results for all EUCs for 3 year CWV intercept patterns.

- Results highlighted are 'new' since last review of model smoothing in Autumn 2011

- Overall there has been an increase in the number of instances of specific EUC bands/WAR bands where a "DD" or "UU" pattern occurs.

- For individual EUC and LDZ details see Table 2 of accompanying document (three year CWV intercept patterns).

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CWV Intercept Trends: Results of Analysis – 4 years

EUC	Type				Total	
	N	D	U	F		
2009/10, 2010/11, 2011/12 and 2012/13 Analysis Years	308	7	75	39	429	Autumn 2013
2008/09, 2009/10, 2010/11 and 2011/12 Analysis Years	335	16	39	39	429	Autumn 2012
2007/08, 2008/09, 2009/10 and 2010/11 Analysis Years	363	5	22	39	429	Autumn 2011
2006/07, 2007/08, 2008/09 and 2009/10 Analysis Years	364	6	20	39	429	Autumn 2010
2005/06, 2006/07, 2007/08 and 2008/09 Analysis Years	356	18	16	39	429	Autumn 2009
2004/05, 2005/06, 2006/07 and 2007/08 Analysis Years	352	25	13	39	429	Autumn 2008
2003/04, 2004/05, 2005/06 and 2006/07 Analysis Years	353	19	19	38	429	Autumn 2007

- Table summarises the results for all EUCs for 4 year CWV intercept patterns.

- Key:
  N: No consistent trend
  D: Decreasing values
  U: Increasing values
  F: Flat or nearly flat models

- When examined over 4 years the predominant effect is one of no consistent pattern across each LDZ and EUC band/WAR band

- For individual EUC and LDZ details see Table 3 of accompanying document (four year CWV intercept patterns).

Model Smoothing: Trends Analysis Assessment

- Over all EUC bands/WAR bands there are 6 predominant occurrence of upward patterns in CWV intercepts over 4 years across all LDZs.

- These 6 EUC bands in the Large NDM sector show an upward four year trend in the majority of LDZs making up 2.89% of NDM load.

- Load Factors are also analysed over the same period in order to assess trends. The graphs of load factors are in supporting document (Figures 10 to 19). Example on next slide.

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Model Smoothing: Predictive Ability Assessment
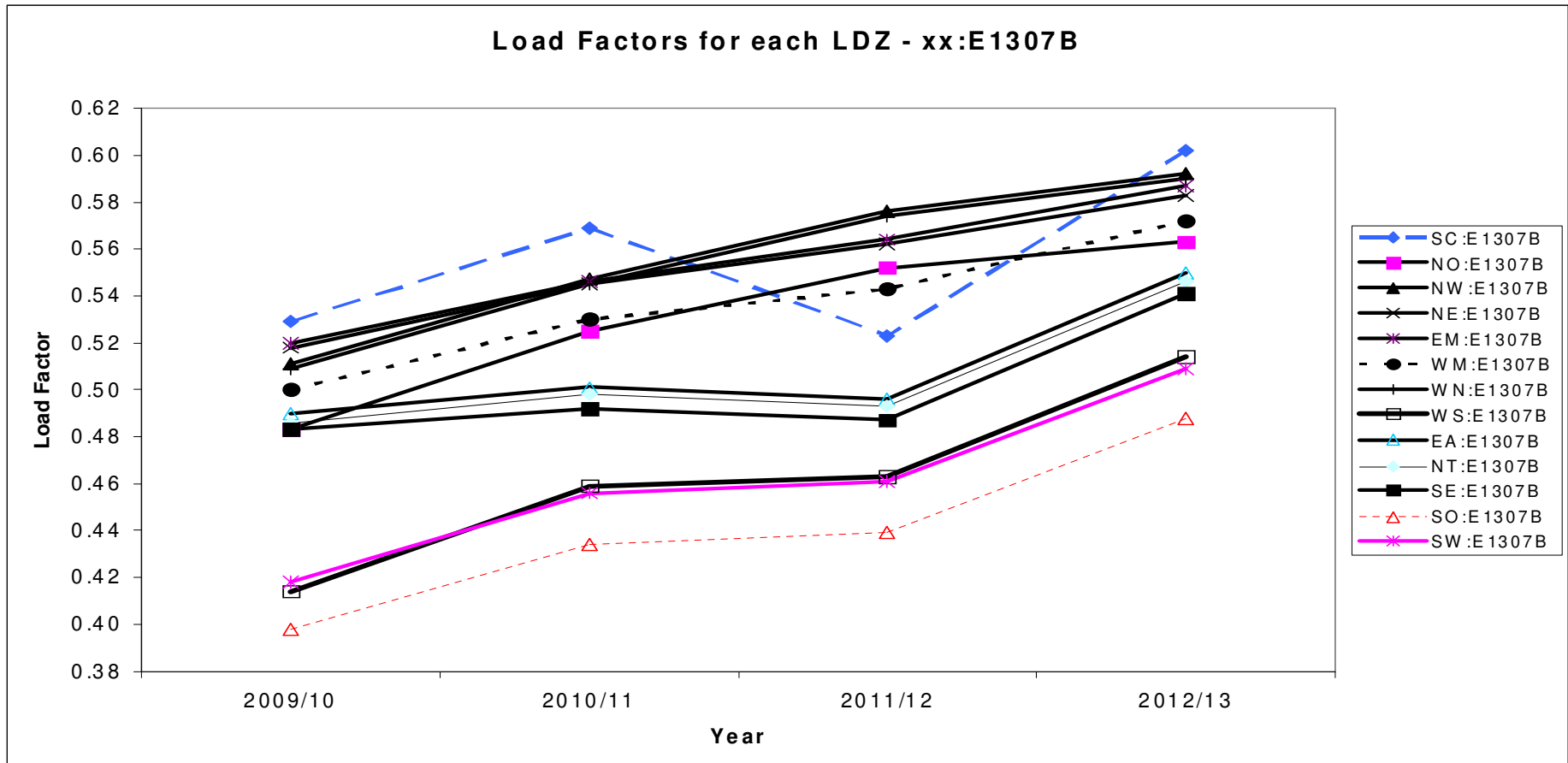
- Upward CWV intercept trend in 10 of 13 cases over the 4 years
- Load Factors also increase year on year in 9 of these 10 cases

Model Smoothing Review : Conclusions

- Principles of model smoothing:

    – Reduce year on year volatility
    – Not necessarily to improve model prediction
    – Necessary to review and assess if emerging trends are identified

- Current analysis consistent with results from previous analysis:

    – Model smoothing overall does reduce year on year volatility
    – No strong evidence that either smoothed or single year models are consistently better in terms of predictive ability for Small NDM.
    – Predictive ability of Large NDM possibly impacted by changes to sample composition
    – No signs of genuine emerging trends of sufficient clarity have been identified

- Xoserve view current methodology to use model smoothing over 3 years to be appropriate and fit for purpose

- Recommend model smoothing approach in the form currently applied is retained for Spring 2014 and Spring 2015 analysis

- DESC views on outcomes and date for next review ?

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