

TAB: DATA (IN %)

ORTHOGONALIZED DATA

Treasury yield data				Normalized Data			PC (O) = V x X*			F = V x X			n = 98				
mean	2.78	4.08	4.87	0.00	0.00	0.00	2.80	0.20	0.00	F1=Index	F2	F3	Correlation of X1 with data	3M*	5Y*	10Y*	
stddev	2.21	1.96	1.68	1.00	1.00	1.00	0.00	0.00	0.00								
Date	3M	5Y	10Y	3M*	5Y*	10Y*	Data	PC1	PC2	PC3							
30-Sep-15	0.15	1.37	2.32	-1.19	-1.38	-1.51	30-Sep-15	-2.36	-0.19	0.07	1.29	1.48	-0.28	correlation	0.42	0.50	0.57
30-Jun-15	0.13	1.59	2.70	-1.20	-1.27	-1.29	30-Jun-15	-2.17	-0.03	0.04	1.49	1.76	-0.32	beta	1.55	1.65	1.60
31-Mar-15	0.12	1.31	2.29	-1.21	-1.41	-1.53	31-Mar-15	-2.40	-0.19	0.06	1.25	1.48	-0.30				
31-Dec-14	0.11	1.55	2.57	-1.21	-1.29	-1.36	31-Dec-14	-2.23	-0.07	0.06	1.43	1.69	-0.27				
30-Sep-14	0.03	1.70	2.90	-1.25	-1.21	-1.17	30-Sep-14	-2.10	0.09	0.02	1.56	1.97	-0.32				
30-Jun-14	0.05	1.57	2.85	-1.24	-1.28	-1.20	30-Jun-14	-2.15	0.05	-0.01	1.51	1.90	-0.40				
31-Mar-14	0.05	1.70	3.07	-1.24	-1.21	-1.07	31-Mar-14	-2.03	0.14	-0.04	1.62	2.06	-0.43				
31-Dec-13	0.07	1.79	3.29	-1.23	-1.16	-0.94	31-Dec-13	-1.92	0.22	-0.07	1.73	2.19	-0.48				
30-Sep-13	0.03	1.47	2.78	-1.25	-1.33	-1.24	30-Sep-13	-2.21	0.03	-0.03	1.44	1.86	-0.43				
30-Jun-13	0.07	1.43	2.68	-1.23	-1.35	-1.30	30-Jun-13	-2.24	-0.03	-0.01	1.41	1.76	-0.42				
31-Mar-13	0.07	0.84	1.82	-1.23	-1.65	-1.81	31-Mar-13	-2.71	-0.38	0.04	0.92	1.17	-0.39				
31-Dec-12	0.09	0.80	1.74	-1.22	-1.67	-1.85	31-Dec-12	-2.75	-0.41	0.05	0.89	1.09	-0.38				
30-Sep-12	0.12	0.70	1.60	-1.21	-1.72	-1.94	30-Sep-12	-2.82	-0.48	0.05	0.81	0.97	-0.39				
30-Jun-12	0.11	0.80	1.68	-1.21	-1.67	-1.89	30-Jun-12	-2.77	-0.45	0.07	0.87	1.03	-0.35				
31-Mar-12	0.11	1.16	2.25	-1.21	-1.49	-1.55	31-Mar-12	-2.46	-0.21	0.02	1.18	1.44	-0.40				
31-Dec-11	0.02	0.92	1.95	-1.25	-1.61	-1.73	31-Dec-11	-2.66	-0.31	0.04	0.97	1.29	-0.39				
30-Sep-11	0.02	1.00	2.03	-1.25	-1.57	-1.68	30-Sep-11	-2.60	-0.27	0.04	1.03	1.35	-0.38				
30-Jun-11	0.04	1.86	3.32	-1.24	-1.13	-0.92	30-Jun-11	-1.90	0.25	-0.06	1.76	2.24	-0.44				
31-Mar-11	0.08	2.26	3.74	-1.23	-0.92	-0.67	31-Mar-11	-1.62	0.41	-0.04	2.05	2.53	-0.37				
31-Dec-10	0.14	2.05	3.56	-1.20	-1.03	-0.78	31-Dec-10	-1.73	0.31	-0.07	1.93	2.34	-0.45				
30-Sep-10	0.14	1.41	2.66	-1.20	-1.36	-1.31	30-Sep-10	-2.24	-0.06	-0.02	1.42	1.70	-0.44				
30-Jun-10	0.20	1.88	3.26	-1.17	-1.12	-0.96	30-Jun-10	-1.87	0.17	-0.04	1.80	2.08	-0.43				
31-Mar-10	0.15	2.63	4.16	-1.19	-0.74	-0.42	31-Mar-10	-1.35	0.57	-0.04	2.34	2.78	-0.34				
31-Dec-09	0.05	2.72	4.18	-1.24	-0.69	-0.41	31-Dec-09	-1.34	0.62	0.00	2.35	2.89	-0.25				
30-Sep-09	0.13	2.36	3.77	-1.20	-0.87	-0.65	30-Sep-09	-1.57	0.42	-0.01	2.11	2.53	-0.32				
30-Jun-09	0.23	2.61	4.06	-1.16	-0.75	-0.48	30-Jun-09	-1.37	0.50	-0.03	2.32	2.66	-0.32				
31-Mar-09	0.23	1.84	3.06	-1.16	-1.14	-1.08	31-Mar-09	-1.95	0.09	0.00	1.72	1.94	-0.35				
31-Dec-08	0.12	1.63	2.87	-1.21	-1.25	-1.18	31-Dec-08	-2.10	0.04	-0.01	1.56	1.87	-0.38				
30-Sep-08	0.87	3.06	4.20	-0.87	-0.52	-0.40	30-Sep-08	-1.02	0.36	0.04	2.73	2.31	-0.20				
30-Jun-08	1.77	3.38	4.27	-0.46	-0.35	-0.35	30-Jun-08	-0.67	0.09	0.04	3.16	1.70	-0.22				
31-Mar-08	1.24	2.54	3.67	-0.70	-0.78	-0.71	31-Mar-08	-1.27	0.00	-0.03	2.49	1.62	-0.40				
31-Dec-07	3.25	3.49	4.29	0.21	-0.30	-0.34	31-Dec-07	-0.26	-0.42	-0.09	3.68	0.56	-0.51				
30-Sep-07	3.95	4.20	4.73	0.53	0.07	-0.08	30-Sep-07	0.29	-0.46	-0.03	4.30	0.38	-0.37				
30-Jun-07	4.86	4.84	5.12	0.94	0.39	0.15	30-Jun-07	0.85	-0.59	-0.01	4.94	0.01	-0.32				
31-Mar-07	5.05	4.47	4.76	1.03	0.20	-0.07	31-Mar-07	0.65	-0.81	-0.06	4.75	-0.42	-0.45				
31-Dec-06	5.06	4.59	4.80	1.03	0.26	-0.04	31-Dec-06	0.71	-0.80	-0.03	4.81	-0.39	-0.38				
30-Sep-06	4.95	4.50	4.74	0.98	0.22	-0.08	30-Sep-06	0.64	-0.78	-0.03	4.73	-0.35	-0.39				
30-Jun-06	5.03	5.01	5.20	1.02	0.48	0.20	30-Jun-06	0.97	-0.60	0.01	5.08	-0.05	-0.28				
31-Mar-06	4.62	4.74	4.97	0.83	0.34	0.06	31-Mar-06	0.70	-0.56	0.03	4.78	0.09	-0.25				
31-Dec-05	4.24	4.28	4.50	0.66	0.10	-0.22	31-Dec-05	0.30	-0.63	0.04	4.34	0.04	-0.26				
30-Sep-05	3.54	4.18	4.49	0.34	0.05	-0.22	30-Sep-05	0.10	-0.39	0.08	4.08	0.57	-0.15				
30-Jun-05	3.07	3.69	4.03	0.13	-0.20	-0.50	30-Jun-05	-0.33	-0.43	0.09	3.60	0.58	-0.16				
31-Mar-05	2.79	4.14	4.61	0.00	0.03	-0.15	31-Mar-05	-0.07	-0.09	0.11	3.86	1.22	-0.07				
31-Dec-04	2.22	3.65	4.36	-0.26	-0.22	-0.30	31-Dec-04	-0.45	-0.01	0.06	3.42	1.45	-0.17				
30-Sep-04	1.72	3.43	4.32	-0.48	-0.33	-0.33	30-Sep-04	-0.66	0.13	0.05	3.17	1.78	-0.19				
30-Jun-04	1.29	3.85	4.88	-0.68	-0.12	0.00	30-Jun-04	-0.44	0.52	0.08	3.37	2.51	-0.07				
31-Mar-04	0.95	2.84	4.10	-0.83	-0.63	-0.45	31-Mar-04	-1.10	0.28	-0.03	2.65	2.15	-0.34				
31-Dec-03	0.91	3.24	4.56	-0.85	-0.43	-0.18	31-Dec-03	-0.83	0.49	-0.02	2.93	2.52	-0.28				
30-Sep-03	0.93	2.87	4.26	-0.84	-0.61	-0.36	30-Sep-03	-1.04	0.35	-0.07	2.71	2.27	-0.40				
30-Jun-03	0.86	2.52	3.80	-0.87	-0.79	-0.64	30-Jun-03	-1.33	0.18	-0.04	2.41	1.99	-0.39				
31-Mar-03	1.14	2.85	4.19	-0.75	-0.62	-0.40	31-Mar-03	-1.02	0.25	-0.08	2.74	2.06	-0.43				
31-Dec-02	1.13	2.88	4.20	-0.75	-0.61	-0.40	31-Dec-02	-1.01	0.25	-0.07	2.75	2.07	-0.41				
30-Sep-02	1.54	2.81	4.03	-0.57	-0.65	-0.50	30-Sep-02	-0.99	0.04	-0.08	2.80	1.64	-0.47				
30-Jun-02	1.65	4.16	5.28	-0.51	0.04	0.25	30-Jun-02	-0.12	0.56	0.02	3.72	2.52	-0.15				
31-Mar-02	1.77	4.96	5.91	-0.46	0.45	0.62	31-Mar-02	0.37	0.80	0.12	4.24	2.93	0.09				
31-Dec-01	1.71	4.48	5.63	-0.49	0.21	0.45	31-Dec-01	0.11	0.69	0.03	3.97	2.74	-0.11				
30-Sep-01	2.32	4.00	5.07	-0.21	-0.04	0.12	30-Sep-01	-0.07	0.23	-0.05	3.81	1.84	-0.32				
30-Jun-01	3.72	5.04	5.74	0.42	0.49	0.52	30-Jun-01	0.83	0.06	-0.02	4.85	1.31	-0.24				
31-Mar-01	4.36	4.67	5.29	0.71	0.30	0.25	31-Mar-01	0.72	-0.37	-0.08	4.78	0.47	-0.43				
31-Dec-00	5.94	5.06	5.35	1.43	0.50	0.29	31-Dec-00	1.27	-0.87	-0.13	5.44	-0.67	-0.55				
30-Sep-00	6.34	5.82	6.00	1.61	0.89	0.67	30-Sep-00	1.82	-0.72	-0.08	6.05	-0.48	-0.42				
30-Jun-00	5.91	6.18	6.21	1.42	1.07	0.79	30-Jun-00	1.89	-0.47	0.04	6.10	0.05	-0.15				
31-Mar-00	6.22	6.23	6.22	1.56	1.10	0.81	31-Mar-00	1.99	-0.57	0.02	6.23	-0.18	-0.19				
31-Dec-99	5.53	6.41	6.66	1.24	1.19	1.07	31-Dec-99	2.02	-0.15	0.02	6.21	0.66	-0.13				
30-Sep-99	5.03	5.89	6.21	1.02	0.93	0.79	30-Sep-99	1.58	-0.18	0.02	5.72	0.69	-0.16				
30-Jun-99	4.95	5.74	6.06	0.98	0.85	0.71	30-Jun-99	1.46	-0.21	0.02	5.59	0.64	-0.17				
31-Mar-99	4.72	5.22	5.56	0.88	0.59	0.41	31-Mar-99	1.08	-0.35	0.01	5.17	0.45	-0.24				
31-Dec-98	4.45	4.67	5.01	0.76	0.30	0.08	31-Dec-98	0.65	-0.50	0.00	4.71	0.24	-0.29				
30-Sep-98	4.48	4.34	4.64	0.77	0.13	-0.14	30-Sep-98	0.									

TAB: PCA CALCULATOR

A. Inputs and Calculator:

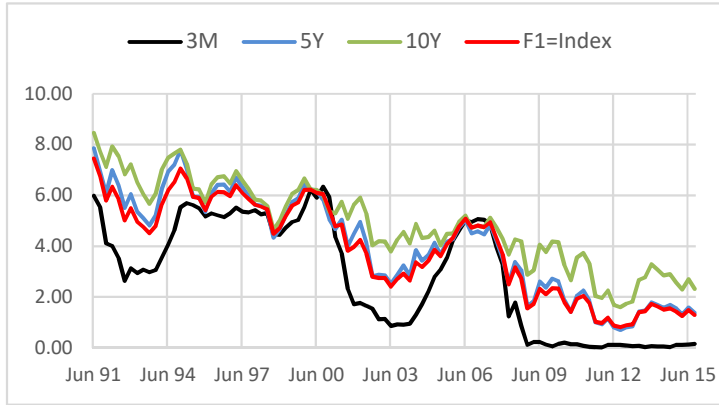
Abbreviation	Dim	Calculator object	Description	Parameter	Date	Row index
X	3 x n	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Data	End date	30-Sep-15	1
PCA		jmathkr.lib.stats.basic.calc.PCA@Mon, 25 Dec	PCA calculator	Start date	30-Jun-91	98
Omega, Ω	3 x 3	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Data covariance matrix	Numbr of lags (p)		1
eig-values, Λ	1 x 3	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Eigen-values	Number of variables		3
eig-vectors, V	3 x 3	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Eigen-vectors	Sample size		98
I	3 x 3	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Eigen-vector test: $V \times V^T = I$	Total number of observations		98
$O = V \times X$	3 x n	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Data transformation into orthogonal system			
$O O^T = \Lambda$	3 x 3	java.util.ArrayList@Mon, 25 Dec 2017 13:28:3	Test: $O \times O^T = \Lambda$			

B. Output

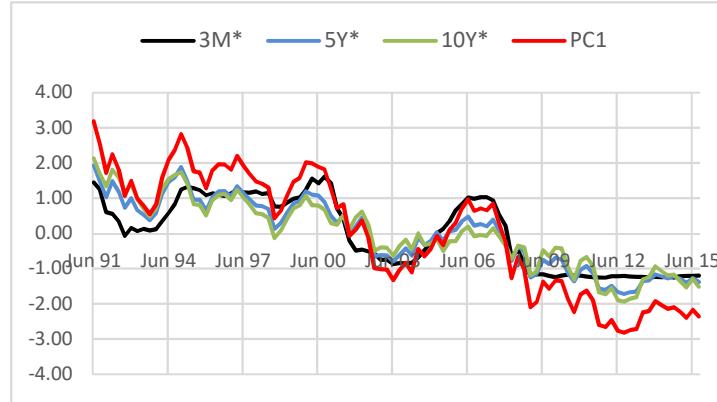
Omega, Ω	3M	5Y	10Y	Comments	Test: $V^T \Lambda V = \Omega$ $V^T \Lambda V$	1			$O O^T = \Lambda$		
						3M	5Y	10Y	3M	5Y	10Y
3M	0.99	0.90	0.80		3M	0.99	0.90	0.80	2.77	0.00	0.00
5Y	0.90	0.99	0.97		5Y	0.90	0.99	0.97	0.00	0.20	0.00
10Y	0.80	0.97	0.99		10Y	0.80	0.97	0.99	0.00	0.00	0.00
Λ	3M	5Y	10Y	$\sqrt{(\max / \min)}$		3M	5Y	10Y			
eig-values	2.77	0.20	0.00	29.88	93.3% of variance is explained by first component	explained var	93.3%	6.6%	0.1%		
eig-vectors, V	3M	5Y	10Y	SUM		V^T	3M	5Y	10Y		
3M	0.56	0.60	0.58	1.73	The line presents the index of the main component	3M	0.56	-0.79	-0.25		
5Y	-0.79	0.17	0.59	-0.03		5Y	0.60	0.17	0.78		
10Y	-0.25	0.78	-0.57	-0.03		10Y	0.58	0.59	-0.57		
Test: $V V^T = I$	3M	5Y	10Y			$V^T \times \Lambda$	3M	5Y	10Y		
3M	1.00	0.00	0.00			3M	1.55	-0.15	0.00		
5Y	0.00	1.00	0.00			5Y	1.65	0.03	0.00		
10Y	0.00	0.00	1.00			10Y	1.60	0.11	0.00		

TAB: CHARTS

Variables and Index



Normalized variables and main principal component



Second and third principal components

