



Model Smoothing - Evaluation

Supporting Document: Model Smoothing 2007.pdf

DESC 8th November 2007

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
- First full assessment of model smoothing results since September 2005
 - Inform decisions on approach and application of model smoothing for Spring 2008
- *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

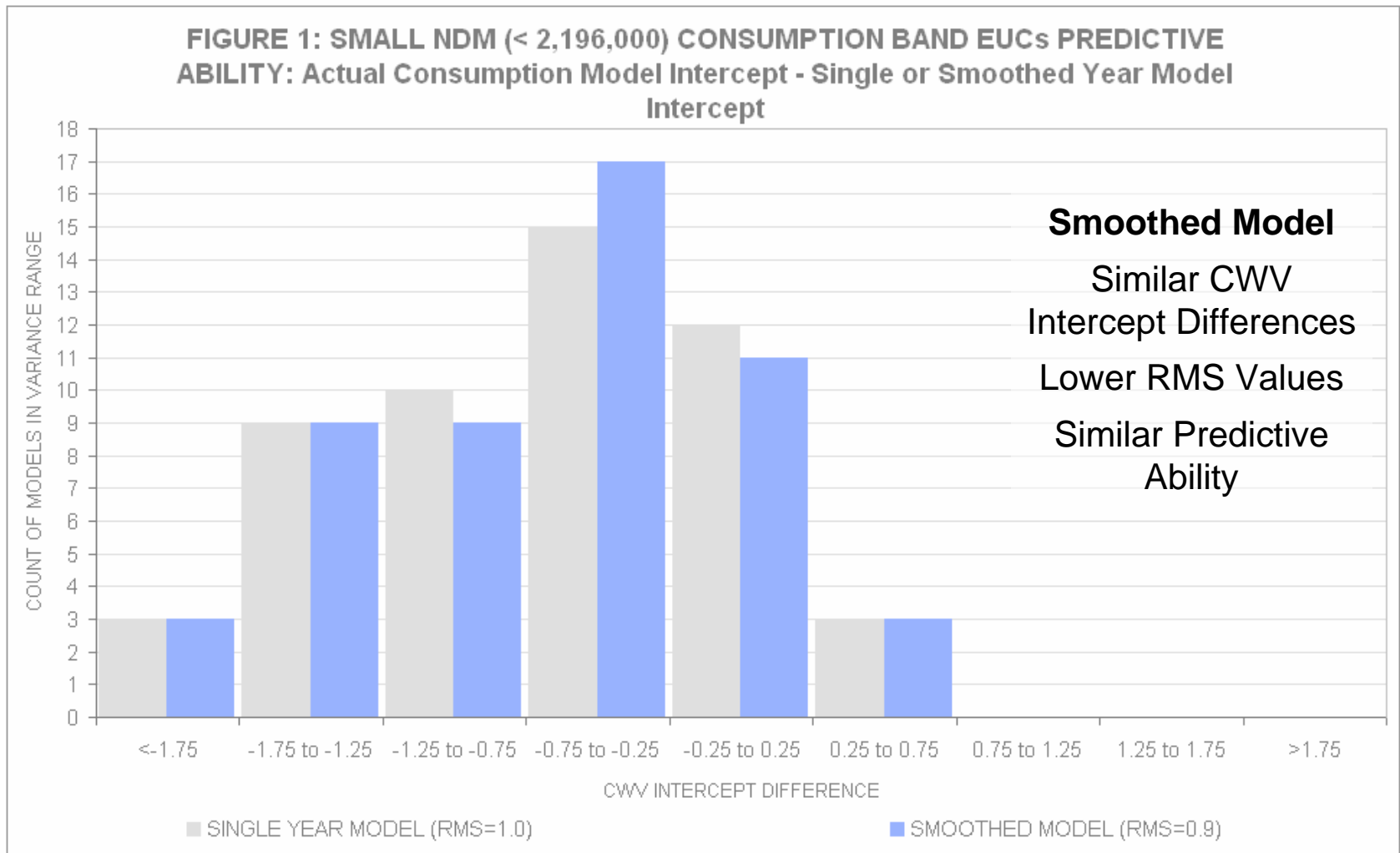
- Analysis compares actual 2006 / 07 consumption data with:
 - 2005/06 Models – **Single Year** model that would have been applied
 - Smoothed models for 2003/04, 2004/05 and 2005/06 – **Smoothed Models** that were applied
- Using (Consumption Band & WAR Bands)
 - **CWV Intercepts** – Point the line 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 2006/07 gas year against
 - Single year model from 2005/06 that would have applied to 2006/07
 - Smoothed model (03/04, 04/05, 05/06) 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

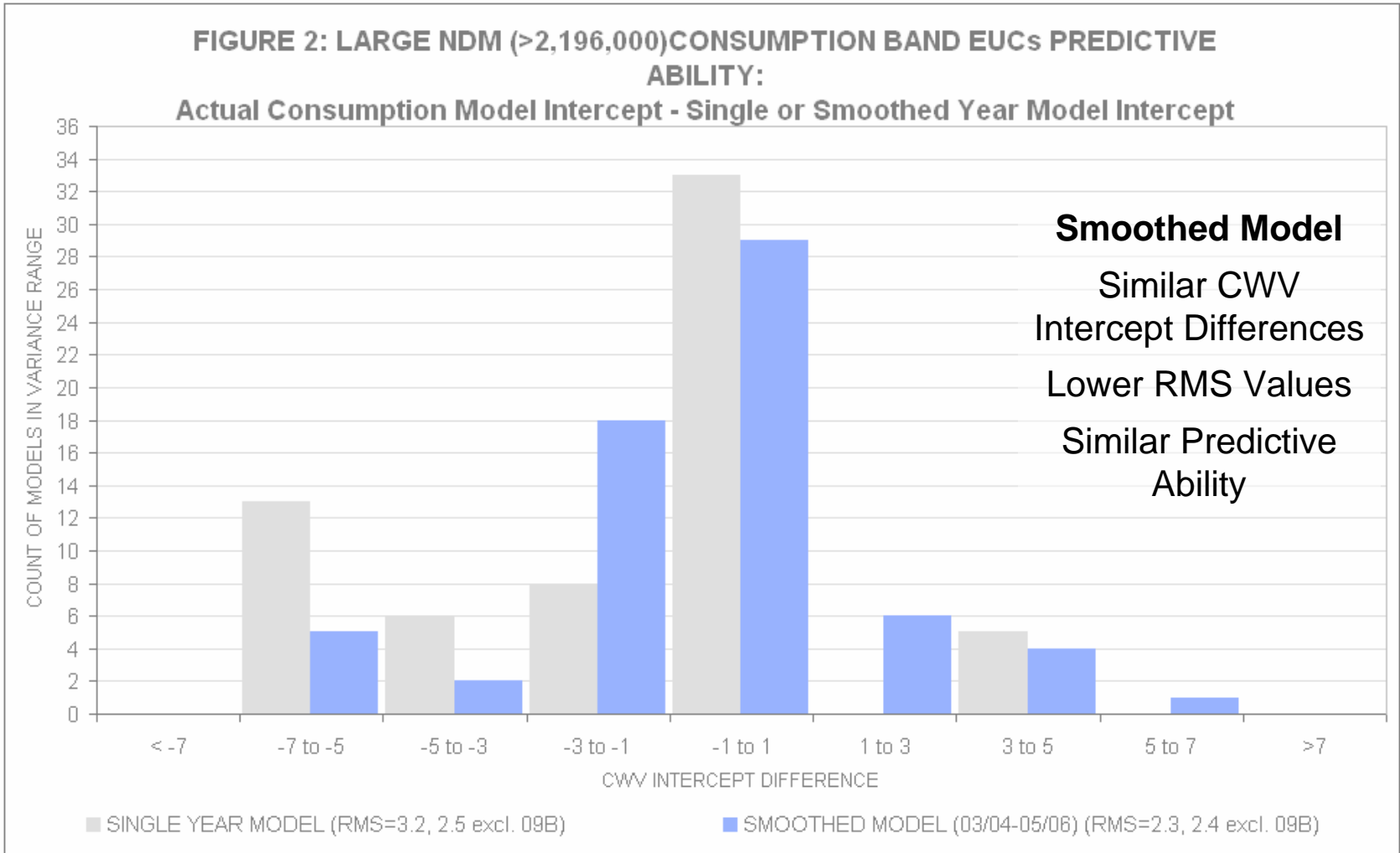
Predictive Analysis: Consumption Bands – Small NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



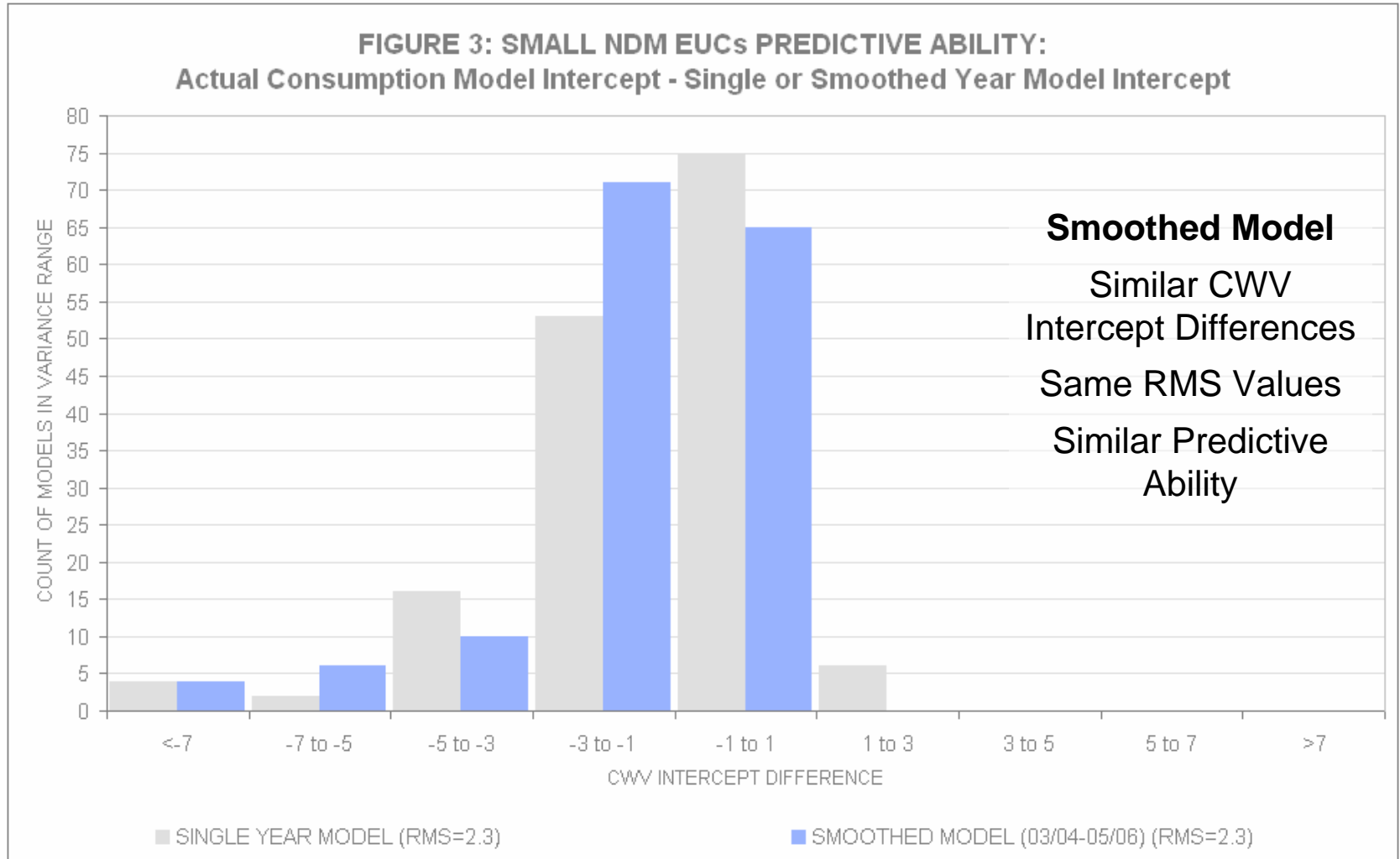
Predictive Analysis: Consumption Bands – Large NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



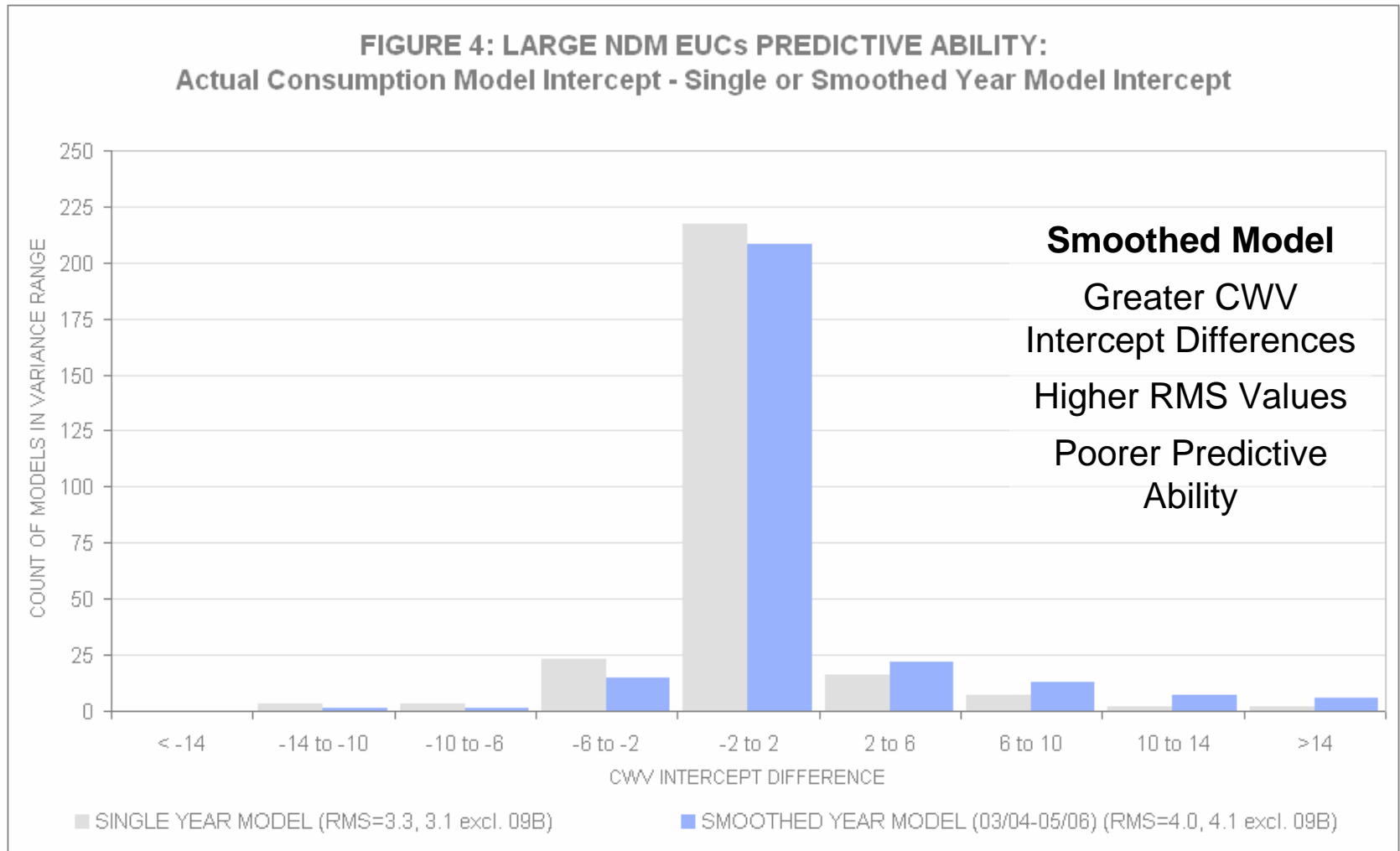
Predictive Analysis: All EUC Bands – Small NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



Predictive Analysis: All EUC Bands – Small NDM

CWV Intercepts: Predictive Accuracy - Smoothed and Single Year Models



Predictive Analysis: Conclusions

- Comparing single & smoothed year model CWV intercepts to actual consumption models:
 - Consumption band analysis highlights smoothed model is similar in predictive ability overall to the single year
 - Consumption + WAR band analysis (all EUCs) highlights:
 - Small NDM smoothed model has similar predictive ability
 - Large NDM smoothed model is not as predictive as the single year model
- Similar results to previous years
 - Small improvement in predictive ability for some smoothed models
 - WAR band model behaviour is not as predictive
 - Possibly due to the Winter Annual Ratio being derived from the most recent winter only (specific to that period)

Analysis 1: Predictive Analysis: Conclusions

- No obvious improvement in model smoothing leading to greater predictability
- BUT
- Purpose of applying model smoothing:
 - Mitigate year on year volatility rather than focusing on predictive capability
 - Also – single year models offer no obvious improvement either
- Further analysis required to identify model smoothing appropriateness...

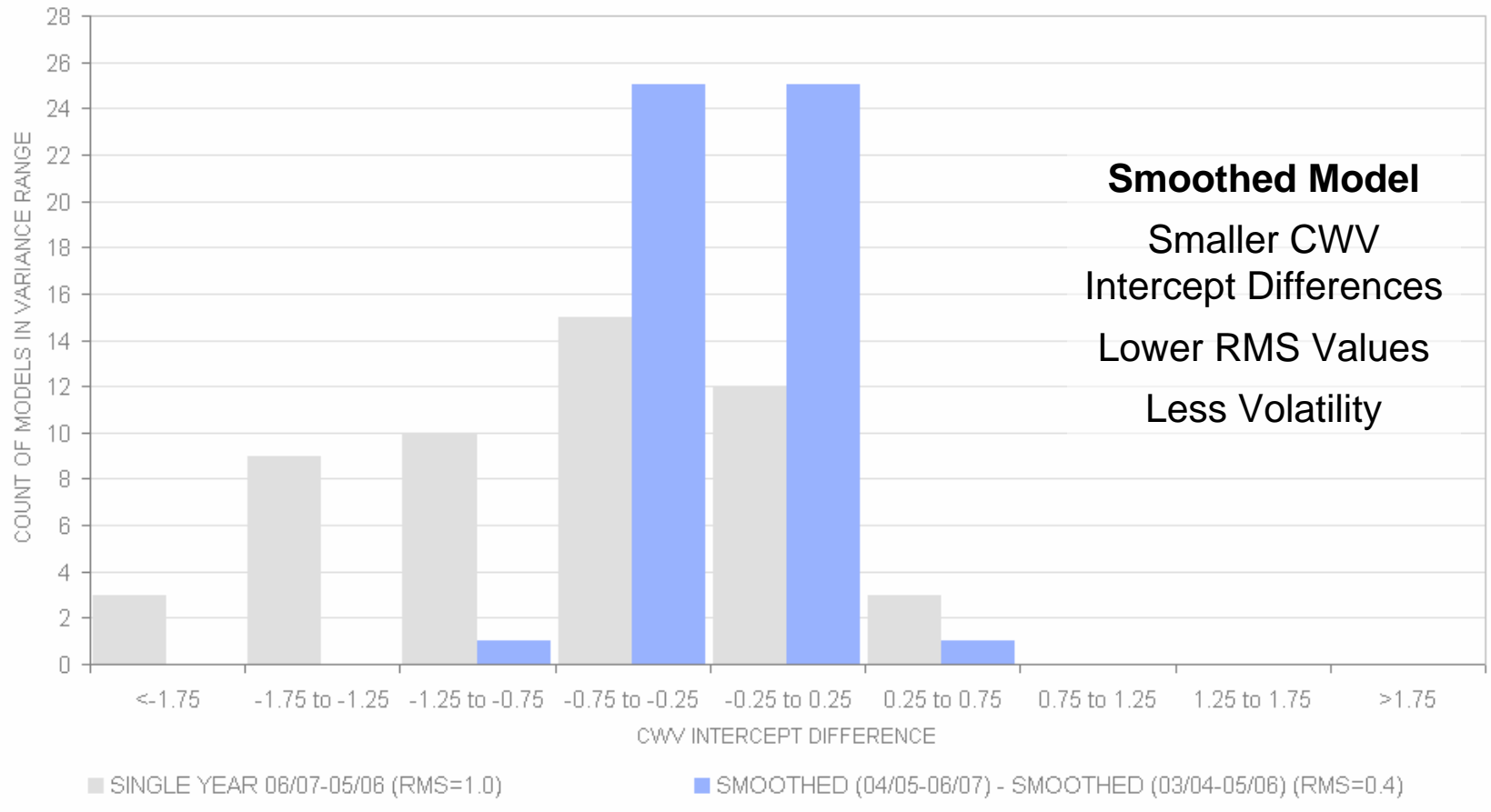
Analysis 2: Year on Year Volatility Analysis - Purpose

- Compares year on year volatility reduction of each model type (smoothed and single year)
 - AIM: To reduce differences in between each year
 - Compare 06/07 applied smoothed model (03/04, 04/05, 05/06)
 - TO
 - Compare 07/08 applied smoothed model (04/05, 05/06, 06/07)
 - Compare 06/07 not applied single year model (05/06)
 - TO
 - Compare 07/08 not applied single year model (06/07)
- Using variations in CWV intercept and RMS values to identify level of volatility between model types and years

Volatility Analysis: Consumption Bands – Small NDM

07/08 - 06/07 Single Year Model : 07/08 - 06/07 Smoothed Model

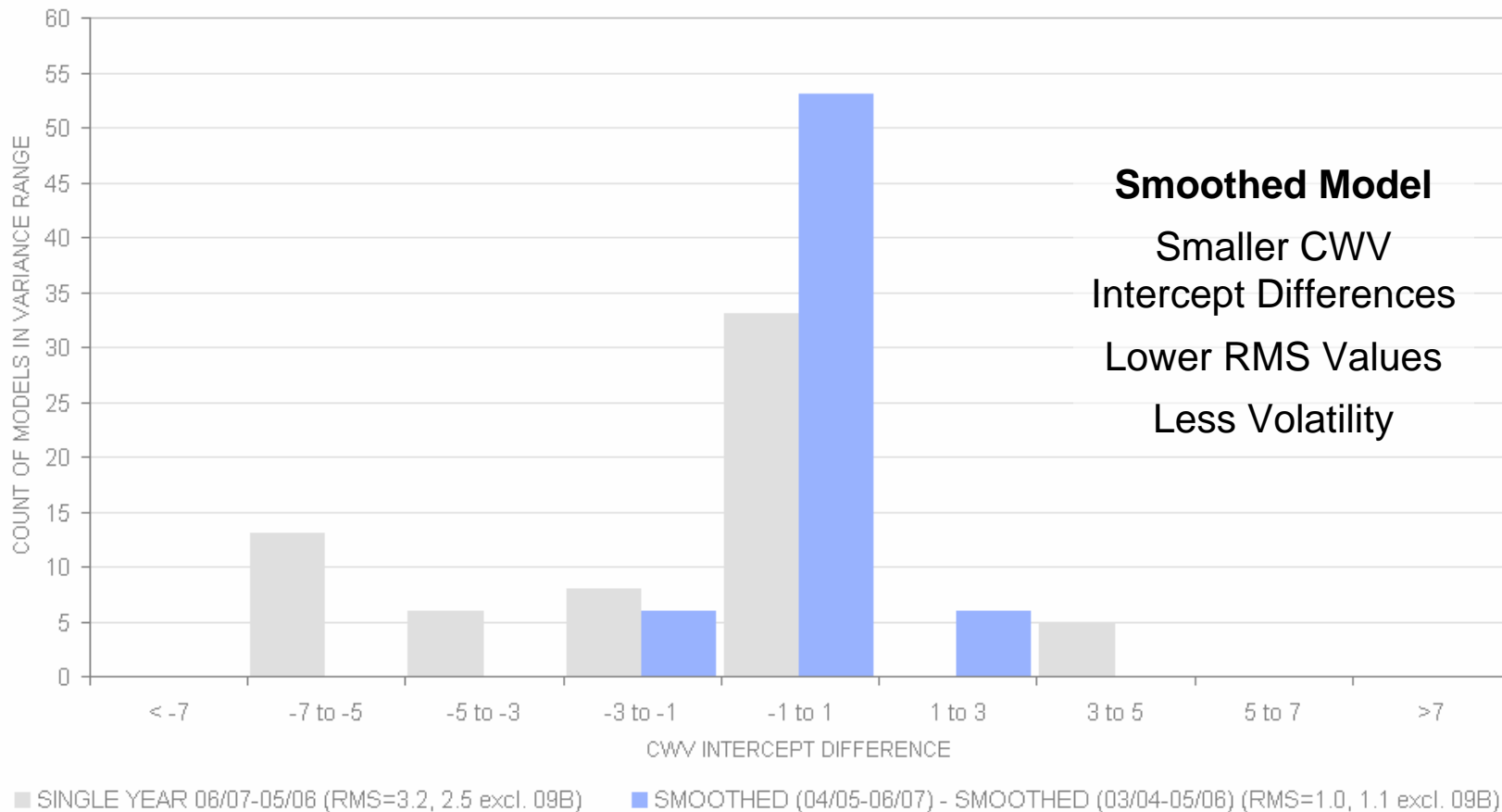
**FIGURE 7: SMALL NDM CONSUMPTION BAND EUCs YEAR ON YEAR VOLATILITY:
07/08 - 06/07 Single Year Model COMPARED TO 07/08 - 06/07 Smoothed Model**



Volatility Analysis: Consumption Bands – Large NDM

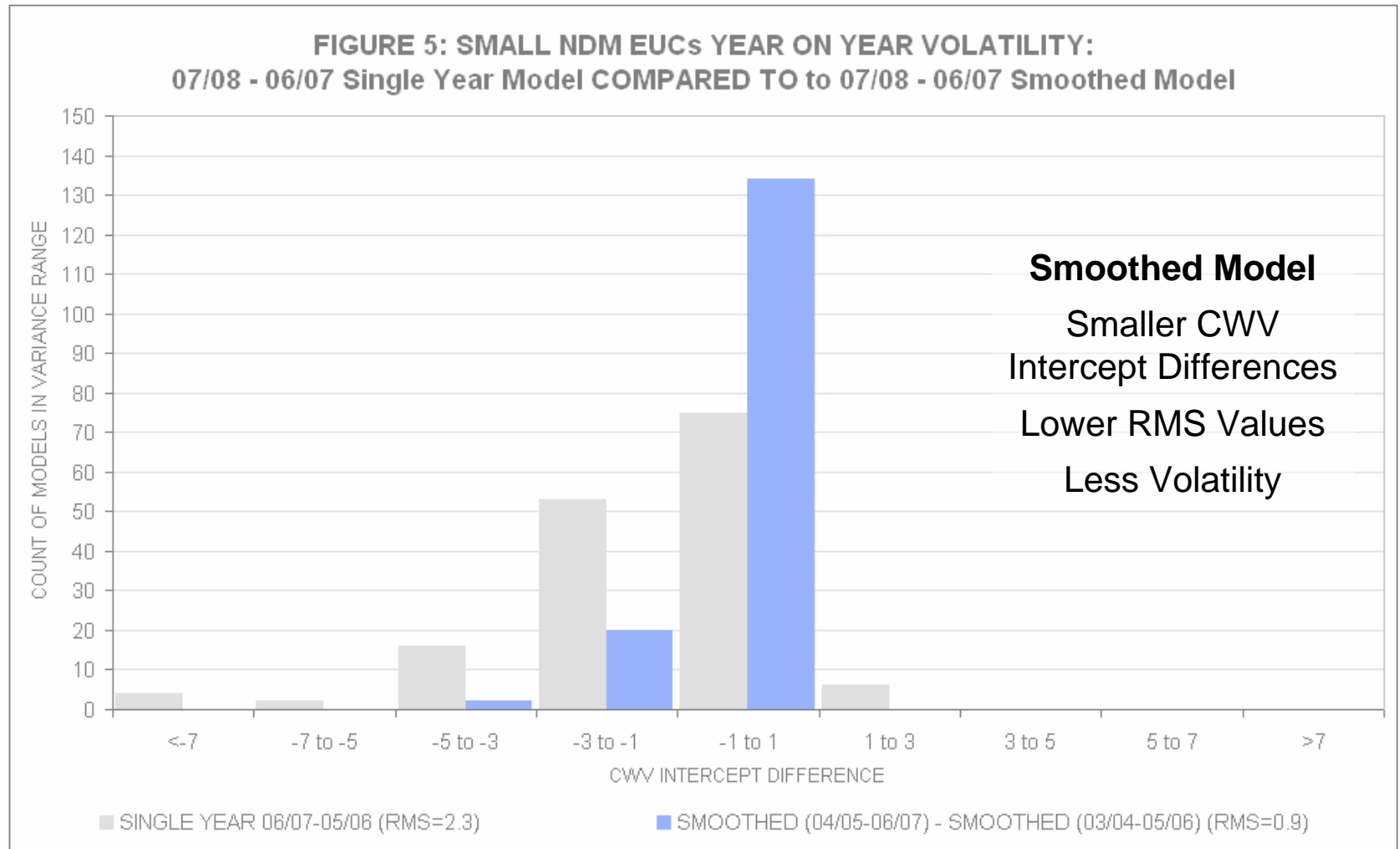
07/08 - 06/07 Single Year Model : 07/08 - 06/07 Smoothed Model

**FIGURE 8: LARGE NDM CONSUMPTION BAND EUCs YEAR ON YEAR VOLATILITY:
07/08 - 06/07 Single Year Model COMPARED TO 07/08 - 06/07 Smoothed Model**



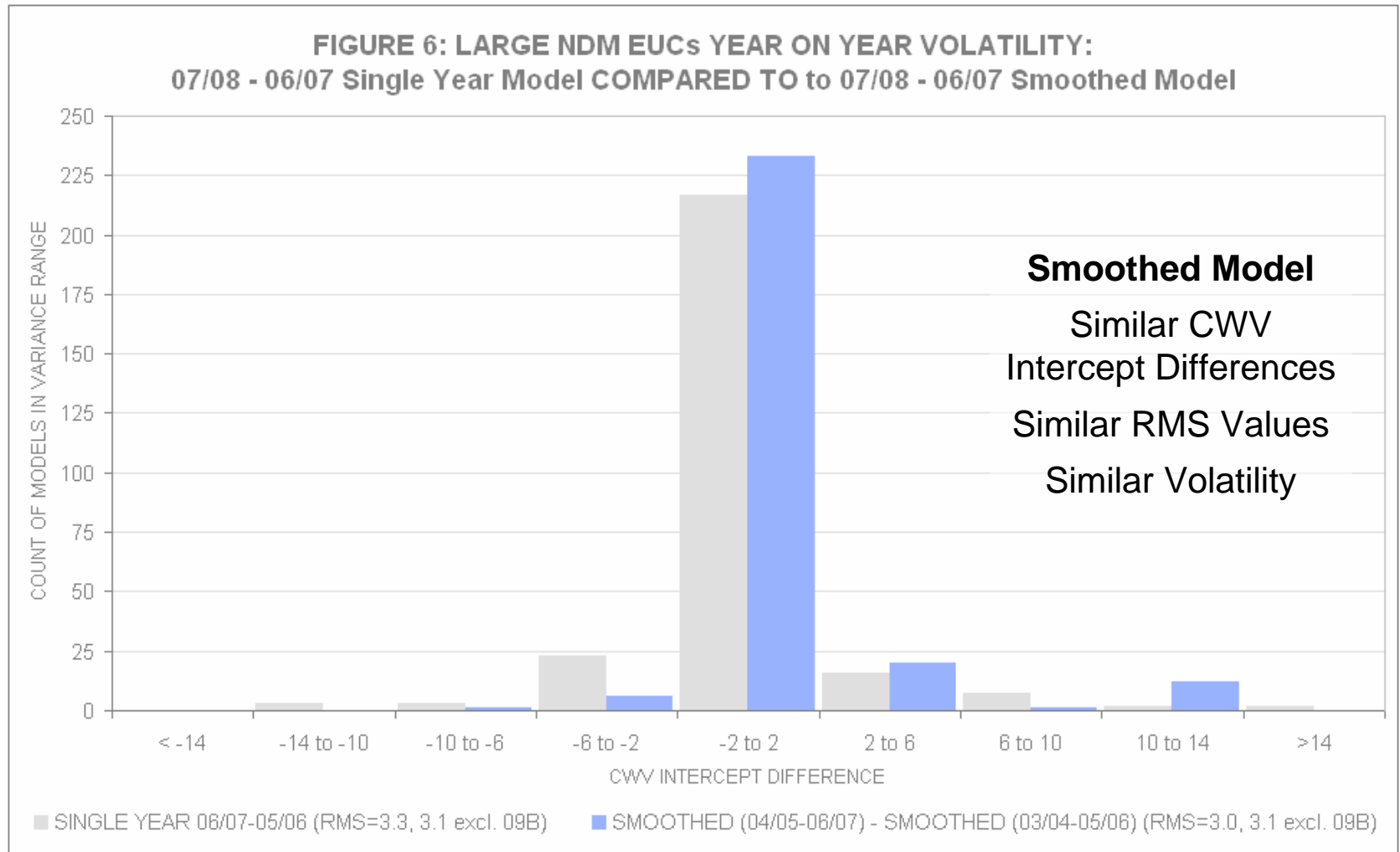
Volatility Analysis: All EUC Bands – Small NDM

07/08 - 06/07 Single Year Model : 07/08 - 06/07 Smoothed Model



Volatility Analysis: All EUC Bands – Large NDM

07/08 - 06/07 Single Year Model : 07/08 - 06/07 Smoothed Model



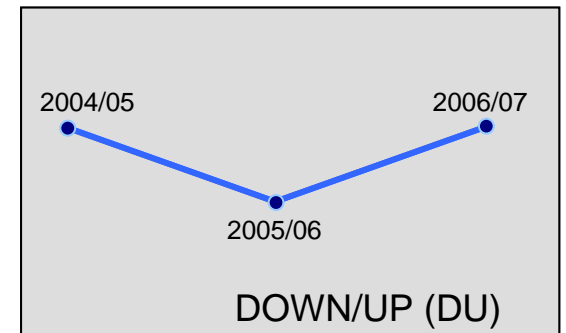
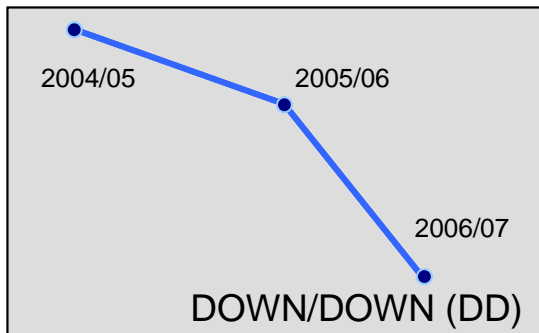
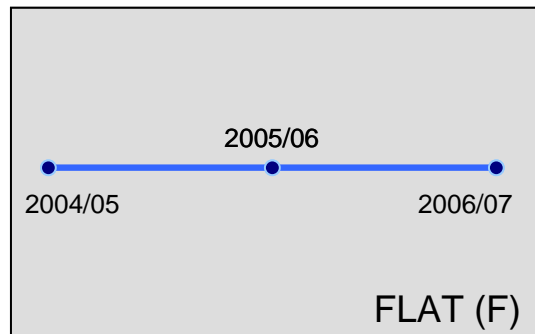
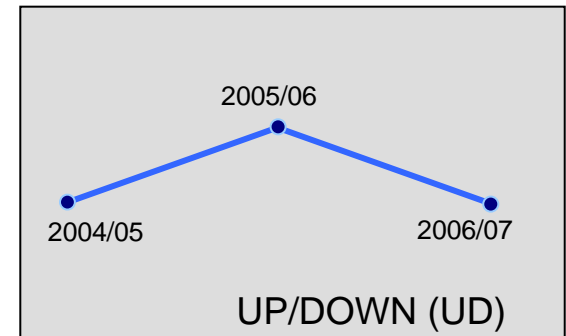
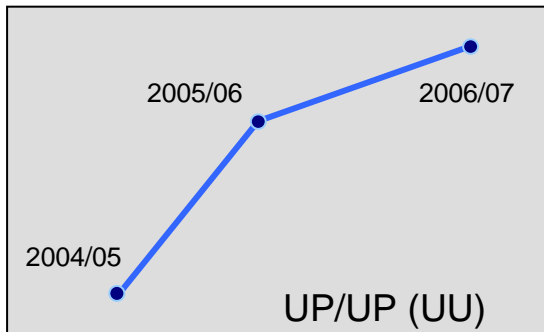
Analysis 2: Year on Year Volatility Analysis: Conclusions

- As expected
- Smoothed models show less year on year volatility
 - Smaller CWV intercept differences between smoothed models
 - Better RMS values
 - Large NDM EUC Models indicates similar volatility
- 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 07/08 smoothed model
 - 2004 /05
 - 2005 / 06
 - 2006 / 07
- 5 possible outcomes...

Trend Analysis - Outcomes



Trend Analysis – 3 Year Analysis Results

- Supporting document Table 1, 2 and 3 highlight full results
 - Most frequently observed pattern: UP / DOWN (195 of 429: 45%)
 - DOWN / UP pattern 68 of 429: 16%
 - Taken together: 263 of 429: 61%
 - Have no increasing or decreasing pattern (trend) over 3 years
 - 127 of 429: 30% do show either an UP / UP or DOWN / DOWN trend (9% Flat)
- BUT occurrences of consistent trend not necessarily greater than might be expected on a random basis
 - Trends this year are also not consistent with previous years
 - UP / UP instances lower than in previous analysis
 - DOWN / DOWN instances higher than in previous analysis
- Further investigation supports this...

Trend Analysis – 4 Year Analysis Results

- Inclusion of 4th year (03/04) to extend analysis
 - 353 of 429 cases indicate no consistent trend (82%)
 - Similar to previous years analysis (355 in 2006 and 360 in 2005)
- EUCs indicating a consistent trend are small
 - 19 of 429 instances indicate a decreasing CWV intercept trend
 - 19 of 429 instances indicate an increasing CWV intercept trend
- Similar to previous investigations:
 - >80% of cases indicate no consistent trend
 - Any 3 year trends are not reflected when extended to 4 years
- Conclusion is further supported when observing the single year model load factors
 - No instances of a consistent year on year increase or decrease in load factors
(see document)

Model Smoothing Analysis: Conclusions

- 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 similar levels of predictability
 - No signs of emerging trends of sufficient clarity have been identified
- Transporters view current methodology to model smoothing over 3 years to be appropriate and fit for purpose
- Recommend model smoothing is applied for 2008/09 analysis