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## DESC: Model Smoothing - Evaluation

8<sup>th</sup> November 2011



## Model Smoothing: Background

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- 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 2009 and has been carried out along the same lines.
- Outcome will help inform decisions on approach and application of model smoothing for Spring 2012.
- Supporting document available provides further commentary and detailed analysis.
- Presentation summarises these results and conclusions

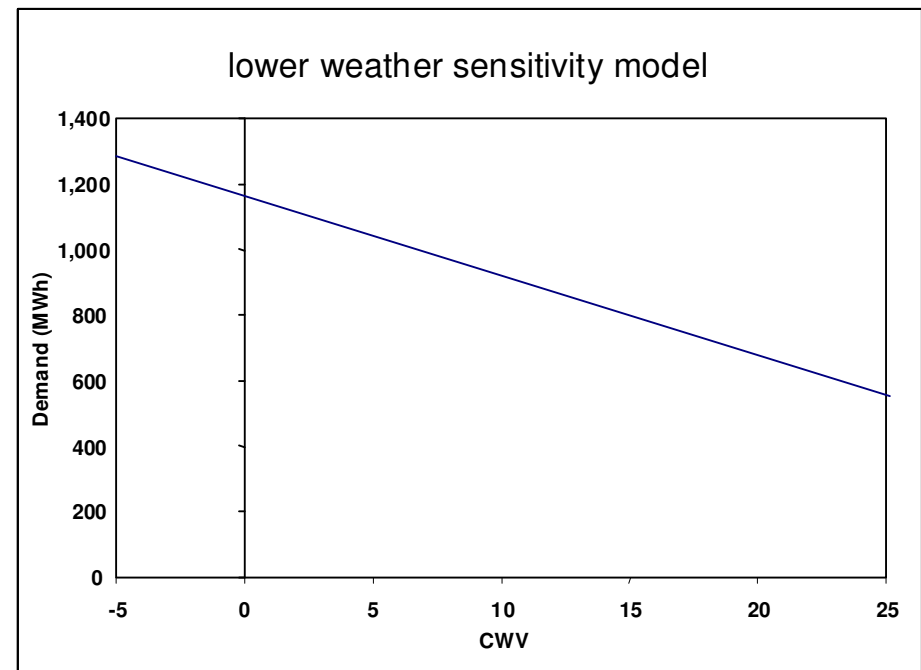
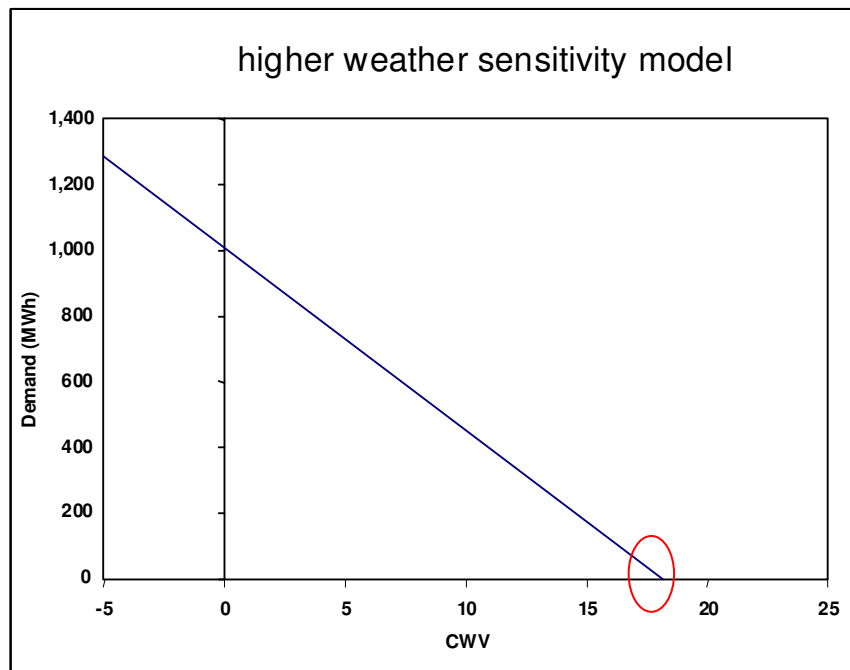
## Model Smoothing: Principles

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- 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 volatility and provide more stability 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

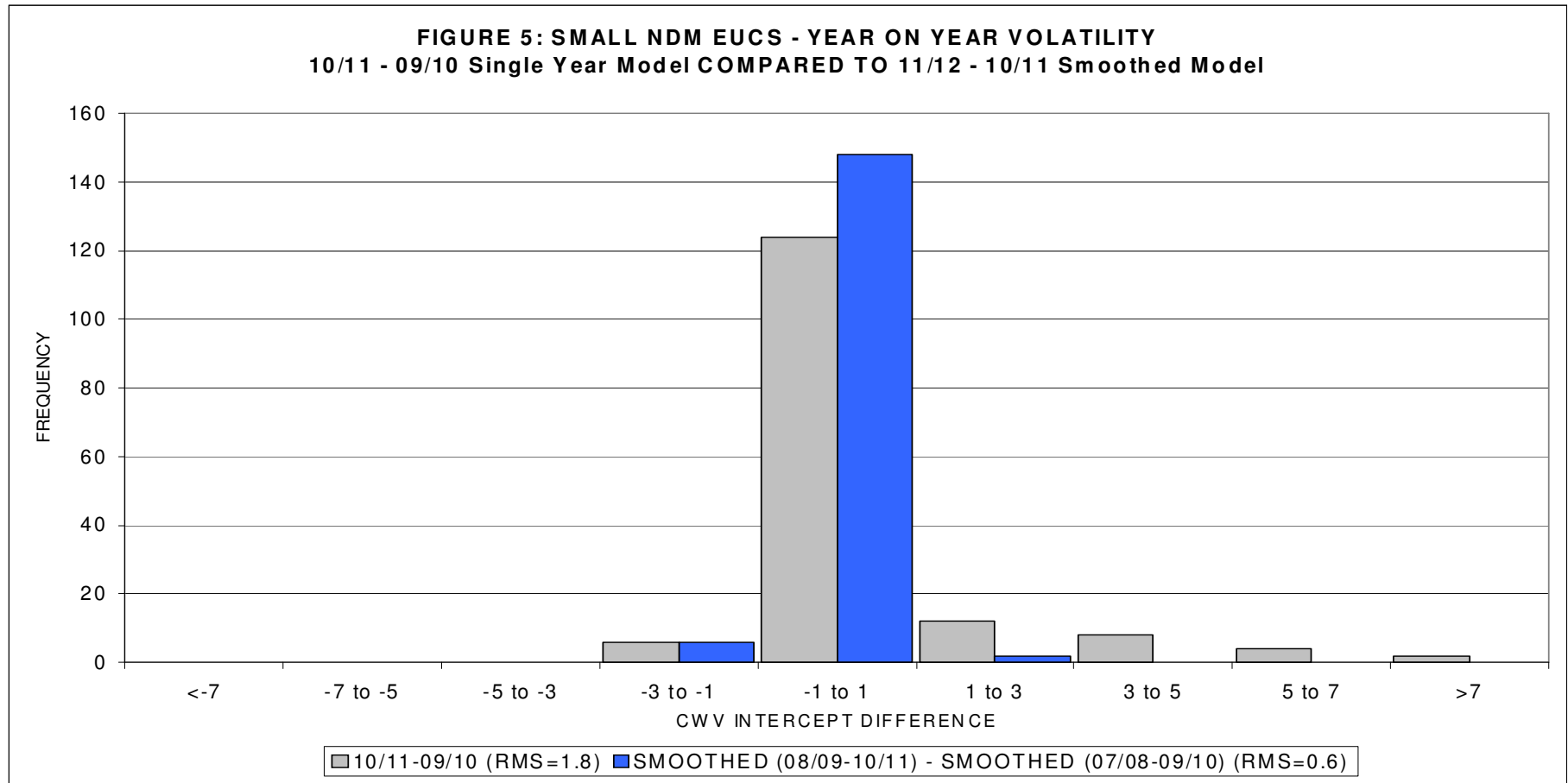


## Model Smoothing: Analysis 1 - Volatility Analysis

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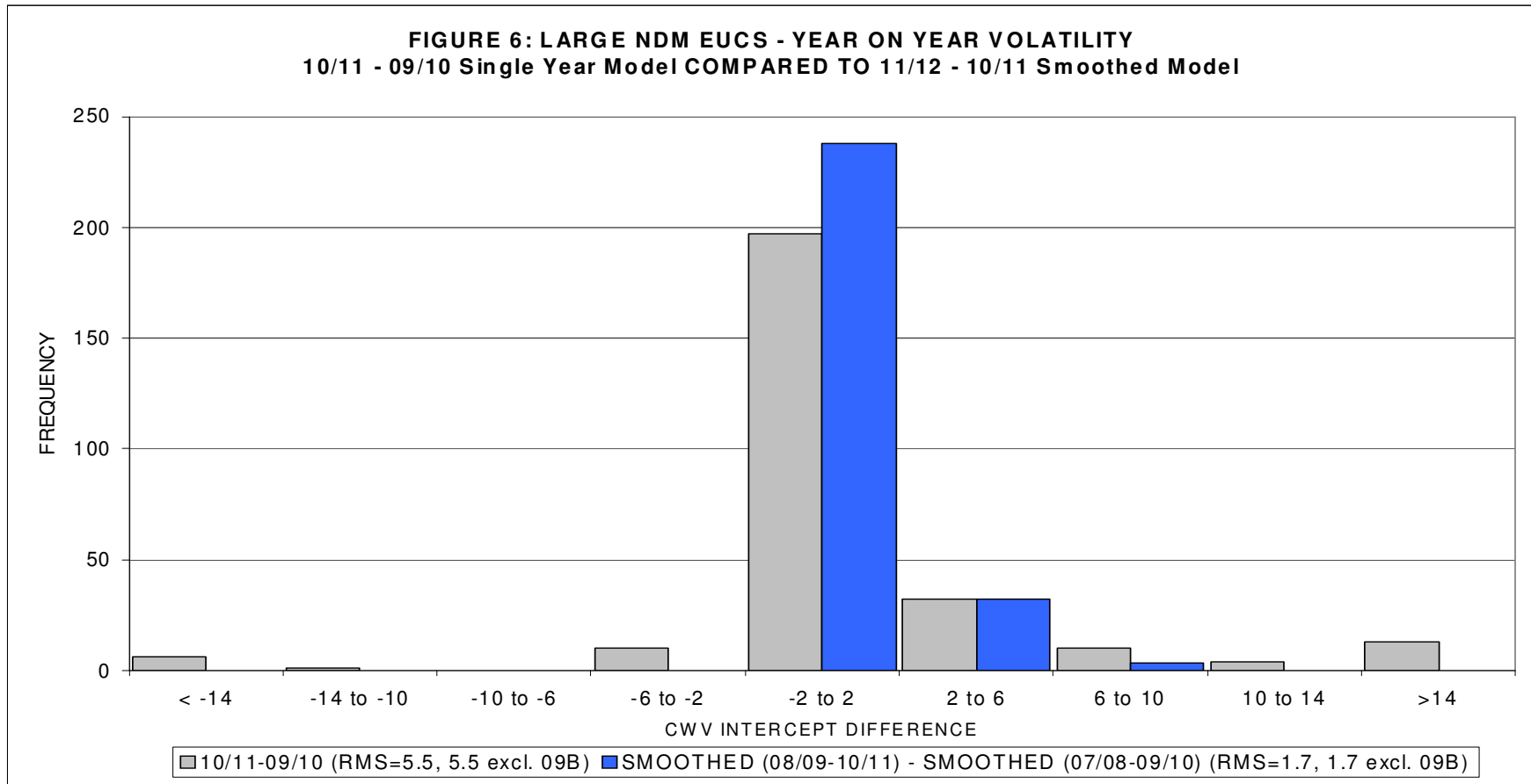
- Compares year on year volatility reduction of each model type (smoothed and single year).
- AIM: To assess differences in between each year:
  - Compare 11/12 applied smoothed model (08/09, 09/10, 10/11)  
To
  - Applied smoothed for 10/11 (07/08, 08/09, 09/10)
  - Compare 10/11 single year model (that would have been applied to 11/12)  
To
  - Single year model for 09/10 (that would have been applied to 10/11)
- Using variations in CWV intercepts and RMS values to identify level of volatility between model types and years.

# Volatility Analysis: All EUC Bands – Small NDM



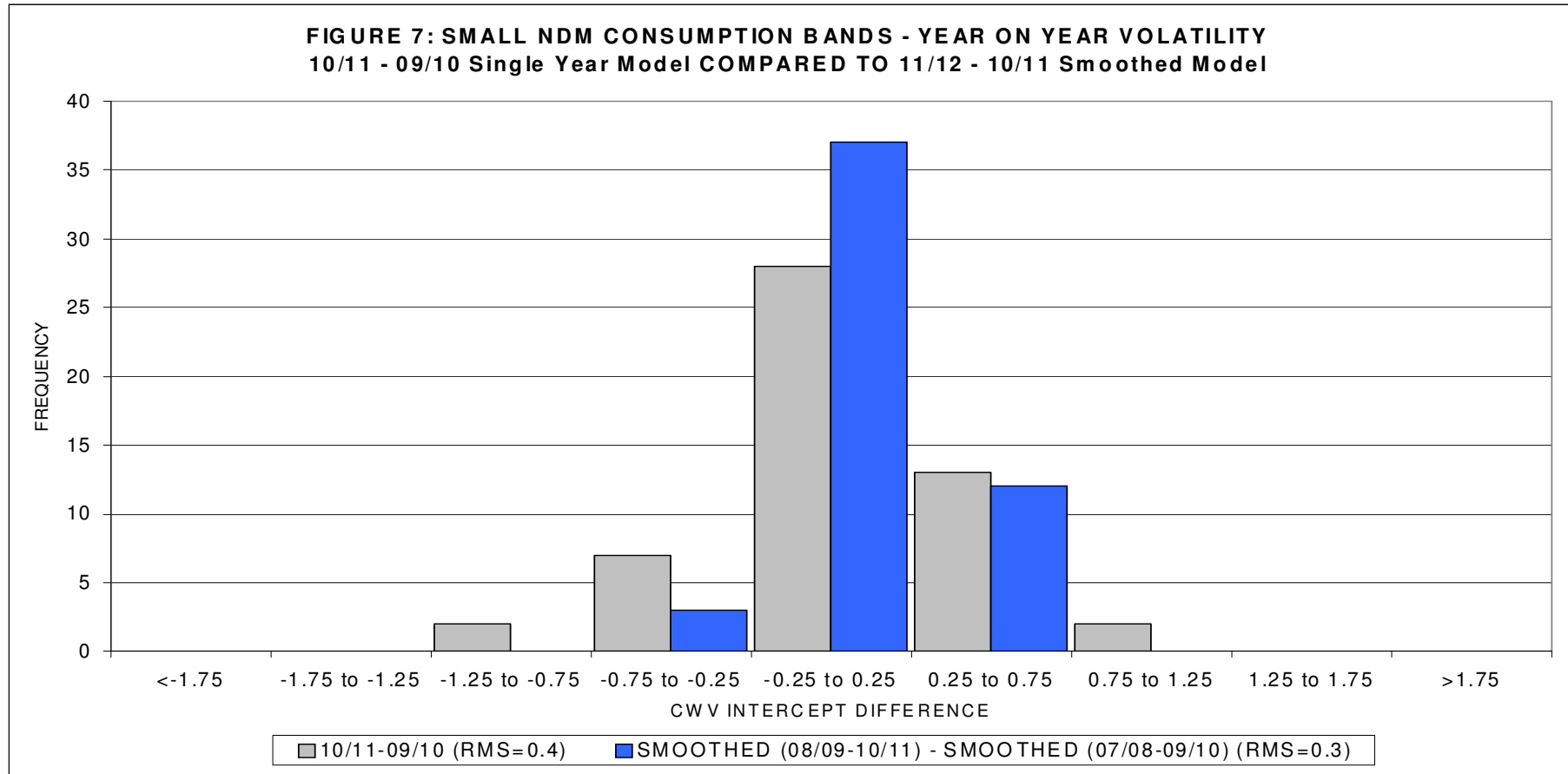
- 156 Small NDM EUCs assessed
- Smoothed Model has smaller CWV Intercept differences and lower RMS values and so overall less volatility

## Volatility Analysis: All EUC Bands – Large NDM



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

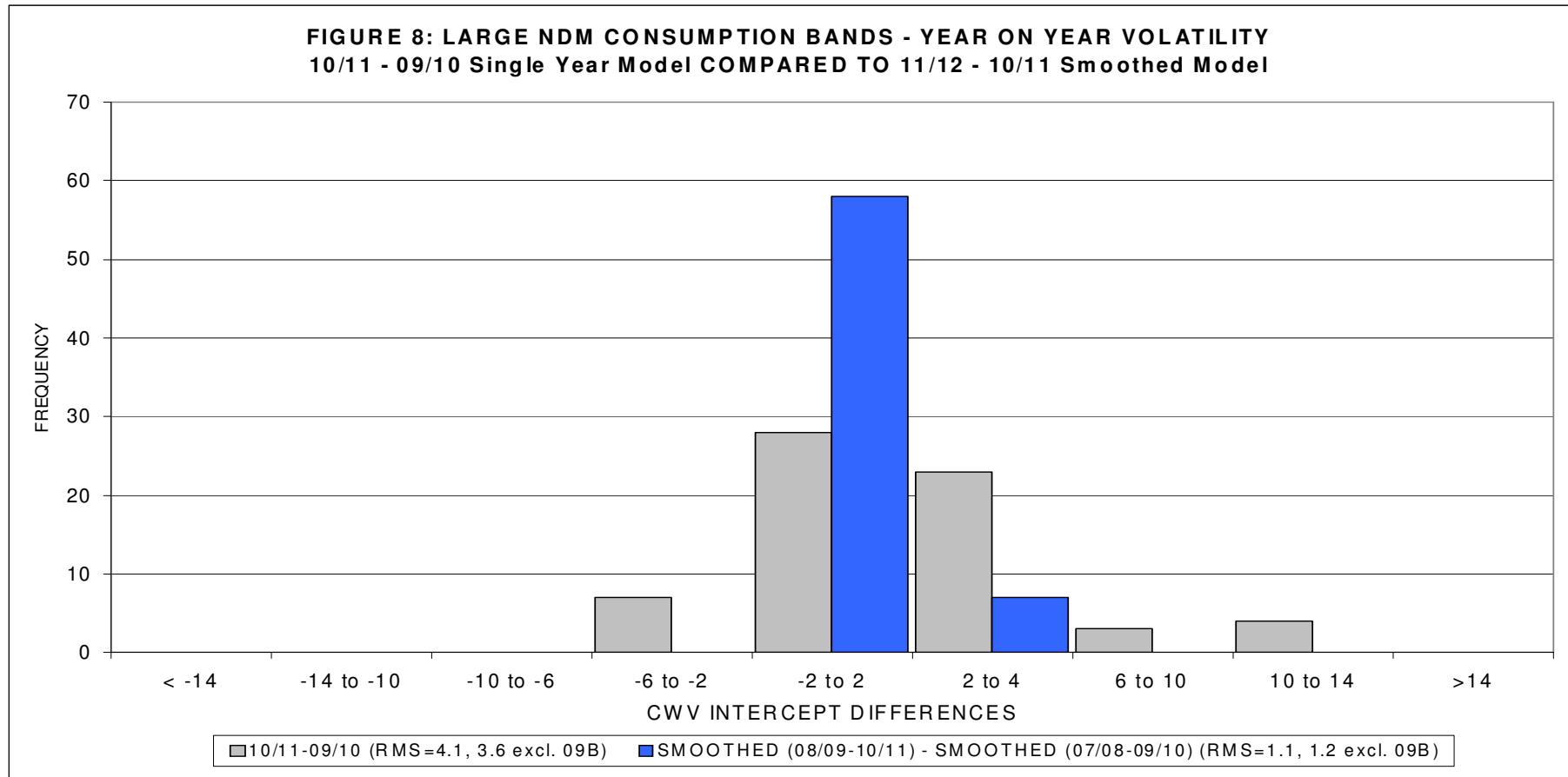
# Volatility Analysis: Consumption Bands – Small NDM



- 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



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



## Model Smoothing: Volatility Analysis Assessment

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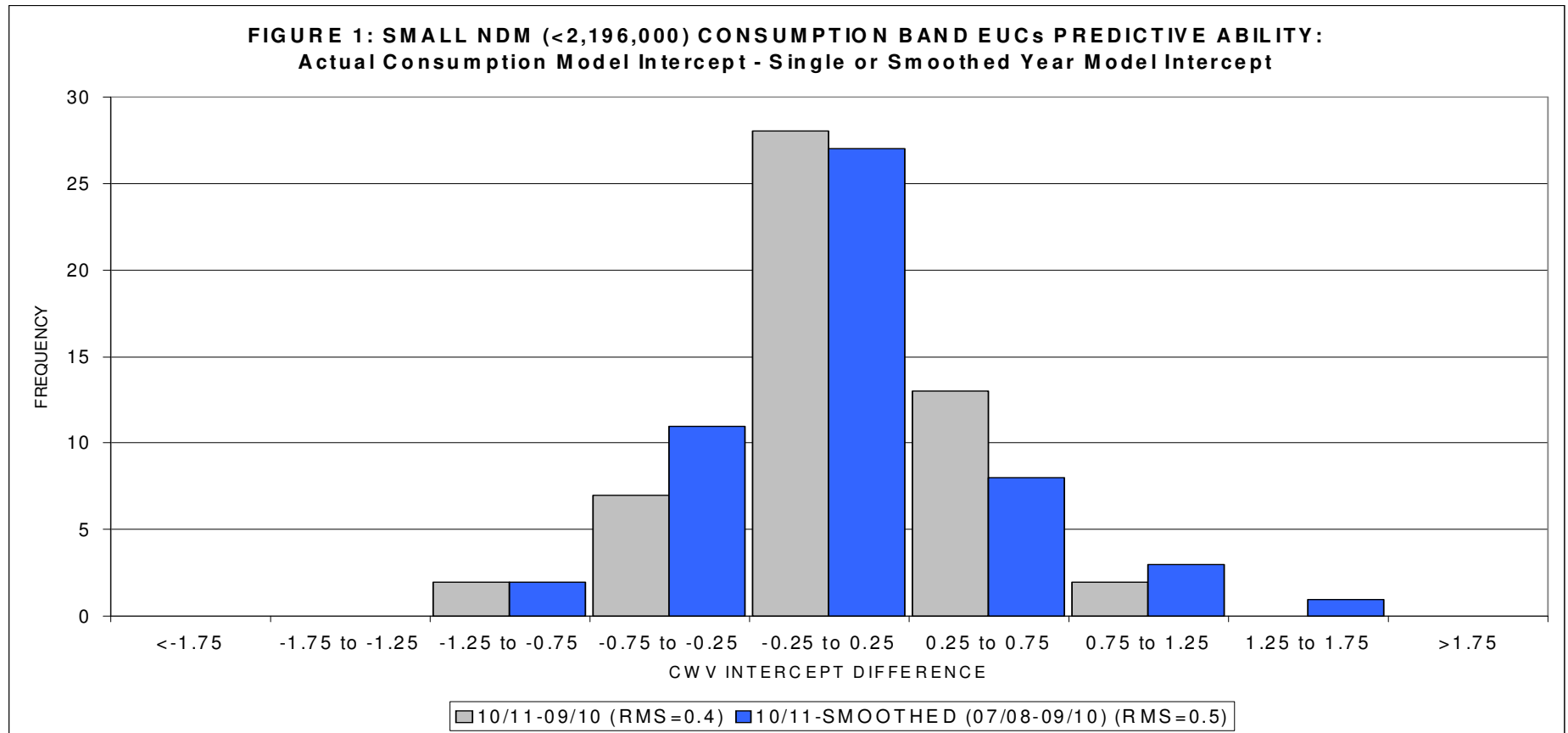
- Analysis shows that the smoothed models for large and small NDM EUCs are associated with significantly lower year on year volatility as shown by:
  - Generally narrower distribution of CWV intercept differences
  - Generally notable reductions in the corresponding RMS values
- Further analysis carried out to assess predictive ability.....

## Model Smoothing: Analysis 2 – Predictive Ability

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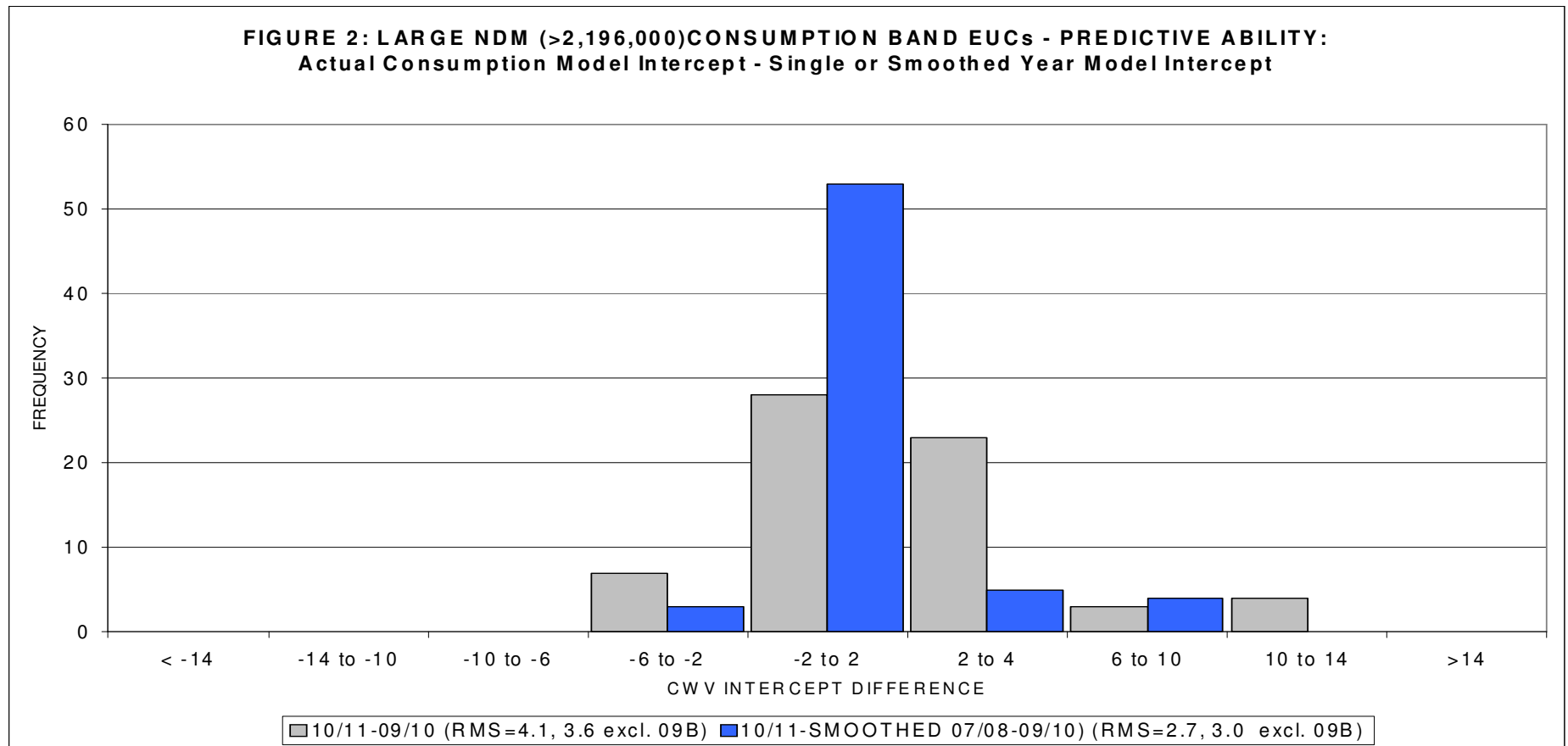
- Compares variance of actual CWV intercept from most recent data set (i.e. 2010/11) to single year model and smoothed model
- AIM: To assess differences in CWV intercepts between each year:
  - Compare 10/11 applied smoothed model (07/08, 08/09, 09/10)  
To
  - Most recent data set for 10/11
  - Compare 09/10 single year model (that would have been applied to 10/11)  
To
  - Most recent data set for 10/11
- Using variations in CWV intercepts and RMS values to identify level of predictability

# Predictive Ability Analysis: Consumption Bands – Small NDM



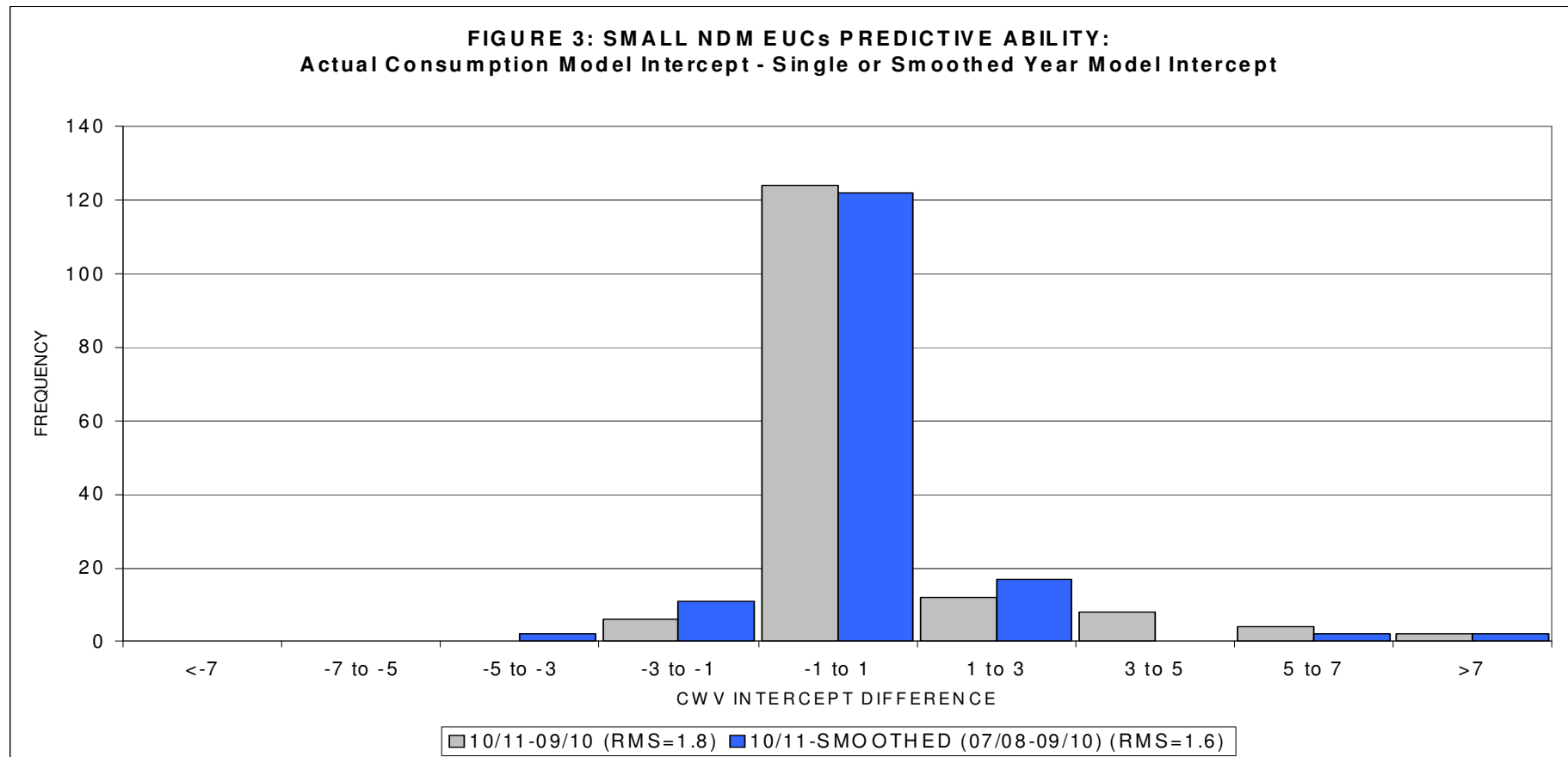
- 52 Small NDM EUCs assessed
- Single year model slightly better than smoothed model at predicting

## Predictive Ability Analysis: Consumption Bands – Large NDM



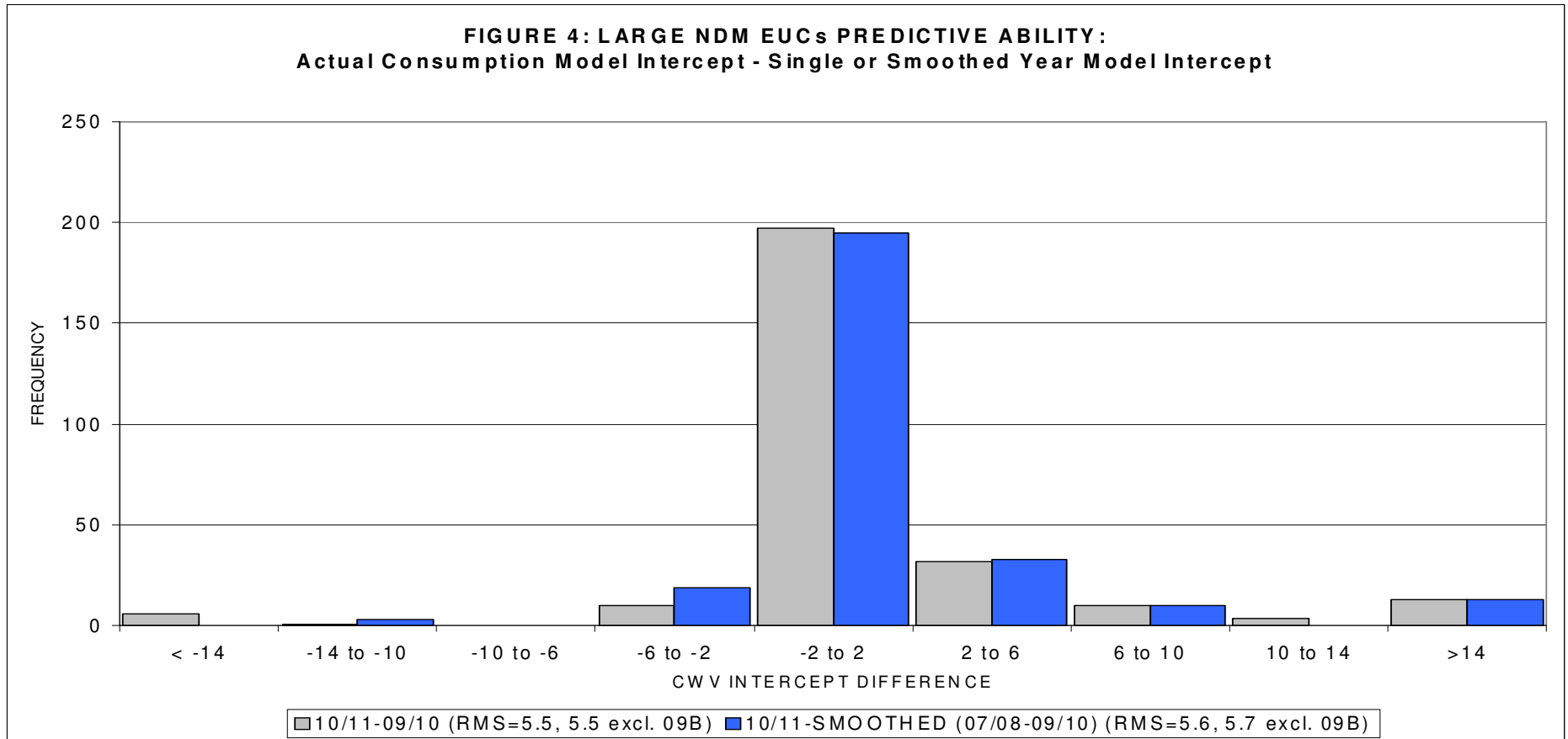
- 65 Large NDM EUCs assessed (includes 09B)
- Smoothed model has smaller CWV Intercept differences and lower RMS values so better at predicting

## Predictive Ability Analysis: All EUC Bands – Small NDM



- 156 Small NDM EUCs assessed
- Smoothed Model is marginally better at predicting with lower RMS values

# Predictive Ability Analysis: All EUC Bands – Large NDM



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

## Model Smoothing: Predictive Ability Assessment

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- Overall there is no strong evidence that either smoothed models or single year models are consistently better in terms of predictive ability
  - Mixed results across Small and Large Consumption bands and all 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 .....

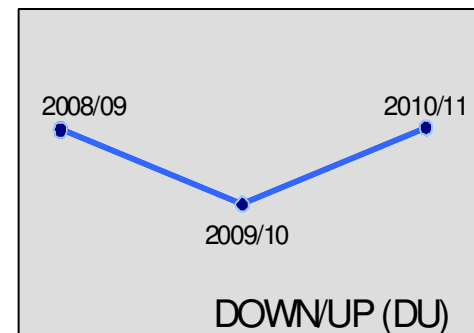
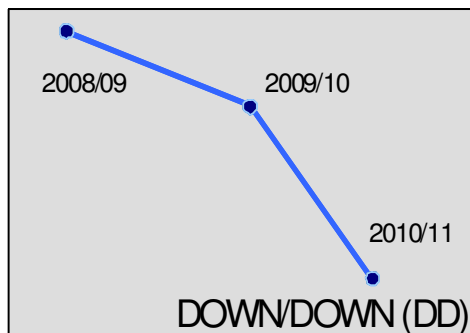
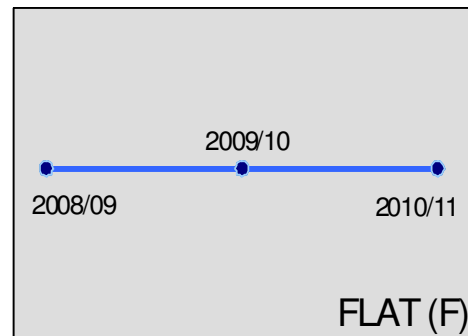
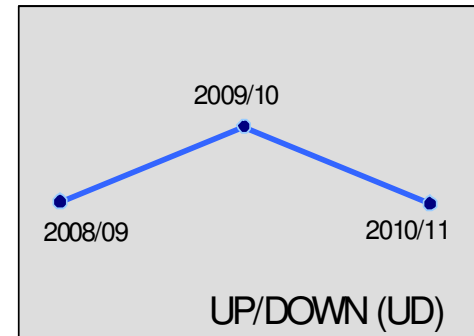
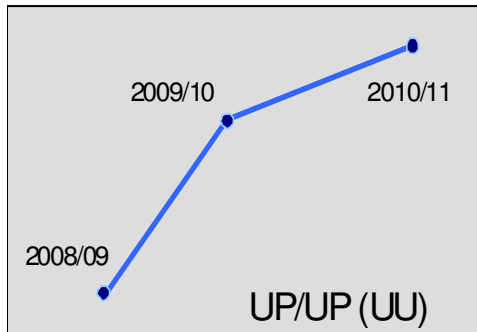


## Model Smoothing: Analysis 3 – CWV Intercept Trends

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- AIM: 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 11/12 smoothed model.
  - 2008/09
  - 2009/10
  - 2010/11
- 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



## CWV Intercept Trends: Results of Analysis – 3 years

EUC	Type					Total	
	UU	UD	DU	DD	F		
<b>2008/09, 2009/10 and 2010/11 Analysis Years</b>	90	85	161	54	39	429	Autumn 2011
<b>2007/08, 2008/09 and 2009/10 Analysis Years</b>	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
2003/04, 2004/05 and 2005/06 Analysis Years	109	169	65	48	38	429	Autumn 2006
2002/03, 2003/04 and 2004/05 Analysis Years	99	111	151	33	35	429	Autumn 2005

- 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 2009
- Overall there is a limited number of instances of specific EUC bands/WAR bands where a “DD” or “UU” pattern occurs to a notable extent.

- 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	
2007/08, 2008/09, 2009/10 and 2010/11 Analysis Years	363	5	22	39	429
2006/07, 2007/08, 2008/09 and 2009/10 Analysis Years	364	6	20	39	429
2005/06, 2006/07, 2007/08 and 2008/09 Analysis Years	356	18	16	39	429
2004/05, 2005/06, 2006/07 and 2007/08 Analysis Years	352	25	13	39	429
2003/04, 2004/05, 2005/06 and 2006/07 Analysis Years	353	19	19	38	429
2002/03, 2003/04, 2004/05 and 2005/06 Analysis Years	355	10	29	35	429
2001/02, 2002/03, 2003/04 and 2004/05 Analysis Years	360	9	25	35	429

Autumn 2011

Autumn 2010

Autumn 2009

Autumn 2008

Autumn 2007

Autumn 2006

Autumn 2005

- 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 (three year CWV intercept patterns).



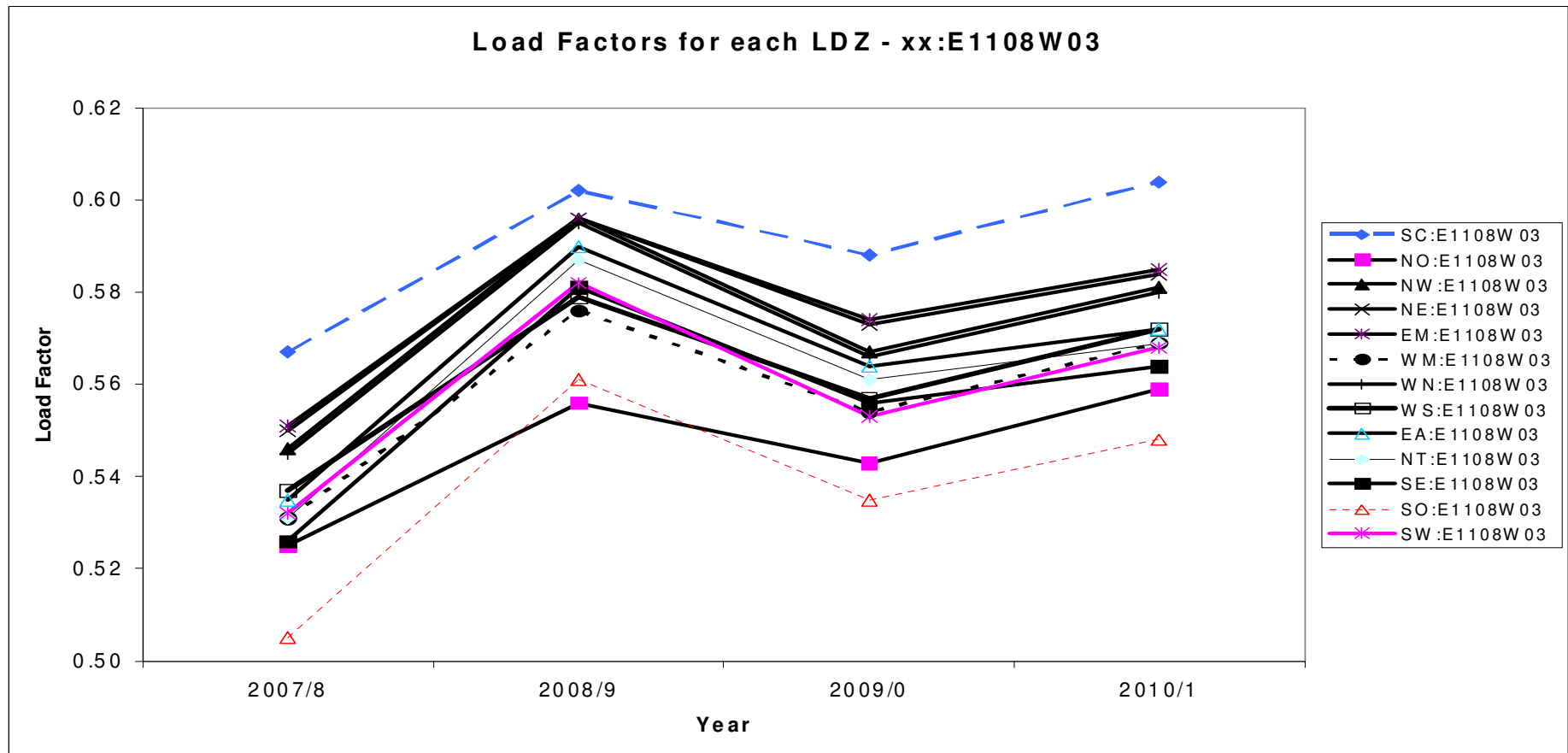

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## Model Smoothing: Trends Analysis Assessment

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- Over all EUC bands/WAR bands there is only one predominant occurrence of downward or upward patterns in CWV intercepts over 4 years across all LDZs.
- This case is EUC xx:E1108W03, which shows an upward four year trend in 7 (of 13 ) LDZs: making up 0.07% of NDM load (but in none of these do load factors show a consistent upward trend).
- The graphs of load factors (Figures 10 to 19 in supporting document) confirm the overriding evidence of the CWV intercept differences analysis.
- The predominant effect is one of no consistent trend.

# Model Smoothing: Predictive Ability Assessment



- Despite the upward CWV intercept trend in 7 of 13 cases over the 4 years Load Factors do not consistently increase year on year in any of these 7 cases.
- Across all the 7 LDZs this EUC has 0.07% of overall NDM load (AQ basis).

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## Model Smoothing Review : Conclusions

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- 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
  - No signs of emerging trends of sufficient clarity have been identified
- Transporters 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 2012/13 analysis.
- Next review of model smoothing approach due in Autumn 2013.

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