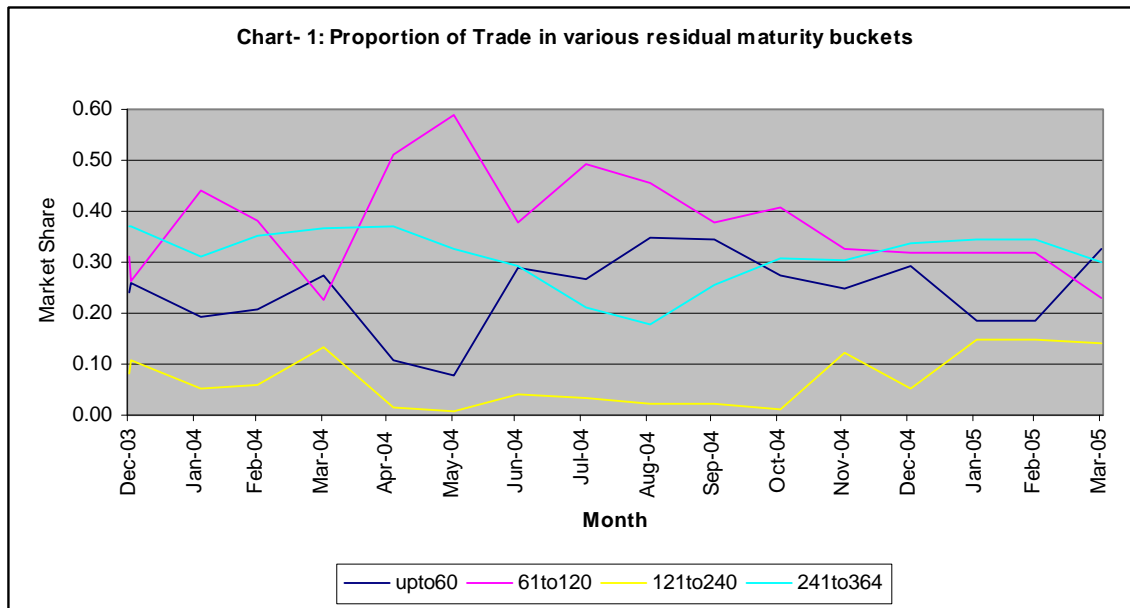


Developing a Treasury-bills Index in Indian Market

Golaka C Nath¹

The T-bills index aims to capture portfolio returns when a certain sum is invested in the short term instruments. The short term instruments have been gaining importance as market participants are increasingly using these instruments for their treasury operations. In 2002-03, the T-bills constituted only 3.48% of the total outright trade in the market but in 2004-05, the same increased substantially to 21.75%. In the beginning of the current fiscal, the T-bills trading activity has seen substantial growth and constitutes about 47% of the total trading till April 25th, 2005. The increasing activity at the shorter-end of the market highlights the importance of T-bills in the current scenario. However, the market reality is that all sub-time bucket segments of the short term market are not equally liquid. The CCIL T-bills indices are instruments that would capture the market movement in short term maturity segment. The trading concentration on the residual maturity bucket of 121 to 240days is the least followed by 1 to 60days residual maturity bucket. The market concentrates more on 61 to 120days. The Chart-1 shows the market share of various residual maturity buckets in trading.



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Table-1 gives the trading behaviour of T-bills in various residual maturity buckets. It can be observed that the residual bucket of 121 to 240 days is illiquid. This may be due to the absence of an appropriate benchmark like 182-day T-bills in Indian market. However, with the re-introduction of 182-day T-bills in the market, the liquidity of this bucket is likely to change. Hence, an ideal T-bills index should incorporate liquidity issues in construction.

Residual Maturity Buckets	Market Share in proportion
1 to 60days	0.2471
61 to 120days	0.3725
121 to 240days	0.0719
241 to 364days	0.3084
Total	1.0000

It would be worthwhile to compute T-bills indices on two accepted principles: (1) taking liquidity into consideration which would mean an uneven duration for the index; and (2) a fixed duration index. A fixed duration index would provide equal weightage to all residual maturity buckets and hence would not take into account the liquidity aspect of the market. However, market participants may have use of the same to compare the performance of portfolio against certain benchmarks. Hence, it is proposed to construct two T-bills indices – CCIL EQUAL WEIGHT T-bills INDEX and CCIL LIQUIDITY WEIGHT T-bills INDEX.

METHODOLOGY:

The CCIL T-bills index is a total return index. The index is based on actual T-bills trades' information with individual trades of Rs.50million or more in face value. The index is based on 5 distinct sub-segments in terms of maturity buckets – (1) less than equal to 60 days; (2) between 61 and 120 days; (3) between 121 and 240 days and (4) between 241 and 360 days and (5) 361 to 364days. The last bucket has been included to provide representation to the longer end of the maturity bucket in T-bills. The 364day T-bills are traded vigorously on auction days and constitute about 5.90% of the total trading during

Jan'04 to March'05. The nearest long dated T-bill traded in substantial quantity are T-bills having residual maturity of 361days (with 1.67% of market share). Hence the CCIL T-bills index proposed to use the midpoint of the first 4 time buckets and a fixed point of 361day as the maturity of the benchmark T-bills. The T-bills yields/prices of 30days, 90days, 180days, 300days and 361days residual maturities would be used in the construction of the index. CCIL EQUAL WEIGHT T-bills INDEX will always have duration of 192days. For the first 4 residual maturity buckets, the prices used in the index are volume weighted average prices of the benchmark T-bills and if trades are executed on instruments having the exact residual maturities cited above, the prices are used for computation of the index. If the trades are not executed for exact residual maturity in a time bucket, then linear interpolation is used to find out the appropriate trade price of the synthetic T-bill of appropriate maturity as given above. However, the interpolation method is used when two yield/price points are available within a particular time bucket. If two yield/price points in a time bucket are not available then, we use CCIL ZCYC prices/yields for the synthetic T-bills of requisite maturities. However, for the 361-day residual maturity benchmark, we use intrapolation/extrapolation method for extracting the price using the two nearest price/yield points. The computation is done duly removing the effect of outliers. For computation of yield, we use the market convention of Actual/365. The index is calculated with a base value of 100 as on 01-Jan-2004 and the same is a Total Return Index and is given by:

$$I_t = I_{t-1} * (1 + TR_t)$$

where TR_t is the total return of the day t and I_{t-1} is the Index on day $t-1$. The total return is calculated from the components. In each component, Total return has two components – the investment yield for the day assuming holding for the day [(redemption price – T-bills price)/T-bills price * number of days] and market return due to change in price as we move from day $t-1$ to day t ($P_t - P_{t-1}/P_{t-1}$).

LIQUIDITY:

As seen in the Chart-1, liquidity among the various maturity buckets is not same. Some maturity buckets are more liquid and some are less. Hence while designing a robust index, liquidity criteria should be incorporated. We consider trading volume as the

liquidity criteria. Each bucket has been assigned weight on the basis of last months trading volume. The weights are rebalanced every month. The price of the composite T-bill is arrived through the weighting scheme – the price of the T-bill of a given residual maturity multiplied by weight assigned to the respective time bucket. The trading behaviour clearly shows high concentration on maturity buckets of 91days followed by 364days. Annexure A gives us the trading behaviour in terms of residual maturities. CCIL LIQUIDITY WEIGHT T-bills INDEX would use liquidity measured by proportion of trading volume as the weight.

DATA:

The CCIL T-bills index will use all T-bills reported to Negotiated Dealing System (NDS) of Reserve Bank of India. All deals in T-bills with a face value of Rs.50million and above would be used for finding out the weighted yield/price. Smaller lots have been kept out to ensure the representative prices go into the computation of the index. The index time series is available from Jan 1, 2004.

CCIL T-bills INDEX:

The CCIL T-bills index movement is plotted in Chart-2.

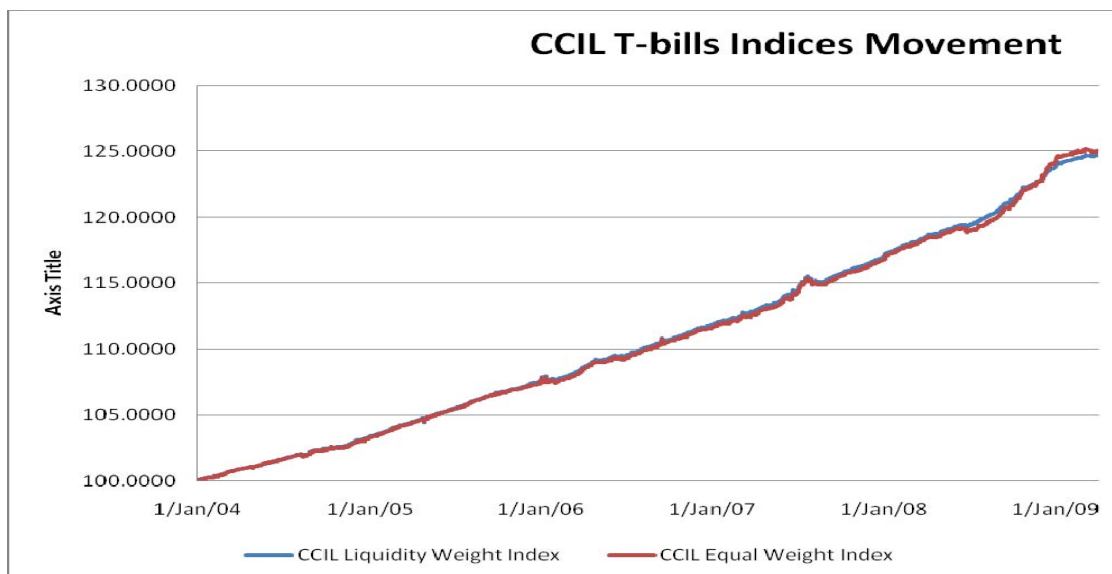


Table – 2 gives the return of the indices during 2004 to 2006.

Year	CCIL Liquidity Weight Index	CCIL Equal Weight Index
2004	3.34%	3.26%
2005	4.07%	4.01%
2006	3.95%	3.92%

Days to Maturity	Amount (Rs. Million)	Percentage of Total trades during the Period	Cummulative Percentage
91	428962.40	15.8391	15.84
364	159853.78	5.9025	21.74
88	70769.83	2.6131	24.35
87	65051.30	2.4020	26.76
86	50751.98	1.8740	28.63
361	45352.23	1.6746	30.31
359	40795.00	1.5063	31.81
85	35346.03	1.3051	33.12
90	32952.03	1.2167	34.33
360	29568.28	1.0918	35.43
84	27514.50	1.0160	36.44
3	25677.48	0.9481	37.39
2	25517.63	0.9422	38.33
358	25266.63	0.9329	39.26
357	24090.45	0.8895	40.15
1	23474.58	0.8668	41.02
353	23250.45	0.8585	41.88
363	20009.08	0.7388	42.62
4	19632.48	0.7249	43.34
79	18905.45	0.6981	44.04
72	18830.85	0.6953	44.74
10	18011.00	0.6650	45.40
352	18003.60	0.6648	46.07
78	17781.60	0.6566	46.72
351	17561.28	0.6484	47.37
36	17557.73	0.6483	48.02
354	17533.23	0.6474	48.67
59	17511.85	0.6466	49.31
57	16797.05	0.6202	49.93
23	16640.63	0.6144	50.55
15	16365.05	0.6043	51.15
89	16306.00	0.6021	51.75
45	16248.85	0.6000	52.35
8	15928.10	0.5881	52.94
80	15855.08	0.5854	53.53
77	15774.30	0.5825	54.11
35	15672.00	0.5787	54.69

7	15537.83	0.5737	55.26
71	15405.95	0.5689	55.83
37	15371.70	0.5676	56.40
64	15247.48	0.5630	56.96
343	15235.00	0.5625	57.52
14	15089.45	0.5572	58.08
9	14606.00	0.5393	58.62
81	14481.95	0.5347	59.16
56	14323.45	0.5289	59.68
66	14280.35	0.5273	60.21
18	13877.83	0.5124	60.72
65	13812.03	0.5100	61.23
39	13667.73	0.5047	61.74
42	13533.50	0.4997	62.24
70	13321.38	0.4919	62.73
22	13293.53	0.4909	63.22
29	13169.40	0.4863	63.71
24	13167.10	0.4862	64.19
63	13104.08	0.4839	64.68
60	12919.95	0.4771	65.16
345	12838.30	0.4740	65.63
31	12816.10	0.4732	66.10
16	12732.28	0.4701	66.57
51	12689.20	0.4685	67.04
25	12640.00	0.4667	67.51
11	12538.45	0.4630	67.97
43	12500.00	0.4616	68.43
17	12491.90	0.4613	68.89
73	12057.13	0.4452	69.34
344	11969.38	0.4420	69.78
21	11675.20	0.4311	70.21
74	11652.05	0.4302	70.64
52	11400.93	0.4210	71.06
356	11272.60	0.4162	71.48
30	11225.98	0.4145	71.89
339	10840.03	0.4003	72.29
28	10816.88	0.3994	72.69
67	10230.00	0.3777	73.07
340	10174.18	0.3757	73.45
49	10018.43	0.3699	73.82
58	9802.40	0.3619	74.18
333	9730.00	0.3593	74.54
53	9672.30	0.3571	74.90
46	9599.00	0.3544	75.25
38	9544.88	0.3524	75.60
32	9432.73	0.3483	75.95
337	9060.18	0.3345	76.28
362	8783.23	0.3243	76.61

83	8685.00	0.3207	76.93
338	8353.00	0.3084	77.24
62	8132.45	0.3003	77.54
44	7969.63	0.2943	77.83
350	7661.50	0.2829	78.12
332	7350.00	0.2714	78.39
329	7280.00	0.2688	78.66
330	6903.40	0.2549	78.91
324	6824.78	0.2520	79.16
325	6735.00	0.2487	79.41
41	6726.48	0.2484	79.66
304	6689.28	0.2470	79.91
303	6618.50	0.2444	80.15
261	6423.50	0.2372	80.39
6	6358.03	0.2348	80.62
69	6150.00	0.2271	80.85
50	6000.00	0.2215	81.07
275	5981.60	0.2209	81.29
323	5941.75	0.2194	81.51
346	5894.13	0.2176	81.73
318	5800.00	0.2142	81.94
297	5757.80	0.2126	82.16
336	5669.40	0.2093	82.37
347	5634.58	0.2081	82.57
342	5358.00	0.1978	82.77
309	5300.00	0.1957	82.97
331	5265.35	0.1944	83.16
48	5262.60	0.1943	83.36
319	5200.00	0.1920	83.55
316	5179.43	0.1912	83.74
27	5024.25	0.1855	83.92
231	5010.20	0.1850	84.11
268	4963.15	0.1833	84.29
315	4893.10	0.1807	84.47
281	4750.00	0.1754	84.65
5	4606.30	0.1701	84.82
13	4597.00	0.1697	84.99
310	4590.00	0.1695	85.16
134	4500.00	0.1662	85.32
249	4490.00	0.1658	85.49
305	4401.73	0.1625	85.65
197	4400.00	0.1625	85.82
274	4400.00	0.1625	85.98
301	4318.20	0.1594	86.14
123	4200.00	0.1551	86.29
226	4144.00	0.1530	86.45
253	4142.50	0.1530	86.60
296	4082.58	0.1507	86.75

287	4050.00	0.1495	86.90
155	4023.20	0.1486	87.05
308	3994.78	0.1475	87.19
276	3953.08	0.1460	87.34
169	3929.25	0.1451	87.49
312	3846.18	0.1420	87.63
225	3836.40	0.1417	87.77
99	3800.00	0.1403	87.91
227	3790.00	0.1399	88.05
203	3770.00	0.1392	88.19
335	3750.00	0.1385	88.33
93	3730.00	0.1377	88.47
76	3568.68	0.1318	88.60
295	3565.00	0.1316	88.73
212	3550.00	0.1311	88.86
34	3383.53	0.1249	88.98
273	3362.48	0.1242	89.11
246	3350.00	0.1237	89.23
317	3326.80	0.1228	89.36
170	3310.00	0.1222	89.48
288	3300.00	0.1218	89.60
143	3290.00	0.1215	89.72
234	3200.00	0.1182	89.84
106	3178.90	0.1174	89.96
294	3174.50	0.1172	90.07
189	3150.00	0.1163	90.19
211	3150.00	0.1163	90.31
248	3120.00	0.1152	90.42
280	3062.48	0.1131	90.53
20	3058.60	0.1129	90.65
326	3000.00	0.1108	90.76
199	2950.00	0.1089	90.87
220	2950.00	0.1089	90.98
322	2893.88	0.1069	91.08
267	2865.48	0.1058	91.19
121	2850.00	0.1052	91.29
311	2770.10	0.1023	91.40
196	2770.00	0.1023	91.50
254	2762.48	0.1020	91.60
235	2750.00	0.1015	91.70
282	2715.48	0.1003	91.80
55	2712.43	0.1002	91.90
135	2550.00	0.0942	92.00
158	2500.00	0.0923	92.09
283	2495.00	0.0921	92.18
82	2489.65	0.0919	92.27
101	2460.00	0.0908	92.36
247	2452.20	0.0905	92.45

33	2416.88	0.0892	92.54
171	2400.00	0.0886	92.63
256	2400.00	0.0886	92.72
213	2371.90	0.0876	92.81
145	2350.00	0.0868	92.90
270	2350.00	0.0868	92.98
284	2350.00	0.0868	93.07
149	2345.63	0.0866	93.16
185	2343.68	0.0865	93.24
328	2305.00	0.0851	93.33
277	2300.00	0.0849	93.41
290	2298.08	0.0849	93.50
221	2290.00	0.0846	93.58
217	2286.50	0.0844	93.67
298	2273.68	0.0840	93.75
262	2268.10	0.0837	93.83
168	2253.00	0.0832	93.92
148	2250.00	0.0831	94.00
206	2250.00	0.0831	94.08
137	2230.00	0.0823	94.17
241	2209.10	0.0816	94.25
165	2200.00	0.0812	94.33
286	2200.00	0.0812	94.41
355	2200.00	0.0812	94.49
204	2181.73	0.0806	94.57
259	2172.68	0.0802	94.65
198	2150.00	0.0794	94.73
314	2135.55	0.0789	94.81
244	2106.80	0.0778	94.89
156	2100.00	0.0775	94.96
191	2100.00	0.0775	95.04
190	2067.68	0.0763	95.12
245	2050.00	0.0757	95.19
238	2013.23	0.0743	95.27
182	2000.00	0.0738	95.34
239	1990.28	0.0735	95.42
266	1976.80	0.0730	95.49
349	1953.13	0.0721	95.56
252	1950.00	0.0720	95.63
40	1925.33	0.0711	95.70
167	1900.00	0.0702	95.77
183	1900.00	0.0702	95.84
240	1900.00	0.0702	95.91
219	1867.10	0.0689	95.98
140	1833.45	0.0677	96.05
289	1833.20	0.0677	96.12
157	1830.00	0.0676	96.19
128	1800.00	0.0665	96.25

228	1800.00	0.0665	96.32
163	1787.85	0.0660	96.39
255	1750.00	0.0646	96.45
129	1730.00	0.0639	96.51
147	1730.00	0.0639	96.58
181	1700.00	0.0628	96.64
232	1700.00	0.0628	96.70
233	1680.00	0.0620	96.77
98	1662.00	0.0614	96.83
178	1650.00	0.0609	96.89
133	1600.00	0.0591	96.95
150	1600.00	0.0591	97.01
299	1600.00	0.0591	97.07
192	1550.00	0.0572	97.12
127	1531.33	0.0565	97.18
216	1517.70	0.0560	97.23
105	1500.00	0.0554	97.29
186	1500.00	0.0554	97.35
263	1500.00	0.0554	97.40
292	1500.00	0.0554	97.46
184	1460.00	0.0539	97.51
92	1450.00	0.0535	97.56
119	1450.00	0.0535	97.62
205	1420.00	0.0524	97.67
142	1370.00	0.0506	97.72
269	1352.60	0.0499	97.77
113	1350.00	0.0498	97.82
291	1350.00	0.0498	97.87
302	1350.00	0.0498	97.92
160	1330.00	0.0491	97.97
321	1330.00	0.0491	98.02
141	1328.08	0.0490	98.07
242	1280.00	0.0473	98.11
136	1250.00	0.0462	98.16
130	1241.33	0.0458	98.21
200	1217.00	0.0449	98.25
107	1208.45	0.0446	98.30
174	1200.00	0.0443	98.34
175	1200.00	0.0443	98.38
94	1162.00	0.0429	98.43
144	1150.00	0.0425	98.47
172	1150.00	0.0425	98.51
210	1150.00	0.0425	98.55
122	1125.00	0.0415	98.60
177	1100.00	0.0406	98.64
307	1100.00	0.0406	98.68
132	1078.45	0.0398	98.72
54	1050.00	0.0388	98.76

47	1020.00	0.0377	98.79
202	1000.00	0.0369	98.83
126	986.35	0.0364	98.87
179	950.00	0.0351	98.90
260	950.00	0.0351	98.94
300	950.00	0.0351	98.97
218	930.00	0.0343	99.01
223	911.38	0.0337	99.04
108	900.00	0.0332	99.07
109	900.00	0.0332	99.11
188	860.00	0.0318	99.14
258	860.00	0.0318	99.17
162	839.25	0.0310	99.20
153	800.00	0.0295	99.23
208	800.00	0.0295	99.26
313	750.00	0.0277	99.29
115	731.25	0.0270	99.32
12	700.00	0.0258	99.34
176	700.00	0.0258	99.37
306	700.00	0.0258	99.39
193	664.68	0.0245	99.42
114	650.00	0.0240	99.44
146	610.00	0.0225	99.46
19	600.00	0.0222	99.49
97	600.00	0.0222	99.51
279	600.00	0.0222	99.53
120	590.00	0.0218	99.55
224	580.00	0.0214	99.57
95	550.00	0.0203	99.59
104	550.00	0.0203	99.61
112	550.00	0.0203	99.63
230	550.00	0.0203	99.65
116	548.83	0.0203	99.67
26	533.78	0.0197	99.69
96	500.00	0.0185	99.71
100	500.00	0.0185	99.73
207	500.00	0.0185	99.75
285	500.00	0.0185	99.77
61	450.00	0.0166	99.79
209	400.00	0.0148	99.80
214	400.00	0.0148	99.81
293	400.00	0.0148	99.83
251	360.00	0.0133	99.84
243	350.00	0.0129	99.86
111	343.08	0.0127	99.87
334	340.00	0.0126	99.88
161	300.00	0.0111	99.89
272	300.00	0.0111	99.90

125	250.00	0.0092	99.91
222	250.00	0.0092	99.92
250	250.00	0.0092	99.93
264	250.00	0.0092	99.94
154	200.00	0.0074	99.95
278	176.03	0.0065	99.95
139	150.00	0.0055	99.96
164	150.00	0.0055	99.96
194	150.00	0.0055	99.97
195	150.00	0.0055	99.98
265	150.00	0.0055	99.98
102	100.00	0.0037	99.99
118	100.00	0.0037	99.99
237	100.00	0.0037	99.99
320	100.00	0.0037	100.00
151	50.00	0.0018	100.00
348	50.00	0.0018	100.00
Total	2708252.50	100.0000	