

ATTACHMENT B

JEA – SJRPP B & C Wells Specific Conductivity Trend & Seasonality Testing Executive Summary

Data from 11 monitoring wells were analyzed to determine whether the specific conductivity data exhibit seasonal patterns across time. Data reflect the results of quarterly sampling from the 1st calendar quarter of 1999 through the 3rd calendar quarter of 2010. The analysis uses the following methodology:

- Trend Analysis – Mann-Kendall test for trend detection; p-values < 0.05 indicate a statistically significant trend component to the series.
 - If a trend is detected, a correlation analysis was conducted to determine if the trend is
 - Linear – indicated by a p-value < 0.05 using Pearson's r
 - Monotonic - indicated by a p-value < 0.05 using Spearman's rho
- Seasonality Test – Mood's Median was used to detect whether the data exhibit seasonal variation, this test was selected due to its robustness against outliers
 - If no monotonic trend was detected, the Mood's Median test was applied to the raw data
 - If a linear, monotonic trend was detected, Mood's Median was applied to linear model residuals (de-trended data).
- Time-series plots and box plots are presented with the results of the Mood's Median tests in the following pages.

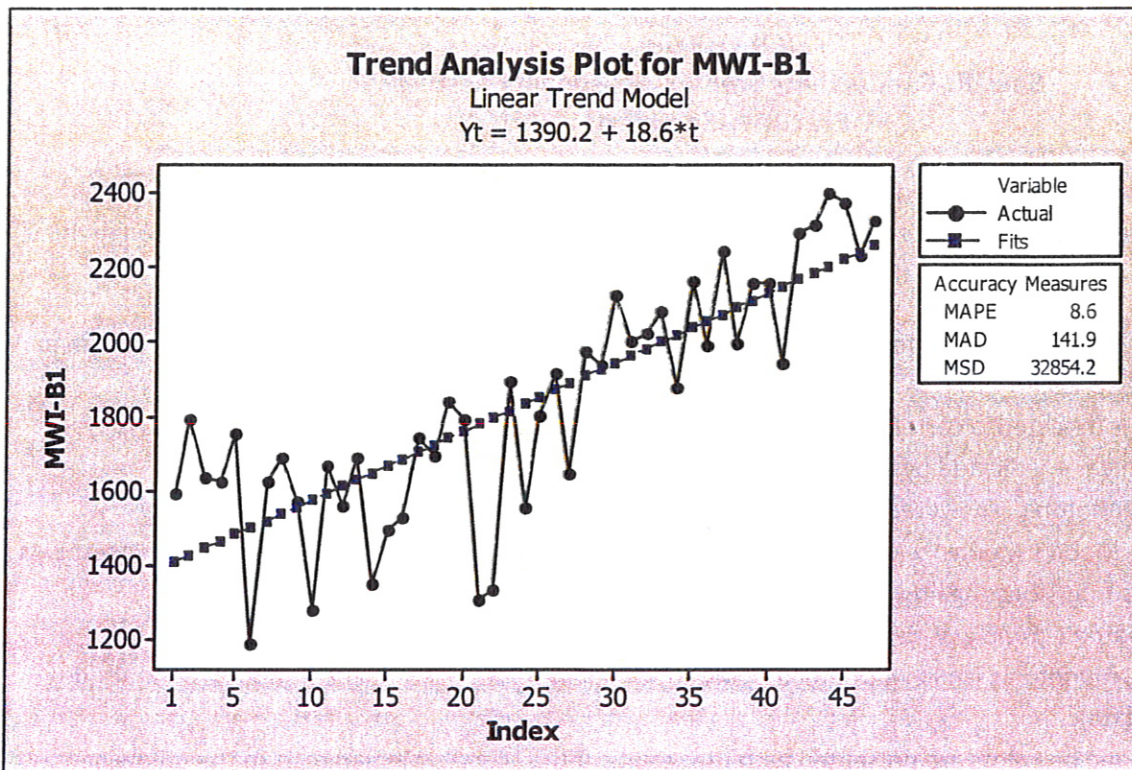
Results for each well are summarized as follows:

- MWI-B1 – Upward Trend, no seasonality in de-trended data
- MWI-B2 – non-monotonic trend (cyclical pattern), no seasonal component in raw data
- MWI-B3 – No trend, no seasonality
- MWI-B4 – Upward linear trend, no seasonal component in de-trended data
- MWB-C1 – Upward linear trend, no statistically significant seasonality in de-trended data
- MWB-C2 – Statistically significant (though slight) upward, non-linear trend with possible outliers present, no seasonal component detected
- MWC-C3 – statistically significant upward linear, monotonic trend, no seasonal component in de-trended data
- MWC-C4 – no trend, no seasonality
- MWC-C5 – statistically significant upward linear trend, no seasonality detected
- MWC-C6 – statistically significant, non-linear trend; no seasonality detected in raw data
- MWC-C7 – No statistically significant trend or seasonal component

In conclusion, trend components of these data series appear to be more significant than seasonal components, from a statistical and practical standpoint. Additional analysis may be warranted in the cases where the trend is either non-monotonic (MWI-B2) or non-linear (MWB-C2, MWC-C6)

MWI-B1

- Trend – Statistically Significant – Mann-Kendall p-value<0.05 for upward trend



- Seasonality – not statistically significant

Mood Median Test: MWI-B1 Residuals versus Quarter

Mood median test for MWI-B1 Residuals

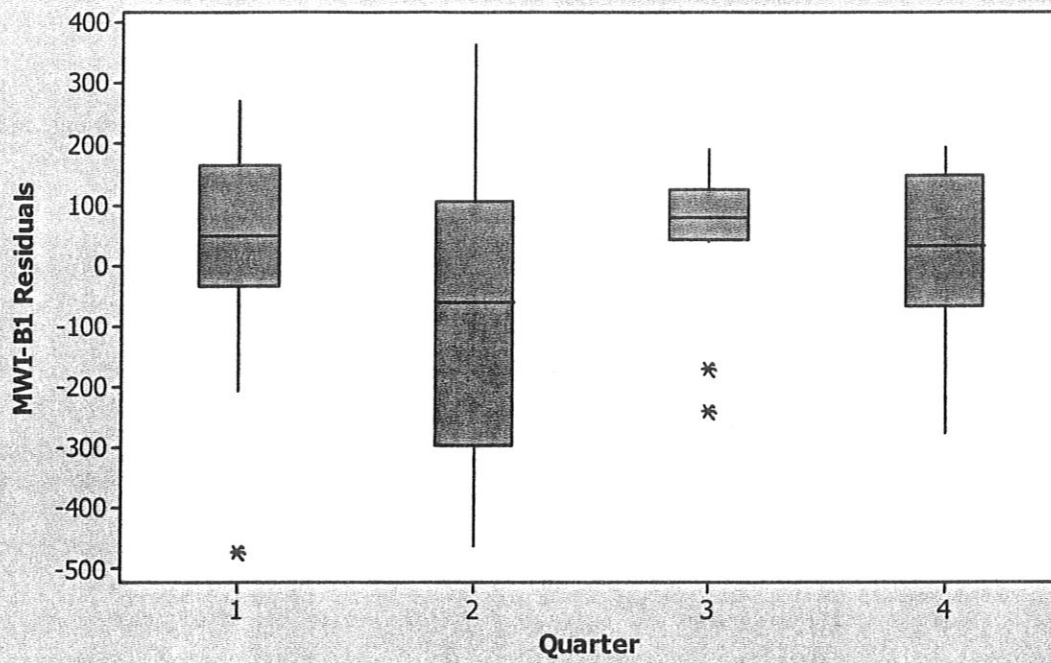
Chi-Square = 5.13 DF = 3 P = 0.162

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	6	6	48	198	(-----+-----)
2	8	4	-63	402	(-----*-----)
3	3	9	76	82	(-----)
4	7	4	33	216	(-----*-----)

-300 -150 0 150

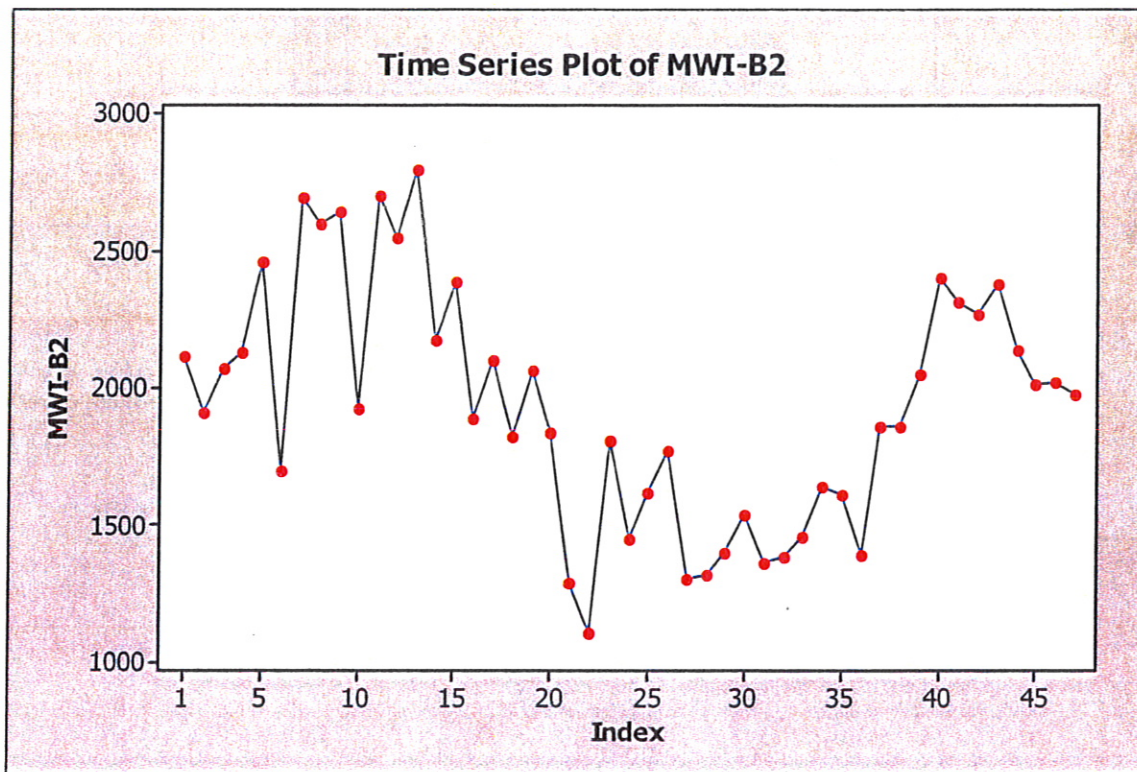
Overall median = 40

Boxplot of MWI-B1 Residuals



MWI-B2

- Trend – non-monotonic trend (cyclical pattern) Spearman's rho >0.05



- Seasonality – not statistically significant

Mood Median Test: MWI-B2 versus Quarter

Mood median test for MWI-B2

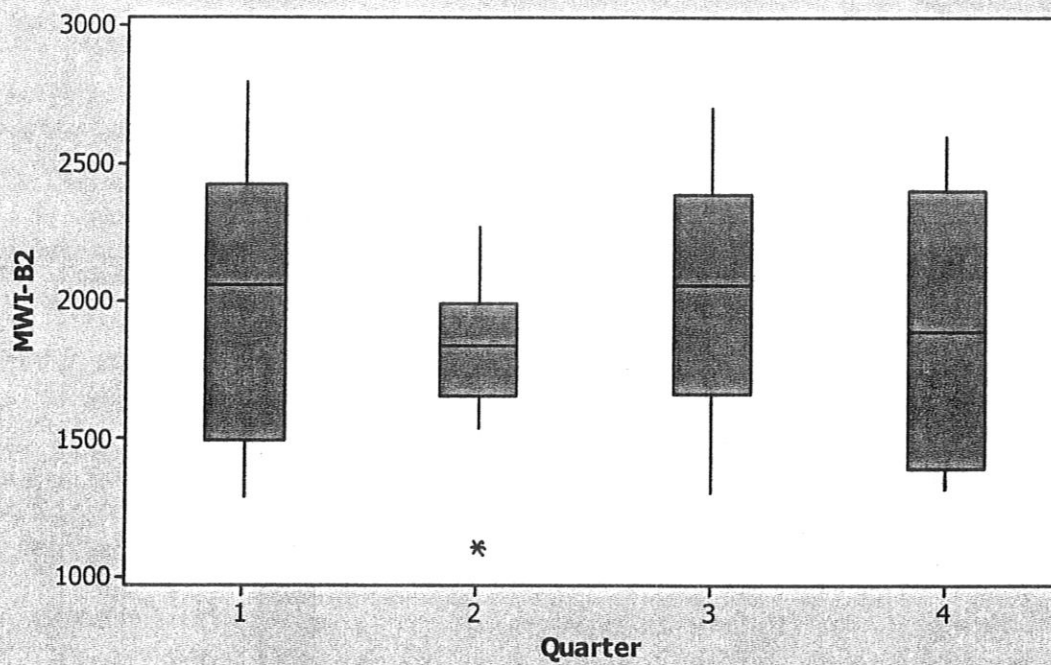
Chi-Square = 4.74 DF = 3 P = 0.192

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	5	7	2059	931	(-----*-----)
2	9	3	1842	341	(-----*-----)
3	4	8	2059	728	(-----*-----)
4	6	5	1889	1015	(-----*-----)

1500 1800 2100 2400

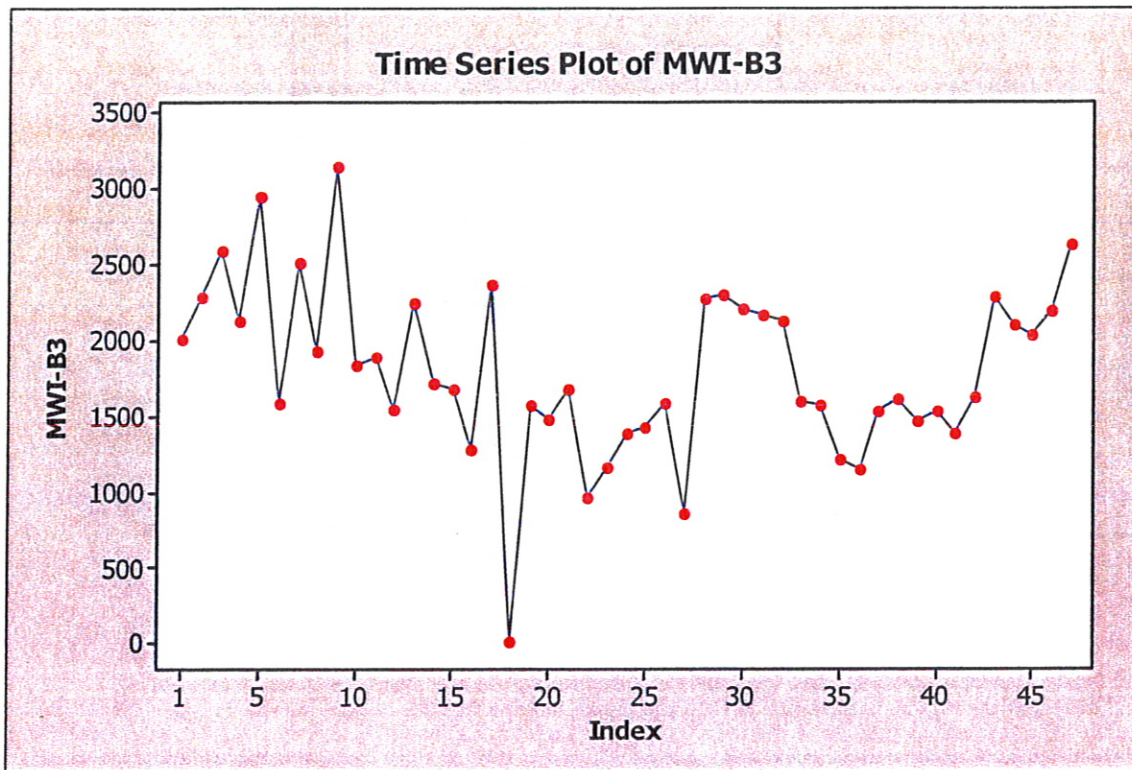
Overall median = 1924

Boxplot of MWI-B2



MWI-B3

- Trend – no statistically significant trend



- Seasonality – not statistically significant

Mood Median Test: MWI-B3 versus Quarter

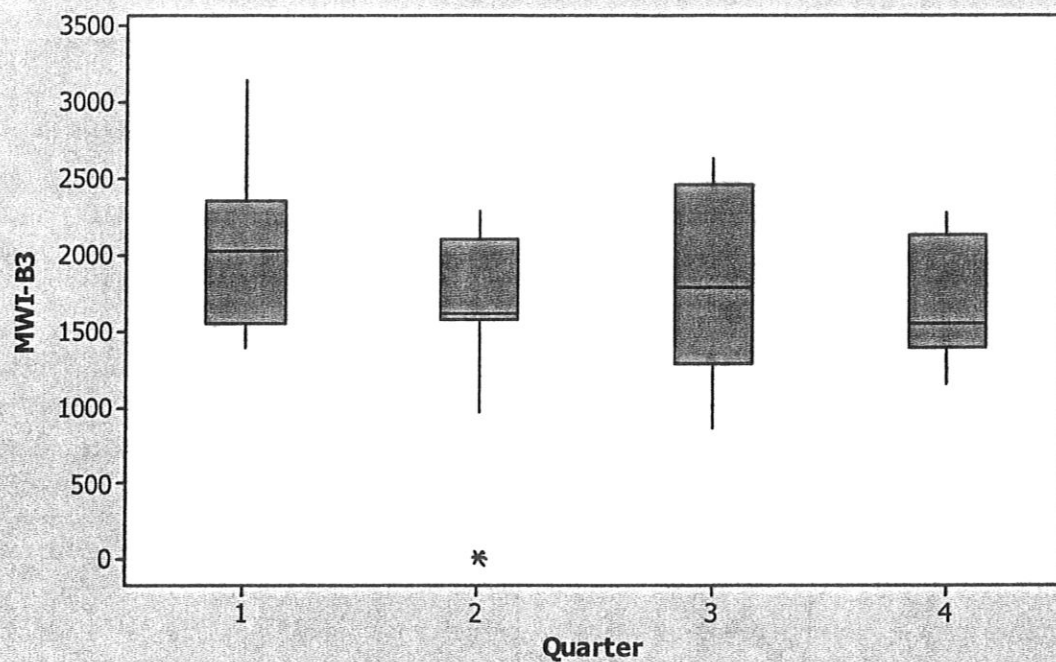
Mood median test for MWI-B3

Chi-Square = 0.74 DF = 3 P = 0.865

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	5	7	2026	802	(-----*-----)
2	7	5	1620	531	(*-----)
3	6	6	1791	1180	(-----*-----)
4	6	5	1552	737	(----*-----)
					-----+-----+-----+-----
					1400 1750 2100 2450

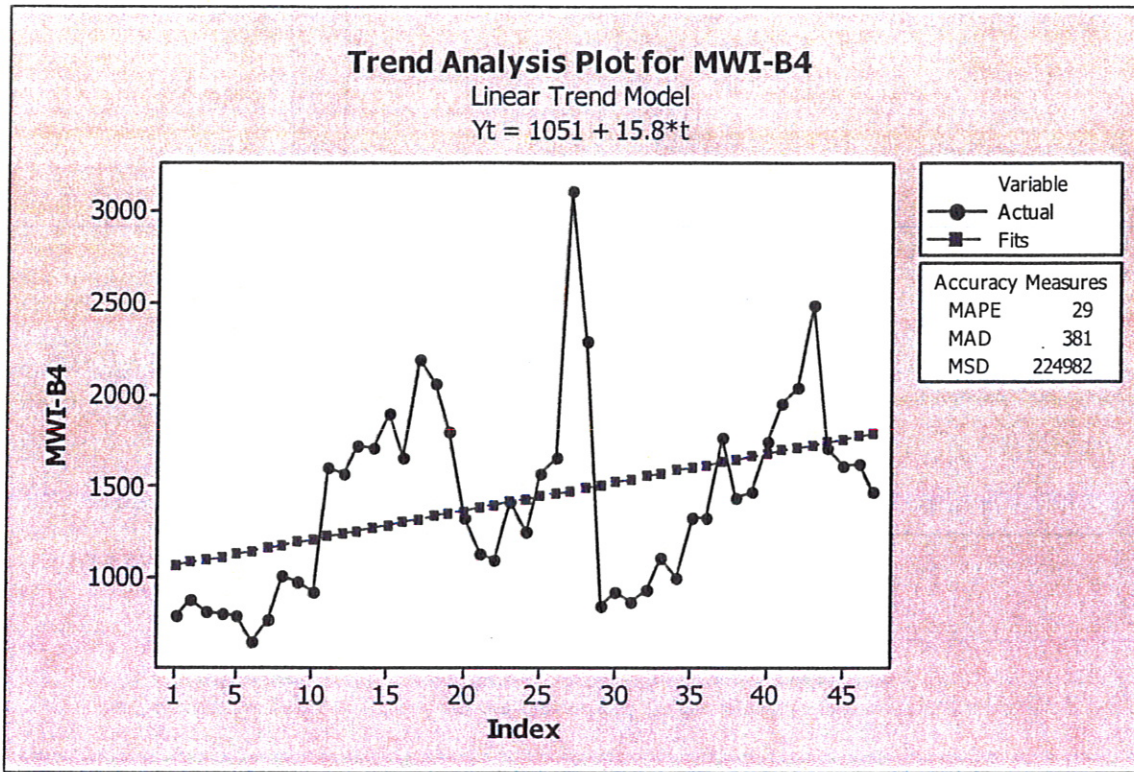
Overall median = 1684

Boxplot of MWI-B3



MWI-B4

- Trend – statistically significant upward trend



- Seasonality – not statistically significant

Mood Median Test: MWI-B4 Residuals versus Quarter

Mood median test for MWI-B4 Residuals

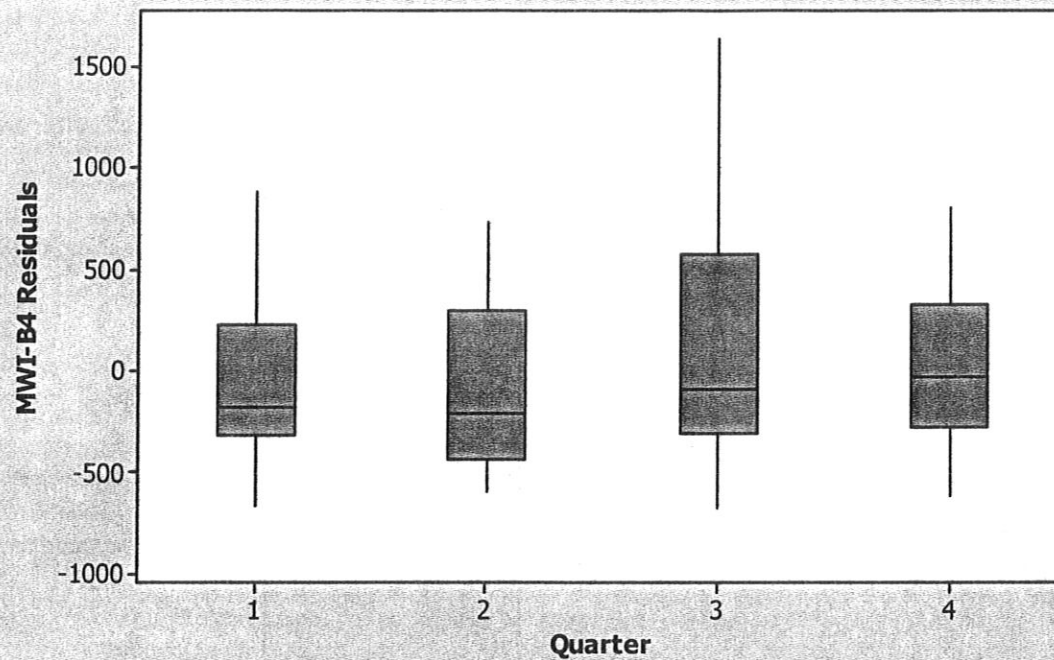
Chi-Square = 0.40 DF = 3 P = 0.940

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	6	6	-180	548	(-----*-----)
2	7	5	-208	738	(-----*-----)
3	6	6	-97	881	(-----*-----)
4	5	6	-33	614	(-----*-----)

-300 0 300 600

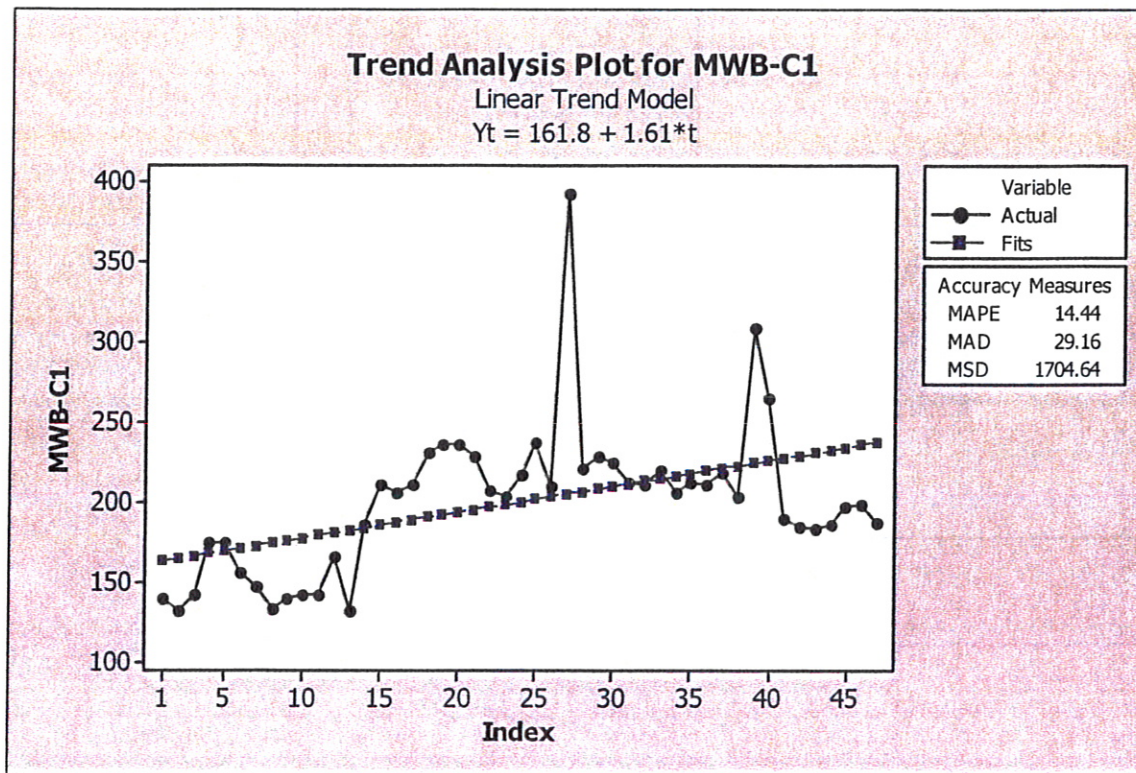
Overall median = -171

Boxplot of MWI-B4 Residuals



MWB-C1

- Trend – Statistically significant upward trend



- Seasonality

Mood Median Test: MWB-C1 Residuals versus Quarter

Mood median test for MWB-C1 Residuals

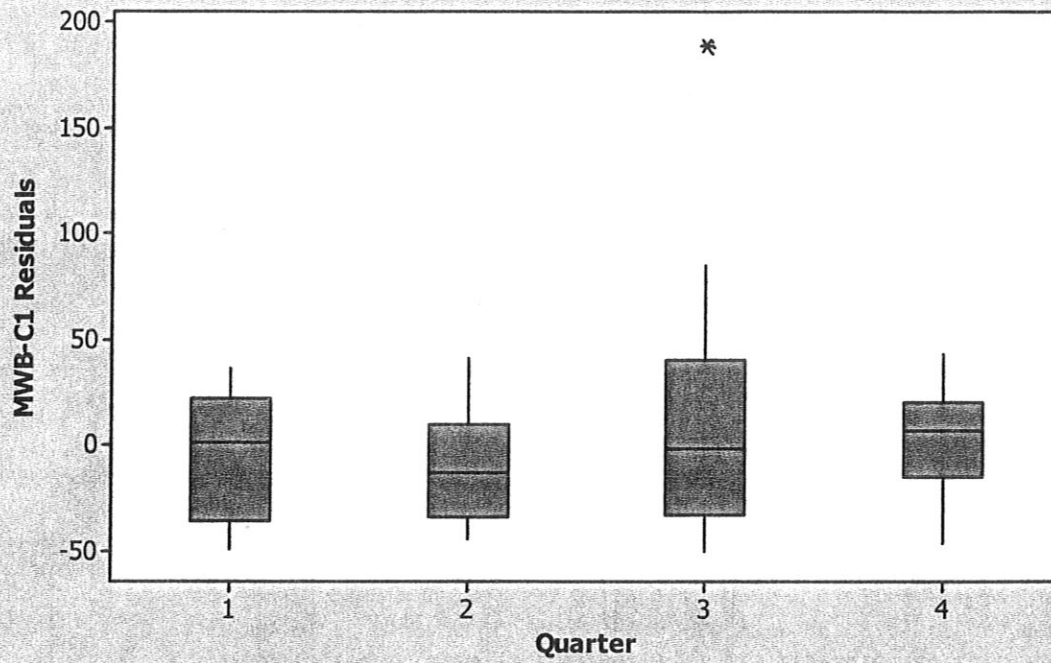
Chi-Square = 0.40 DF = 3 P = 0.940

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	6	6	1.2	58.6	(-----*-----)
2	7	5	-13.1	44.0	(-----*-----)
3	6	6	-2.1	73.3	(-----*-----)
4	5	6	6.7	34.5	(-----*-----)

-25 0 25 50

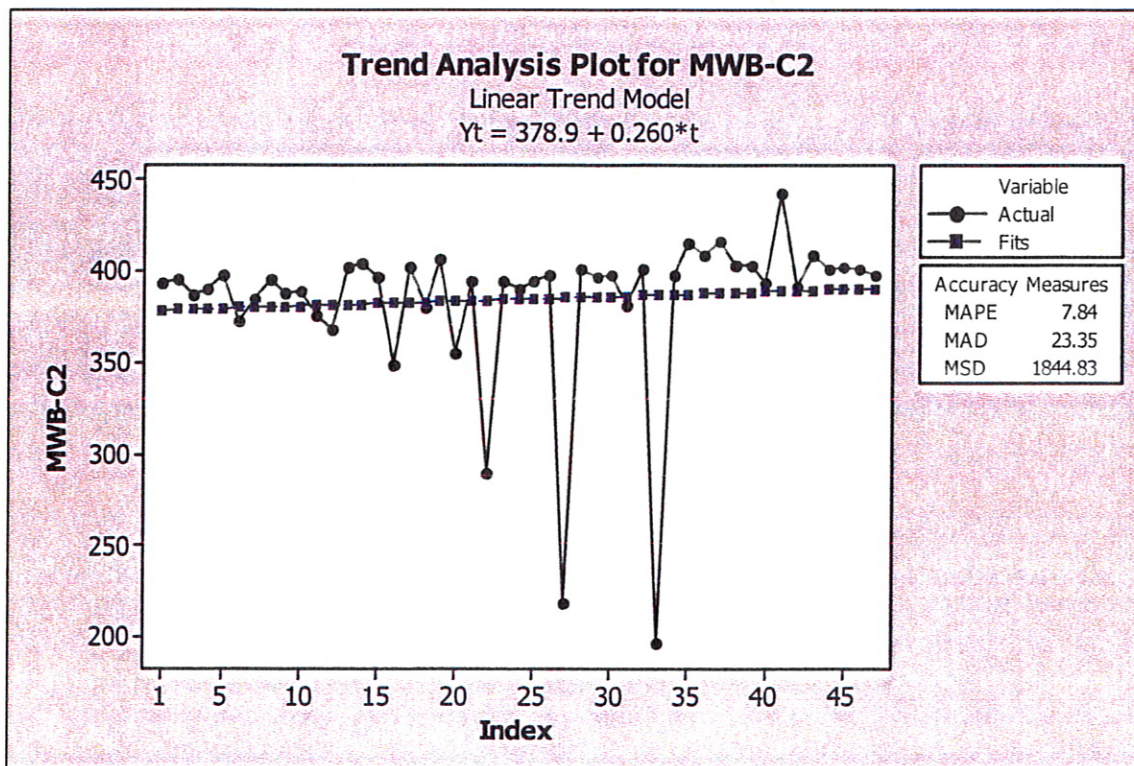
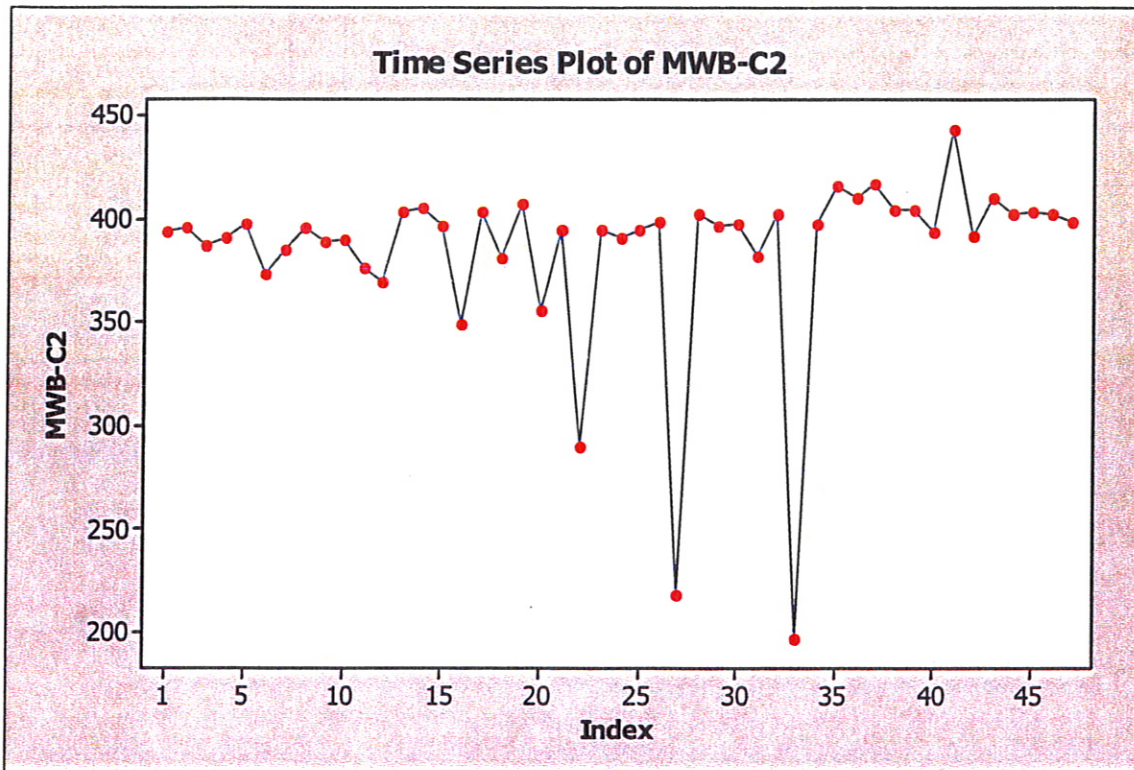
Overall median = -2.5

Boxplot of MWB-C1 Residuals



MWB-C2

- Trend – statistically significant upward, non-linear trend, though results may be skewed by outliers, may warrant further analysis



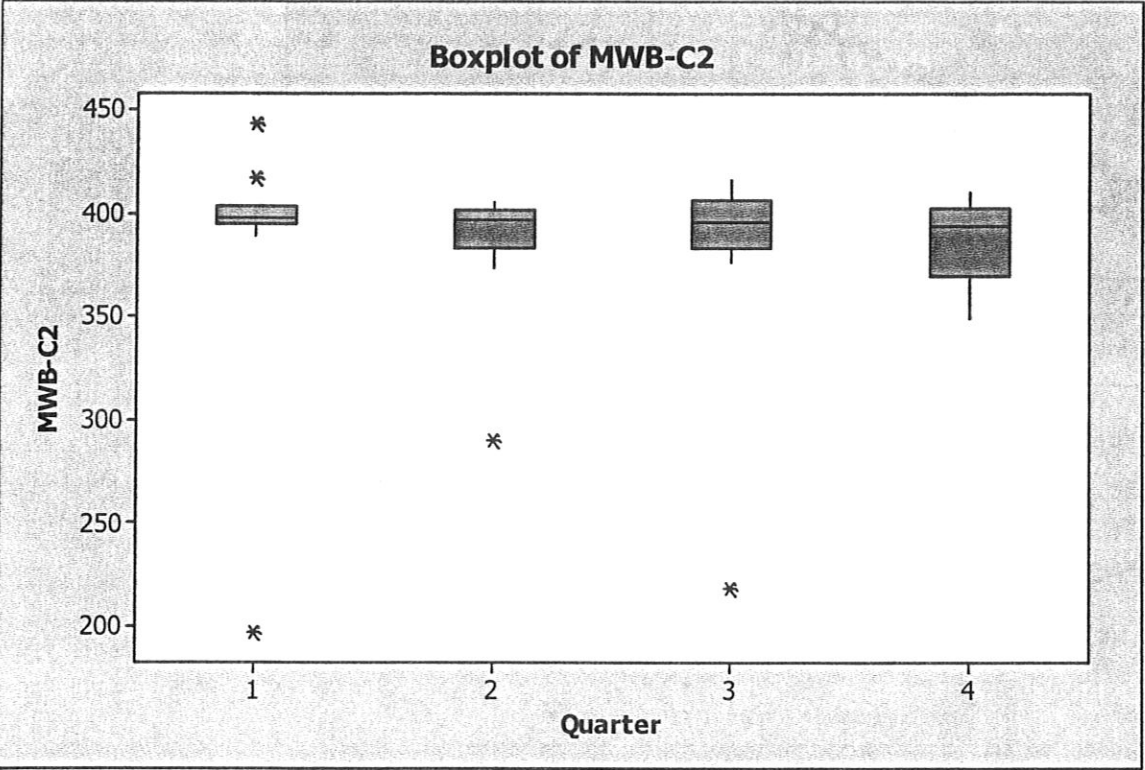
- Seasonality

Mood Median Test: MWB-C2 versus Quarter

Mood median test for MWB-C2
Chi-Square = 1.13 DF = 3 P = 0.770

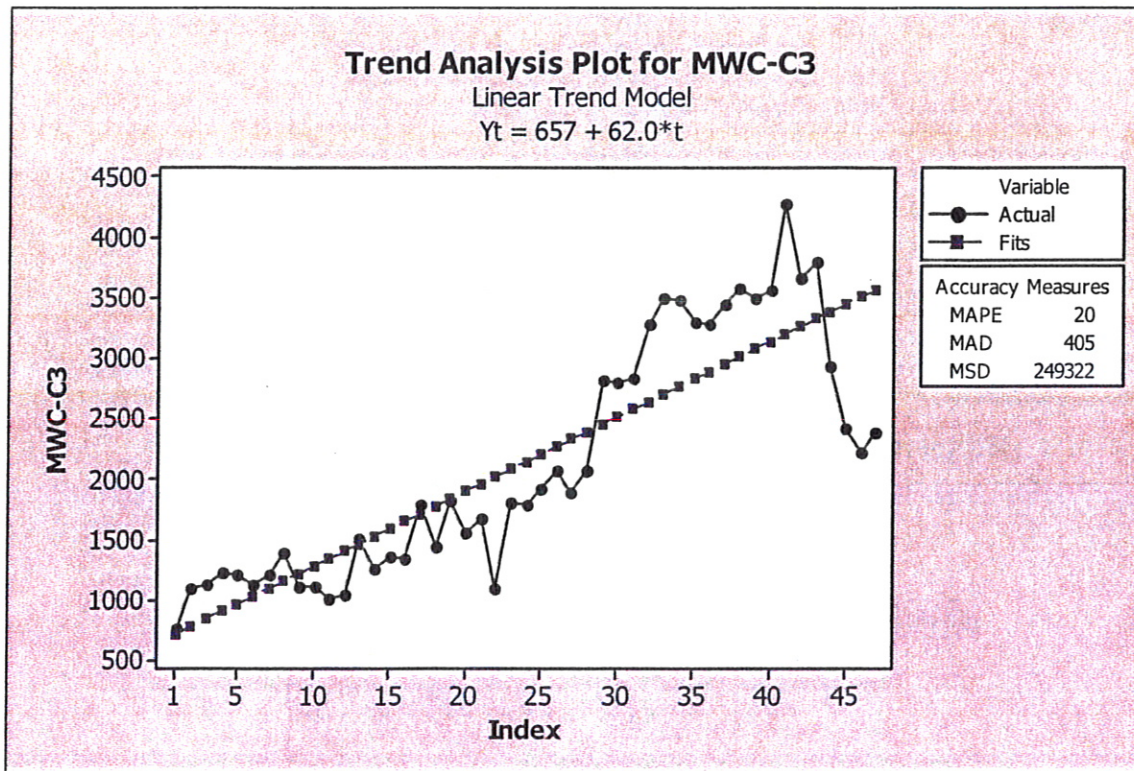
Individual 95.0% CIs				
Quarter	N<=	N>	Median	Q3-Q1
1	5	7	397.5	8.8
2	6	6	397.0	18.0
3	6	6	396.0	23.5
4	7	4	394.0	33.0

Overall median = 396.0



MWC-C3

- Trend – statistically significant, linear, monotonic



- Seasonality – not detected in residuals

Mood Median Test: MWC-C3 Residuals versus Quarter

Mood median test for MWC-C3 Residuals

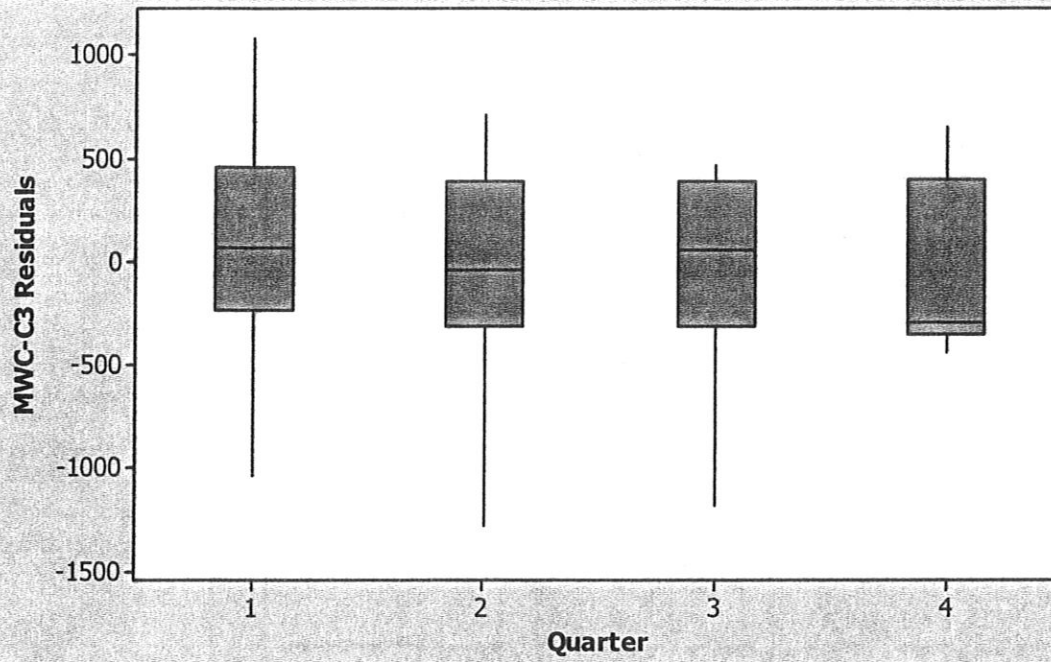
Chi-Square = 0.07 DF = 3 P = 0.995

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	6	6	64	693	(-----*-----)
2	6	6	-39	697	(-----*-----)
3	6	6	52	707	(-----*-----)
4	6	5	-302	752	(-*-----)

-250 0 250 500

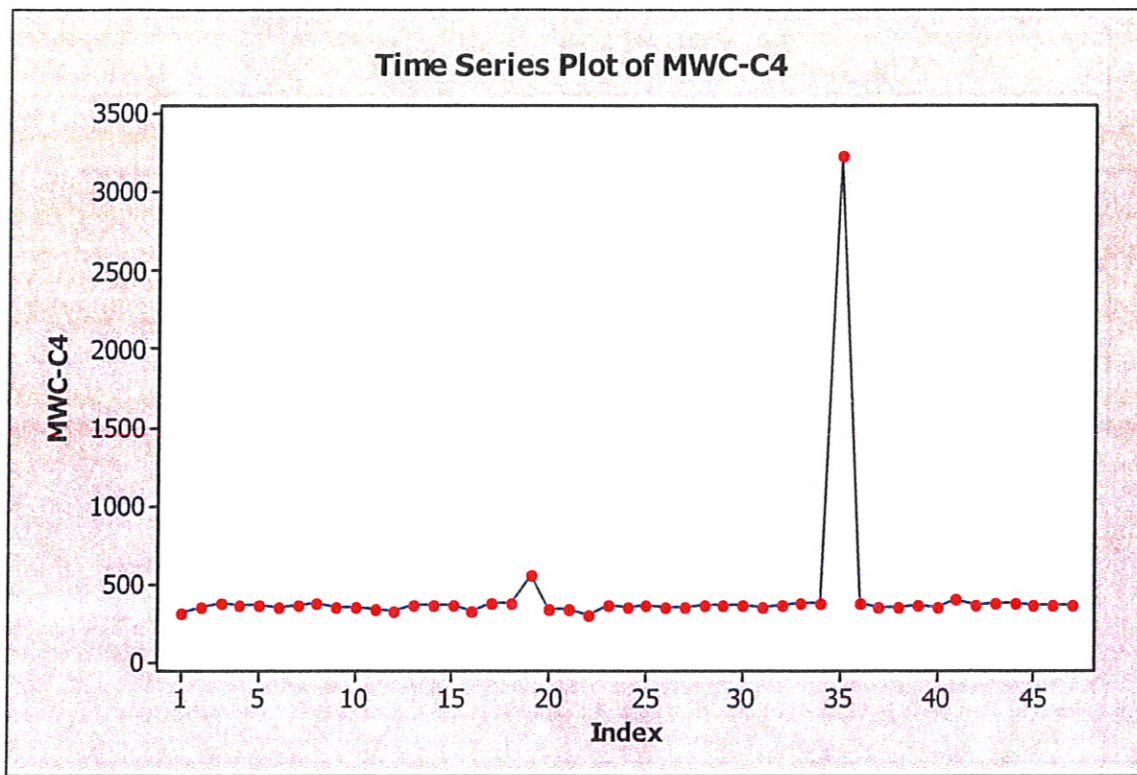
Overall median = 44

Boxplot of MWC-C3 Residuals



MWC-C4

- Trend – No statistically significant trend



- Seasonality – no statistically significant seasonal component

Mood Median Test: MWC-C4 versus Quarter

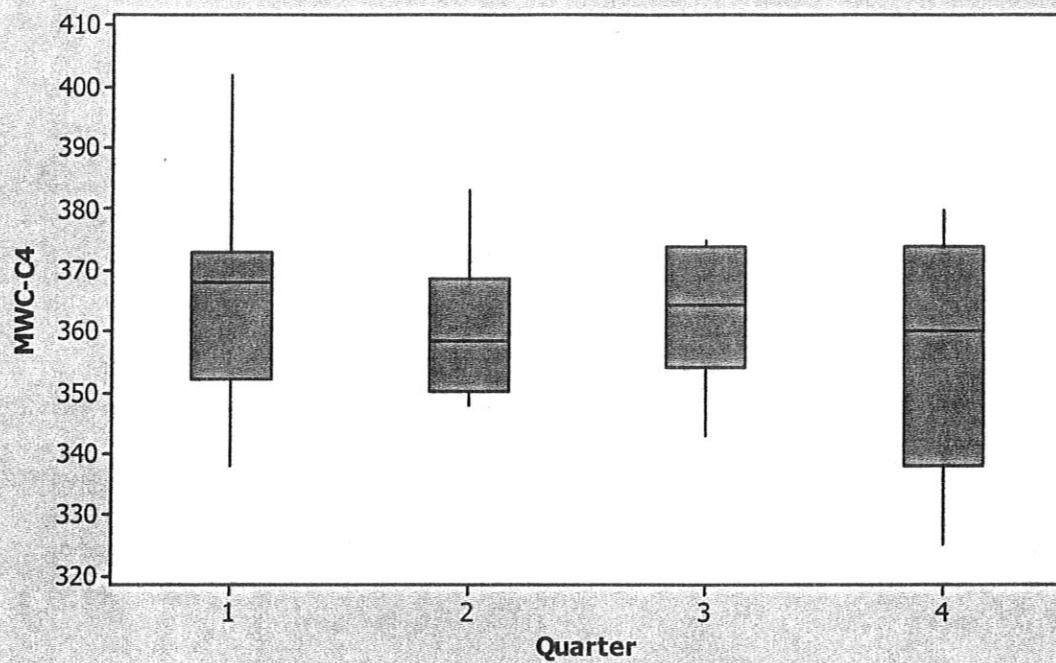
Mood median test for MWC-C4

Chi-Square = 2.07 DF = 3 P = 0.558

Quarter	N<=	N>	Median	Q3-Q1	Individual 95.0% CIs
1	5	7	368.0	21.0	(-----*-----)
2	8	4	358.5	18.5	(-----*-----)
3	5	7	364.5	20.0	(-----*-----)
4	6	5	360.0	36.0	(-----*-----)
					-----+-----+-----+-----+-----
					340 350 360 370

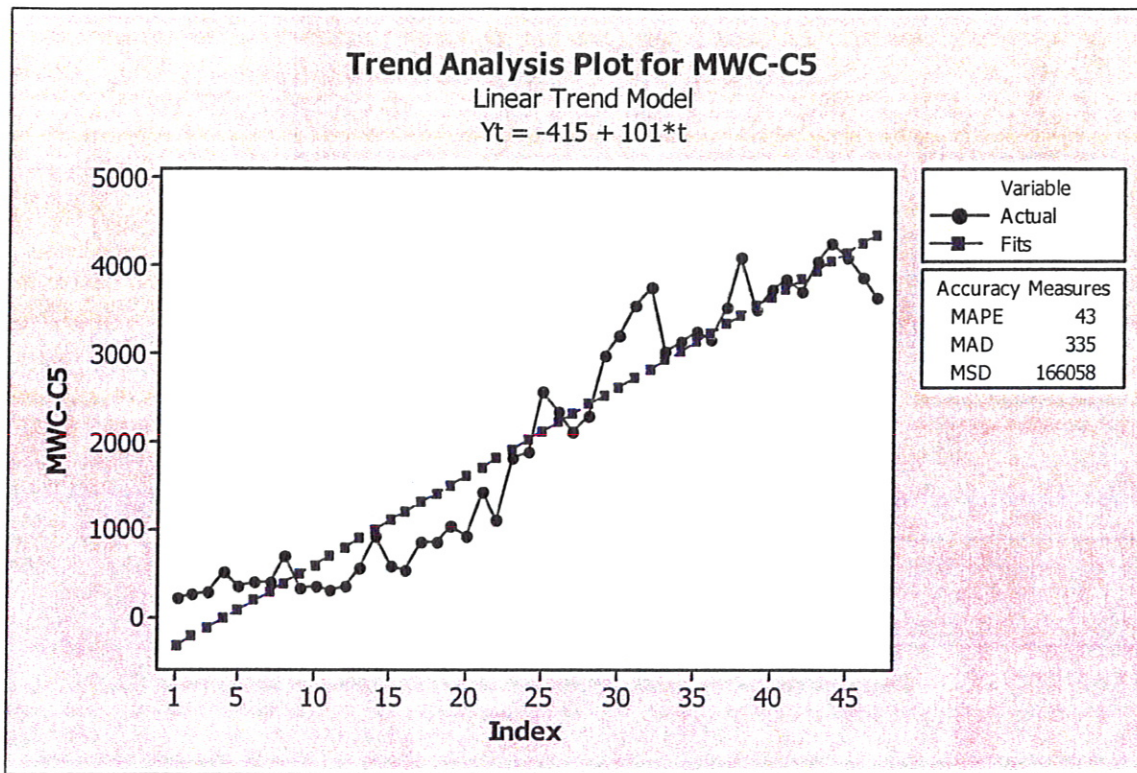
Overall median = 362.0

Boxplot of MWC-C4



MWC-C5

- Trend – statistically significant, upward, monotonic, and linear



- Seasonality – not statistically significant

Mood Median Test: MWC-C5 Residuals versus Quarter

Mood median test for MWC-C5 Residuals

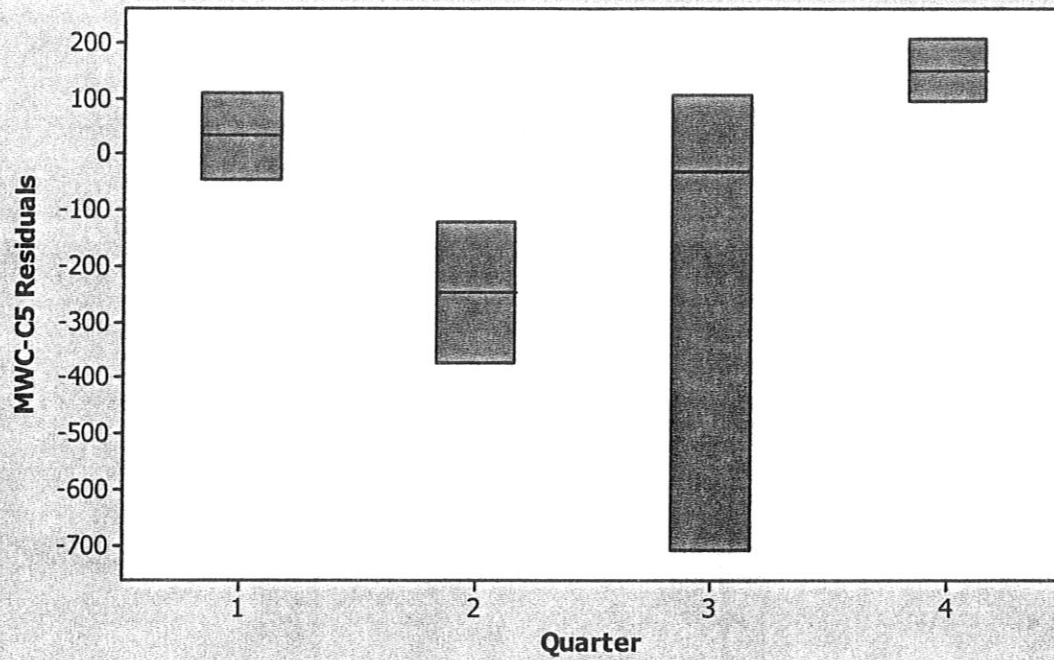
Chi-Square = 4.28 DF = 3 P = 0.233

					Individual 95.0% CIs	
Quarter	N<=	N>	Median	Q3-Q1	-----+-----+-----+-----	
1	1	1	32	157	(---*---)	
2	2	0	-249	249	(----*----)	
3	2	1	-32	813	(------*-----)	
4	0	2	150	111	(-*-)	
					-----+-----+-----+-----	
					-500 -250 0	

Overall median = -32

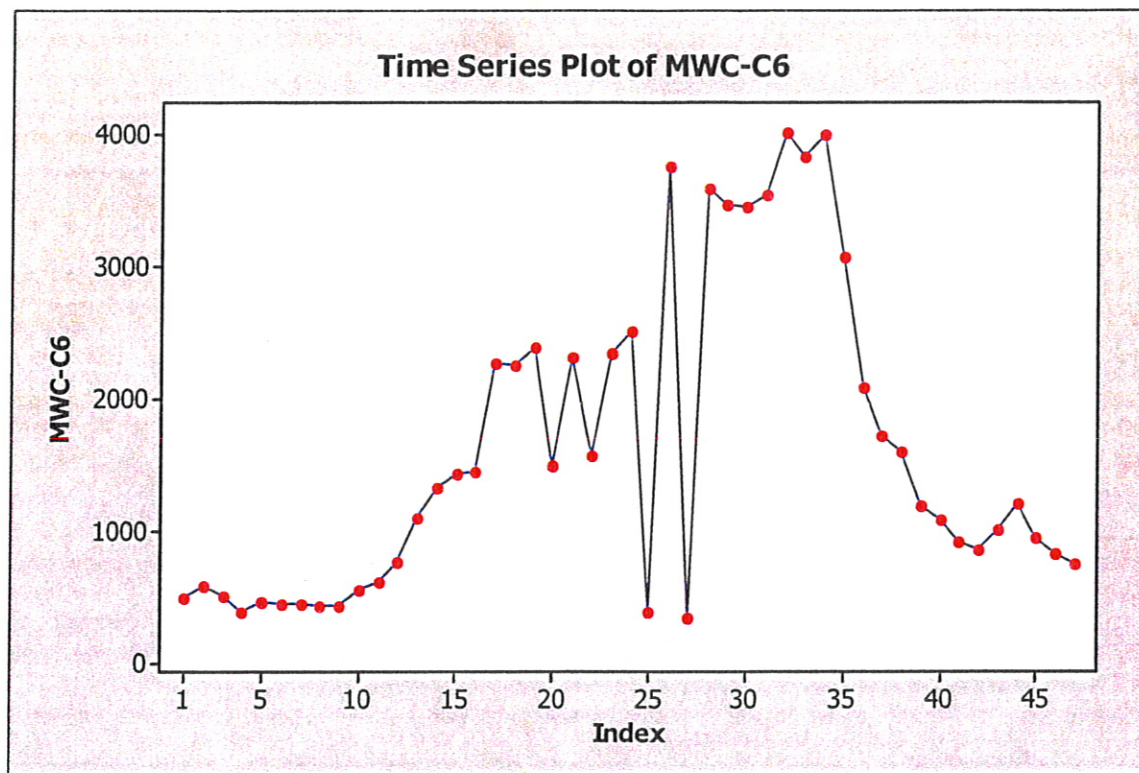
* NOTE * Levels with < 6 observations have confidence < 95.0%

Boxplot of MWC-C5 Residuals



MWC-C6

- Trend is statistically significant and monotonic, but non-linear



- Seasonality – not detected in raw data, and adequate trend model should be applied

Mood Median Test: MWC-C6 versus Quarter

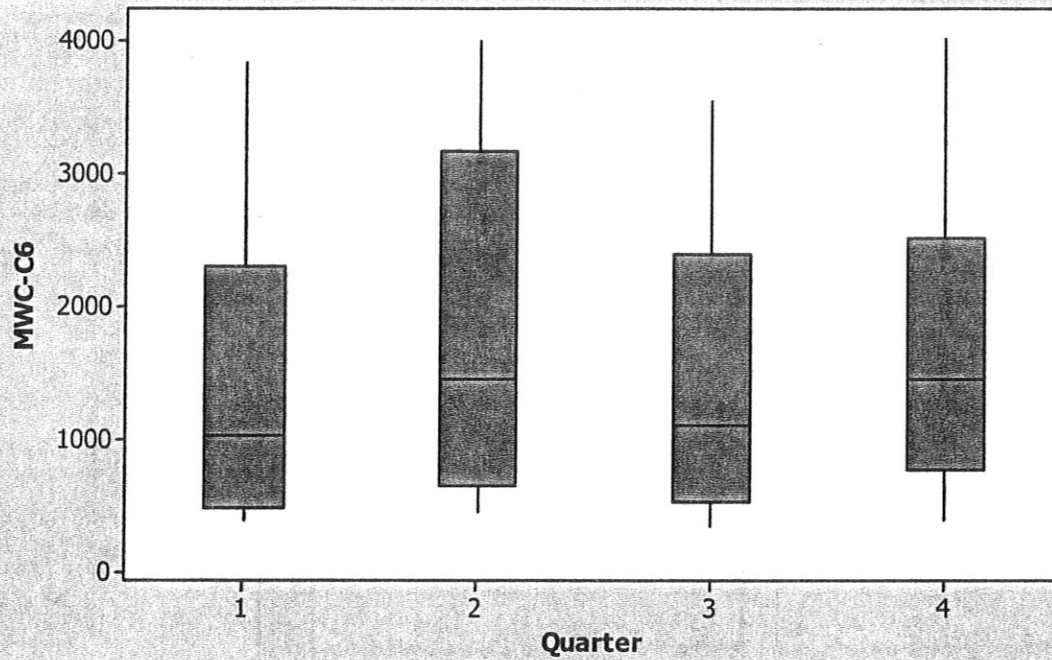
Mood median test for MWC-C6

Chi-Square = 1.07 DF = 3 P = 0.784

					Individual 95.0% CIs
Quarter	N<=	N>	Median	Q3-Q1	
1	7	5	1021	1831	(-----*-----)
2	5	7	1453	2525	(-----*-----)
3	7	5	1100	1859	(-----*-----)
4	5	6	1442	1746	(-----*-----)
					-----+-----+-----+-----+-----
					800 1600 2400 3200

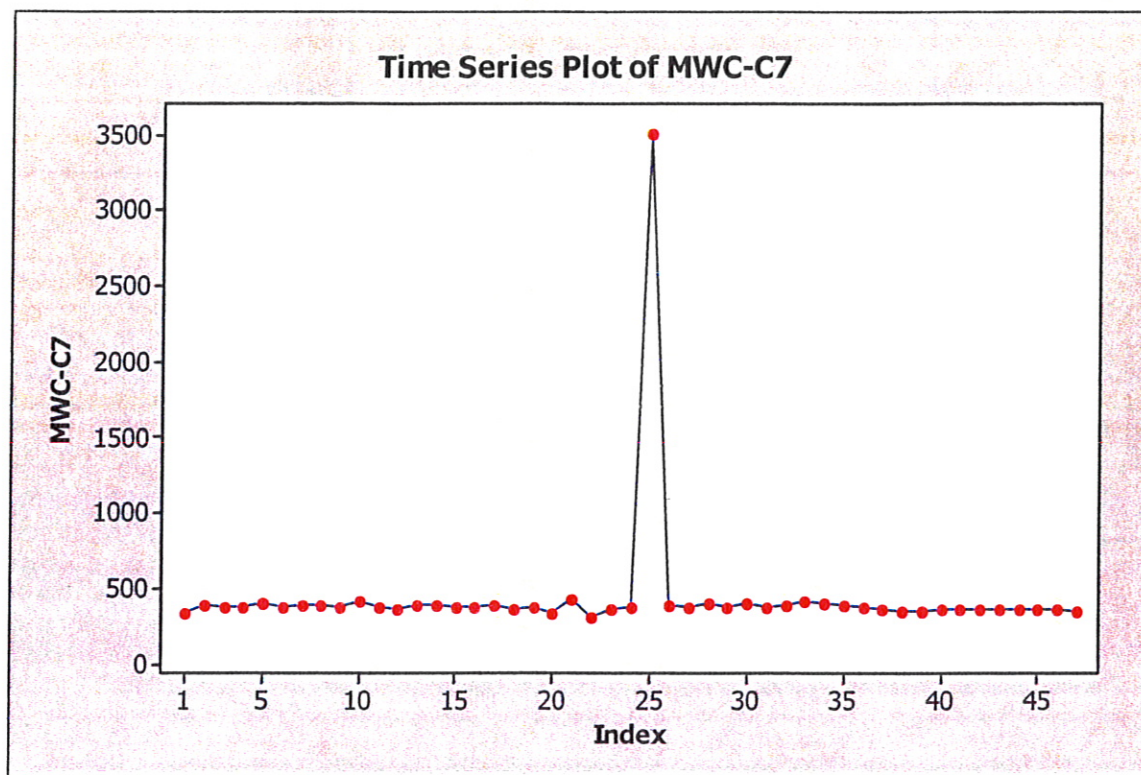
Overall median = 1205

Boxplot of MWC-C6



MWC-C7

- Trend – not statistically significant, possible outlier present



- Seasonality – not statistically significant

Mood Median Test: MWC-C7 versus Quarter

Mood median test for MWC-C7

Chi-Square = 0.74 DF = 3 P = 0.865

					Individual 95.0% CIs
Quarter	N<=	N>	Median	Q3-Q1	
1	6	6	381.5	46.5	(-----*-----)
2	5	7	380.5	38.0	(-----*-----)
3	7	5	375.0	21.8	(-----*--)
4	6	5	377.0	23.0	(-----*-----)
					-----+-----+-----+-----+-----
					360 375 390 405

Overall median = 377.0

Boxplot of MWC-C7

