MODEL SMOOTHING – INVESTIGATIVE ANALYSIS

1.0 Background

The application of model smoothing was first undertaken in formulating the NDM proposals for 1999/00. Model smoothing has since been applied to the NDM proposals for all subsequent years, and most recently for 2009/10.

It was agreed with the Demand Estimation Sub-Committee (DESC) and Ofgem shortly after the first application of model smoothing that the method applied would be subject each year to the scrutiny of DESC and that the results of successive years of demand modelling (feeding into model smoothing) would be examined for evidence of trends if any, so as to inform decisions on the approach to and mode of application of model smoothing in future years.

The first such investigative analysis was undertaken in autumn 1999 and in the light of those results it was decided to retain model smoothing without change for deriving the NDM proposals for 2000/01. Further investigations of model smoothing were undertaken during each autumn thereafter (in each of the years from 2000 to 2005) and following discussion of those results at DESC on each occasion, it was decided to continue to apply model smoothing in deriving the NDM proposals for the forthcoming year.

In January 2006, DESC agreed to move to a biennial assessment of the continued applicability of model smoothing. Accordingly, the next formal assessment (after September 2005) of model smoothing undertaken was in autumn 2007. Following discussion of those results at DESC in November 2007, it was decided to continue to apply model smoothing in deriving the NDM proposals for 2008/09 and 2009/10.

The proposals for 2009/10 having been finalised, it is now appropriate to undertake a re-assessment so that informed decisions on the continued future application of model smoothing can be taken.

Therefore, this note is a full formal assessment of model smoothing along the lines undertaken two years ago.

2.0 Principles of Model Smoothing

Model smoothing was introduced because EUC models were exhibiting some year on year volatility. It was therefore anticipated that averaging more than one year's models would achieve greater stability.

A further obvious aspiration for the EUC models is that of improved accuracy. However, the two objectives of stability and accuracy are not necessarily consistent: if there is an underlying drift in customer behaviour which leads to changes in model characteristics then stability may be achieved at the expense of accuracy.

It is proposed here (as in the investigative analyses undertaken in all previous occasions) that accuracy is defined as the capability of a model (or a smoothed model) to predict the model that will be fitted to the following year's data.

In order to attempt to illuminate this aspect it is possible to perform the following test on EUC models:

Compare the models fitted to the (single year) 2008/09 consumption data with:

- *The 2007/08 (single year) models*
- *The smoothed models based on 2005/06, 2006/07 and 2007/08 data*

The test has been applied to CWV intercepts, which give a simple indication of weather sensitivity - i.e. high CWV intercept implies low weather sensitivity. For each case root mean square (RMS) values of the CWV intercept differences have been computed.

For this year's investigation of model smoothing the CWV intercepts from the analyses of the data sets for 2005/06, 2006/07 and 2007/08 along with those for 2008/09, provide the necessary information.

Note that revised composite weather variable definitions applicable to the LDZs EA, NT and SE were implemented for the spring 2007 NDM analysis and became effective on gas industry systems from 1st October 2007. For EUCs in these three LDZs, the values of CWV intercepts presented here pertain to this revised definition of CWV. For EUCs in WS LDZ, the values of CWV intercepts presented here pertain to the definition of CWV that came in to effect on 1st October 2006. The values of CWV intercepts in respect of EUCs in all other LDZs pertain to the revised definitions of all those CWVs which were implemented from 1st October 2005. In general, for EUCs in LDZs where a CWV definition has changed, the CWV intercepts now presented here are not directly comparable with CWV intercepts published prior to the change of CWV definition.

3.0 Analysis

3.1 Consumption Band Analysis (Figures 1 & 2)

The bar charts attached as Figures 1 and 2 show, for the small and large NDM consumption band EUCs only, the difference between the respective CWV intercepts on the two bases. For the small NDM consumption band EUCs (Figure 1) the bar chart for the smoothed model for 2008/09 (based on 2005/06, 2006/07 and 2007/08 data) shows an improvement, in terms of the spread of CWV intercept differences, over that for the single year (2007/08) model, and this is also reflected in the respective RMS values – i.e. lower for the smoothed model. For large NDM consumption band EUCs (Figure 2) the RMS value is also better for the smoothed model both including and excluding the contribution of band 09B. So, for both small and large NDM **consumption band** EUCs, the smoothed three-year model is better at predicting 2008/09 than the single year, 2007/08, model).

3.2 WAR Band Analysis (Figures 3 & 4)

This analysis has also been extended to include WAR band EUCs, the results from which are shown in Figures 3 and 4. The spread of CWV intercept differences for all small NDM EUCs (Figure 3) shows an improvement for the smoothed model case compared to the single year model case, and the RMS value (which indicates the spread of CWV intercept differences around zero) is clearly lower for the smoothed model.

For all large NDM EUCs (Figure 4) the spread of CWV intercept differences again shows an improvement for the smoothed model case compared to the single year model case. For all large NDM EUCs, the relevant RMS values (both including and excluding EUC09B) are clearly lower for the smoothed model.

This analysis of “predictive ability”, undertaken on the same basis as two years ago, has yielded similar results to those of previous years: there are signs of an improvement in “predictive ability” with the smoothed model for small and large NDM EUCs, and this is so both when consumption band EUCs only are considered and when all EUCs are considered (for small and large NDM).

Overall, it cannot be suggested that these comparisons provide exceptional evidence as to the superior predictive capability of smoothed models, but there is nevertheless a small benefit in predictive ability.

The main driver for using a smoothed model is the mitigation of year of year volatility rather than predictive capability.

3.3 Year on Year Volatility Analysis (Figures 5, 6, 7 & 8)

Consequently, a similar test has been applied to observe the year-on-year volatility of smoothed models as against individual years’ models. The bar charts in Figures 5 & 7 (small NDM) and Figures 6 & 8 (large NDM) show:

- Difference in CWV intercepts between the smoothed models applicable to gas year 2008/09 (based on 2005/06, 2006/07 and 2007/08) and the smoothed models applicable to gas year 2009/10 (based on 2006/07, 2007/08 and 2008/09)

- Difference in CWV intercepts between individual year models for 2007/08 and 2008/09 that would have been applied to gas years 2008/09 and 2009/10 respectively if model smoothing had not been implemented.

The results in Figures 5 and 6 relate to both consumption band and WAR band EUCs, while the results in Figures 7 and 8 relate to just the consumption band EUCs. As expected, the smoothed models are associated with notably lower year-on-year volatility as shown by both the generally narrower distribution of CWV intercept differences and notable reductions in the corresponding RMS values.

4.0 Model Smoothing – Average or Trend (Figure 9, Table 1, 2 & 3)

On each occasion when this investigation of model smoothing has been carried out, there has been some discussion as to whether model averaging or model extrapolation is more appropriate. Extrapolation would only be worthy of consideration if a clear trend could be detected. There has also been some discussion in previous years about whether a trend based on a limited number of years' data should be regarded as a reliable basis for extrapolation.

An analysis of CWV intercepts (all of which are on the currently applicable CWV definitions) is attached which attempts to shed some light on whether trends exist. This analysis is usually presented to DESC every two years (last presented to DESC in autumn 2007). However, for a complete view of CWV intercepts from one year to another, the summary results of this CWV intercept analysis undertaken on an annual basis must be included and this has been done in the results presented here.

The CWV intercept analysis has been applied to all EUCs, small and large NDM, including both consumption band and WAR band EUCs. Figure 9 shows the classification scheme that has been applied to the individual years comprising the smoothed models for gas year 2009/10 - essentially there are five possible patterns for a series of three CWV intercepts to follow: Essentially there are 5 possible patterns for a series of 3 CWV intercepts to follow:

- UP/ UP (UU)
- UP / DOWN (UD)
- DOWN / UP (DU)
- DOWN / DOWN (DD)
- FLAT (F)

A symbol has been associated with each of the patterns, and Table 1 shows how each EUC is classified. In Table 2, the counts of each type are shown, firstly a count by EUC across the LDZs, and secondly a count by LDZ across the EUCs.

For the analysis years 2006/07, 2007/08 and 2008/09, the overall count of the different pattern types indicates that:

- The "down/up", pattern shows 101 occurrences out of 429 (there were 173 in 2008, 68 in 2007, 65 in 2006 and 151 in 2005).
- The “up/down” pattern shows 123 occurrences (there were 81 in 2008, 195 in 2007, 169 in 2006 and 111 in 2005).
- Thus, taken together, 224 occurrences (254 in 2008, 263 in 2007, 234 in 2006 and 262 in 2005) have no increasing or decreasing pattern over the three years.
- This year also shows 39 flat models (39 in 2008, 39 in 2007, 38 in 2006 and 35 in 2005).

The prevalence of “down/up” and up/down” patterns (224) remains greater than half of the number of cases (429), Since there are 39 cases of flat models (all of which are EUCs applicable to WAR band 1) 224 of 390 remaining cases show no consistent pattern over three years. Instances with a decreasing pattern number just 37 (the lowest since the analysis done in 2005). However, instances of an increasing pattern over three years amount to 129 which is higher than the previous high of 109 in the analysis done in 2006.

Instances of EUCs where there is an increasing pattern over three years in a majority of LDZs (i.e. 7 or more of 13) are mostly in the WAR band EUCs, except for band 02B. There is just one instance of an EUC where there is an decreasing pattern over three years in a majority of LDZs and this too is for a WAR band EUC. There are no instances of LDZs where there is an increasing (or decreasing) pattern over three years in a majority of EUCs (there are 33 EUCs in each LDZ). For the higher consumption bands and most WAR band analyses, demand modelling is done with data sets grouped across LDZs. In these circumstances instances of multiple EUCs with increasing or decreasing patterns are down to the same underlying demand model and not due to multiple models showing a trend.

To reiterate, there are some instances of specific EUCs and specific LDZs, where a “down/down” pattern or an “up/up” pattern occurs to a notable extent over the three years. However, three data points do not necessarily point to a trend and examination of a fourth year of CWV intercept data reveals that these possible instances are not sustained. For the four most recent analysis years (2005/06, 2006/07, 2007/08 and 2008/09) CWV intercepts are available on a consistent basis. These may be categorised into four groups, namely: no consistent trend, increasing values, decreasing values and flat models. Summary results are presented as Table 3.

These show that 356 out of 429 occurrences (there were 352 in 2008, 353 in 2007, 355 in 2006 and 360 in 2005) indicate no consistent trend while the numbers of consistently decreasing or consistently increasing occurrences are now small (18 and 16 respectively this year – 25 and 13 respectively in 2008, 19 and 19 respectively in 2007, 10 and 29 respectively in 2006 and 9 and 25 respectively in 2005). Although a full model smoothing investigation was not undertaken in 2008, these relevant counts were derived in 2008 for use in this assessment.

The count of EUCs of no consistent pattern (356) is very similar to that of all previous assessments - the lowest observed was 348 in 2001. As Table 3 shows, the results for all previous model smoothing investigations have been very similar. The vast majority of cases are always that of no consistent trend. Furthermore, in all these investigations, the occurrences of consistent trends have been very much smaller than might be expected on purely random grounds.

For every LDZ over four years, the predominant effect is of no consistent pattern. In each LDZ 24 or more (of 33) EUCs shown no consistent pattern over the four years. The number of EUCs with a consistent pattern (upwards or downwards) in any LDZ does not exceed 3 (of 33).

For all the EUCs which showed a majority of occurrences (7 or more out of 13) of a upward pattern in CWV intercepts over three years, the four year picture for most of these EUCs is one of no consistent trend. Over four years only 16 EUCs of 429 showed consistently upward pattern.

In particular for band 02B, for which 7 LDZs showed an upward trend over 3 years, only 2 LDZs (of 13) show an upward trend over four years. Examination of the load factors for individual year models over four years for band 02B (Figure 11) shows no instances of consistently increasing load factors.

In EUC xx:E0905W01 there were 6 LDZs (of 13, which is not a majority) with an upward trend. Due to sample size limitations, EUC demand modelling is often undertaken with data grouped across LDZs, and thus, these 6 EUCs are made up of just two distinct demand models. Overall across all LDZs the equivalent EUC (xx:E0805W01 as of April 2009) constituted only 0.005% of supply point numbers and they constituted 0.72% of overall NDM load (AQ basis). Examination of the load factors for individual year models over four years for this EUC (see Figure 19) showed that none of the six instances with an upward trend in CWV intercepts (in LDZs: NO, NW, WN, NE, EM and WM) showed a similar upward trend in load factors. In this EUC, three other LDZs namely EA, NT and SE (corresponding to just one underlying demand model due to data aggregation) showed an increasing pattern of load factors. In these three LDZs the equivalent EUC (xx:E0805W01) constituted only 0.001% of all NDM supply points as of April 2009 and made up just 0.19% of total NDM load (AQ basis, April 2009 figures).

Only one EUC showed a majority of occurrences (in this case 7 out of 13) of a downward pattern in CWV intercepts over three years (namely xx:E0906W04). Over four years for this EUC all LDZs showed no consistent pattern. Over four years only 18 of 429 EUCs showed a consistently downward pattern. Of these 18 occurrences, EUC xx:E0908B showed a downward pattern in 5 (of 13) LDZs. Overall across all LDZs the equivalent EUC (xx:E0808B as of April 2009) constituted only 0.0005% of supply point numbers and they constituted 0.74% of overall NDM load (AQ basis).

Examination of the load factors for individual year models over four years for this EUC (Figure 17) showed that (unsurprisingly) the load factors also decreased over four years in the same 5 LDZs: EA, NT, SE, SO and SW. This is to be expected since the EUC demand modelling for this band has been done in all recent years with LDZs: EA/NT/SE/SO/WS/SW aggregated into one group. Thus this trend in 5 LDZs for this band (08B) originates from a single demand model.

4.0 Load Factor Trends (Figure 10 to 18)

The final set of information to be considered as part of this analysis is presented in Figures 10 to 18. These show the load factors for the individual years' models of the consumption band EUCs, over the four years available on a consistent basis.

These graphs of load factors (Figures 10 to 18) confirm the evidence of the CWV intercept information previously presented: there are no instances of a year on year increase or decrease in load factors in any of the consumption band EUCs that are consistently expressed across all of the LDZs.

5.0 Conclusion

It is the collective view of Transporters, on the basis of this material, supported also by the results of this same analysis undertaken in 2007 and in previous years, that there are no signs of trends in the EUC demand models of sufficient clarity to influence the manner in which model smoothing is applied.

Consequently Transporters believe that the current averaging approach to model smoothing applied over three years continues to be appropriate and fit for purpose.

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

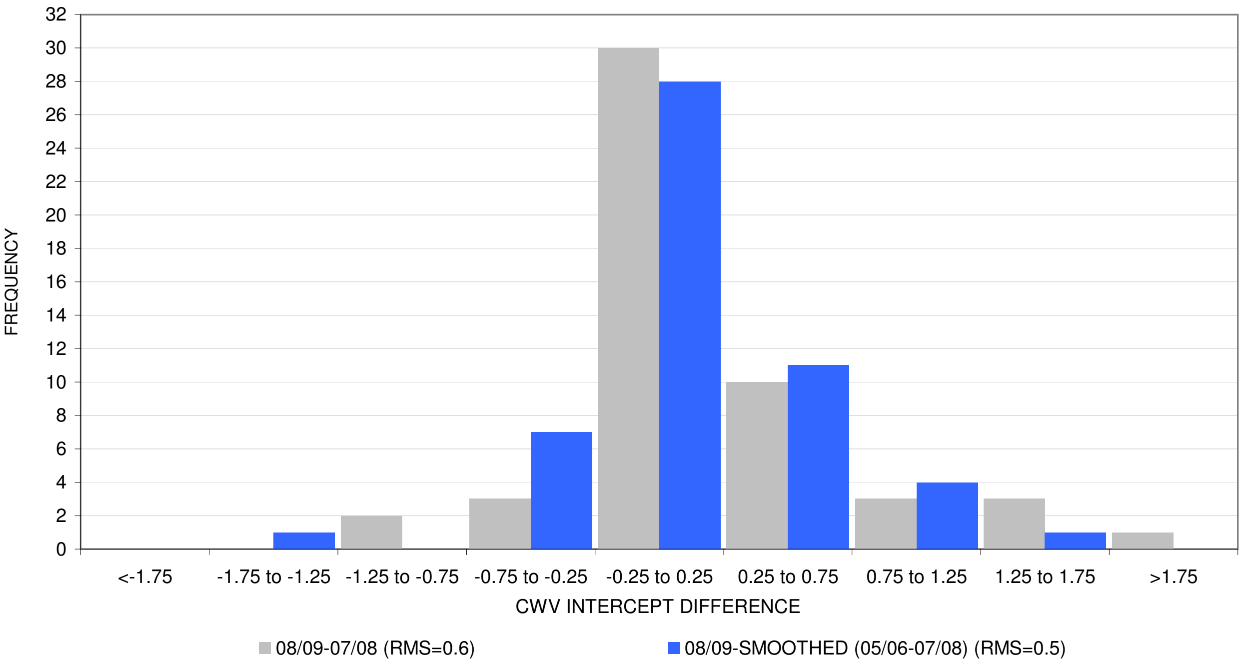


FIGURE 2: LARGE NDM (>2,196,000)CONSUMPTION BAND EUCs - PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

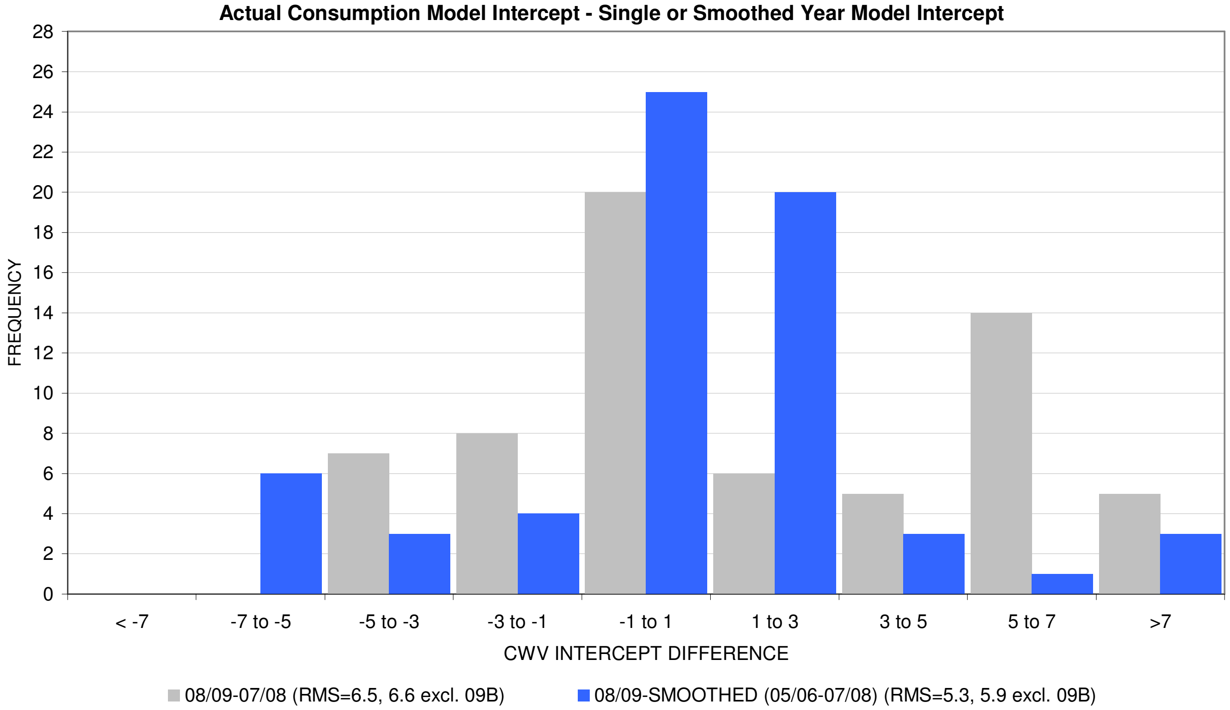


FIGURE 3: SMALL NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept

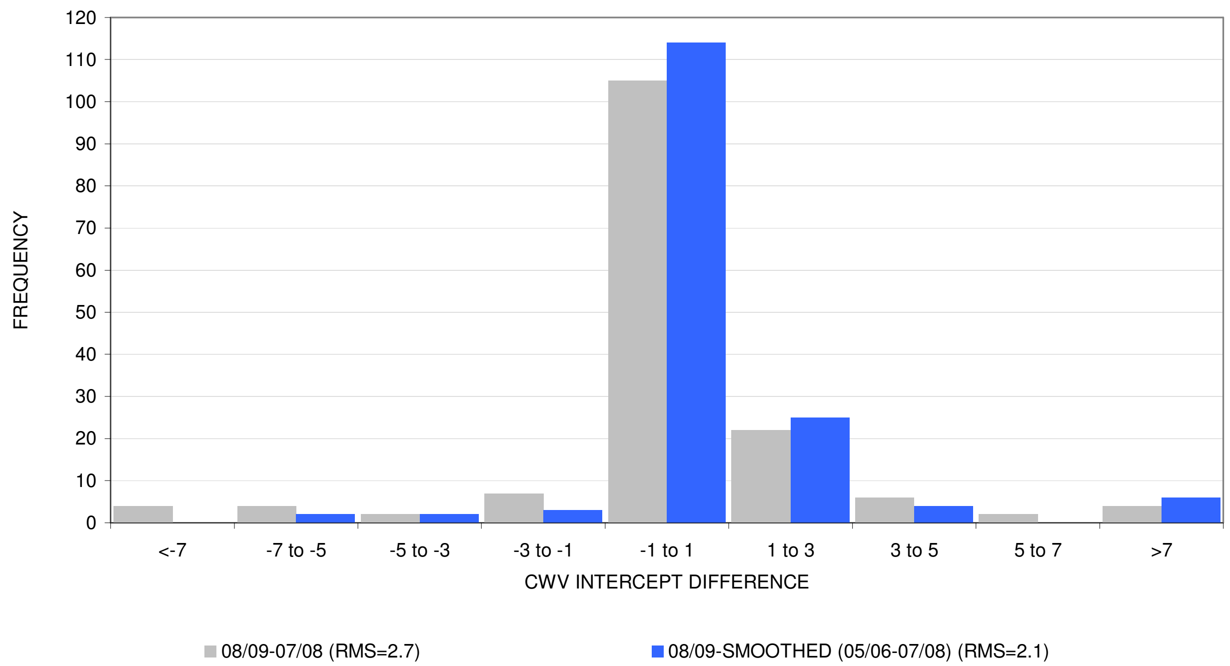
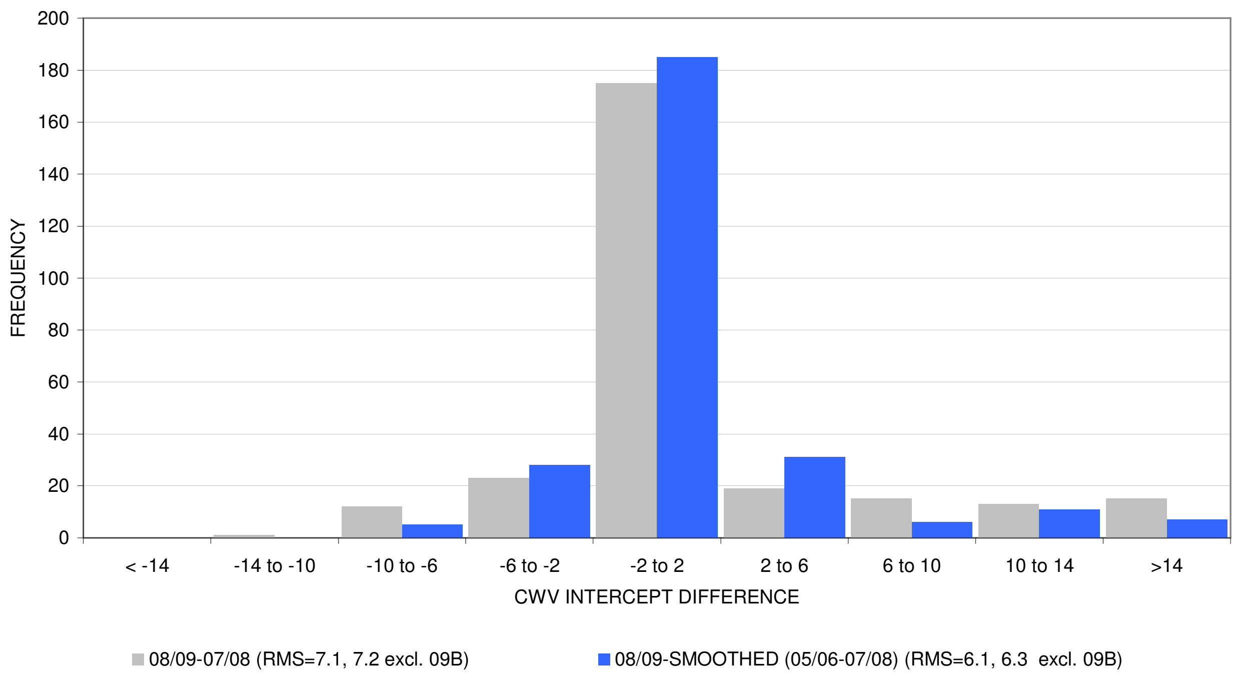


FIGURE 4: LARGE NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept



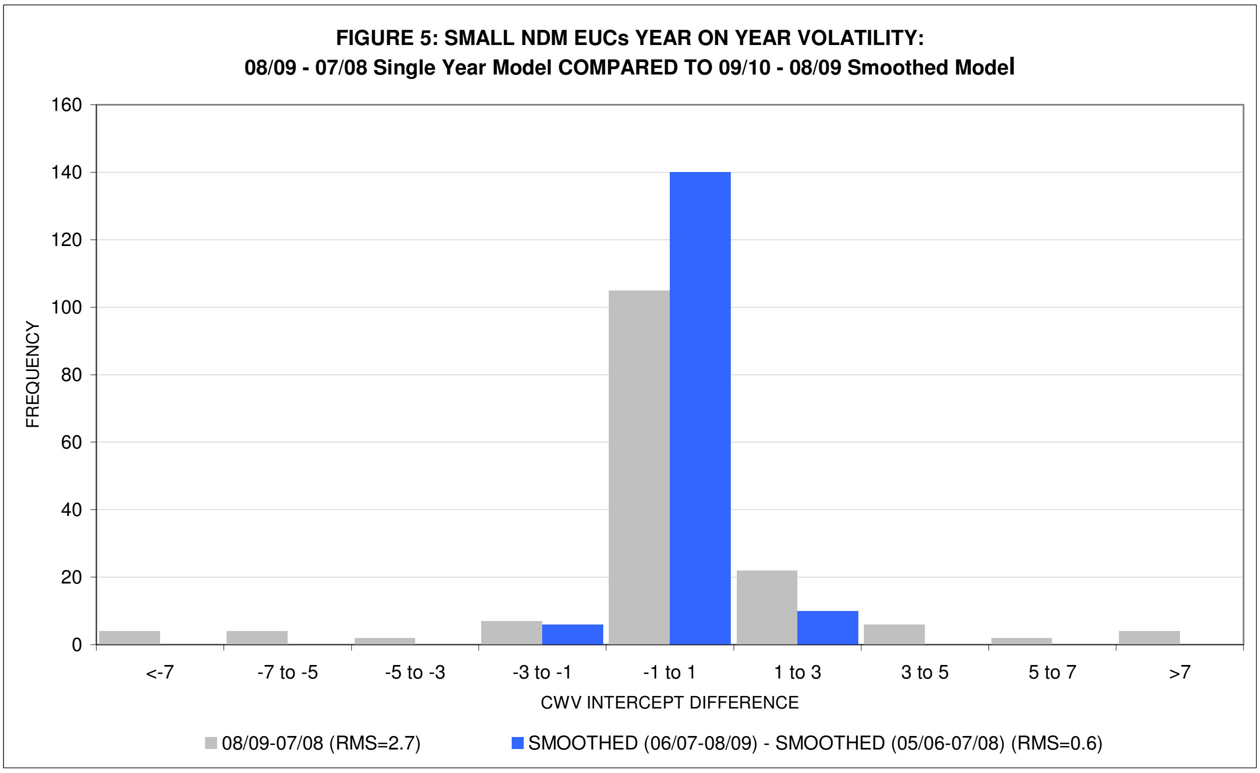


FIGURE 5: SMALL NDM EUCs YEAR ON YEAR VOLATILITY:
08/09 - 07/08 Single Year Model COMPARED TO 09/10 - 08/09 Smoothed Model
FREQUENCY
160
140
120
100
80
60
40
20
0
<-7
-7 to -5
-5 to -3
-3 to -1
-1 to 1
1 to 3
3 to 5
5 to 7
>7
CWV INTERCEPT DIFFERENCE
08/09-07/08 (RMS=2.7)
SMOOTHED (06/07-08/09) - SMOOTHED (05/06-07/08) (RMS=0.6)

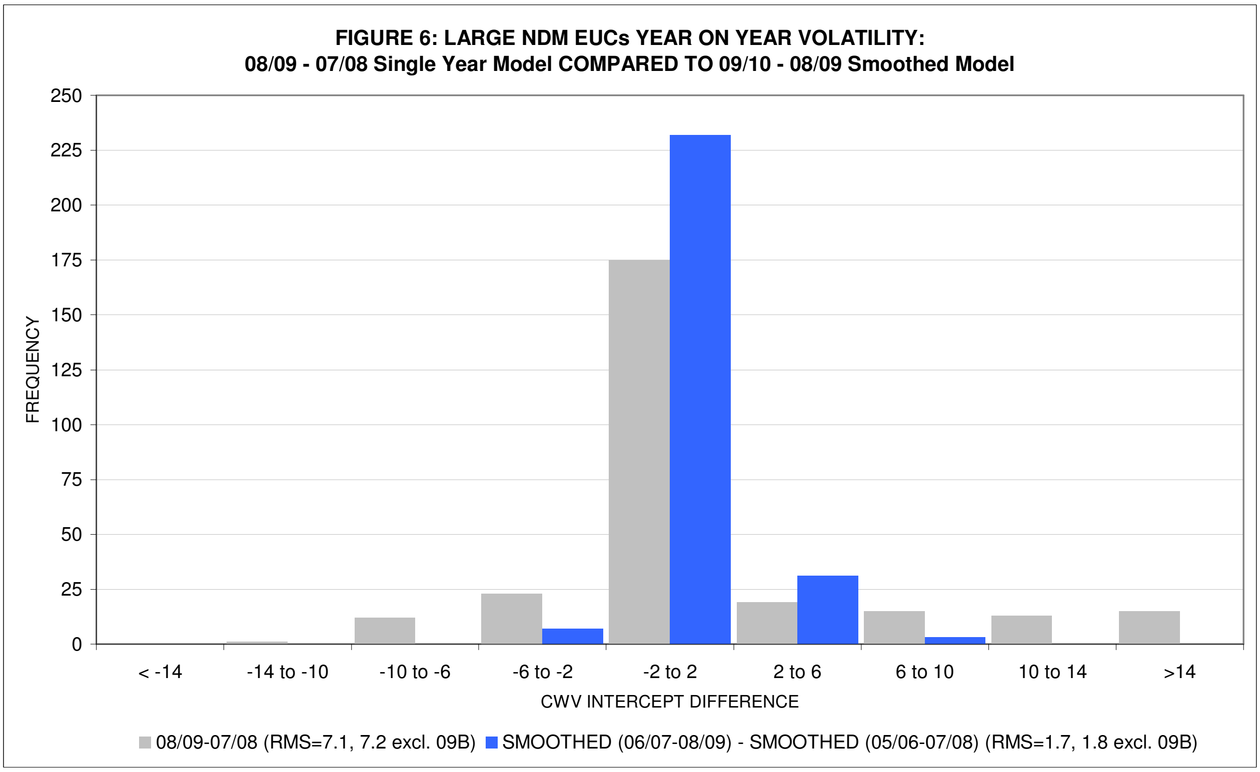


FIGURE 6: LARGE NDM EUCs YEAR ON YEAR VOLATILITY:
08/09 - 07/08 Single Year Model COMPARED TO 09/10 - 08/09 Smoothed Model
FREQUENCY
250
225
200
175
150
125
100
75
50
25
0
< -14
-14 to -10
-10 to -6
-6 to -2
-2 to 2
2 to 6
6 to 10
10 to 14
>14
CWV INTERCEPT DIFFERENCE
08/09-07/08 (RMS=7.1, 7.2 excl. 09B)
SMOOTHED (06/07-08/09) - SMOOTHED (05/06-07/08) (RMS=1.7, 1.8 excl. 09B)

FIGURE 7: SMALL NDM CONSUMPTION BAND EUCs YEAR ON YEAR VOLATILITY:
08/09 - 07/08 Single Year Model COMPARED TO 09/10 - 08/09 Smoothed Model

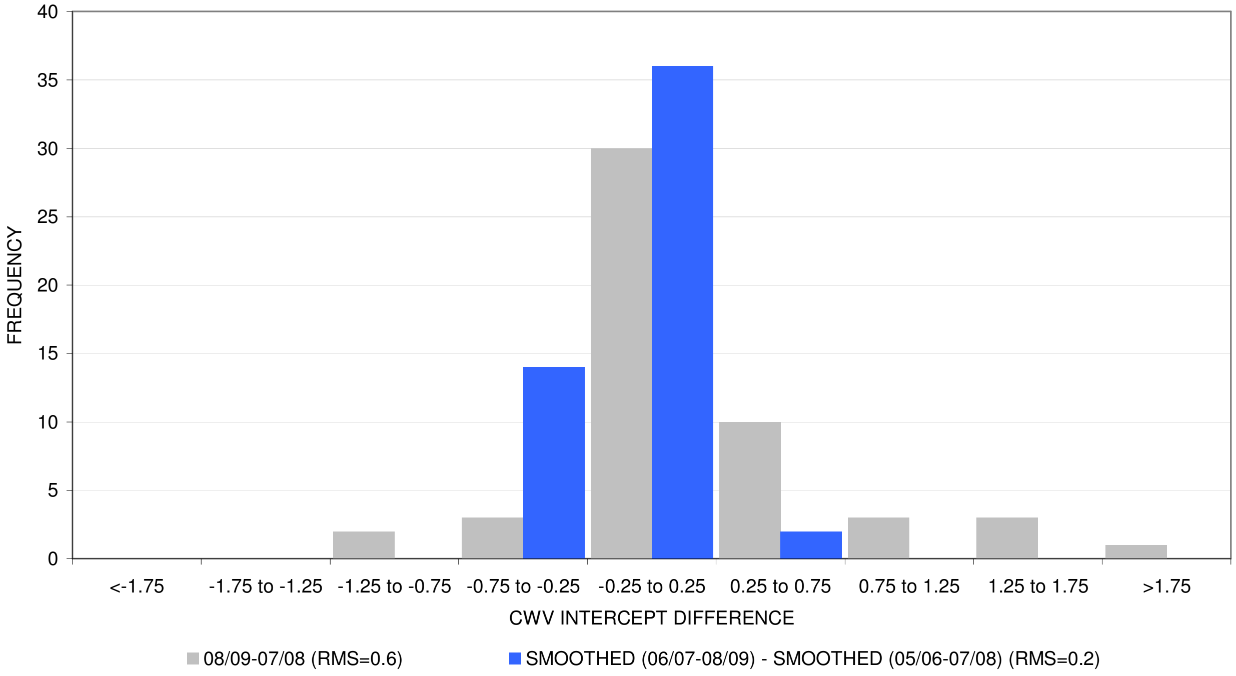


FIGURE 8: LARGE NDM CONSUMPTION BAND EUCs YEAR ON YEAR VOLATILITY:
08/09 - 07/08 Single Year Model COMPARED TO 09/10 - 08/09 Smoothed Model

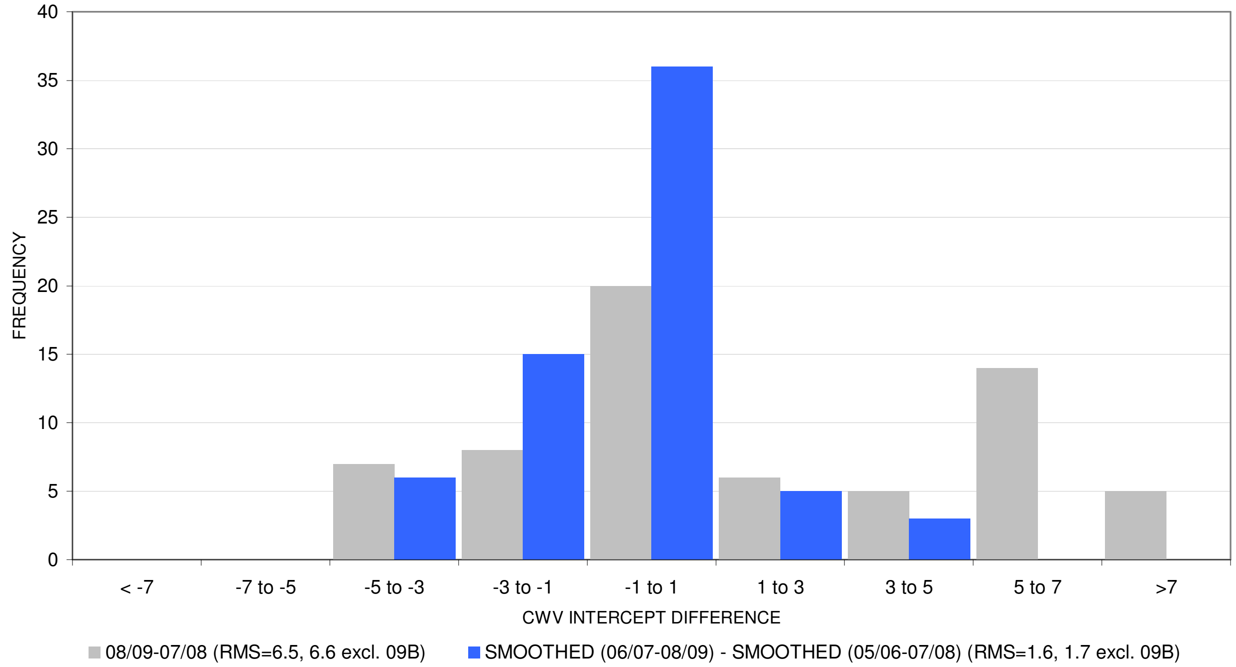


Figure 9: Key for CWV Intercept Pattern Types

3 Years of NDM Demand Models

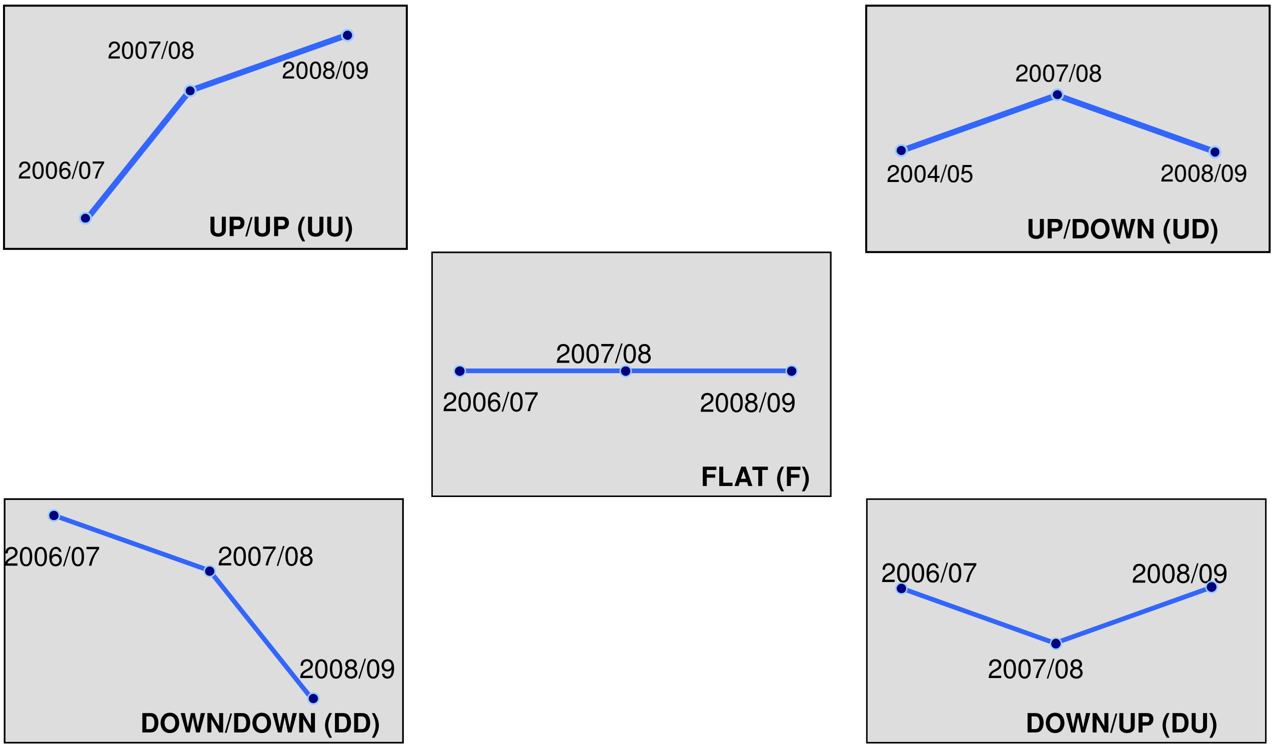


TABLE 1: CWV INTERCEPT PATTERNS
NDM DEMAND MODELS FOR 2006/07, 2007/08, 2008/09

Consumption Band EUCs

xx=LDZ=	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E0901B	DU	DU	DU	DU	UD	DD	DU	UU	UU	UD	UD	UD	UD
xx:E0902B	UD	UD	UU	DU	UU	UU	UU	UD	UU	UU	UD	UU	UD
xx:E0903B	DU	UD	UU	DU	DU	UU	UU	DD	UD	DU	UU	UD	UU
xx:E0904B	UD	UU	DU	UD	UU	UD	DU	UD	UU	UU	UU	UD	UD
xx:E0905B	UU	UD	DU	UD	DU	UU	DU	UD	UU	UD	UU	UU	UU
xx:E0906B	UD	UU	DU	UU	UU	DU	DU	UU	DU	UD	UD	UU	UU
xx:E0907B	DD	UD	UD	UD	UD	UD	UD	UD	DD	DD	DD	UU	UD
xx:E0908B	DU	DU	DU	DU	DU	DU	DU	UD	DD	DD	DD	DD	DD
xx:E0909B	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

First (i.e. Flattest, W01) WAR Bands in each Consumption Range

xx=LDZ=	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E0903W01	UD	UD	UD	UD	UD	UU	UD	UD	UU	UU	UU	UU	UU
xx:E0904W01	UD	UD	UD	UD	UD	UU	UD	UD	UU	UU	UU	UU	UU
xx:E0905W01	DD	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UD	UU
xx:E0906W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E0907W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E0908W01	F	F	F	F	F	F	F	F	F	F	F	F	F

Second (i.e. W02) WAR Bands in each Consumption Range

xx=LDZ=	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E0903W02	UD	UD	UU	UD	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E0904W02	UD	UD	UU	UD	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E0905W02	DD	UD	UD	UU	UU	UU	UD	UU	UU	UU	DU	UU	UU
xx:E0906W02	DU	DU	DU	DU	DU	DU	DU	UU	DU	DU	DU	UU	UD
xx:E0907W02	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
xx:E0908W02	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

Third (i.e. W03) WAR Bands in each Consumption Range

xx=LDZ=	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E0903W03	UD	UD	UU	UU	UU	UD	UU	UD	UU	UU	UU	UU	UU
xx:E0904W03	UD	UD	UU	UU	UU	UD	UU	UD	UU	UU	UU	UU	UU
xx:E0905W03	UD	UD	UU	UD	DU	DU	UU	UU	UU	UU	UU	UU	UU
xx:E0906W03	DD	DD	DU	DD	DU	UD	DU	DU	DU	DU	DU	DU	UU
xx:E0907W03	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
xx:E0908W03	DD	DD	DU	DD	DD	DU	DU	DD	DU	DU	DU	DU	DU

Fourth (i.e. W04) WAR Bands in each Consumption Range

xx=LDZ=	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E0903W04	UD	UD	UU	UD	UU	UD	UU	UD	UU	UU	UD	UU	UD
xx:E0904W04	UD	UD	UU	UD	UU	UD	UU	UD	UU	UU	UD	UU	UD
xx:E0905W04	DD	UD	UD	UD	UD	UD	UD	UU	UU	UU	UU	DU	UU
xx:E0906W04	DD	DD	DD	DD	DD	DD	DD	UD	DU	DU	DU	UD	UD
xx:E0907W04	DD	DD	DU	DD	DD	DU	DU	UD	DU	DU	DU	DU	DD
xx:E0908W04	DD	UD	DU	DU	DD	DU	DU	DU	DU	DU	DU	DU	DD

KEY

UU	UP UP	(2006/07 < 2007/08 < 2008/09)
UD	UP DOWN	(2006/07 < 2007/08 > 2008/09)
DU	DOWN UP	(2006/07 > 2007/08 < 2008/09)
DD	DOWN DOWN	(2006/07 > 2007/08 > 2008/09)
F	FLAT	(2006/07 = 2007/08 = 2008/09)

TABLE 2: CWV INTERCEPTS PATTERNS: NDM DEMAND MODELS FOR 2006/07, 2007/08 AND 2008/09
COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type					Total	
	UU	UD	DU	DD	F		
xx:E0901B	2	5	5	1	0	13	
xx:E0902B	7	5	1	0	0	13	
xx:E0903B	5	3	4	1	0	13	
xx:E0903W01	6	7	0	0	0	13	
xx:E0903W02	10	3	0	0	0	13	
xx:E0903W03	9	4	0	0	0	13	
xx:E0903W04	6	7	0	0	0	13	
xx:E0904B	5	6	2	0	0	13	
xx:E0904W01	6	7	0	0	0	13	
xx:E0904W02	10	3	0	0	0	13	
xx:E0904W03	9	4	0	0	0	13	
xx:E0904W04	6	7	0	0	0	13	
xx:E0905B	6	4	3	0	0	13	
xx:E0905W01	11	1	0	1	0	13	
xx:E0905W02	8	3	1	1	0	13	
xx:E0905W03	8	3	2	0	0	13	
xx:E0905W04	5	6	1	1	0	13	
xx:E0906B	6	3	4	0	0	13	
xx:E0906W01	0	0	0	0	13	13	
xx:E0906W02	2	1	10	0	0	13	
xx:E0906W03	1	1	8	3	0	13	
xx:E0906W04	0	3	3	7	0	13	
xx:E0907B	1	8	0	4	0	13	
xx:E0907W01	0	0	0	0	13	13	
xx:E0907W02	0	13	0	0	0	13	
xx:E0907W03	0	13	0	0	0	13	
xx:E0907W04	0	1	7	5	0	13	
xx:E0908B	0	1	7	5	0	13	
xx:E0908W01	0	0	0	0	13	13	
xx:E0908W02	0	0	13	0	0	13	
xx:E0908W03	0	0	8	5	0	13	
xx:E0908W04	0	1	9	3	0	13	
xx:E0909B	0	0	13	0	0	13	
Total by Type	129	123	101	37	39	429	Autumn 2009
2005/06, 2006/07 and 2007/08 Analysis Years	46	81	173	90	39	429	Autumn 2008
2004/05, 2005/06 and 2006/07 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
2001/02, 2002/03 and 2003/04 Analysis Years	62	95	182	57	33	429	Autumn 2004
2000/01, 2001/02 and 2002/03 Analysis Years	21	145	130	94	39	429	Autumn 2003
1999/00, 2000/01 and 2001/02 Analysis Years	66	194	80	50	39	429	Autumn 2002
1998/99, 1999/00 and 2000/01 Analysis Years	39	83	186	82	39	429	Autumn 2001
1997/98, 1998/99 and 1999/00 Analysis Years	77	223	58	31	40	429	Autumn 2000
1996/97, 1997/98 and 1998/99 Analysis Years	57	46	233	54	39	429	Autumn 1999

LDZ	Type					Total
	UU	UD	DU	DD	F	
SC	1	14	6	9	3	33
NO	3	18	5	4	3	33
NW	10	7	12	1	3	33
NE	5	13	8	4	3	33
EM	11	7	8	4	3	33
WM	9	10	9	2	3	33
WN	10	7	12	1	3	33
WS	9	15	4	2	3	33
EA	16	3	9	2	3	33
NT	14	5	9	2	3	33
SE	12	7	9	2	3	33
SO	15	7	7	1	3	33
SW	14	10	3	3	3	33
Total	129	123	101	37	39	429

KEY	
UU	Increasing trend
UD	Increasing then decreasing trend
DU	Decreasing then increasing trend
DD	Decreasing trend
F	Flat model

TABLE 3: CWV INTERCEPTS PATTERNS: NDM DEMAND MODELS FOR 2005/06, 2006/07, 2007/08 AND 2008/09
COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type				Total	
	N	U	D	F		
xx:E0901B	12	1	0	0	13	
xx:E0902B	11	0	2	0	13	
xx:E0903B	11	1	1	0	13	
xx:E0903W01	13	0	0	0	13	
xx:E0903W02	13	0	0	0	13	
xx:E0903W03	13	0	0	0	13	
xx:E0903W04	13	0	0	0	13	
xx:E0904B	13	0	0	0	13	
xx:E0904W01	13	0	0	0	13	
xx:E0904W02	13	0	0	0	13	
xx:E0904W03	13	0	0	0	13	
xx:E0904W04	13	0	0	0	13	
xx:E0905B	12	0	1	0	13	
xx:E0905W01	7	0	6	0	13	
xx:E0905W02	10	0	3	0	13	
xx:E0905W03	13	0	0	0	13	
xx:E0905W04	13	0	0	0	13	
xx:E0906B	11	0	2	0	13	
xx:E0906W01	0	0	0	13	13	
xx:E0906W02	13	0	0	0	13	
xx:E0906W03	13	0	0	0	13	
xx:E0906W04	13	0	0	0	13	
xx:E0907B	9	3	1	0	13	
xx:E0907W01	0	0	0	13	13	
xx:E0907W02	13	0	0	0	13	
xx:E0907W03	13	0	0	0	13	
xx:E0907W04	11	2	0	0	13	
xx:E0908B	8	5	0	0	13	
xx:E0908W01	0	0	0	13	13	
xx:E0908W02	13	0	0	0	13	
xx:E0908W03	10	3	0	0	13	
xx:E0908W04	10	3	0	0	13	
xx:E0909B	13	0	0	0	13	
Total by Type	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
2002/03, 2003/04, 2004/05 and 2005/06 Analysis Years	355	10	29	35	429	Autumn 2006
2001/02, 2002/03, 2003/04 and 2004/05 Analysis Years	360	9	25	35	429	Autumn 2005
2000/01, 2001/02, 2002/03 and 2003/04 Analysis Years	364	23	9	33	429	Autumn 2004
1999/00, 2000/01, 2001/02 and 2002/03 Analysis Years	353	32	5	39	429	Autumn 2003
1998/99, 1999/00, 2000/01 and 2001/02 Analysis Years	352	26	12	39	429	Autumn 2002
1997/98, 1998/99, 1999/00 and 2000/01 Analysis Years	348	15	27	39	429	Autumn 2001
1996/97, 1997/98, 1998/99 and 1999/00 Analysis Years	361	15	14	39	429	Autumn 2000

LDZ	Type				Total
	N	U	D	F	
SC	29	1	0	3	33
NO	28	0	2	3	33
NW	28	0	2	3	33
NE	27	1	2	3	33
EM	24	3	3	3	33
WM	26	1	3	3	33
WN	28	0	2	3	33
WS	28	2	0	3	33
EA	28	2	0	3	33
NT	28	2	0	3	33
SE	27	2	1	3	33
SO	28	1	1	3	33
SW	27	3	0	3	33
Total	356	18	16	39	429

KEY	
N	No consistent trend over 4 years
U	Increasing trends over 4 years
D	Decreasing trends over 4 years
F	Flat models

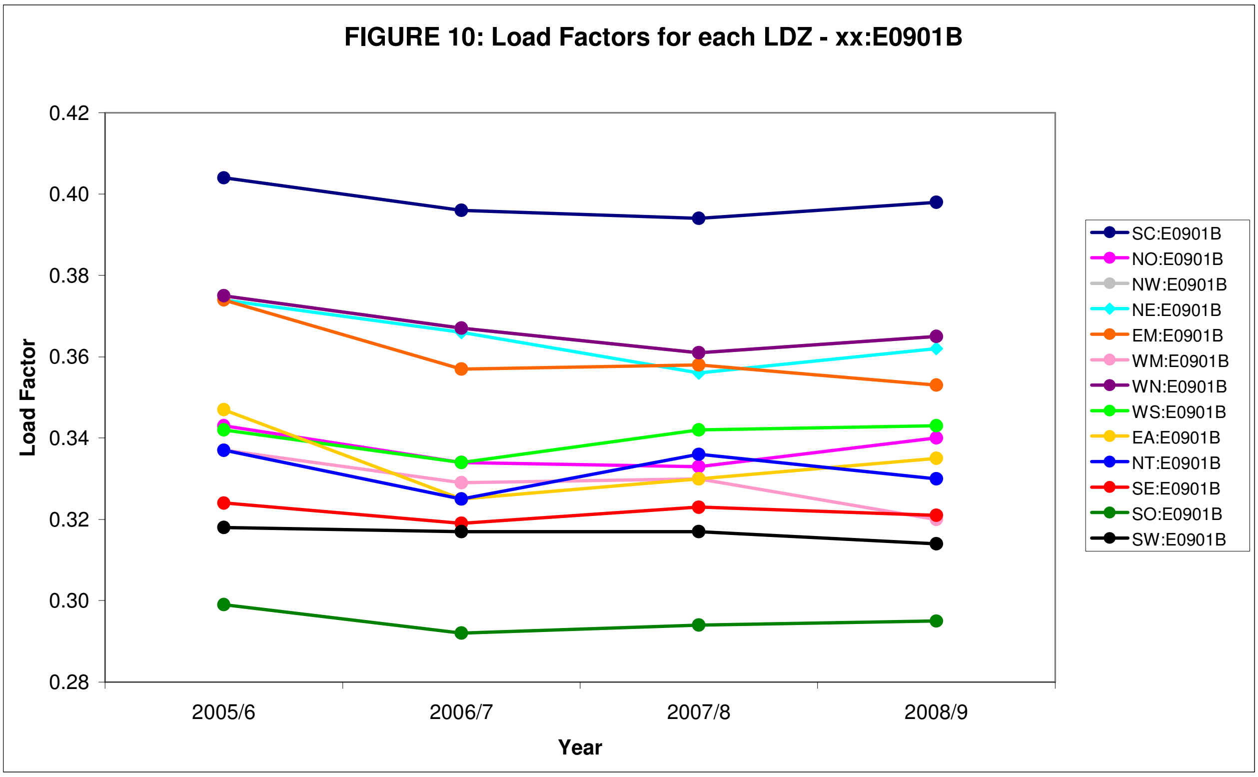


FIGURE 10: Load Factors for each LDZ - xx:E0901B
Load Factor
0.42
0.40
0.38
0.36
0.34
0.32
0.30
0.28
2005/6
2006/7
2007/8
2008/9
Year
SC:E0901B
NO:E0901B
NW:E0901B
NE:E0901B
EM:E0901B
WM:E0901B
WN:E0901B
WS:E0901B
EA:E0901B
NT:E0901B
SE:E0901B
SO:E0901B
SW:E0901B

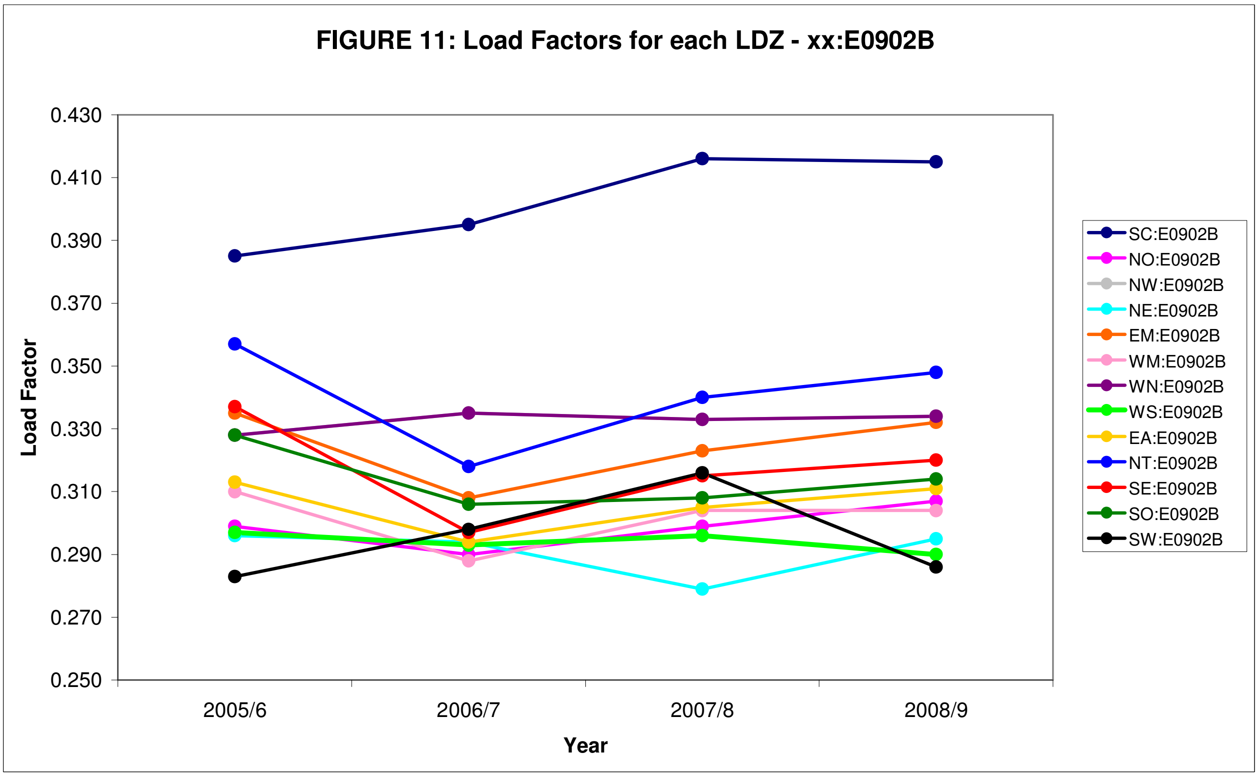


FIGURE 11: Load Factors for each LDZ - xx:E0902B
Load Factor
0.430
0.410
0.390
0.370
0.350
0.330
0.310
0.290
0.270
0.250
2005/6
2006/7
2007/8
2008/9
Year
SC:E0902B
NO:E0902B
NW:E0902B
NE:E0902B
EM:E0902B
WM:E0902B
WN:E0902B
WS:E0902B
EA:E0902B
NT:E0902B
SE:E0902B
SO:E0902B
SW:E0902B

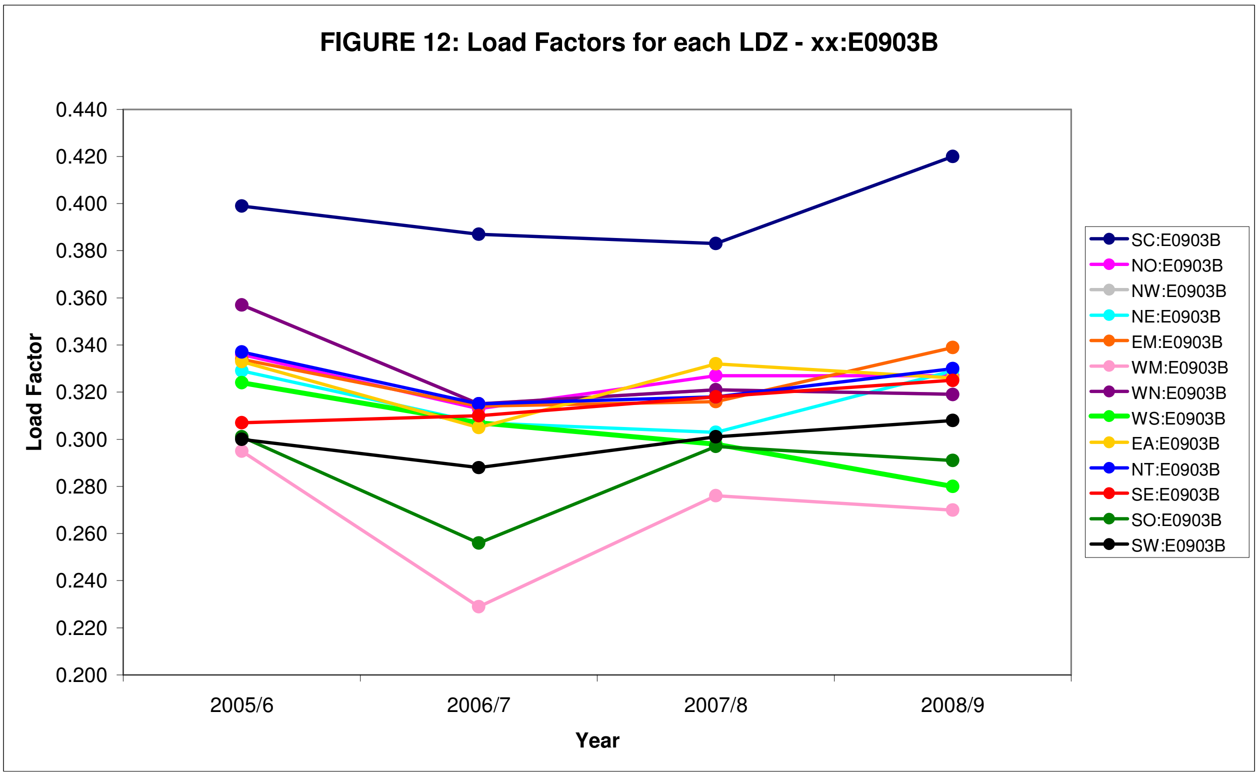


FIGURE 12: Load Factors for each LDZ - xx:E0903B
Load Factor
0.440
0.420
0.400
0.380
0.360
0.340
0.320
0.300
0.280
0.260
0.240
0.220
0.200
2005/6
2006/7
2007/8
2008/9
Year
SC:E0903B
NO:E0903B
NW:E0903B
NE:E0903B
EM:E0903B
WM:E0903B
WN:E0903B
WS:E0903B
EA:E0903B
NT:E0903B
SE:E0903B
SO:E0903B
SW:E0903B

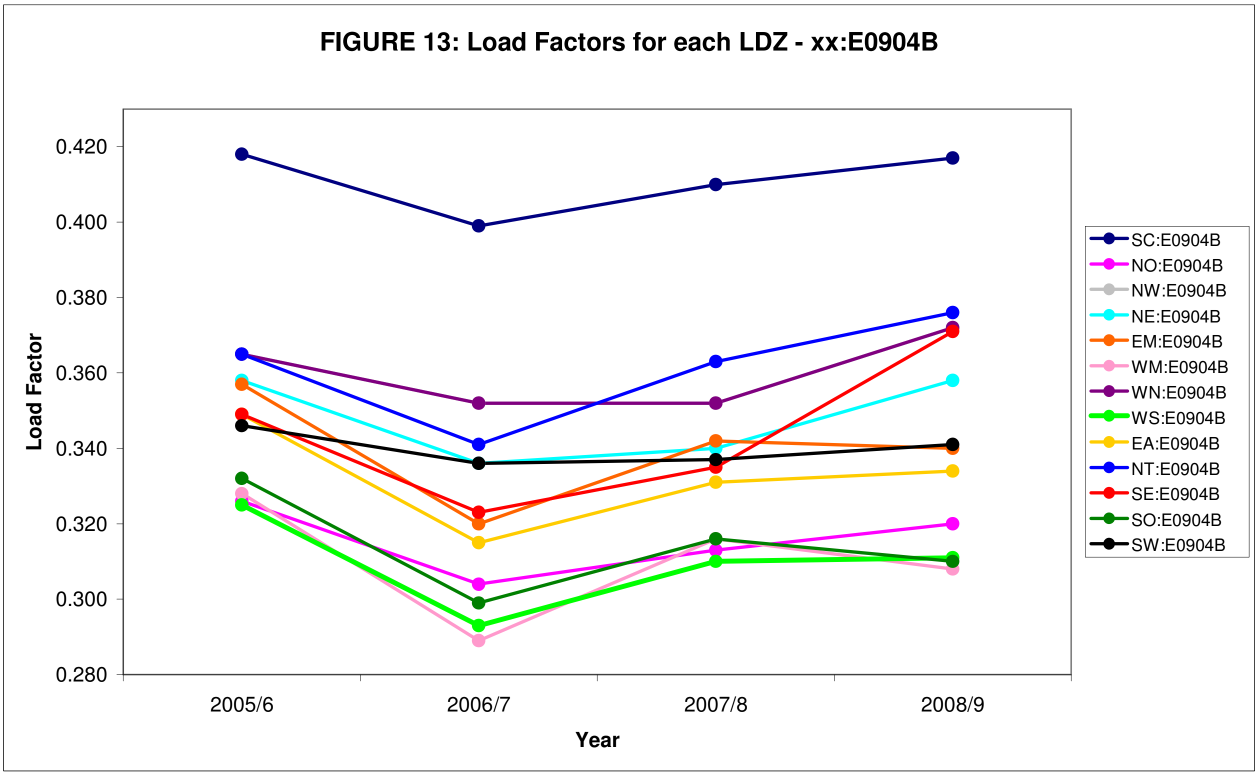


FIGURE 13: Load Factors for each LDZ - xx:E0904B
Load Factor
0.420
0.400
0.380
0.360
0.340
0.320
0.300
0.280
2005/6
2006/7
2007/8
2008/9
Year
SC:E0904B
NO:E0904B
NW:E0904B
NE:E0904B
EM:E0904B
WM:E0904B
WN:E0904B
WS:E0904B
EA:E0904B
NT:E0904B
SE:E0904B
SO:E0904B
SW:E0904B

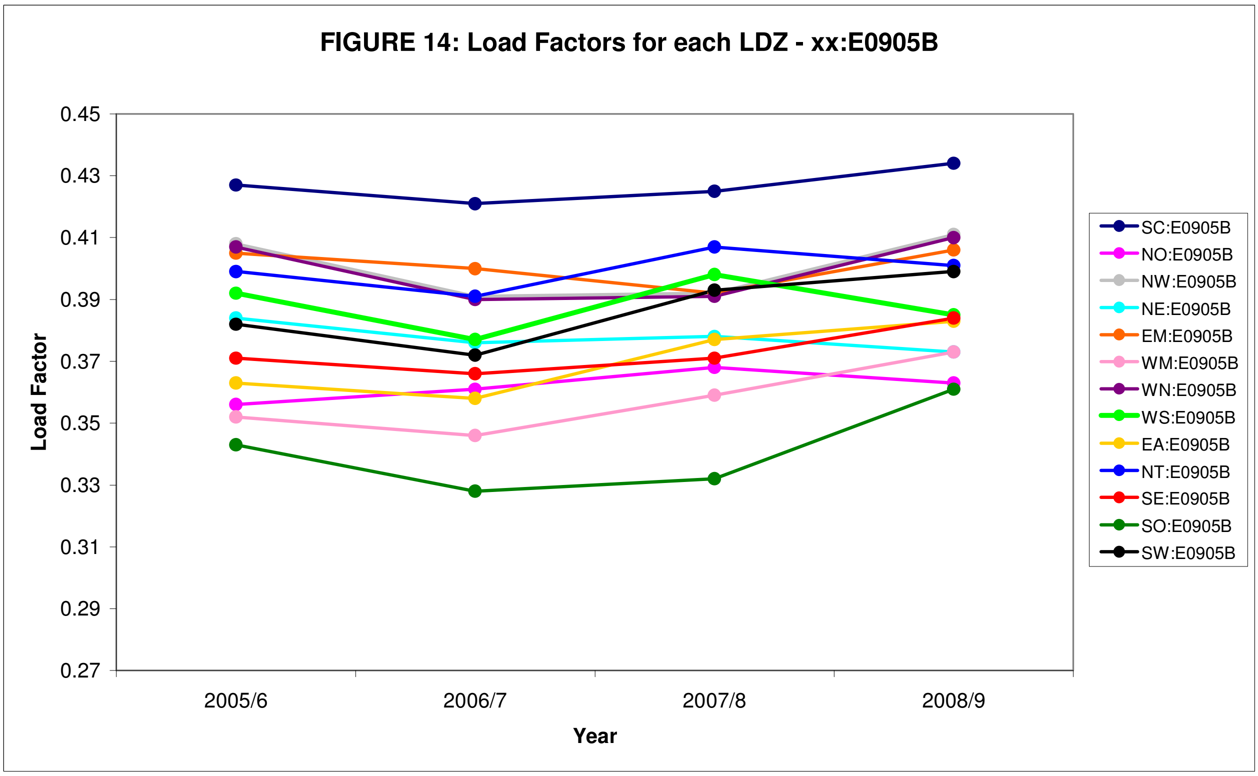


FIGURE 14: Load Factors for each LDZ - xx:E0905B
Load Factor
0.45
0.43
0.41
0.39
0.37
0.35
0.33
0.31
0.29
0.27
2005/6
2006/7
2007/8
2008/9
Year
SC:E0905B
NO:E0905B
NW:E0905B
NE:E0905B
EM:E0905B
WM:E0905B
WN:E0905B
WS:E0905B
EA:E0905B
NT:E0905B
SE:E0905B
SO:E0905B
SW:E0905B

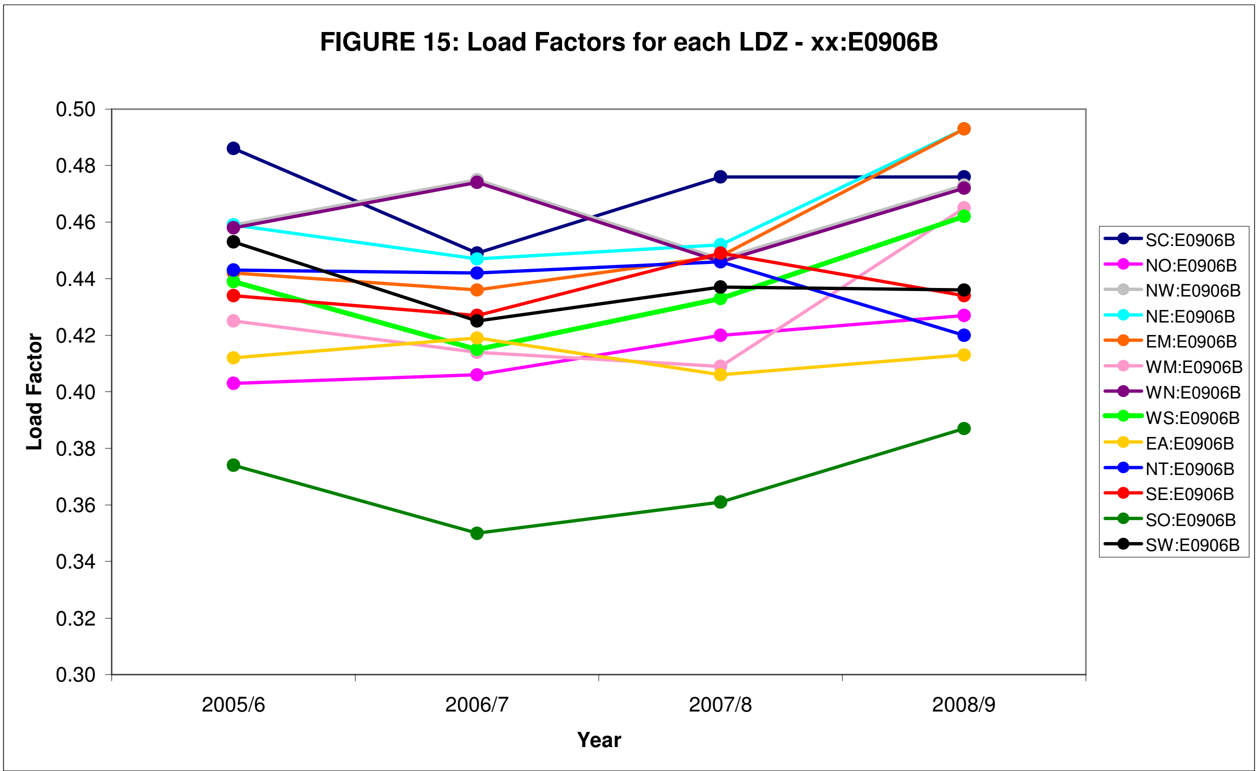


FIGURE 15: Load Factors for each LDZ - xx:E0906B
Load Factor
0.50
0.48
0.46
0.44
0.42
0.40
0.38
0.36
0.34
0.32
0.30
2005/6
2006/7
2007/8
2008/9
Year
SC:E0906B
NO:E0906B
NW:E0906B
NE:E0906B
EM:E0906B
WM:E0906B
WN:E0906B
WS:E0906B
EA:E0906B
NT:E0906B
SE:E0906B
SO:E0906B
SW:E0906B

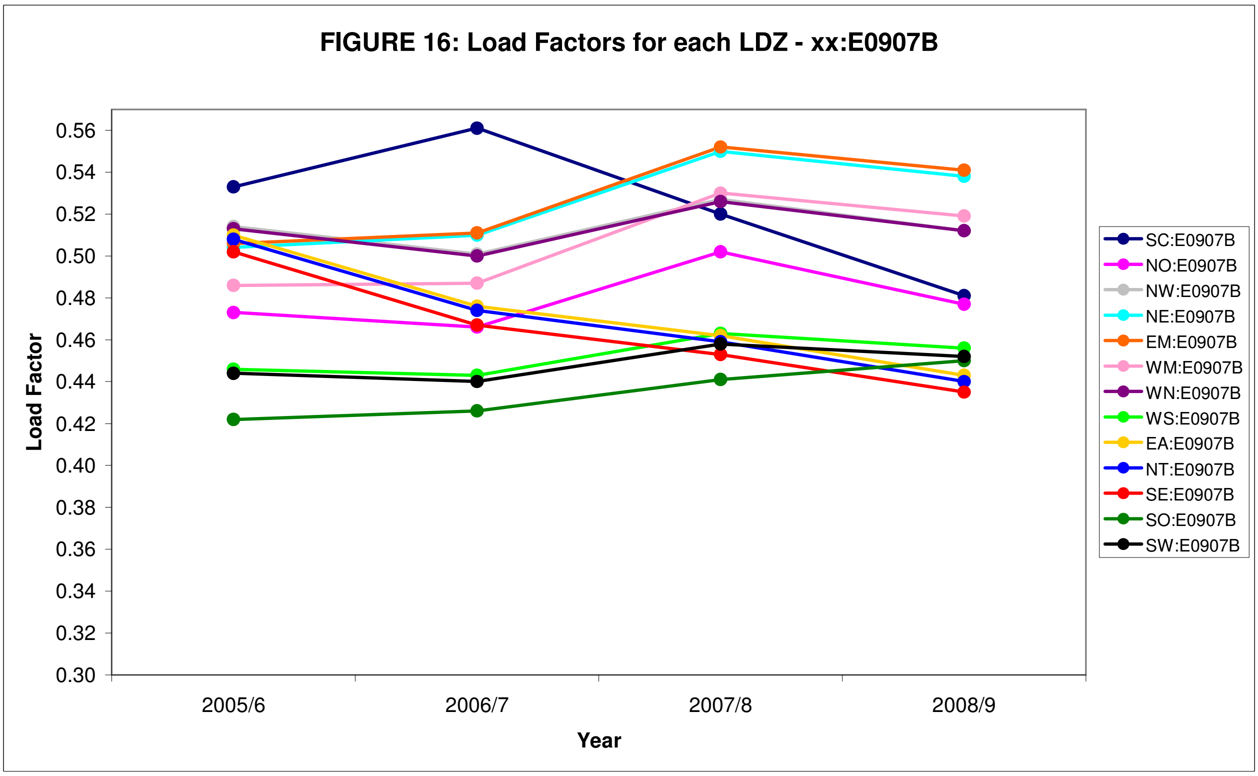


FIGURE 16: Load Factors for each LDZ - xx:E0907B
Load Factor
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
0.38
0.36
0.34
0.32
0.30
2005/6
2006/7
2007/8
2008/9
Year
SC:E0907B
NO:E0907B
NW:E0907B
NE:E0907B
EM:E0907B
WM:E0907B
WN:E0907B
WS:E0907B
EA:E0907B
NT:E0907B
SE:E0907B
SO:E0907B
SW:E0907B

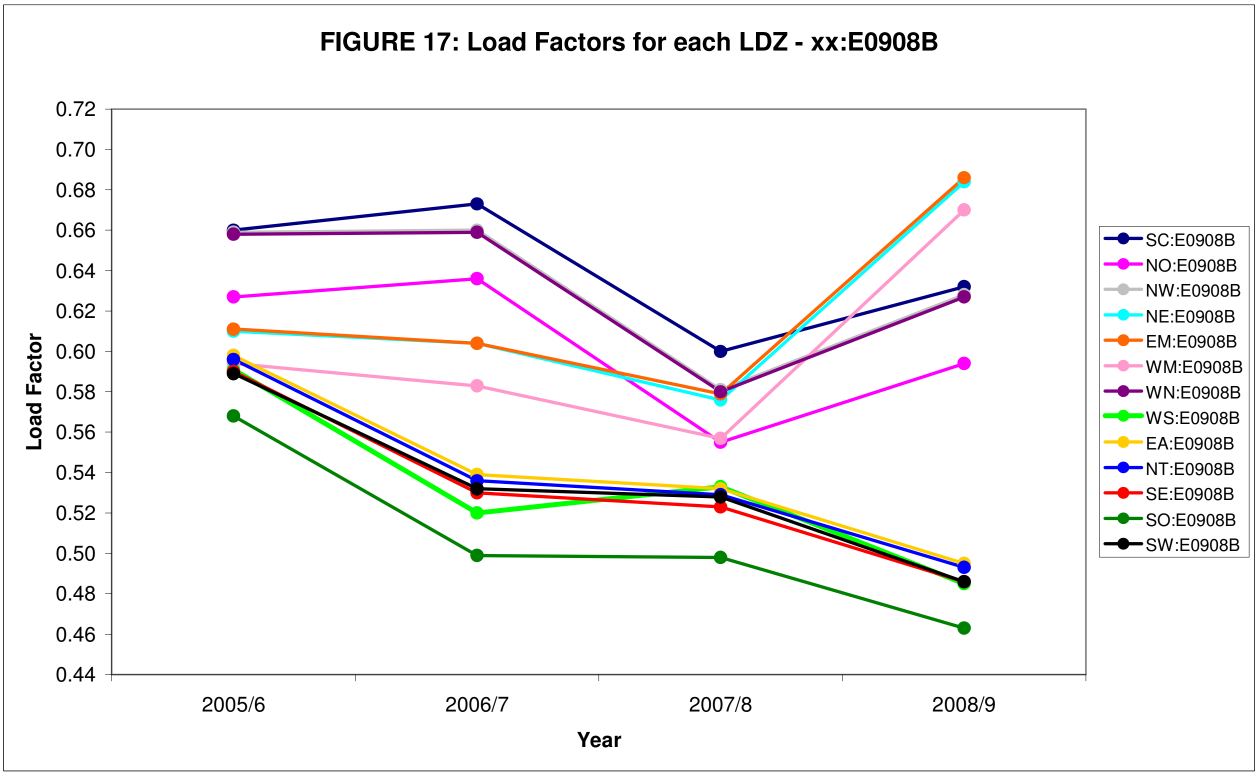


FIGURE 17: Load Factors for each LDZ - xx:E0908B
Load Factor
0.72
0.70
0.68
0.66
0.64
0.62
0.60
0.58
0.56
0.54
0.52
0.50
0.48
0.46
0.44
2005/6
2006/7
2007/8
2008/9
Year
SC:E0908B
NO:E0908B
NW:E0908B
NE:E0908B
EM:E0908B
WM:E0908B
WN:E0908B
WS:E0908B
EA:E0908B
NT:E0908B
SE:E0908B
SO:E0908B
SW:E0908B

FIGURE 18: Load Factors for each LDZ - xx:E0909B

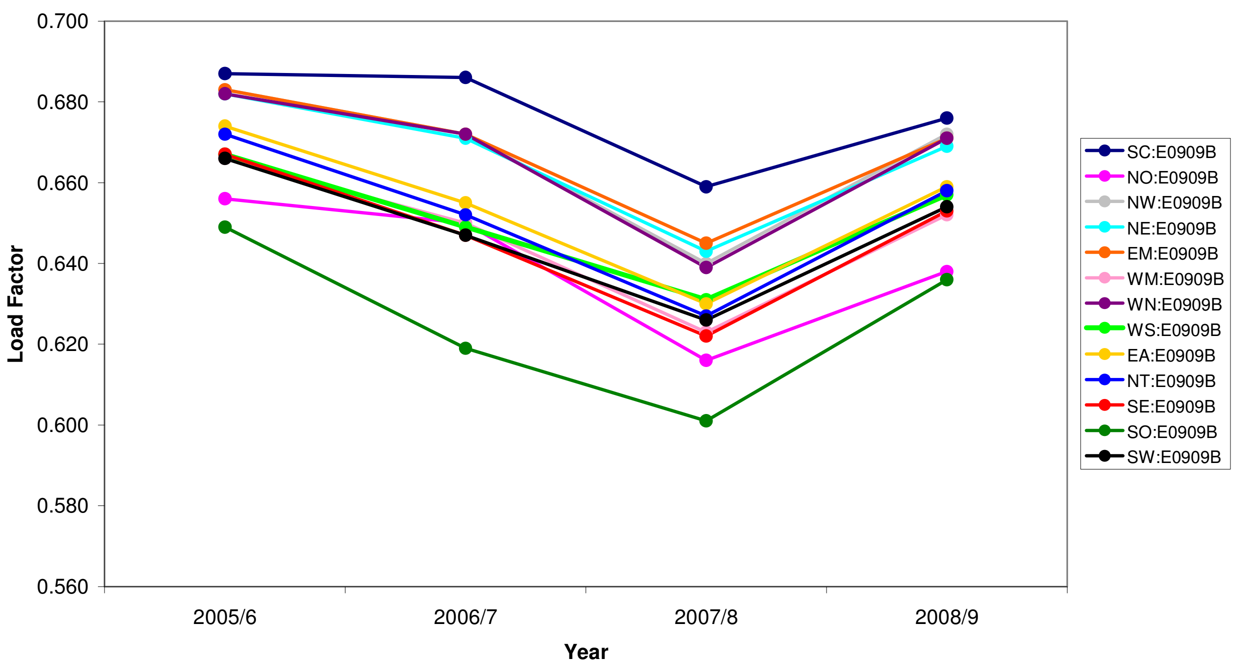


FIGURE 19: Load Factors for each LDZ - xx:E0905W01