Model Smoothing - Evaluation

Supporting Document: DESC_Model Smoothing Review09_101109.pdf

DESC 10th November 2009

Model Smoothing

- Model smoothing: Averaging of 3 years models (including the current / most recent data sets) to derive new parameters
- First undertaken 1999/00 and applied to all subsequent years based on similar methodology
- This current analysis is the first full assessment of model smoothing results since Autumn 2007 and has been carried out along the same lines
  - Inform decisions on approach and application of model smoothing for Spring 2010
- *Supporting document gives full commentary and detailed analysis*

Principles of Model Smoothing

- Introduced to address year on year volatility in EUC models
  - Averaging 3 years models
  - Greater stability and removal of year on year volatility rather than improving model predictability ('accuracy')
  - Two objectives of stability and accuracy are not necessarily consistent
  - Underlying change in customer behaviour
    - May lead to changes in model characteristics
    - BUT: May then be stabilised by model smoothing
    - BUT: Underlying change or trend of single year? (Modelling annual trends)
- Consider: predictive, volatility and trend analysis - single to smoothed year comparisons to assess appropriateness

Principles of Model Smoothing Evaluation

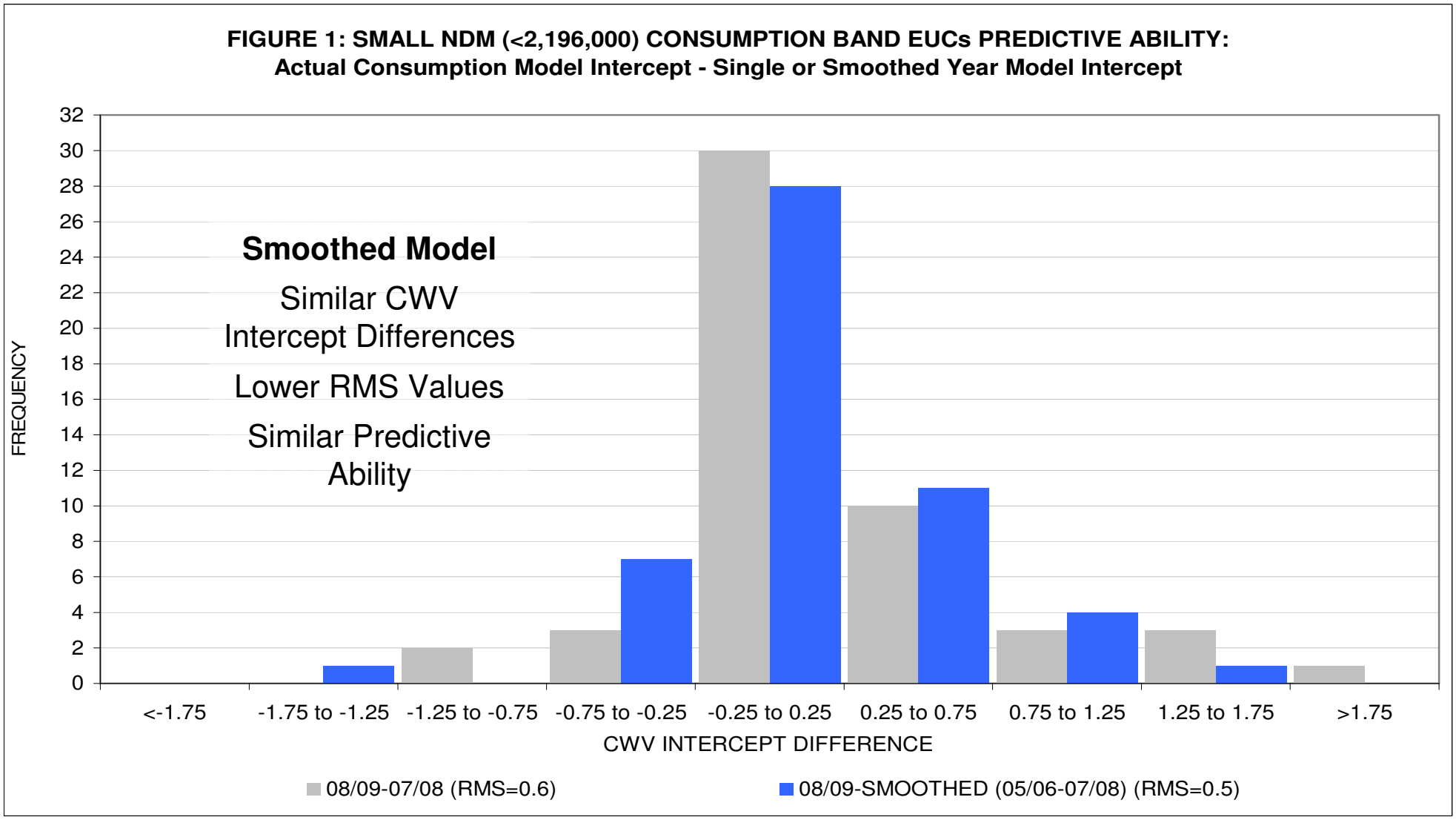
- Analysis compares actual 2008 / 09 consumption data with:
  - 2007/08 Models – Single Year model that would have been applied
  - Smoothed models for 2005/06, 2006/07 and 2007/08 – Smoothed Models that were applied
- Using (Consumption Band & WAR Bands)
  - CWV Intercepts – Point the line crosses the x-axis (weather sensitivity): predictive ability of single or smoothed compared to actual
  - Root Mean Squared (RMS) - Variance of smoothed or single year from actual
  - Year on Year Volatility - Change in CWV intercept values each year in single year and smoothed models
  - Trend Analysis - Identification of trends in single year CWV intercepts and change in load factor values

Analysis 1: Predictive Analysis - Purpose

- Compares CWV intercept values for:
  - Most recent actual data set 2008/09 gas year against
    - Single year model from 2007/08 that would have applied to 2008/09
    - Smoothed model (05/06, 06/07, 07/08) that was applied
- Compare variance of actual intercept to single year model and smoothed year model
- Includes RMS value for smoothed & single model
  - Highlights the variance of the model from the actual

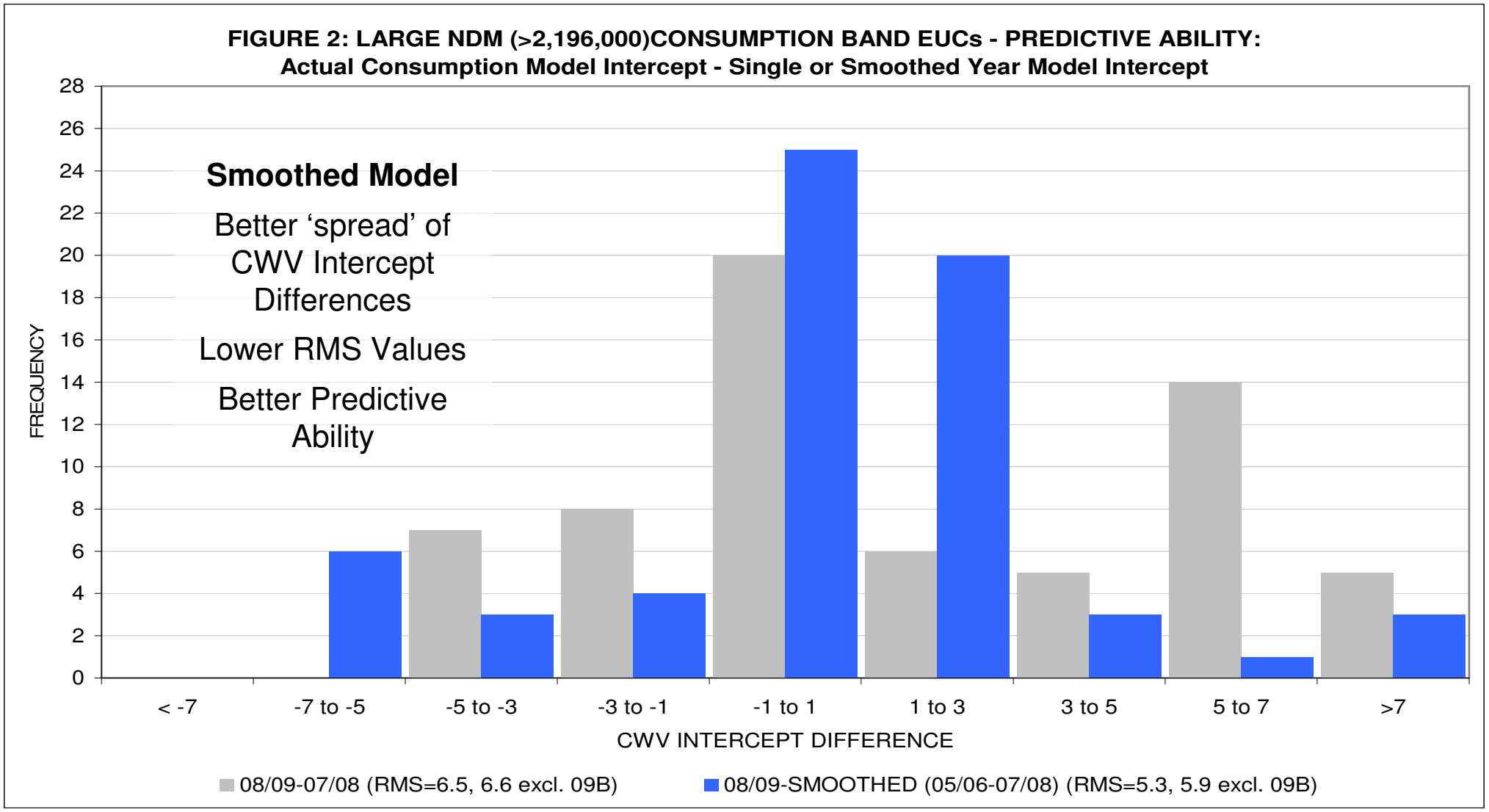
Predictive Analysis: Consumption Bands – Small NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



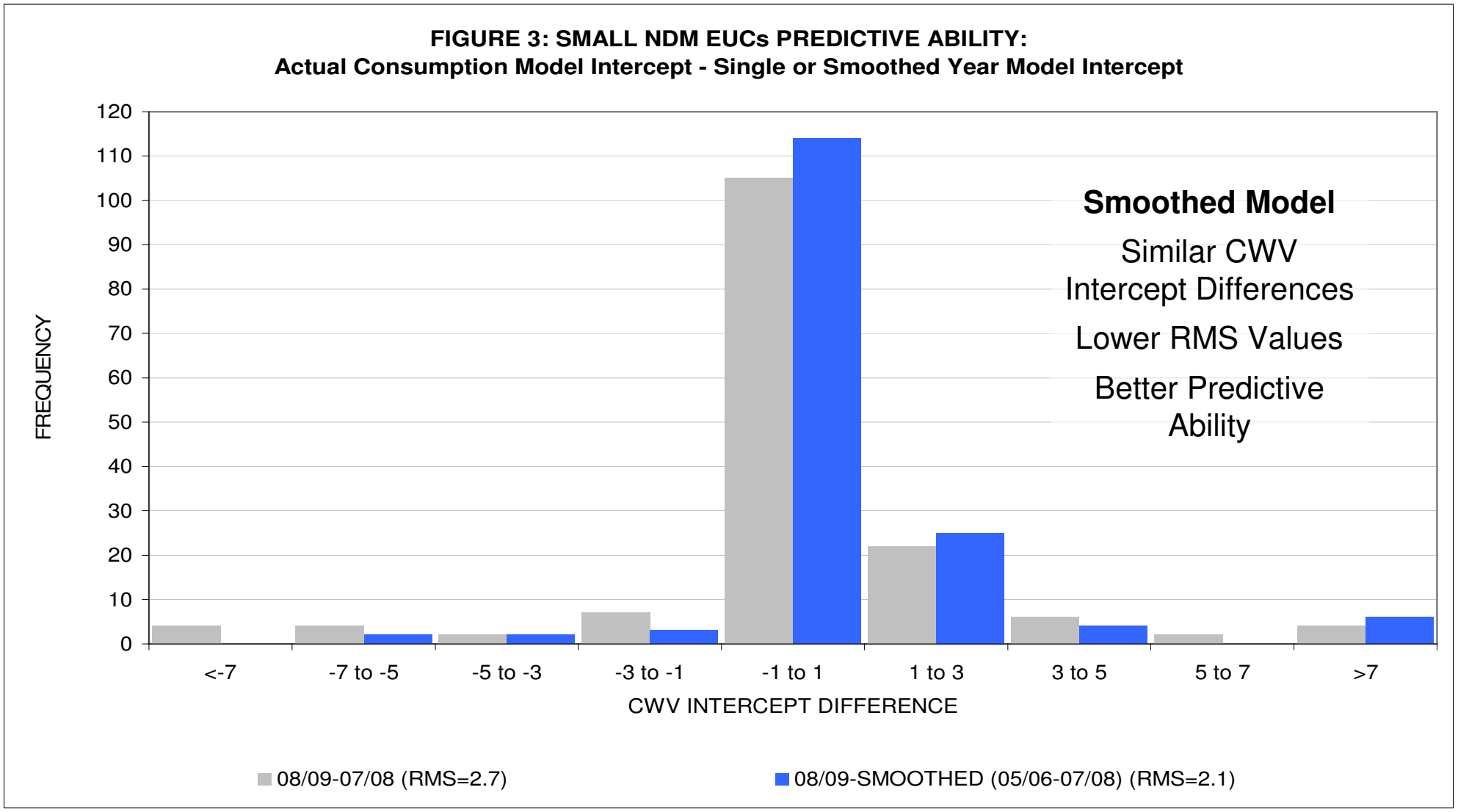
Predictive Analysis: Consumption Bands – Large NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



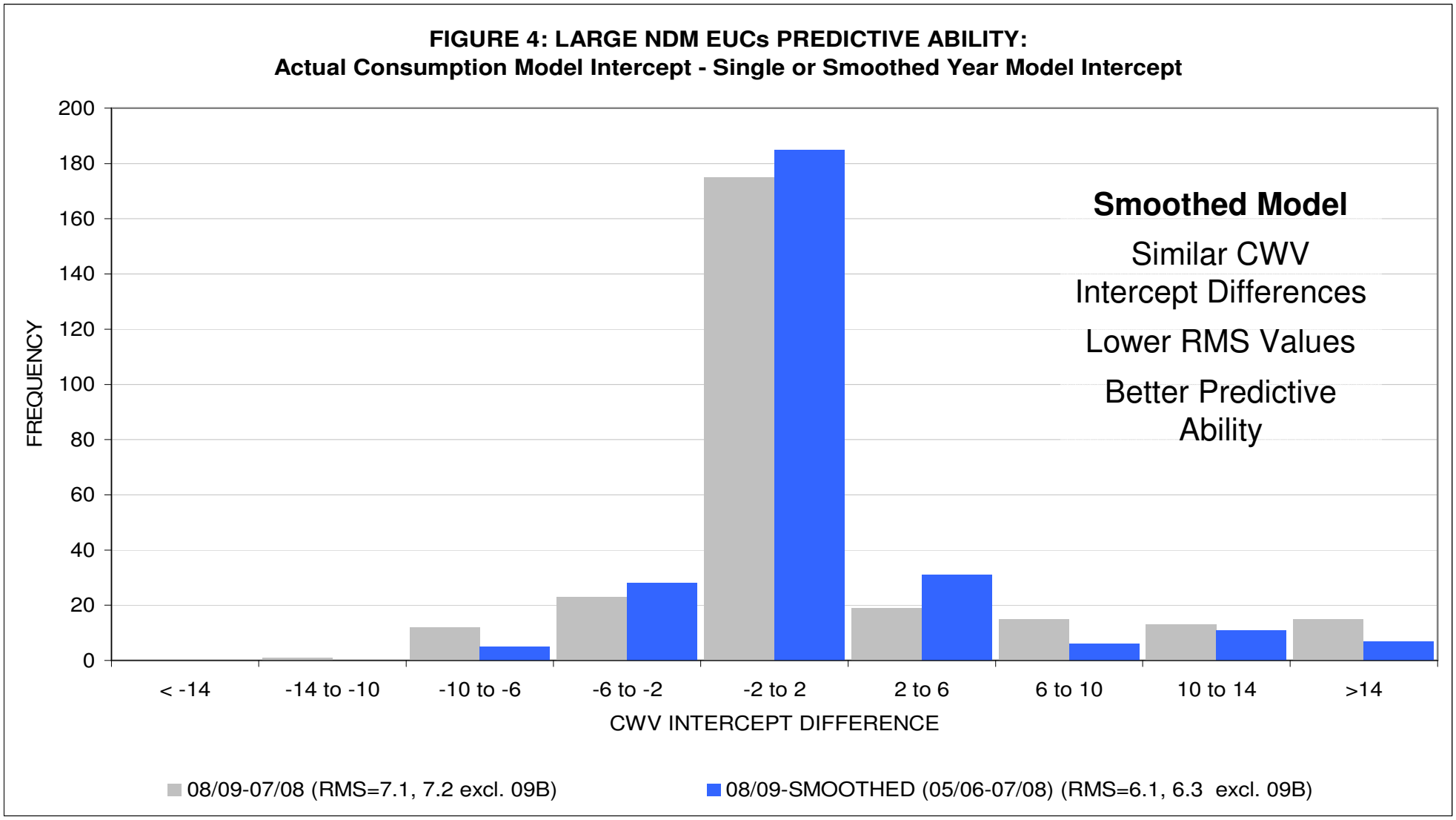
Predictive Analysis: All EUC Bands – Small NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



Predictive Analysis: All EUC Bands – Large NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



Analysis 1: Predictive Analysis - Conclusions

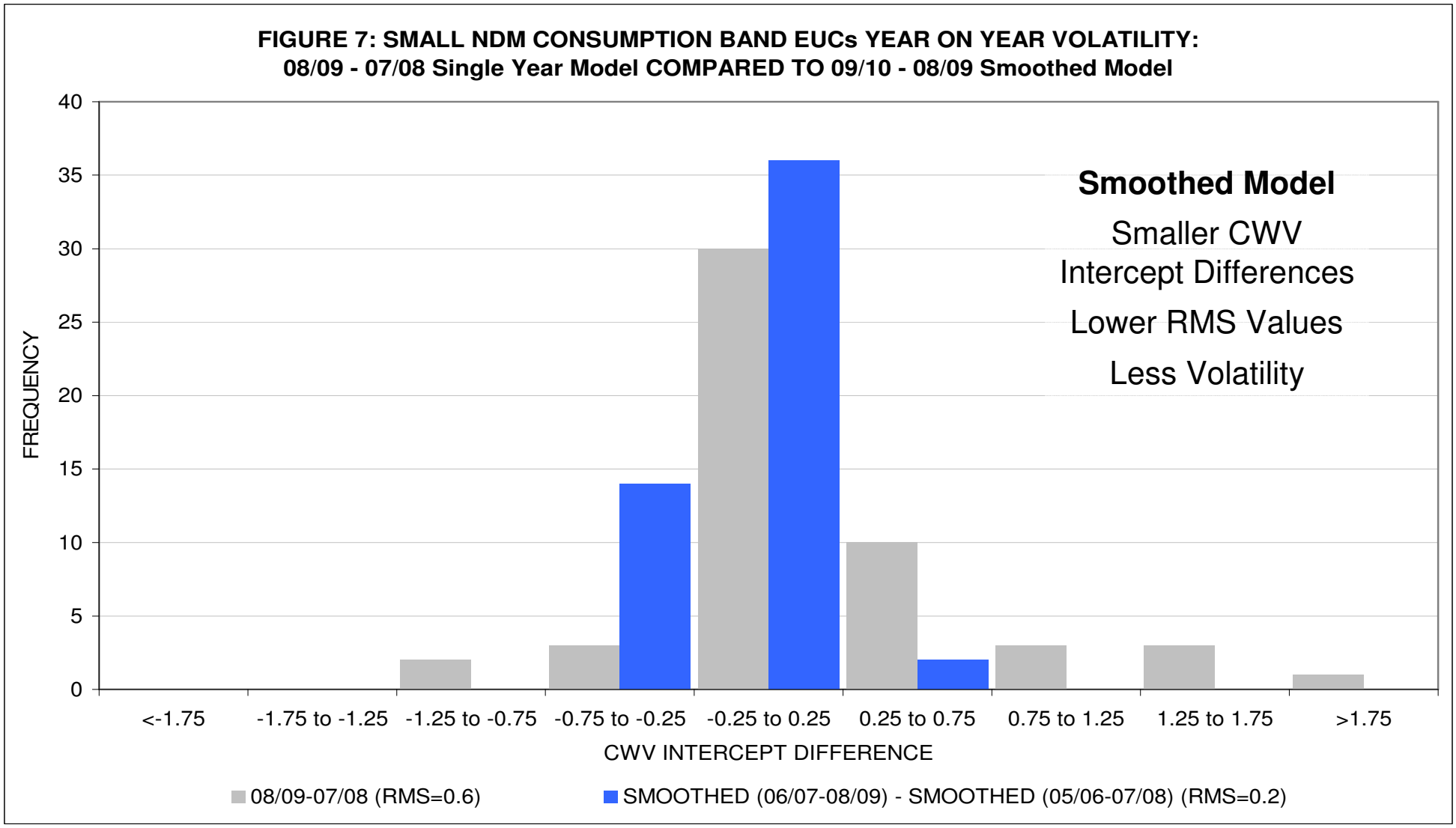
- Comparing single & smoothed year model CWV intercepts to actual consumption models:
  - Consumption band analysis highlights smoothed model is slightly better in predictive ability overall to the single year model
  - Consumption + WAR band analysis (all EUCs) highlights smoothed model has an improved spread of CWV intercepts compared to the single year model and RMS values are lower for smoothed model
- Overall, comparisons are not overwhelming evidence as to the superior predictive capability of smoothed models. However there is a small improvement
- Main driver for using a smoothed model is the mitigation of year on year volatility rather than predictive capability.
- Further analysis required to confirm model smoothing appropriateness…..

Analysis 2: Year on Year Volatility Analysis - Purpose

- Compares year on year volatility reduction of each model type (smoothed and single year)
  - AIM: To reduce differences in between each year
  - Compare 09/10 applied smoothed model (06/07, 07/08, 08/09)
  - TO
  - Applied smoothed model for 08/09 (05/06, 06/07, 07/08)
  - Compare 08/09 single year model (that would have been applied to 09/10)
  - TO
  - Single year model for 07/08 (that would have been applied to 08/09)
- Using variations in CWV intercept and RMS values to identify level of volatility between model types and years

Volatility Analysis: Consumption Bands – Small NDM

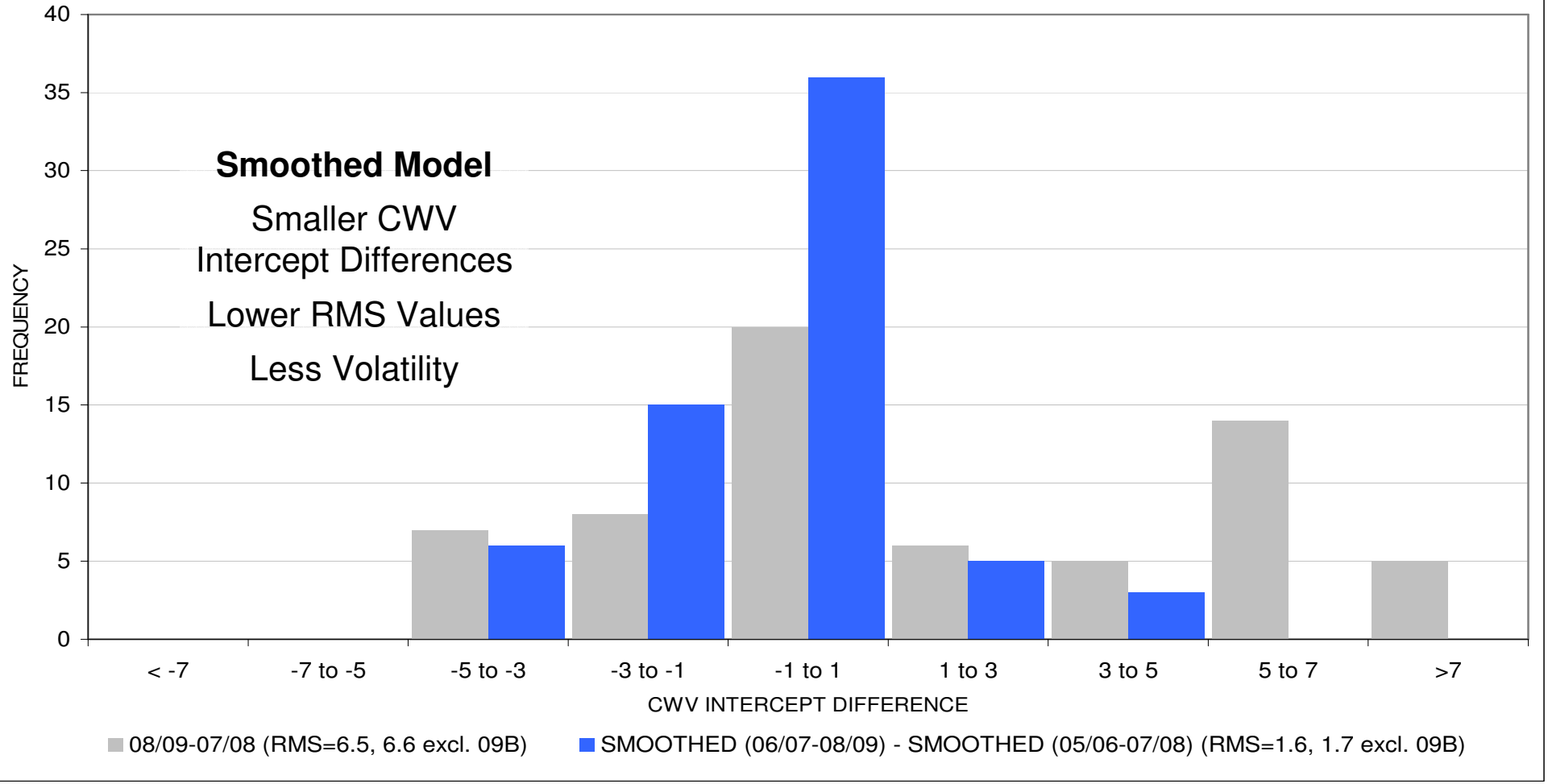
08/09 - 07/08 Single Year Model : 09/10 - 08/09 Smoothed Model



Volatility Analysis: Consumption Bands – Large NDM

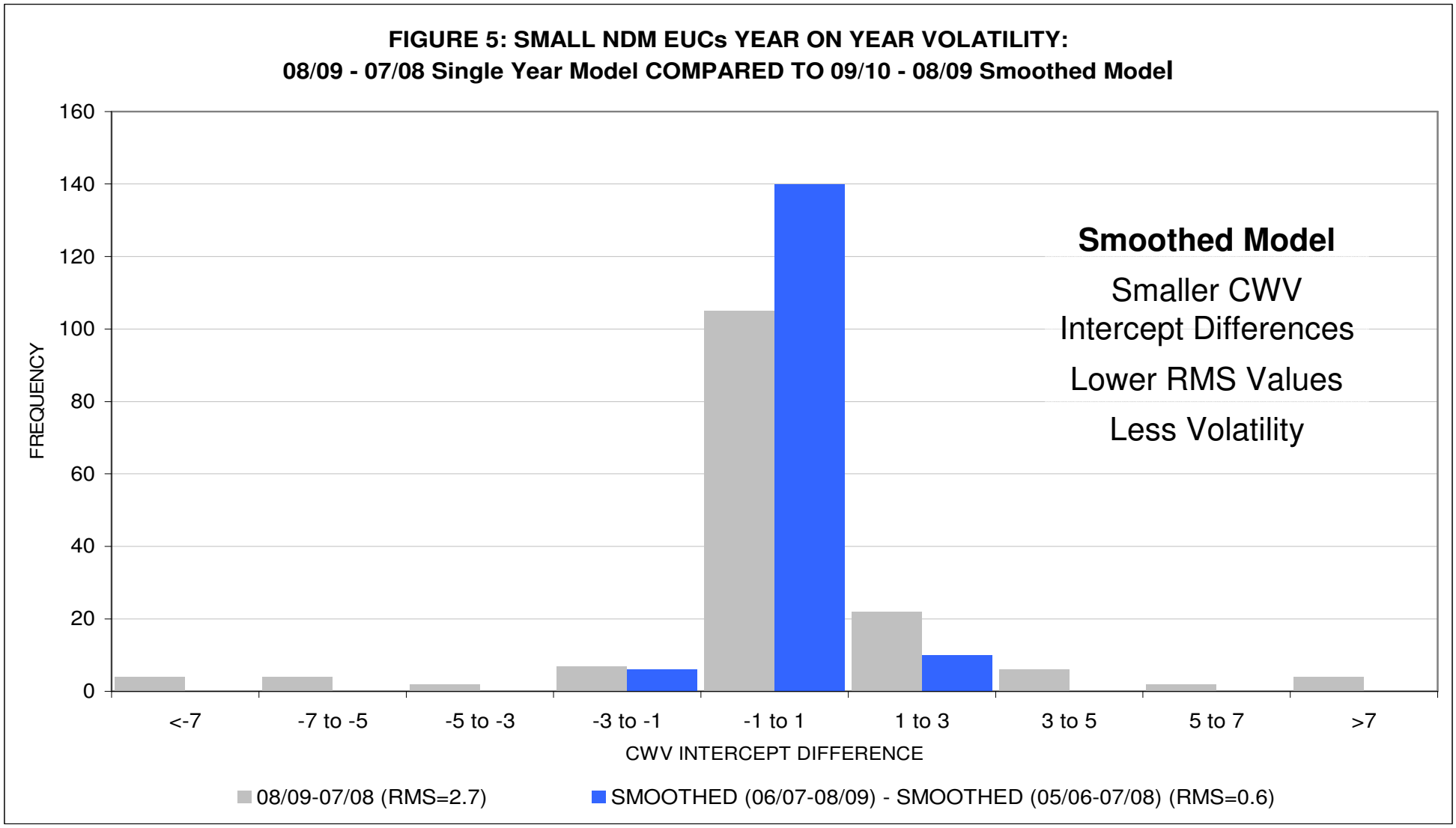
08/09 - 07/08 Single Year Model : 09/10 - 08/09 Smoothed Model

FIGURE 8: LARGE NDM CONSUMPTION BAND EUCs YEAR ON YEAR VOLATILITY:
08/09 - 07/08 Single Year Model COMPARED TO 09/10 - 08/09 Smoothed Model



Volatility Analysis: All EUC Bands – Small NDM

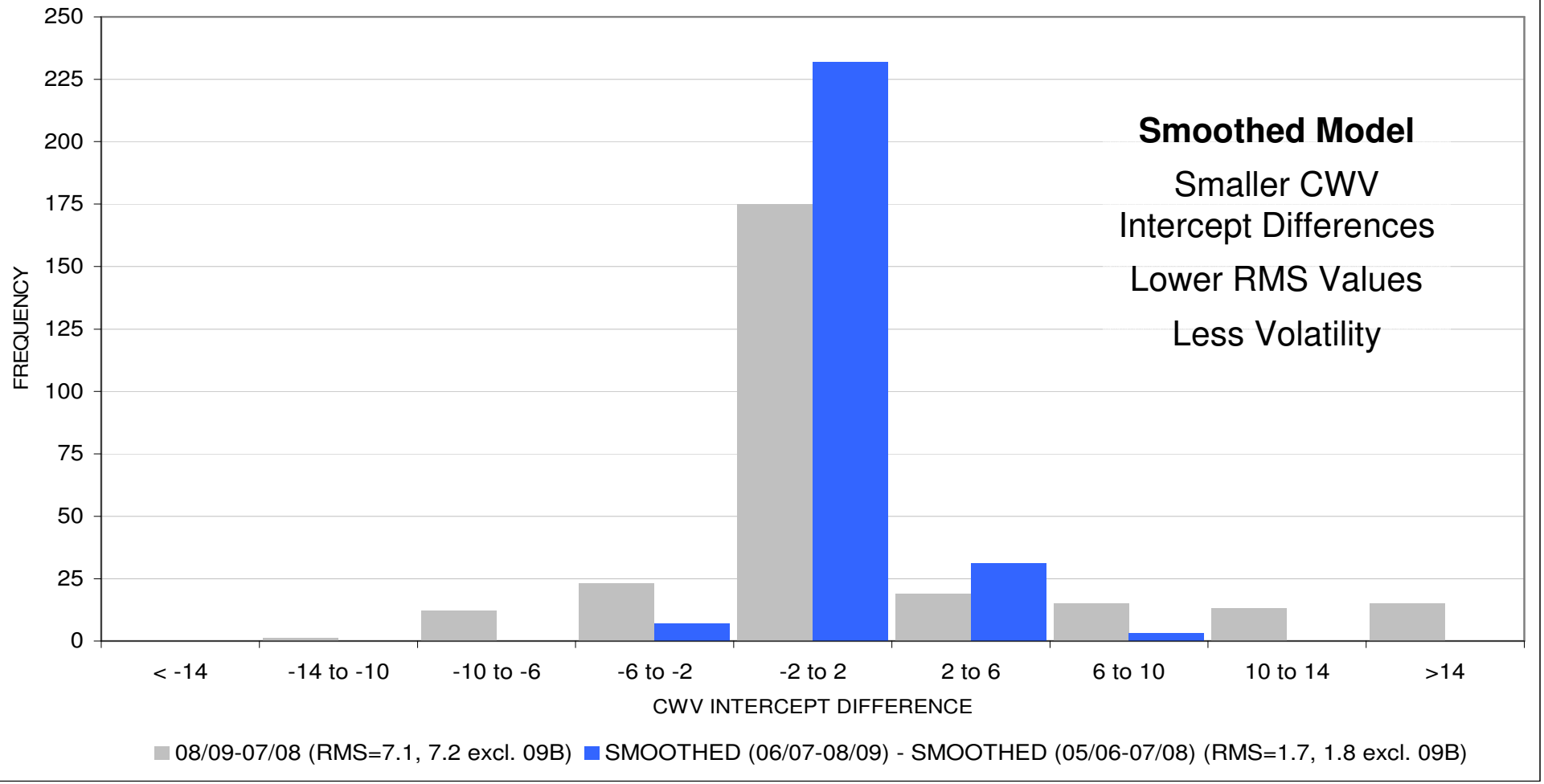
08/09 - 07/08 Single Year Model : 09/10 - 07/08 Smoothed Model



Volatility Analysis: All EUC Bands – Large NDM

08/09 - 07/08 Single Year Model : 09/10 - 07/08 Smoothed Model

FIGURE 6: LARGE NDM EUCs YEAR ON YEAR VOLATILITY:
08/09 - 07/08 Single Year Model COMPARED TO 09/10 - 08/09 Smoothed Model



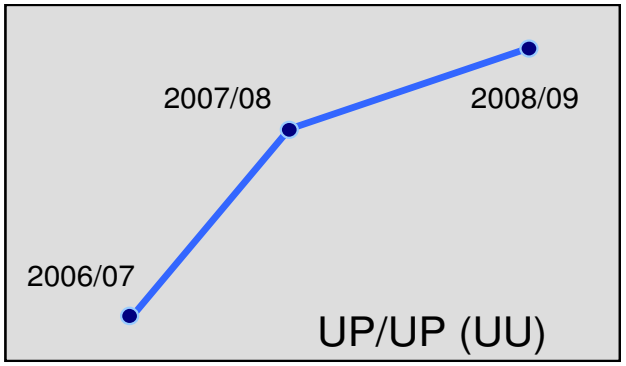
Analysis 2: Volatility Assessment - Conclusions

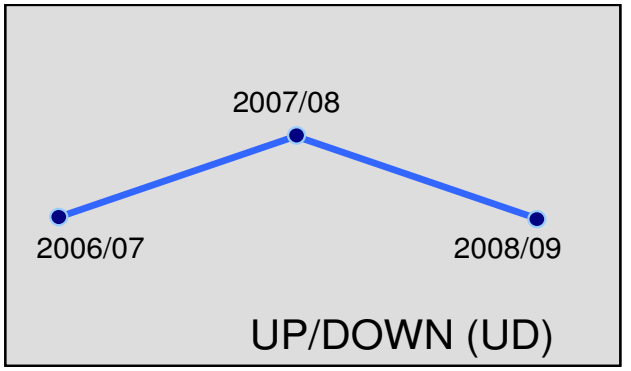
- Results as expected
- Smoothed models show less year on year volatility
  - Smaller CWV intercept differences between smoothed models
  - Better RMS values for all Small and Large NDM EUCs
- Analysis continues to support principles of model smoothing
- 3rd aspect of model smoothing appropriateness needs to be considered...

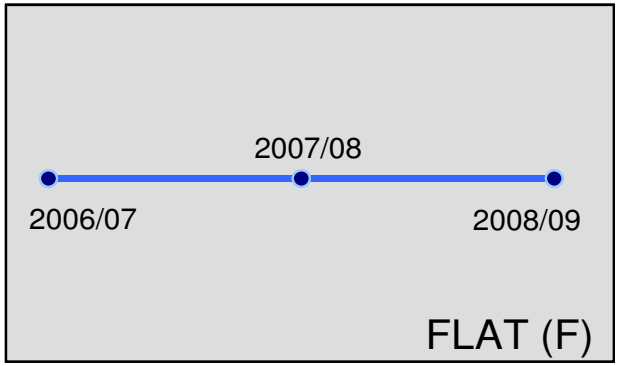
Analysis 3: Trend Analysis - Purpose

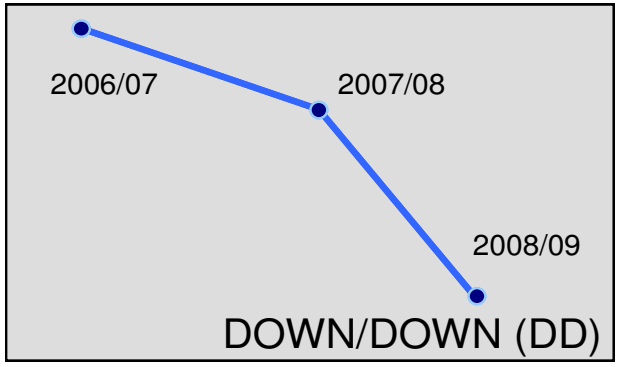
- Identification of trends occurring
- Appropriate: Model averaging or annual model extrapolation
  - Extrapolation of annual trend (no smoothing) has been deemed as only appropriate if a clear trend emerging over recent years could be detected
  - Applying single year models without such evidence = higher levels of volatility in ALP, DAF and load factors each year
- Analysis: Compares ‘trends’ in CWV intercept value for the 3 single year models constituting the 09/10 smoothed model
  - 2006 / 07
  - 2007 / 08
  - 2009 / 10
- 5 possible outcomes…

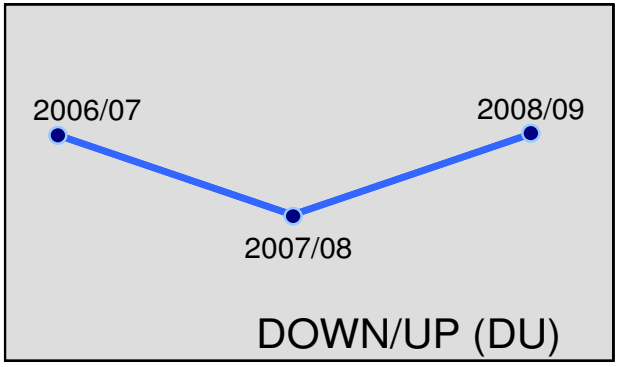
Trend Analysis - Outcomes











Trend Analysis – 3 Year Analysis Results

- Over the three years there are limited number of instances of specific EUCs and LDZs where a trends occur to a notable extent

- Supporting document Table 1, 2 and 3 highlight full results
  - Most frequently observed pattern: UP / UP (129 of 429: 30%)
  - DOWN / DOWN: 37 of 429 (9%)
  - DOWN / UP & UP / DOWN: 224 of 429 (52%)

- Trends this year are not consistent with previous years
  - UP / UP instances 11% in Autumn 2008
  - DOWN / DOWN instances higher at 21% in Autumn 2008

- No obvious trend developing, further investigation supports this…….

Trend Analysis – 4 Year Analysis Results

- Inclusion of 4th year (05/06) to extend analysis
  - 356 of 429 cases indicate no consistent trend (83%)
  - Similar to previous years analysis (352 in 2008 and 353 in 2007)
- EUCs indicating a consistent trend are small
  - 18 of 429 instances indicate a decreasing CWV intercept trend
  - 16 of 429 instances indicate an increasing CWV intercept trend
  - Worst case is EUC xxE0905W01 which shows upward trend for 4 years (in 6 of 13 LDZs) – LFs show upward trend in 3 of them (representing 0.19% of aggregate NDM load).
- Conclusion is further supported when observing the single year model load factors
  - Overriding evidence shows the predominant effect is one of no consistent trend *(see document)*

Model Smoothing - Conclusion

- Principles of model smoothing
  - Reduce year on year volatility (remove modelling just annual trends)
  - Not necessarily 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
  - Model smoothing highlights slightly better level of predictability
  - 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 is applied for 2010/11 analysis