


Reverse What-if Graphs (Implementation Plan Version 1.0: Draft: work in progress)

Link to project proposal:  (Subject: project proposal: reverse what-if graph; Database: Time Series Analysis WDB; Author: Craig McLaren; Created: 10/01/2006; Doc Ref: CMLN-6KVVV2)

Description of Project

This project will enable alternative what-if estimates to be produced. The underlying principle is fixing or explicitly defining the current change at the most recent time point and calculating the value of the seasonally adjusted estimate for the next period which will allow that scenario to happen. We consider a more general case, specifically:

How much movement can we tolerate in SA_{t+1} , such that the trend estimate at time t does not vary by more than some constraint defined by the historical movements in the series at times $\leq t$.

Proposed Algorithm

1. Suppose we have a seasonally adjusted series up to some time t , the most recent time point: $\{SA_{t-n}, SA_{t-n+1}, \dots, SA_{t-1}, SA_t\}$

2. Apply an asymmetric L - term Henderson filter to these seasonally adjusted values to derive the trend at time t , T_t :

$$T_{t|t} = \sum_{j=-\frac{(L-1)}{2}}^0 w_j^0 SA_{t+j}, \quad (1)$$

where the w_j^0 are the zero-order asymmetric surrogate filter weights.

3. Add a new estimate SA_{t+1} to the seasonally adjusted series at time $t+1$.

4. Re-apply the asymmetric L - term Henderson filter to derive the new trend estimate at time t with the new seasonally adjusted value included. (Note that the surrogate weights are now different, and for the purposes of these "what-if" calculations, we assume that the re-estimated seasonally adjusted values do not change, ie. $SA_{\tau|t} = SA_{\tau|t+1}$ for all $\tau \leq t$)

$$T_{t|t+1} = \sum_{j=-\frac{(L-1)}{2}}^1 w_j^1 SA_{t+j}. \quad (2)$$

5. We quantify the allowed change in the $T_{t|t+1}$ estimate when time point $t + 1$ becomes available by requiring $T_{t|t+1}$ to not vary by more than $x\%$ of the original previous trend value $T_{t-1|t}$, where x is constrained by the distribution of historical movements in the original trend series (without the additional $t+1$ point) for times $\leq t$. In other words, we can define an arbitrary percentage (or fractional) movement for the new trend estimate at time t relative to $t - 1$ as:

$$x = \frac{T_{t|t+1} - T_{t-1|t}}{T_{t-1|t}}, \quad \text{and rearranging gives:}$$

$$T_{t|t+1} = (x + 1)T_{t-1|t}. \quad (3)$$

The distribution in movement x can be asymmetric with an upper and lower bound for some confidence interval of interest (eg. 95% or other). Rearranging equation (2), the new seasonally adjusted value, SA_{t+1} , can be written:

$$SA_{t+1} = \frac{1}{w_1^1} \left[T_{t|t+1} - \sum_{j=-\frac{(L-1)}{2}}^0 w_j^1 SA_{t+j} \right]. \quad (4)$$

From equation (4), there are two interesting cases:

Case 1

Substituting (3) into (4) gives an equation for our unknown SA_{t+1} in terms of the relative movement x :

$$SA_{t+1} = \frac{1}{w_1^1} \left[(x + 1)T_{t-1|t} - \sum_{j=-\frac{(L-1)}{2}}^0 w_j^1 SA_{t+j} \right]. \quad (5)$$

Case 2

For the "hypothetical" case where $T_{t|t} = T_{t|t+1}$ is enforced (i.e. the estimated trend value at time t does not change with the addition of new data at time point $t+1$), equation (4) can be written:

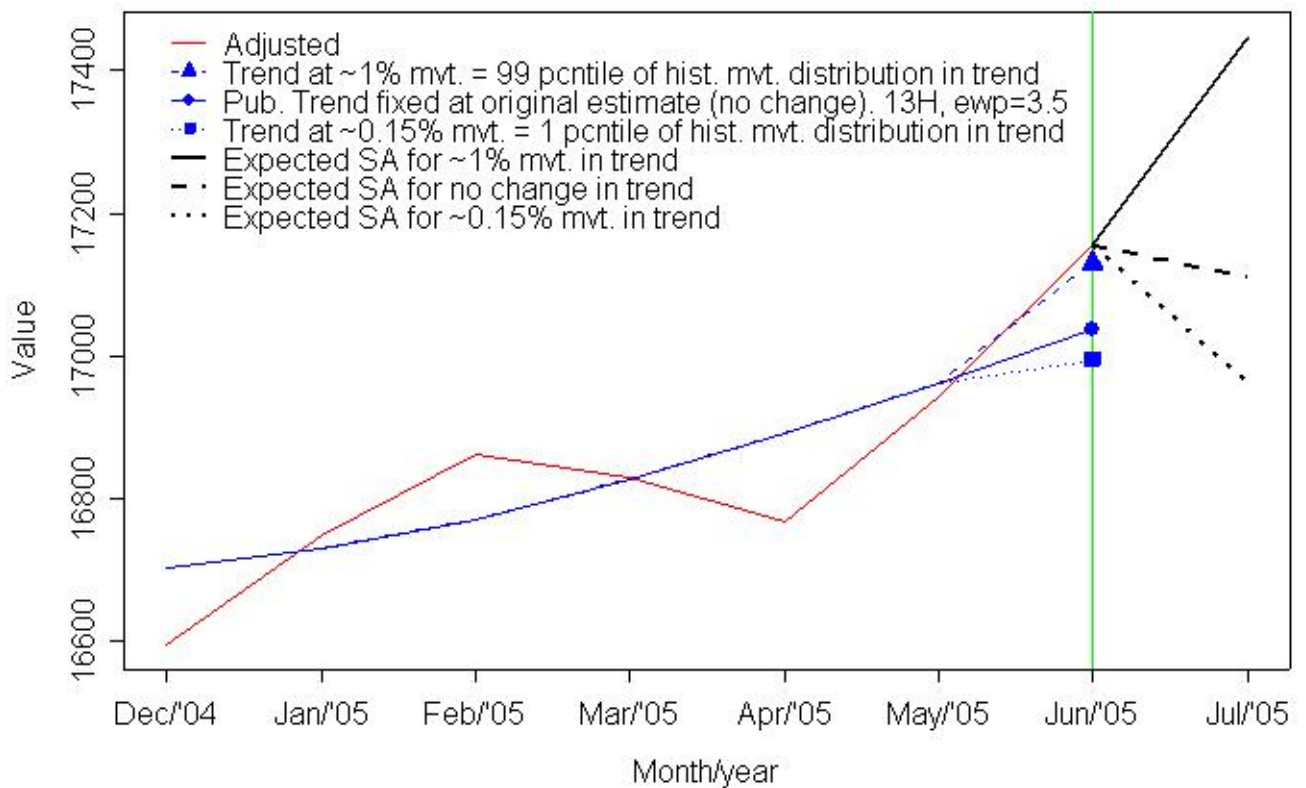
$$SA_{t+1} = \frac{1}{w_1^1} \left[T_{t|t} - \sum_{j=-\frac{(L-1)}{2}}^0 w_j^1 SA_{t+j} \right]. \quad (6)$$

6. Under the general case (given by eq. 5), we can therefore solve for the range taken by the $t+1$ SA value, " ΔSA ", such that $T_{t|t+1}$ is constrained to lie within a range determined by the historical movement distribution " Δx ".

Proposed What-if Graphs

- The following is an example of a "reverse what-if" graph for the Australian total retail series. In a nutshell, this asks: what seasonally adjusted values would we expect for the new month of "July" if the trend value at the current end ("June") is constrained to be revised by no more than an amount fixed by the historical movements (ie. our best guess). Such trend revisions are a consequence of the application of an asymmetric filter at the series end.
- In this example, the "maximum" and "minimum" allowed movements for the "June" trend values (relative to May) were assumed from the 1% upper and lower quantiles of the historical movement distribution. These are purely illustrative and we could have chosen anything we wished to define this interval.

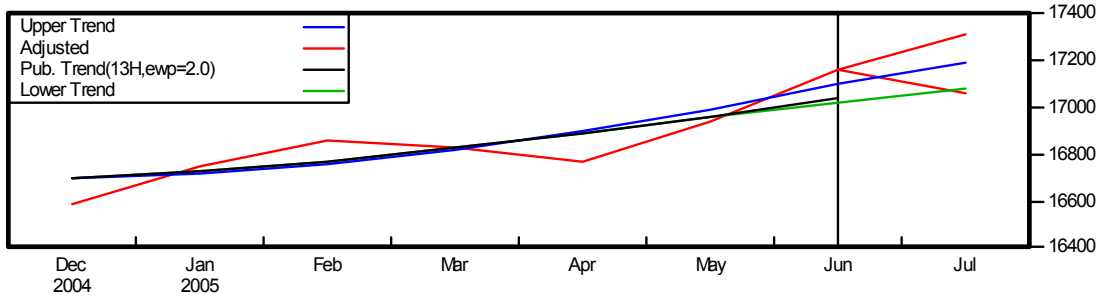
"Reverse What-if" for Aust. Total Retail Series (PG98)



Current What-if Graphs available in SEASABS

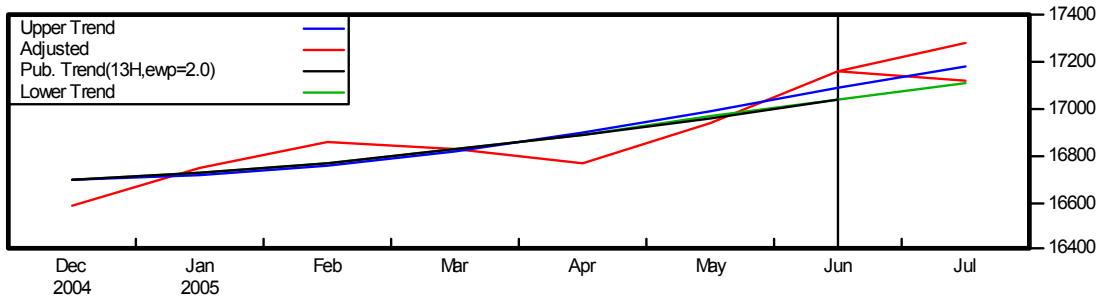
The various what-if graphs available in SEASABS were produced for the Total Australian Retail series (see following).

**Trend behaviour if the Adjusted value rises by the Mean Upward movement (0.91%)
or falls by the Mean Downward movement(-0.56%) next period**



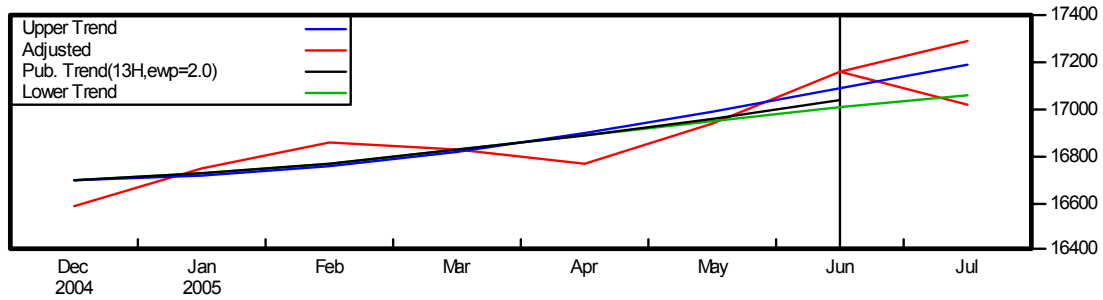
	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Upper Trend	16721.03	16759.10	16821.64	16902.89	16995.63	17098.10	17196.09
% Change	0.12	0.23	0.37	0.48	0.55	0.60	0.57
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17313.88
Upper	"	"	"	"	"	"	17061.74
Lower	"	"	"	"	"	"	17061.74
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	
Lower Trend	16725.91	16767.73	16826.09	16891.89	16968.32	17026.13	17083.26
% Change	0.15	0.25	0.35	0.39	0.39	0.40	0.34

**Trend behaviour if the Adjusted value rises by the Median Upward movement (0.72%)
or falls by the Median Downward movement(-0.19%) next period**



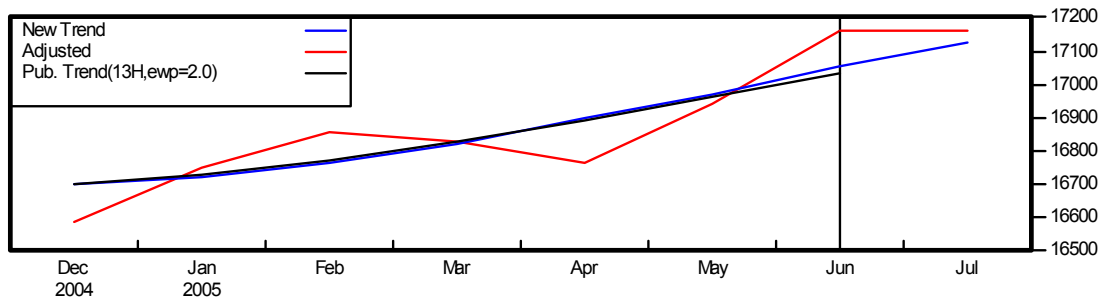
	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Upper Trend	16721.64	16760.19	16822.20	16901.50	16990.91	17088.99	17181.81
% Change	0.12	0.23	0.37	0.47	0.53	0.58	0.54
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17281.97
Upper	"	"	"	"	"	"	17125.10
Lower	"	"	"	"	"	"	17125.10
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	
Lower Trend	16724.68	16765.56	16824.97	16894.65	16967.70	17044.22	17111.61
% Change	0.14	0.24	0.35	0.41	0.43	0.45	0.40

Trend behaviour if the Adjusted value rises or falls by the AAPC (0.80%) next period



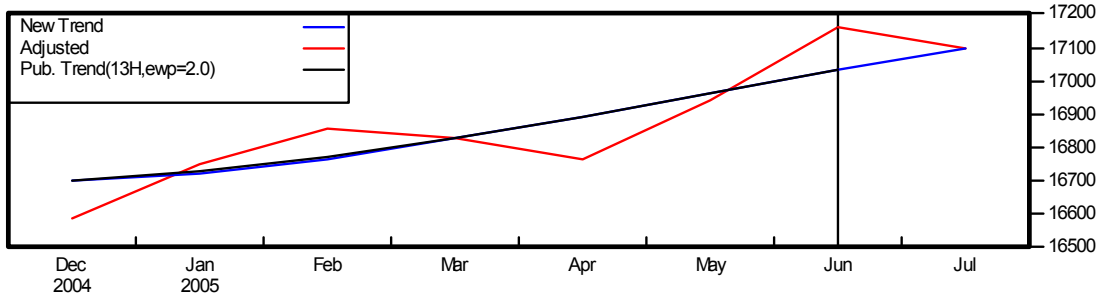
	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Upper Trend	16721.37	16759.71	16821.95	16902.11	16992.98	17092.99	17188.09
% Change	0.12	0.23	0.37	0.48	0.54	0.59	0.56
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17296.00
Upper	"	"	"	"	"	"	17296.00
Lower	"	"	"	"	"	"	17020.50
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	
Lower Trend	16726.70	16769.14	16826.82	16890.09	16952.22	17014.36	17064.80
% Change	0.15	0.25	0.34	0.38	0.37	0.37	0.30

Trend behaviour if the Adjusted value is the same next period



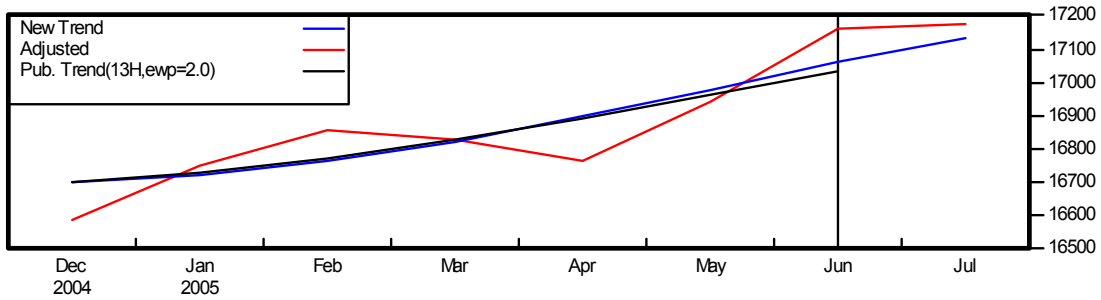
	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Trend	16724.04	16764.43	16824.39	16896.10	16972.60	17053.68	17126.45
% Change	0.14	0.24	0.36	0.43	0.45	0.48	0.43
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17158.25
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	0.00

**No revision to Trend value at the current period
(Revision to previous period. etc. may occur)**



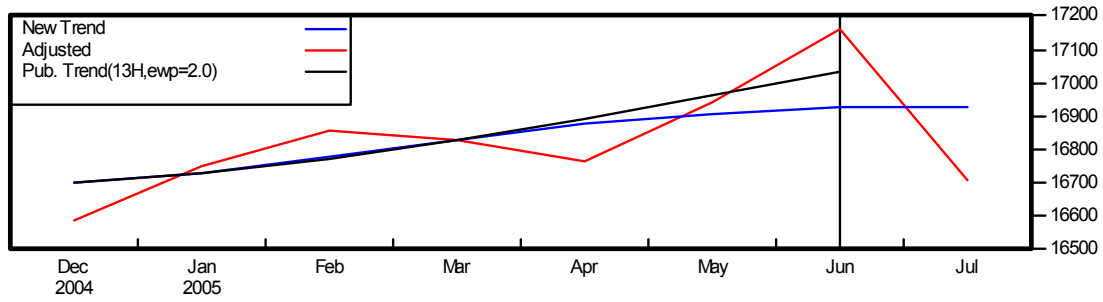
	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Trend	16725.20	16766.48	16825.45	16893.48	16963.70	17036.51	17099.53
% Change	0.14	0.25	0.35	0.40	0.42	0.43	0.37
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17098.09
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	-0.35

Maintenance of current Trend growth



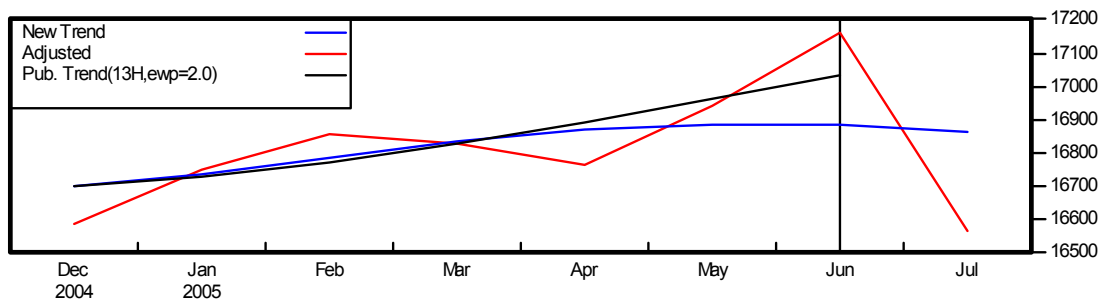
	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Trend	16723.65	16763.74	16824.03	16896.98	16975.58	17059.43	17135.47
% Change	0.14	0.24	0.36	0.43	0.47	0.49	0.45
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17178.42
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	0.12

Zero Trend growth between current and next period



	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Trend	16732.73	16779.78	16832.32	16876.51	16906.17	16925.53	16925.53
% Change	0.19	0.28	0.31	0.26	0.18	0.11	0.00
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	16709.29
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	-2.62

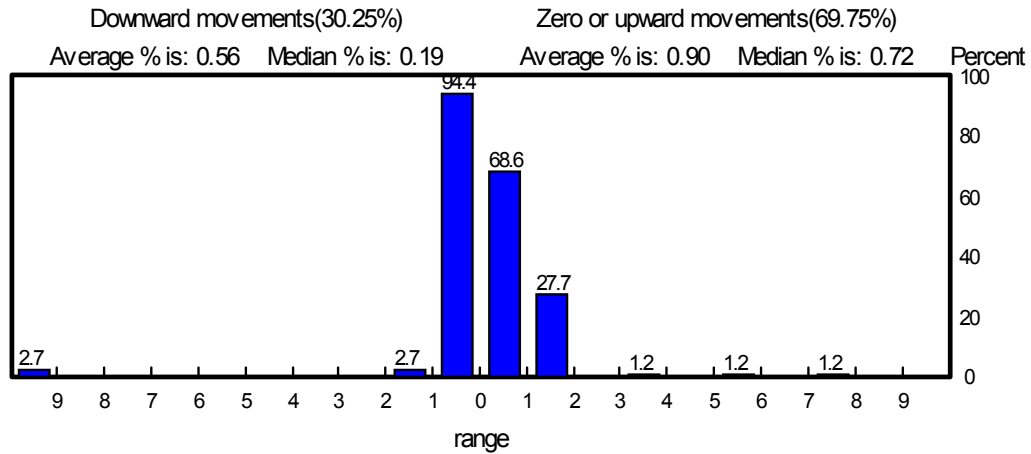
Zero Trend growth between previous and current period



	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Trend	16735.45	16784.60	16834.81	16870.37	16885.32	16885.32	16862.49
% Change	0.21	0.29	0.30	0.21	0.09	-0.00	-0.14
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	16568.42
% Change	0.95	0.66	-0.18	-0.38	1.04	1.28	-3.44

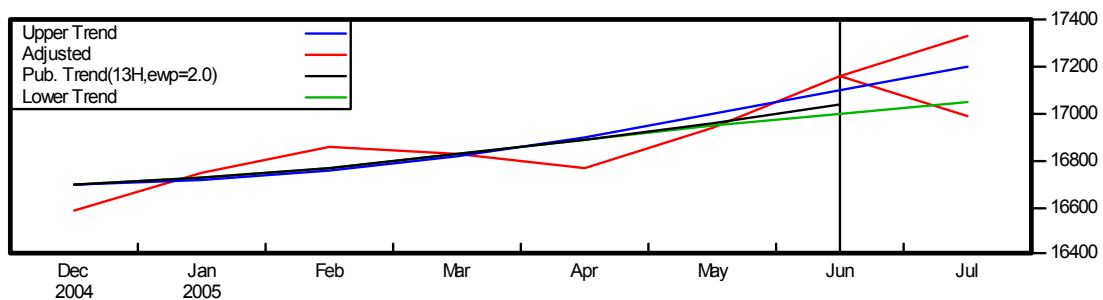
Sensitivity Analysis - Distribution

April 1962 to June 2005



The following is the standard graph that is usually published (under the SEASABS "publication view"). It predicts the trend behaviour for an assumed $\pm 1\%$ movement in the new seasonally adjusted value relative to the previous value.

Trend behaviour if the Adjusted value rises or falls by 1.00 %next period



	Jan 2005	Feb 2005	Mar 2005	Apr 2005	May 2005	Jun 2005	Jul 2005
Upper Trend	16720.72	16758.56	16821.36	16903.59	16997.99	17102.65	17203.23
%Change	0.12	0.23	0.37	0.49	0.56	0.62	0.59
Adjusted	16748.69	16859.96	16829.81	16766.46	16941.29	17158.25	17329.83
Upper	"	"	"	"	"	"	17329.83
Lower	"	"	"	"	"	"	16986.66
%Change	0.95	0.66	-0.18	-0.38	1.04	1.28	
Lower Trend	16727.36	16770.29	16827.42	16888.61	16947.21	17004.70	17049.66
%Change	0.16	0.26	0.34	0.36	0.35	0.34	0.26