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 2013/14.

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 last formal assessment of model smoothing undertaken was in autumn 2011. Following discussion of those results at DESC in November 2011, it was decided to continue to apply model smoothing in deriving the NDM proposals for 2012/13 and 2013/14.

The proposals for 2013/14 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) 2012/13 consumption data with:

- the 2011/12 (single year) models
- the smoothed models based on 2009/10, 2010/11 and 2011/12 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 2009/10, 2010/11 and 2011/12 along with those for 2012/13, provide the necessary information. All of these CWV intercepts relate to models derived using the current definitions of CWVs and the current basis for SNCWVs that were used in the spring 2012 and 2013 NDM analyses and came into effect on 1st October 2010. In general, for EUCs in LDZs where a CWV definition has changed, the CWV intercepts presented here are not directly comparable with CWV intercepts published prior to the change of CWV definition. In addition the current definitions of holiday codes (implemented in the spring 2011 analysis) were applied in deriving the models for all the years.

3.0 Analysis

3.1 Consumption Band Analysis (Figures 1 & 2)

The bar charts attached as Figures 1 and 2 shows, 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 2012/13 (based on 2009/10, 2010/11 and 2011/12 data) is slightly better, in terms of the spread of CWV intercept differences, when compared with those for the single year (2011/12) model, and this is also reflected in the respective RMS values, which are marginally better for the smoothed model. For large NDM consumption band EUCs (Figure 2) the RMS value is clearly better for the single year model both including and excluding the contribution of band 09B. So, on balance, the picture is mixed for small and large NDM consumption band EUCs, the smoothed three-year model is marginally better at predicting 2012/13 than the single year, 2011/12 model for small NDM "B" EUCs and clearly worse for large NDM "B" EUCs.

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), for the single year model case and smoothed model case are quite similar, however the RMS value (which indicates the spread of CWV intercept differences around zero) is lower for the single year model.

For all large NDM EUCs (Figure 4) the spread of CWV intercept differences shows degradation 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 band 09B) are higher for the smoothed model.

This analysis of "predictive ability", undertaken on the same basis as previous years, has shown overall there is little difference in "predictive ability" with the smoothed model and singe year model for small NDM EUCs but clearly a difference for large NDM EUCs. Overall, there is some evidence, on this occasion, that single year models were better in terms of 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)

In order to assess this 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 2012/13 (based on 2009/10, 2010/11 and 2011/12) and the smoothed models applicable to gas year 2013/14 (based on 2010/11, 2011/12 and 2012/13)

- Difference in CWV intercepts between individual year models for 2011/12 and 2012/13 that would have been applied to gas years 2012/13 and 2013/14 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 current weather basis) 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 2011). 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 2013/14 - essentially there are five possible patterns for a series of three CWV intercepts to follow:

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

A code 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 2010/11, 2011/12 and 2012/13, the overall count of the different pattern types indicates that:

- The "down/up", pattern shows 115 occurrences out of 429 (there were 74 in 2012, 161 in 2011, 91 in 2010 and 101 in 2009).
- The "up/down" pattern shows 117 occurrences (there were 150 in 2012, 85 in 2011, 214 in 2010 and 123 in 2009).
- Thus, taken together, 232 occurrences (224 in 2012, 246 in 2011, 305 in 2010 and 224 in 2009) have no increasing or decreasing pattern over the three years.
- This year also shows 39 flat or nearly flat models (the same numbers as in 2012, 2011, 2010 and 2009).

The prevalence of "down/up" and up/down" patterns (232) remains greater than half of the number of cases (429), Since there are 39 cases of flat or nearly flat models (all of which are EUCs applicable to WAR band 1) 232 of 390 remaining cases show no consistent pattern over three years. Instances with a decreasing pattern number 26 (31 in 2012, 54 in 2011, 33 in 2010 and 37 in 2009) and instances of an increasing pattern over three years amount to 132 (135 in 2012, 90 in 2011, 52 in 2010 and 129 in 2009).

There were nine instances of EUCs where there is an increasing pattern over three years in a majority of LDZs (i.e. 7 or more of 13), of which 7 were in the WAR band EUCs. The one instance of an EUC where there is a decreasing pattern over three years in a majority of LDZs was also a WAR band EUC. There were no LDZs that showed an increasing pattern in the majority of EUCs (17 or more), however there was a notable increase generally in the number of EUCs that displayed an upward trend across most LDZs. 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 (2009/10, 2010/11, 2011/12 and 2012/13) 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 (or nearly flat) models. Summary results are presented as Table 3.

These show that 308 out of 429 occurrences (there were 335 in 2012, 363 in 2011, 364 in 2010 and 356 in 2009) indicate no consistent trend while the numbers of consistently decreasing or consistently increasing occurrences have grown slightly from previous years (7 and 75 respectively this year – 16 and 39 respectively in 2012, 5 and 22 respectively in 2011, 6 and 20 respectively in 2010 and 18 and 16 respectively in 2009). Although a full model smoothing investigation was not undertaken in 2010 and 2012, these relevant counts were derived for use in this assessment.

The count of EUCs of no consistent pattern (308) is lower than that of all previous assessments - the lowest observed was 335 in 2012. As Table 3 shows, the results for all previous model smoothing investigations up to and including Autumn 2011 have been very similar with the vast majority of cases always that of no consistent trend. This recent trend may have been caused by the introduction of a significant number of new sample sites in the higher bands which were previously interruptible sites and became Firm as of 1st October 2011, and consequently display demand behaviour which may be different to that seen in previous years for those specific EUCs.

For every LDZ over four years, the predominant effect is of no consistent pattern. In each LDZ 19 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 11(of 33).

For the 9 EUCs that showed a majority of occurrences of an upward pattern in CWV intercepts over three years, the four year picture for 3 of these EUCs is one of no consistent trend, leaving 6 EUCs (in the Large NDM sector, representing 2.89% of NDM load). However, over four years there were still 75 EUCs of 429 which showed a consistently upward pattern.

In particular, for EUCs xx:E1307W03, xx:E1307W04 and xx:E1308W02 at least 9 LDZs in each case showed an upward trend over three years. In these three EUCs, demand modelling was undertaken with a national data set, and thus, these EUCs were derived from one single data aggregation in each case. Overall across all LDZs the equivalent EUCs (xx:E1307W03, xx:E1307W04 and xx:E1308W02 as of October 2013) constituted only 0.0004%, 0.0002% and 0.0001% of supply point numbers and 0.38%, 0.22% and 0.26% of overall NDM load (AQ basis) respectively.

For the one WAR band EUC that showed a majority of occurrences of a downward pattern in CWV intercepts over three years, the four year picture for this EUC is one of no consistent trend in 13 out of 13 LDZs. Over four years only 7 EUCs of 429 showed a consistently downward pattern.

5.0 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) show that there is only one instance of a year on year increase (or decrease) in load factors in any of the consumption band EUCs that is consistently expressed across all of the LDZs, namely xx:E1307B

6.0 Conclusion

Xoserve believe that the current averaging approach to model smoothing applied over three years continues to be appropriate and fit for purpose despite there being some evidence from the latest review of possible trends in Large NDM bands. In practice these trends have only been seen in a handful of models due to the fact data is aggregated in these bandings.

DESC will be consulted on this topic at a meeting on 13th November to seek their views

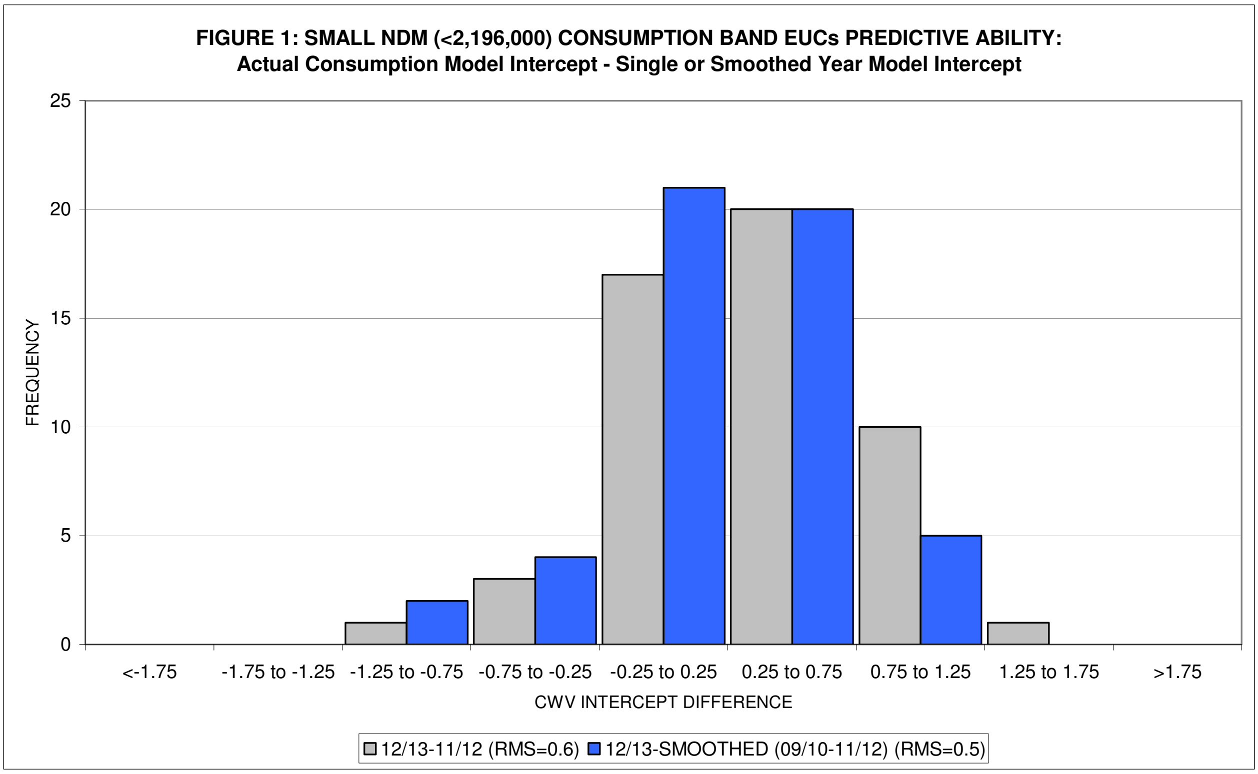


FIGURE 1: SMALL NDM (<2,196,000) CONSUMPTION BAND EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept
FREQUENCY
0
5
10
15
20
25
<-1.75
-1.75 to -1.25
-1.25 to -0.75
-0.75 to -0.25
-0.25 to 0.25
0.25 to 0.75
0.75 to 1.25
1.25 to 1.75
>1.75
CWV INTERCEPT DIFFERENCE
12/13-11/12 (RMS=0.6)
12/13-SMOOTHED (09/10-11/12) (RMS=0.5)

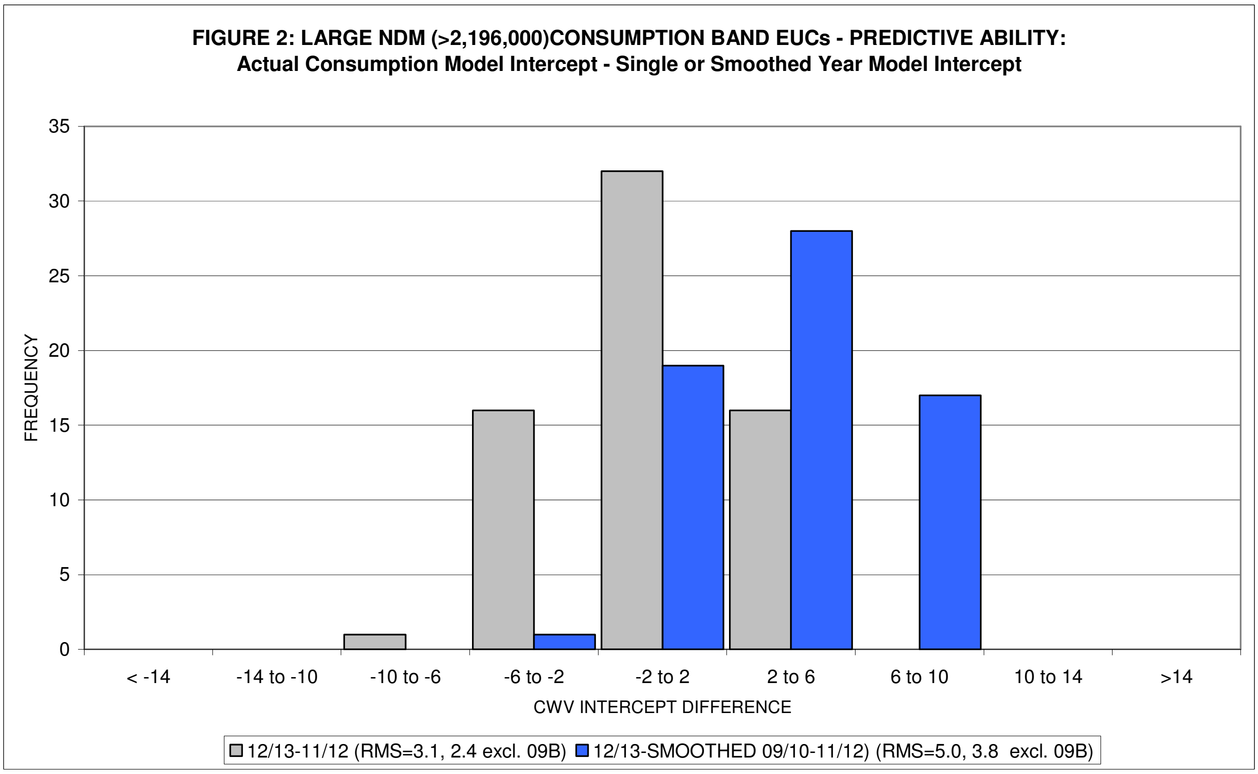


FIGURE 2: LARGE NDM (>2,196,000)CONSUMPTION BAND EUCs - PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept
FREQUENCY
0
5
10
15
20
25
30
35
< -14
-14 to -10
-10 to -6
-6 to -2
-2 to 2
2 to 6
6 to 10
10 to 14
>14
CWV INTERCEPT DIFFERENCE
12/13-11/12 (RMS=3.1, 2.4 excl. 09B)
12/13-SMOOTHED 09/10-11/12) (RMS=5.0, 3.8 excl. 09B)

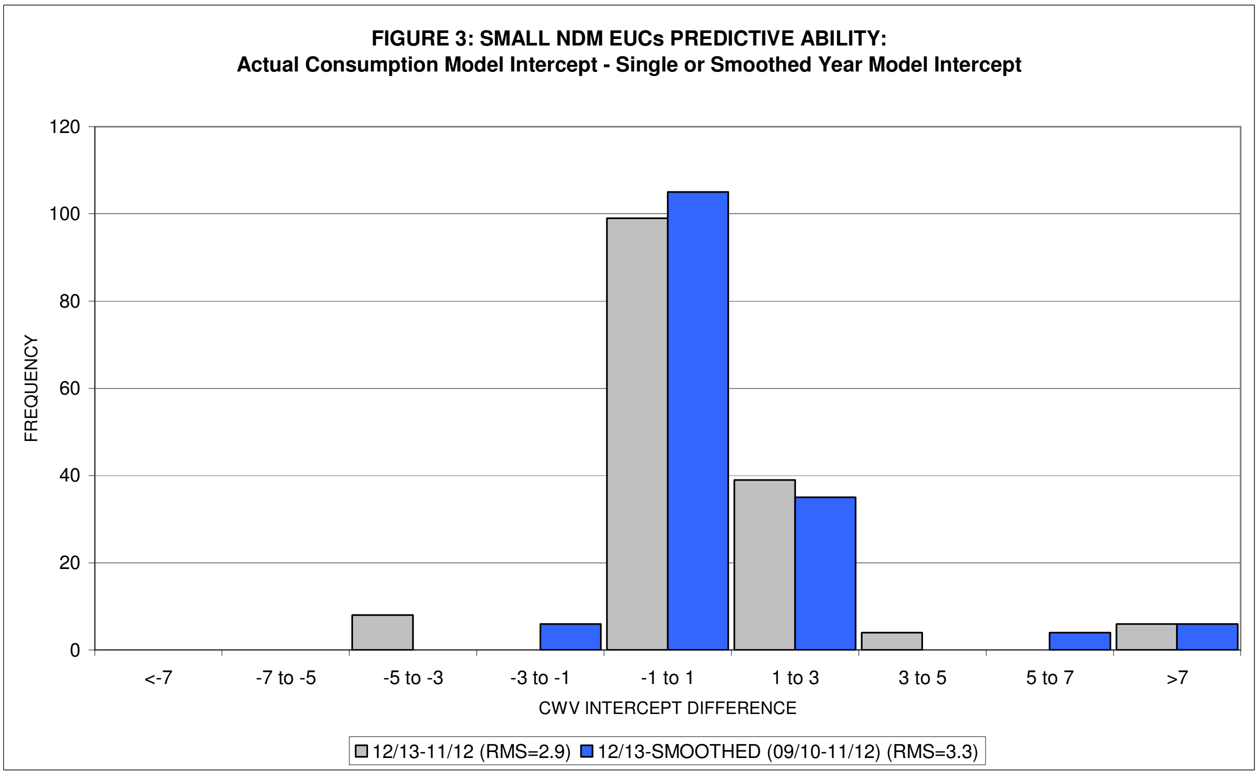


FIGURE 3: SMALL NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept
FREQUENCY
0
20
40
60
80
100
120
<-7
-7 to -5
-5 to -3
-3 to -1
-1 to 1
1 to 3
3 to 5
5 to 7
>7
CWV INTERCEPT DIFFERENCE
12/13-11/12 (RMS=2.9)
12/13-SMOOTHED (09/10-11/12) (RMS=3.3)

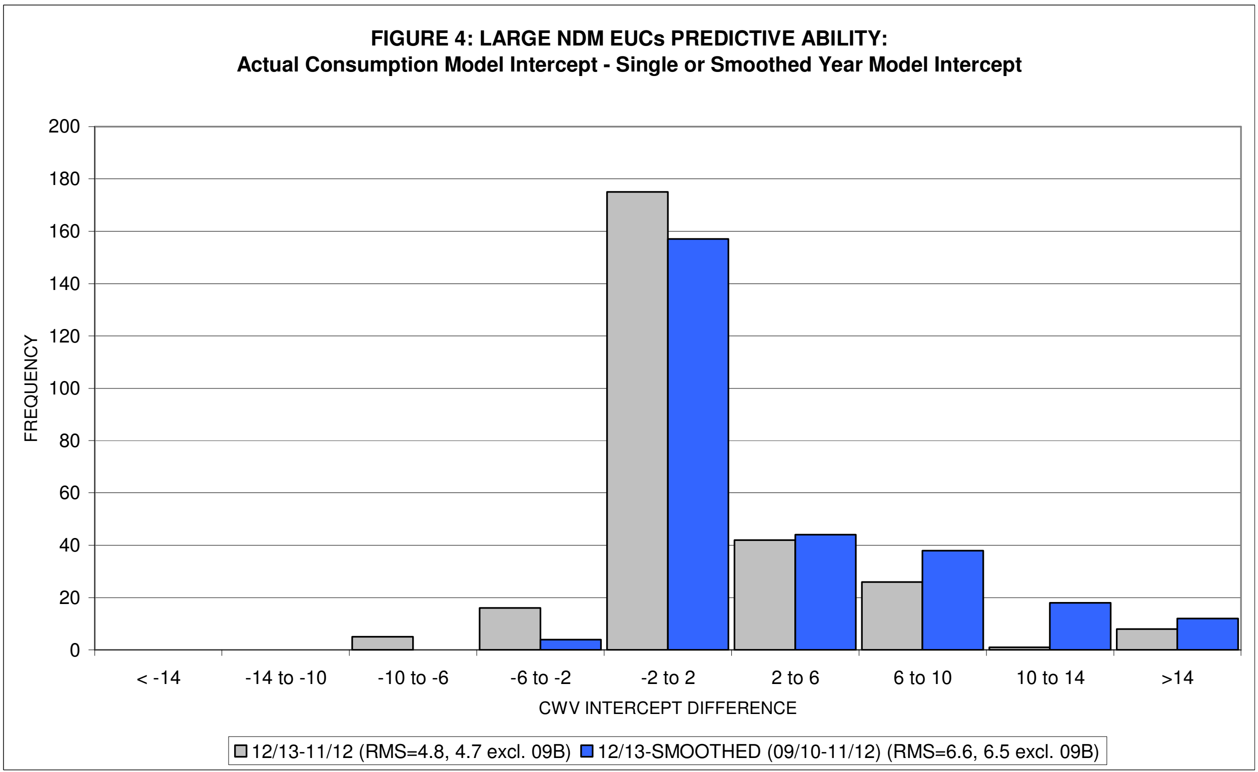


FIGURE 4: LARGE NDM EUCs PREDICTIVE ABILITY:
Actual Consumption Model Intercept - Single or Smoothed Year Model Intercept
FREQUENCY
0
20
40
60
80
100
120
140
160
180
200
< -14
-14 to -10
-10 to -6
-6 to -2
-2 to 2
2 to 6
6 to 10
10 to 14
>14
CWV INTERCEPT DIFFERENCE
12/13-11/12 (RMS=4.8, 4.7 excl. 09B)
12/13-SMOOTHED (09/10-11/12) (RMS=6.6, 6.5 excl. 09B)

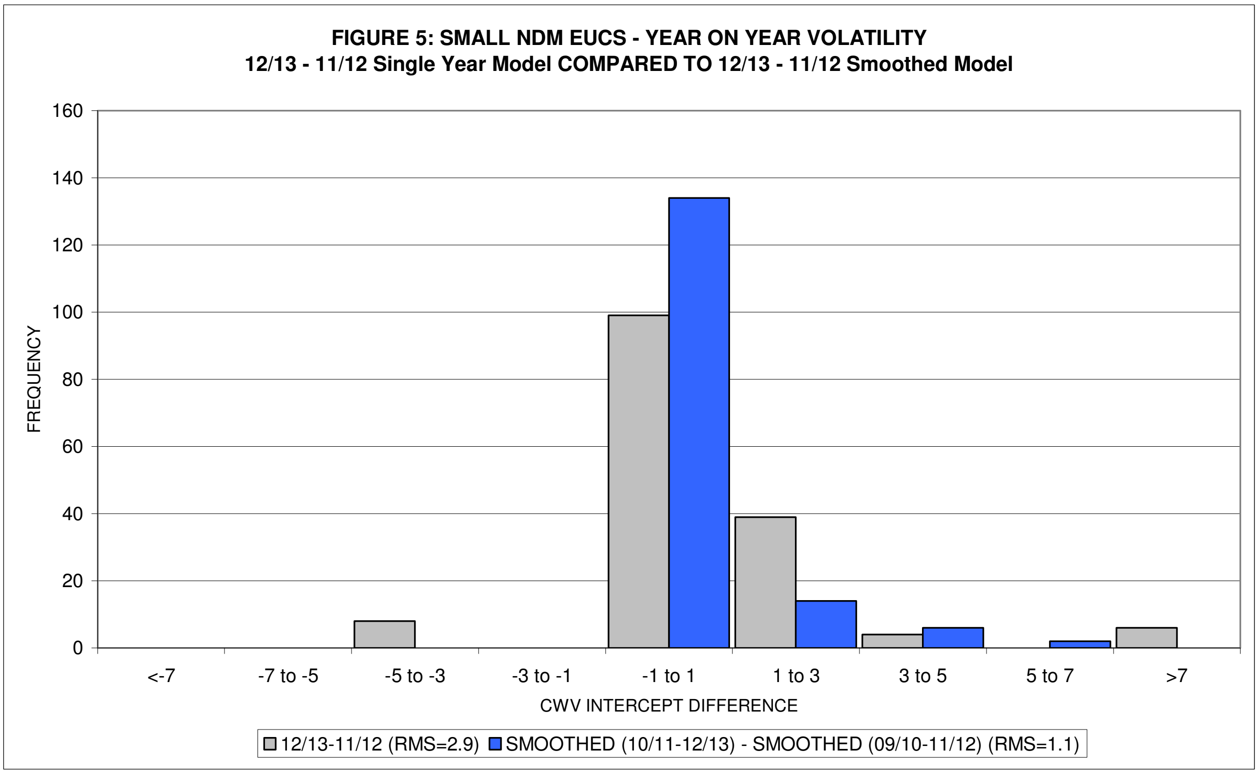


FIGURE 5: SMALL NDM EUCS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model
FREQUENCY
160
140
120
100
80
60
40
20
0
<-7
-7 to -5
-5 to -3
-3 to -1
-1 to 1
1 to 3
3 to 5
5 to 7
>7
CWV INTERCEPT DIFFERENCE
12/13-11/12 (RMS=2.9)
SMOOTHED (10/11-12/13) - SMOOTHED (09/10-11/12) (RMS=1.1)

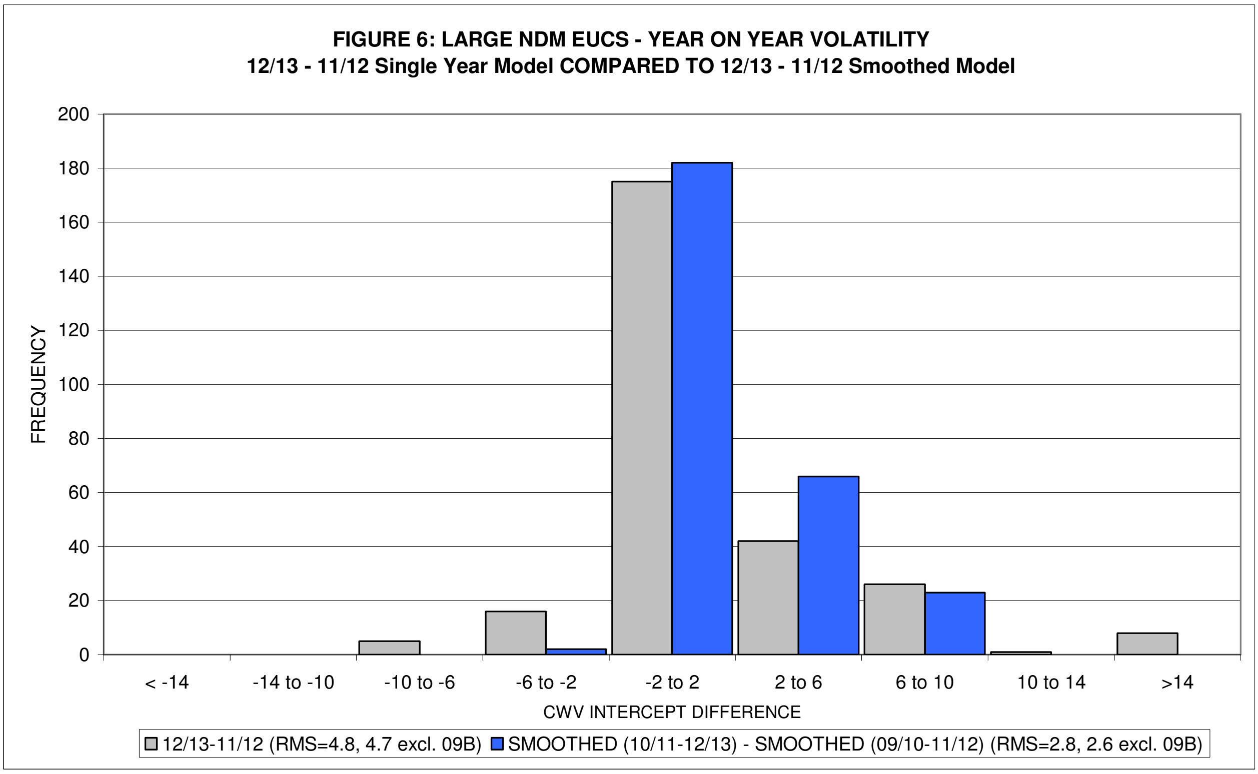


FIGURE 6: LARGE NDM EUCS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model
FREQUENCY
200
180
160
140
120
100
80
60
40
20
0
< -14
-14 to -10
-10 to -6
-6 to -2
-2 to 2
2 to 6
6 to 10
10 to 14
>14
CWV INTERCEPT DIFFERENCE
12/13-11/12 (RMS=4.8, 4.7 excl. 09B)
SMOOTHED (10/11-12/13) - SMOOTHED (09/10-11/12) (RMS=2.8, 2.6 excl. 09B)

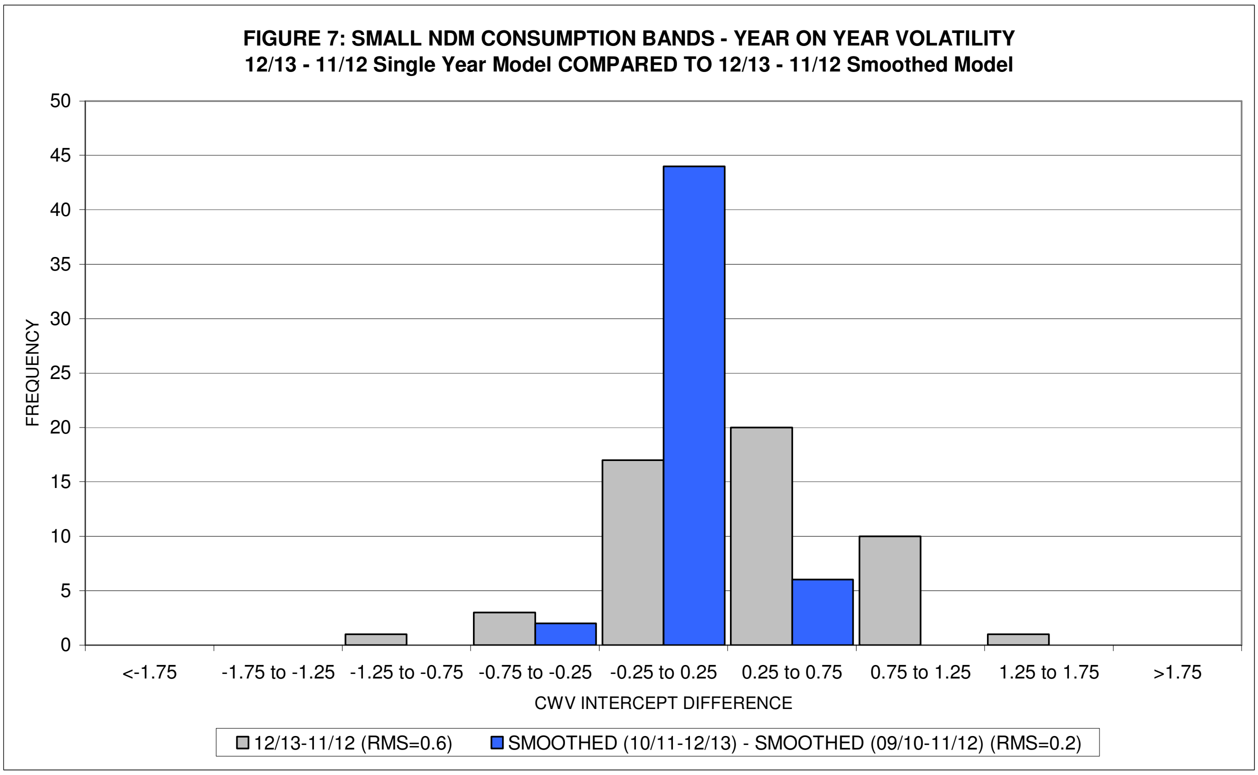


FIGURE 7: SMALL NDM CONSUMPTION BANDS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model
FREQUENCY
CWV INTERCEPT DIFFERENCE
<-1.75
-1.75 to -1.25
-1.25 to -0.75
-0.75 to -0.25
-0.25 to 0.25
0.25 to 0.75
0.75 to 1.25
1.25 to 1.75
>1.75
12/13-11/12 (RMS=0.6)
SMOOTHED (10/11-12/13) - SMOOTHED (09/10-11/12) (RMS=0.2)

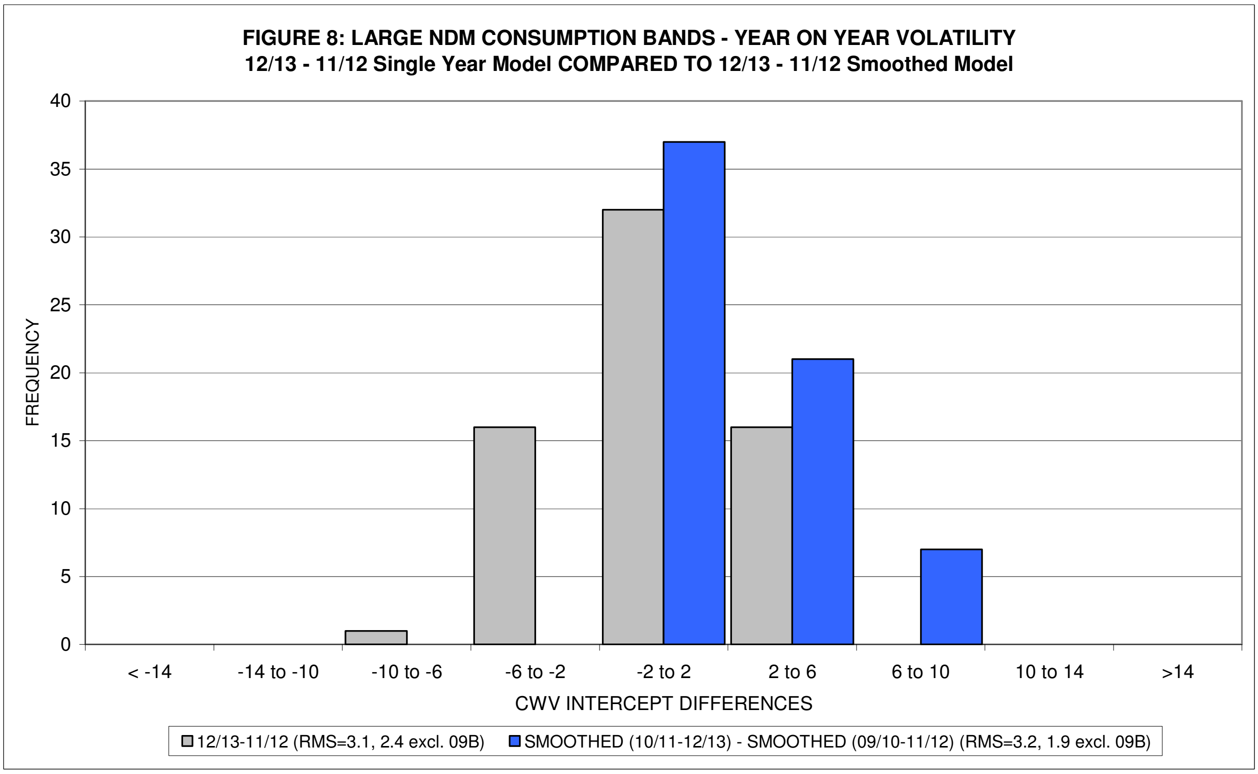


FIGURE 8: LARGE NDM CONSUMPTION BANDS - YEAR ON YEAR VOLATILITY
12/13 - 11/12 Single Year Model COMPARED TO 12/13 - 11/12 Smoothed Model
FREQUENCY
CWV INTERCEPT DIFFERENCES
< -14
-14 to -10
-10 to -6
-6 to -2
-2 to 2
2 to 6
6 to 10
10 to 14
>14
12/13-11/12 (RMS=3.1, 2.4 excl. 09B)
SMOOTHED (10/11-12/13) - SMOOTHED (09/10-11/12) (RMS=3.2, 1.9 excl. 09B)

Figure 9: Key for CWV Intercept Pattern Types

3 Years of NDM Demand Models

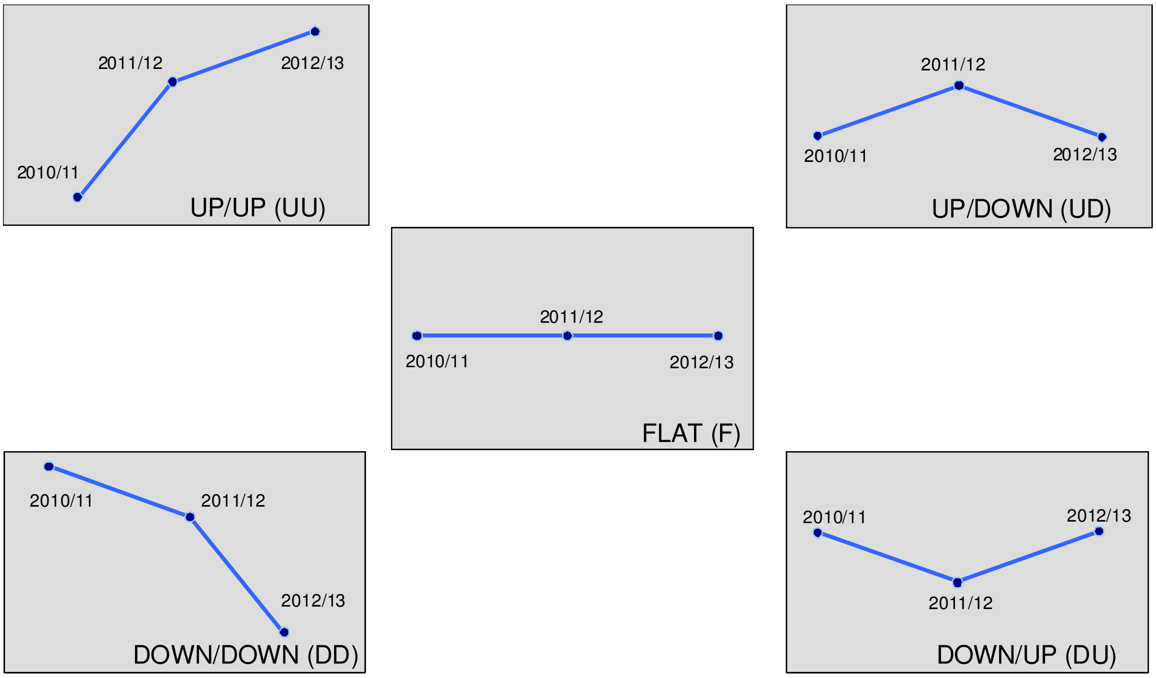


TABLE 1: CWV INTERCEPT PATTERNS

NDM DEMAND MODELS FOR 2010/11, 2011/12, 2012/13

Consumption Band EUCs

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1301B	UU	DU	UU	DU	DU	DU	UU	UD	DU	DU	UD	DU	UD
xx:E1302B	UU	UD	UU	UD	UU	UU	UU	UU	DU	DU	UU	UD	UU
xx:E1303B	DU	UD	DU	DU	DU	UD	DU	DD	DU	DU	UD	DU	UD
xx:E1304B	DU	DU	UD	UD	DU	UU	UD	DU	DU	DU	UD	DU	DU
xx:E1305B	DU	DD	UU	DU	UD	DU	UU	UD	UD	DU	DU	DD	UU
xx:E1306B	DU	UU	UD	UU	DU	UU	UD	UD	UU	UD	DD	UD	UD
xx:E1307B	DU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E1308B	DU	DU	DU	UU	UU	UU	DU	UD	UD	UD	UD	UD	UD
xx:E1309B	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD

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:E1303W01	UD	DU	UD	UU	UU	DU	UD	UD	DU	UD	UU	DU	UD
xx:E1304W01	UD	DU	UD	UU	UU	DU	UD	UD	DU	UD	UU	DU	UD
xx:E1305W01	UD	UU	UU	UU	UU	UU	UU	UD	UU	UU	UU	DU	UU
xx:E1306W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E1307W01	F	F	F	F	F	F	F	F	F	F	F	F	F
xx:E1308W01	F	F	F	F	F	F	F	F	F	F	F	F	F

Second (ie. W02) ,WAR Bands in Each Consumption Range

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1303W02	DD	DD	UD	UU	UU	DU	UD	UU	UU	DU	DU	DU	UU
xx:E1304W02	DD	DD	UD	UU	UU	DU	UD	UU	UU	DU	DU	DU	UU
xx:E1305W02	UD	UD	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E1306W02	UD	UD	UD	UU	UU	DU	UD	UU	UU	UU	UU	UU	UU
xx:E1307W02	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU
xx:E1308W02	DU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU

Third (ie. W03) ,WAR Bands in Each Consumption Range

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1303W03	DU	DD	UU	UU	UU	DU	UU	DU	UD	UD	UU	DU	DU
xx:E1304W03	DU	DD	UU	UU	UU	DU	UU	DU	UD	UD	UU	DU	DU
xx:E1305W03	UD	UD	UD	UU	UU	DU	UD	DU	DU	DU	DU	UU	DU
xx:E1306W03	DD	UD	UD	UU	UU	UU	UD	UU	UU	UU	UU	DU	DU
xx:E1307W03	DU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU	UU
xx:E1308W03	DU	DD	DU	DU	DD	DD	DU	DU	DD	DD	DD	DD	DD

Fourth (ie. peakiest, W04) ,WAR Bands in Each Consumption Range

xx=LDZ =	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
xx:E1303W04	DD	UD	UD	UD	DU	DU	UD	DU	UD	DU	UD	DU	DU
xx:E1304W04	DD	UD	UD	UD	DU	DU	UD	DU	UD	DU	UD	DU	DU
xx:E1305W04	DU	UD	UD	UD	UD	UD	UD	DU	DU	DU	DU	UD	DD
xx:E1306W04	DD	UD	UD	UD	UD	UD	UD	DU	UD	UD	UD	DD	DD
xx:E1307W04	DU	UD	UU	UD	UD	UU	UU	UU	UU	UU	UU	UU	UU
xx:E1308W04	DU	DD	UD	UD	UD	UD	UD	DU	UD	UD	UD	UD	DU

KEY

UU	UP UP 2010/11 < 2011/12 < 2012/13
UD	UP DOWN 2010/11 < 2011/12 >= 2012/13
DU	DOWN UP 2010/11 >= 2011/12 < 2012/13
DD	DOWN DOWN 2010/11 > 2011/12 > 2012/13
F	FLAT OR NEARLY FLAT MODELS

TABLE 2: CWV INTERCEPTS PATTERNS: NDM DEMAND MODELS FOR 2010/11, 2011/12 AND 2012/13 COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type					Total	
	UU	UD	DU	DD	F		
xx:E1301B	3	3	7	0	0	13	
xx:E1302B	8	3	2	0	0	13	
xx:E1303B	0	4	8	1	0	13	
xx:E1303W01	3	6	4	0	0	13	
xx:E1303W02	5	2	4	2	0	13	
xx:E1303W03	5	2	5	1	0	13	
xx:E1303W04	0	6	6	1	0	13	
xx:E1304B	1	4	8	0	0	13	
xx:E1304W01	3	6	4	0	0	13	
xx:E1304W02	5	2	4	2	0	13	
xx:E1304W03	5	2	5	1	0	13	
xx:E1304W04	0	6	6	1	0	13	
xx:E1305B	3	3	5	2	0	13	
xx:E1305W01	10	2	1	0	0	13	
xx:E1305W02	11	2	0	0	0	13	
xx:E1305W03	3	4	6	0	0	13	
xx:E1305W04	0	7	5	1	0	13	
xx:E1306B	4	6	2	1	0	13	
xx:E1306W01	0	0	0	0	13	13	
xx:E1306W02	8	4	1	0	0	13	
xx:E1306W03	7	3	2	1	0	13	
xx:E1306W04	0	9	1	3	0	13	
xx:E1307B	12	0	1	0	0	13	
xx:E1307W01	0	0	0	0	13	13	
xx:E1307W02	0	0	13	0	0	13	
xx:E1307W03	12	0	1	0	0	13	
xx:E1307W04	9	3	1	0	0	13	
xx:E1308B	3	6	4	0	0	13	
xx:E1308W01	0	0	0	0	13	13	
xx:E1308W02	12	0	1	0	0	13	
xx:E1308W03	0	0	5	8	0	13	
xx:E1308W04	0	9	3	1	0	13	
xx:E1309B	0	13	0	0	0	13	
Total by Type	**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
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

LDZ	Type					Total
	UU	UD	DU	DD	F	
SC	2	7	15	6	3	33
NO	5	12	6	7	3	33
NW	11	15	4	0	3	33
NE	16	9	5	0	3	33
EM	16	6	7	1	3	33
WM	11	5	13	1	3	33
WN	11	15	4	0	3	33
WS	10	8	11	1	3	33
EA	11	9	9	1	3	33
NT	8	9	12	1	3	33
SE	13	9	6	2	3	33
SO	7	6	14	3	3	33
SW	11	7	9	3	3	33
Totals	132	117	115	26	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 2009/10, 2010/11, 2011/12 AND 2012/13
COUNTS OF CWV INTERCEPT PATTERN TYPES BY END USER CATEGORY AND BY LDZ

EUC	Type				Total	
	N	U	D	F		
xx:E1301B	13	0	0	0	13	
xx:E1302B	12	0	1	0	13	
xx:E1303B	12	1	0	0	13	
xx:E1303W01	12	0	1	0	13	
xx:E1303W02	9	1	3	0	13	
xx:E1303W03	12	1	0	0	13	
xx:E1303W04	13	0	0	0	13	
xx:E1304B	12	0	1	0	13	
xx:E1304W01	12	0	1	0	13	
xx:E1304W02	9	1	3	0	13	
xx:E1304W03	12	1	0	0	13	
xx:E1304W04	13	0	0	0	13	
xx:E1305B	12	1	0	0	13	
xx:E1305W01	12	0	1	0	13	
xx:E1305W02	11	0	2	0	13	
xx:E1305W03	12	0	1	0	13	
xx:E1305W04	13	0	0	0	13	
xx:E1306B	8	1	4	0	13	
xx:E1306W01	0	0	0	13	13	
xx:E1306W02	5	0	8	0	13	
xx:E1306W03	6	0	7	0	13	
xx:E1306W04	13	0	0	0	13	
xx:E1307B	3	0	10	0	13	
xx:E1307W01	0	0	0	13	13	
xx:E1307W02	13	0	0	0	13	
xx:E1307W03	1	0	12	0	13	
xx:E1307W04	4	0	9	0	13	
xx:E1308B	13	0	0	0	13	
xx:E1308W01	0	0	0	13	13	
xx:E1308W02	2	0	11	0	13	
xx:E1308W03	13	0	0	0	13	
xx:E1308W04	13	0	0	0	13	
xx:E1309B	13	0	0	0	13	
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
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

LDZ	Type				Total
	N	U	D	F	
SC	28	2	0	3	33
NO	24	2	4	3	33
NW	25	0	5	3	33
NE	19	0	11	3	33
EM	23	0	7	3	33
WM	22	0	8	3	33
WN	25	0	5	3	33
WS	21	1	8	3	33
EA	25	0	5	3	33
NT	24	0	6	3	33
SE	24	1	5	3	33
SO	24	1	5	3	33
SW	24	0	6	3	33
Totals	308	7	75	39	429

KEY	
N	No consistent trend over 4 years
U	Increasing values over 4 years
D	Decreasing values over 4 years
F	Flat or nearly flat models

Figure 10: Load Factors for each LDZ - xx:E1301B

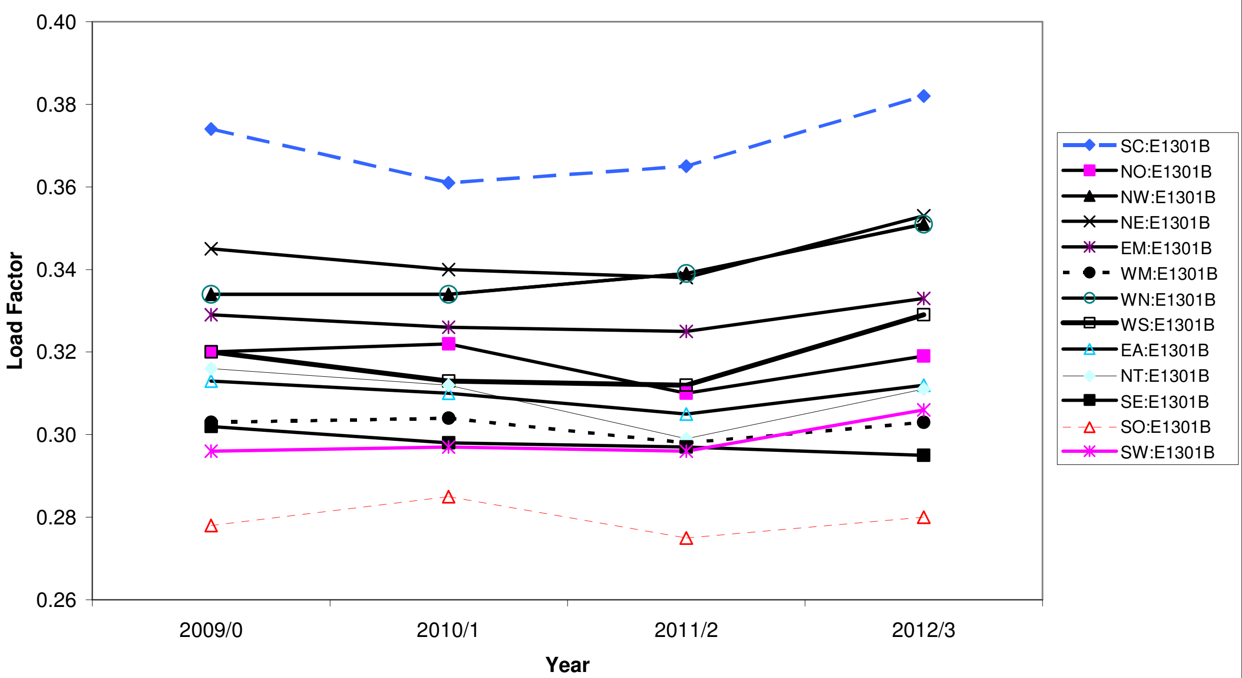


Figure 11: Load Factors for each LDZ - xx:E1302B

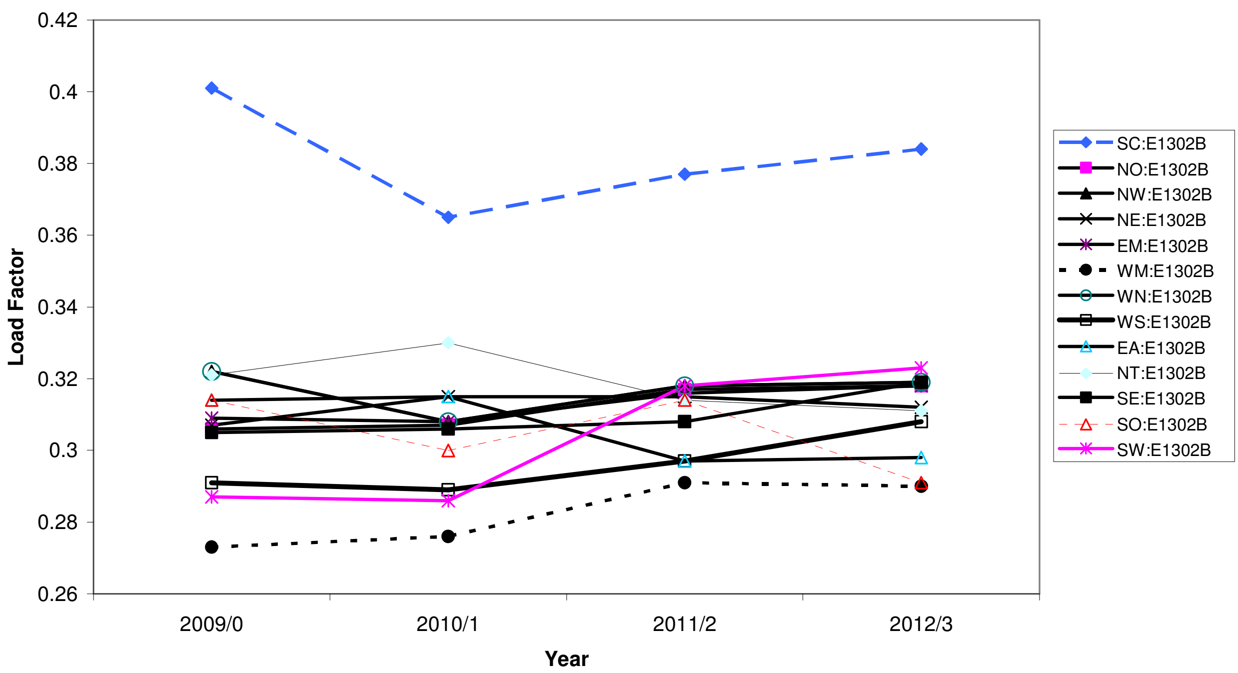


Figure 12: Load Factors for each LDZ - xx:E1303B

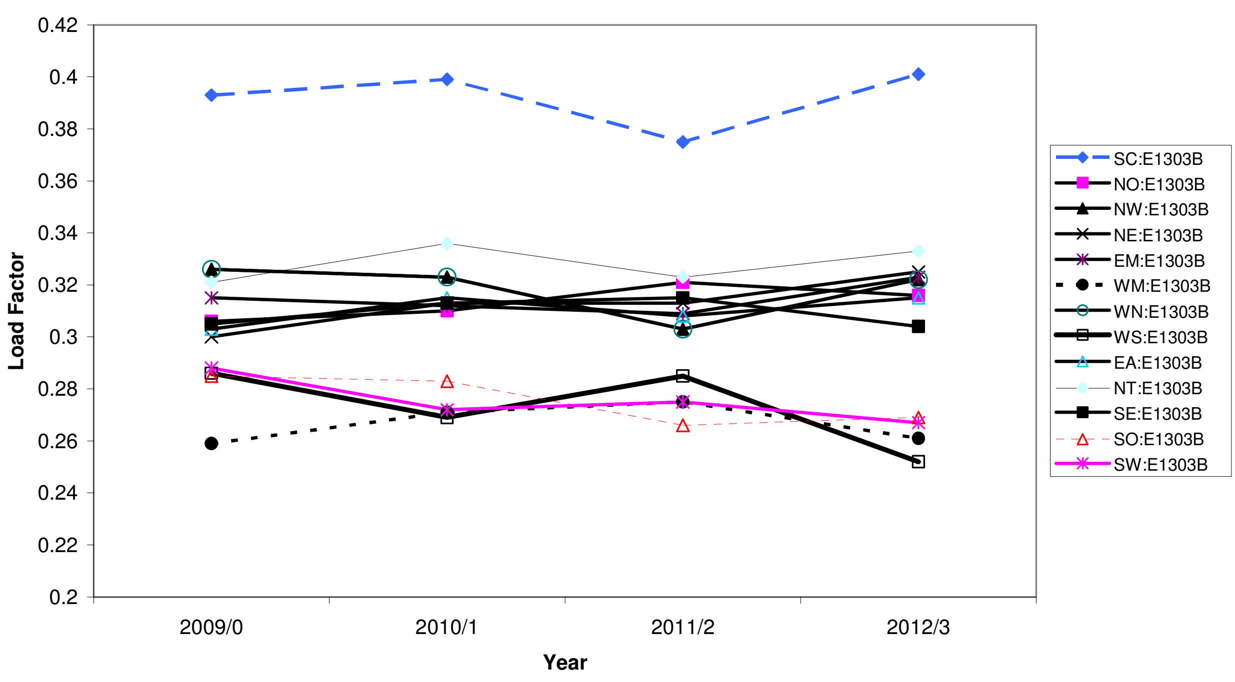
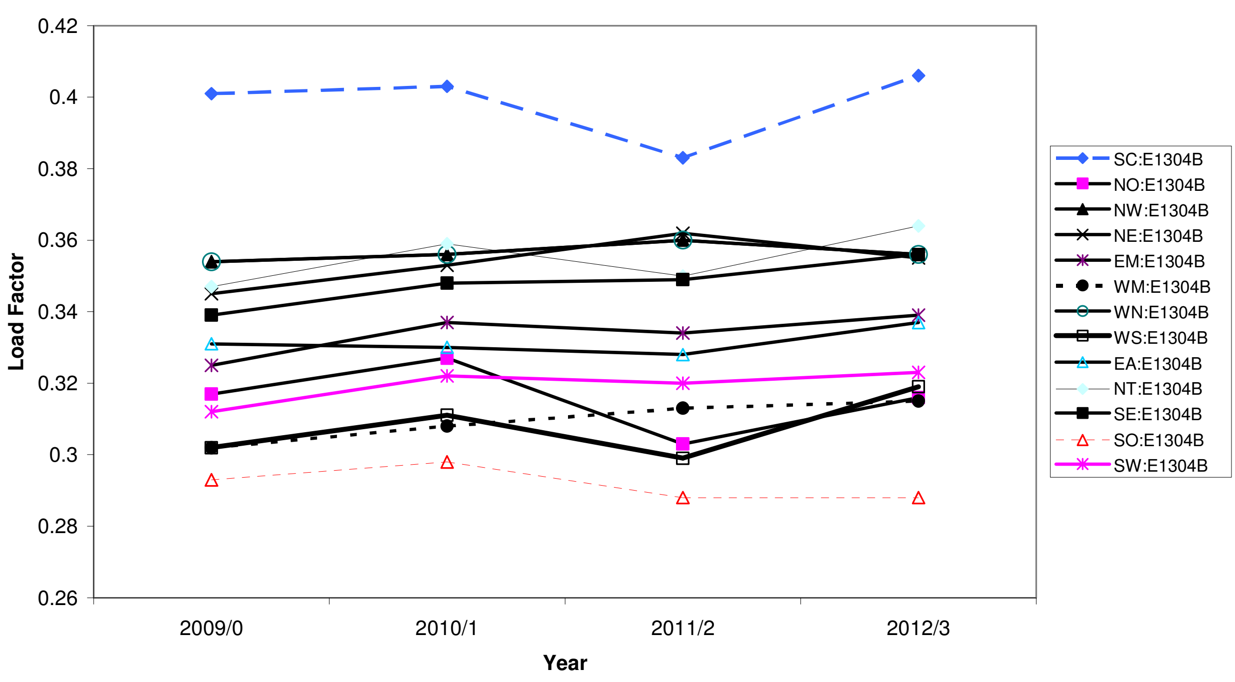


Figure 13: Load Factors for each LDZ - xx:E1304B



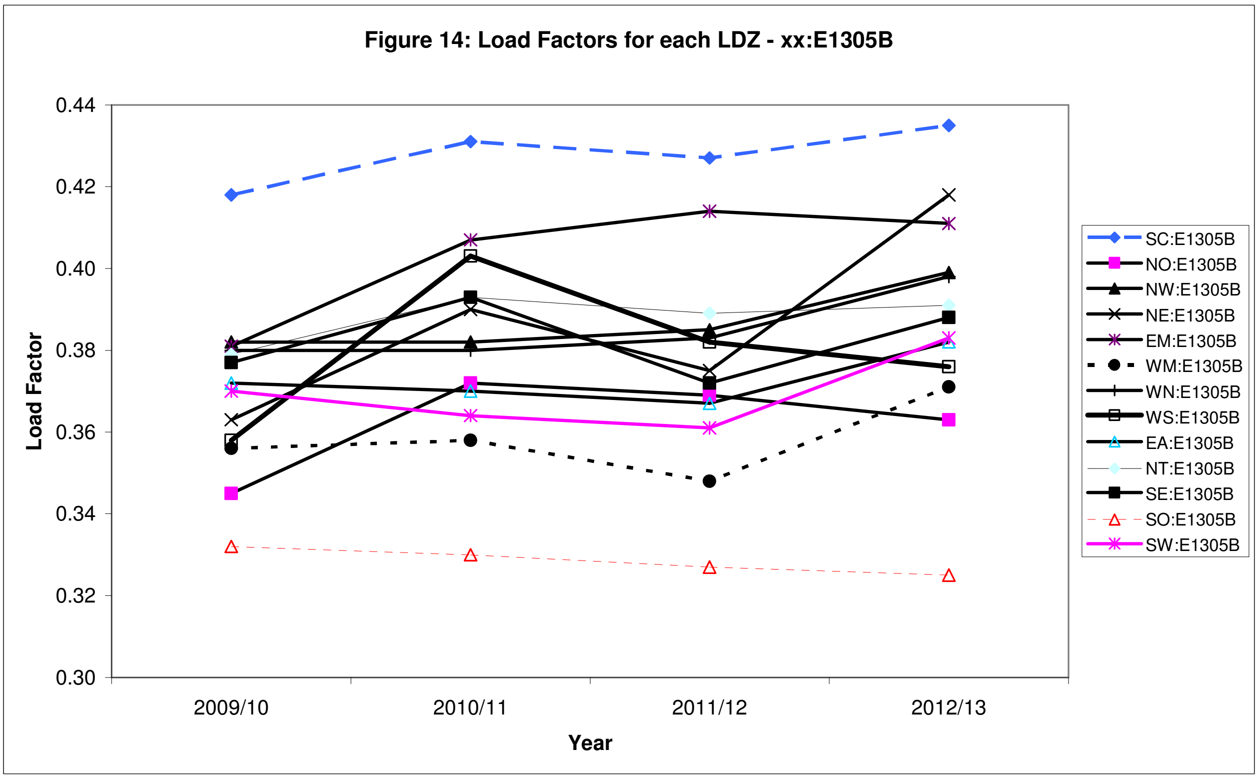


Figure 14: Load Factors for each LDZ - xx:E1305B
Load Factor
0.44
0.42
0.40
0.38
0.36
0.34
0.32
0.30
2009/10
2010/11
2011/12
2012/13
Year
SC:E1305B
NO:E1305B
NW:E1305B
NE:E1305B
EM:E1305B
WM:E1305B
WN:E1305B
WS:E1305B
EA:E1305B
NT:E1305B
SE:E1305B
SO:E1305B
SW:E1305B

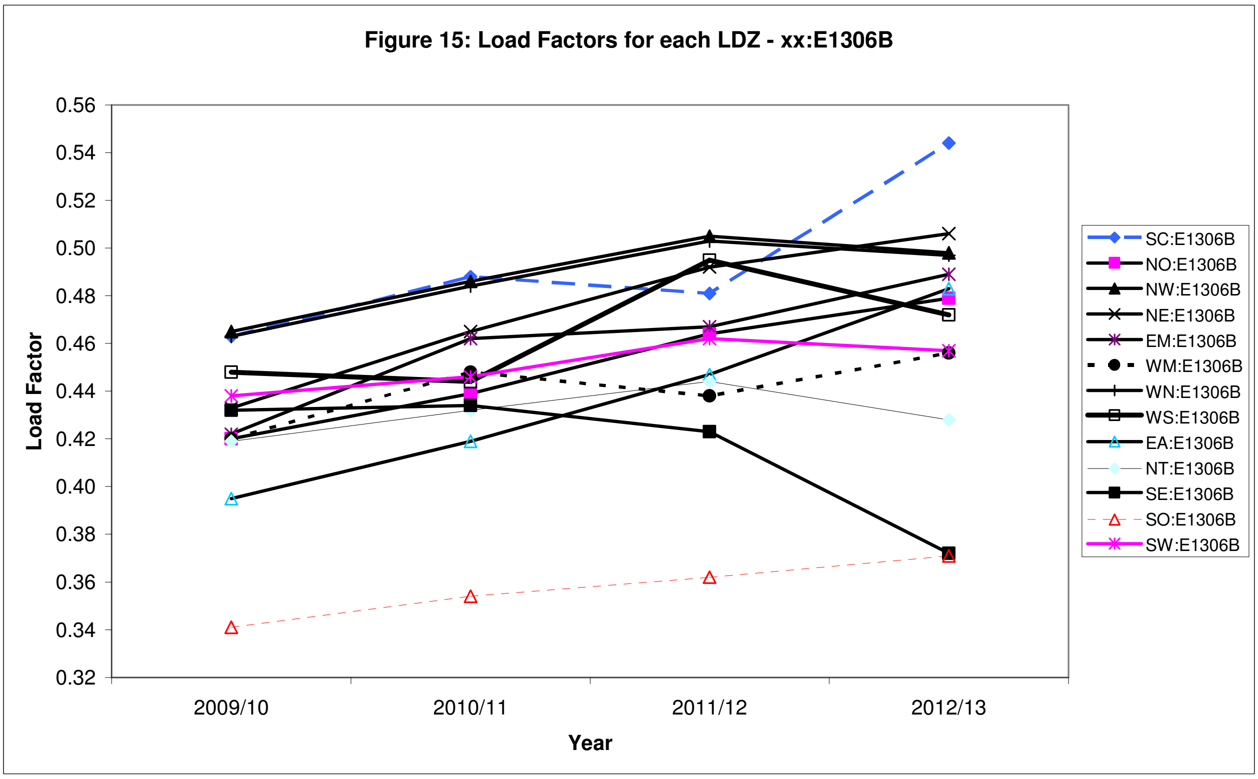


Figure 15: Load Factors for each LDZ - xx:E1306B
Load Factor
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
0.38
0.36
0.34
0.32
2009/10
2010/11
2011/12
2012/13
Year
SC:E1306B
NO:E1306B
NW:E1306B
NE:E1306B
EM:E1306B
WM:E1306B
WN:E1306B
WS:E1306B
EA:E1306B
NT:E1306B
SE:E1306B
SO:E1306B
SW:E1306B

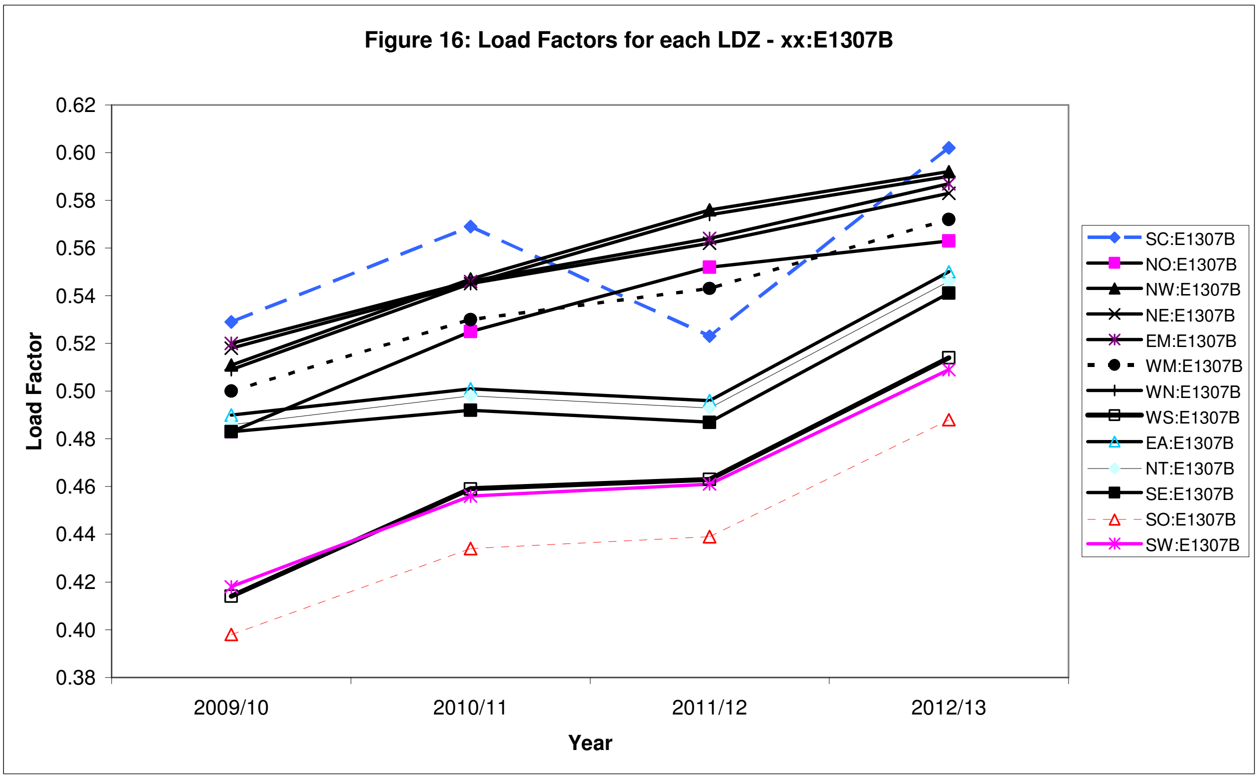


Figure 16: Load Factors for each LDZ - xx:E1307B
0.62
0.60
0.58
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
0.38
Load Factor
2009/10
2010/11
2011/12
2012/13
Year
SC:E1307B
NO:E1307B
NW:E1307B
NE:E1307B
EM:E1307B
WM:E1307B
WN:E1307B
WS:E1307B
EA:E1307B
NT:E1307B
SE:E1307B
SO:E1307B
SW:E1307B

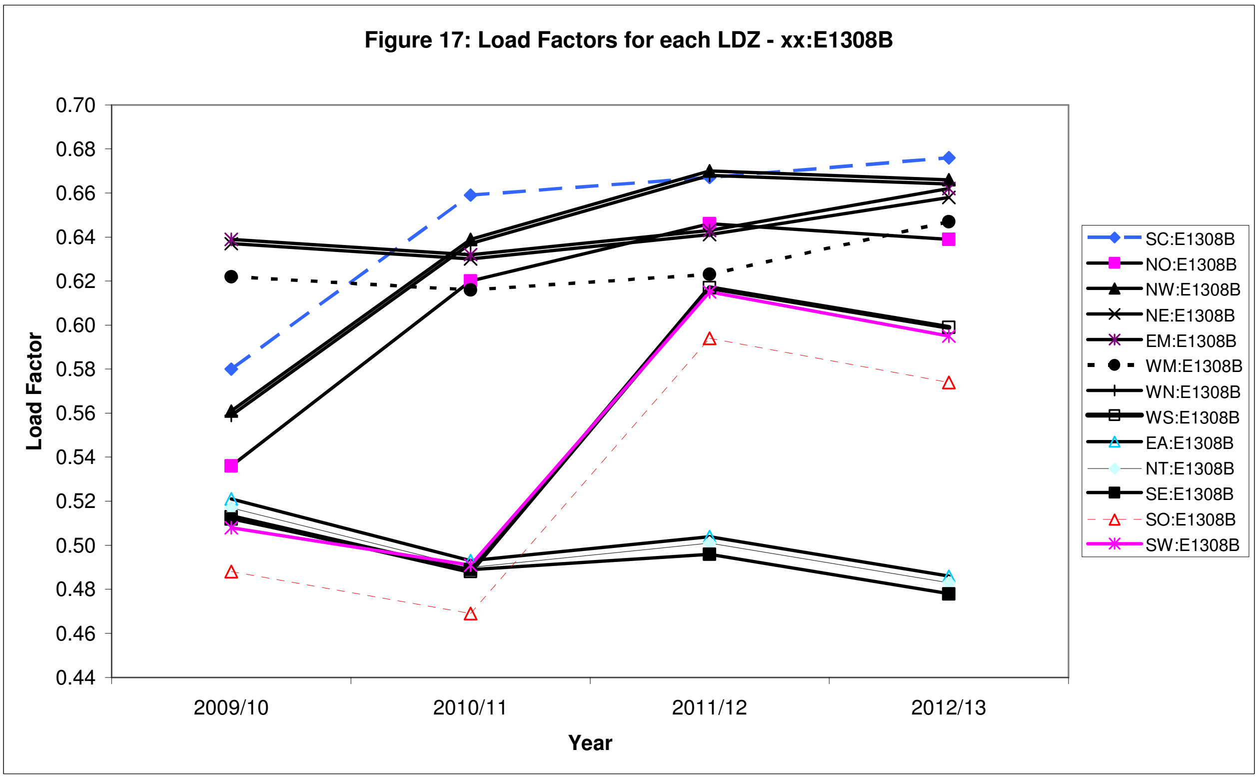


Figure 17: Load Factors for each LDZ - xx:E1308B
0.70
0.68
0.66
0.64
0.62
0.60
0.58
0.56
0.54
0.52
0.50
0.48
0.46
0.44
Load Factor
2009/10
2010/11
2011/12
2012/13
Year
SC:E1308B
NO:E1308B
NW:E1308B
NE:E1308B
EM:E1308B
WM:E1308B
WN:E1308B
WS:E1308B
EA:E1308B
NT:E1308B
SE:E1308B
SO:E1308B
SW:E1308B

Figure 18: Load Factors for each LDZ - xx:E1309B