

## Project – Explore Weather Trends

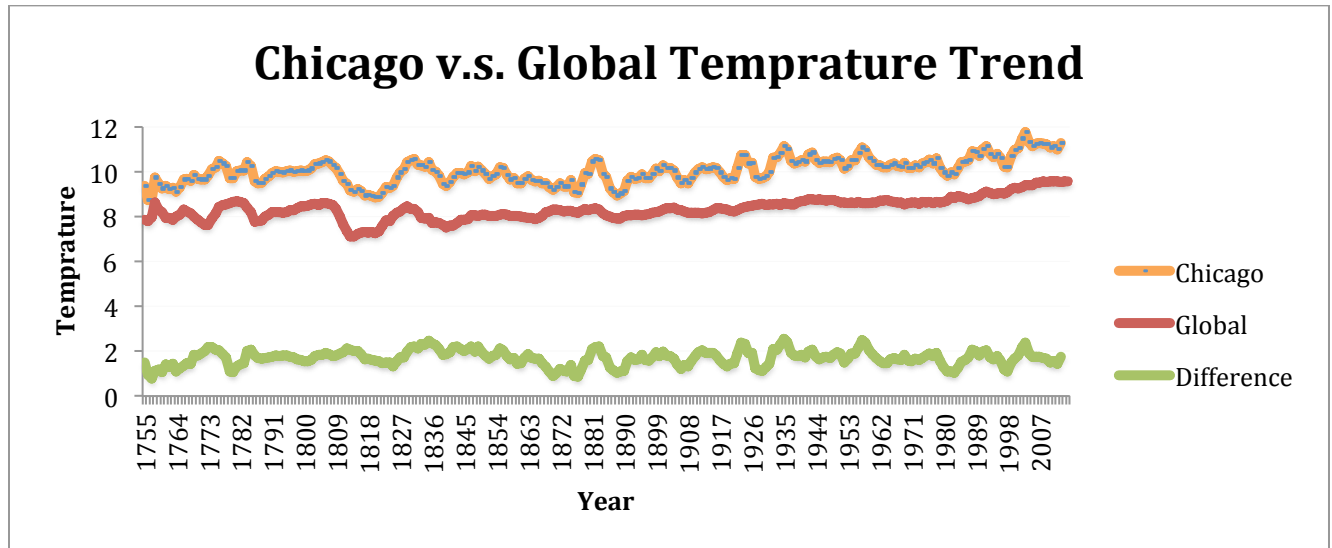
### Outline

1. Write a SQL query to make sure the city list contains my living city  

```
SELECT *  
FROM city_list  
WHERE city = 'Chicago';
```
2. Write SQL queries to retrieve the data temperature data from global\_data and city\_data respectively  

```
SELECT *  
FROM city_data  
WHERE city = 'Chicago';  
SELECT *  
FROM global_data;
```
3. Open the two CSVs using Excel and combine them into one sheet with the same year at one row
4. Since Chicago's annual temperature was recorded starting from 1743 but no record in 1746-1749, while Global annual temperature started from 1750, therefore I choose to disregard the records of Chicago from 1743 to 1745 but use both records starting from 1750.
5. Then, I decide to calculate 5-year average to show temperature trends. Using the moving average rather than the yearly averages would smooth out the lines, making trends more observable. I choose 5-year since I believe it is a reasonable period to show the change, if applicable. (Worksheet attached)
6. To visualize and compare the temperature trend of Chicago and Global since 1750, I use the line chart in Excel to put two series on the same timeline, starting from 1755, which is the first year that can calculate a meaningful 5-year average temperature data. Since using 5-year average, the horizontal axis also uses 5-year as the major interval.
7. To put two series on the same timeline, it would be easier to observe the similarities and differences between the trends of two lines. I also add another column to calculate the difference between Chicago and Global temperatures each year and add that series called 'Difference' to make it more easily to observe.

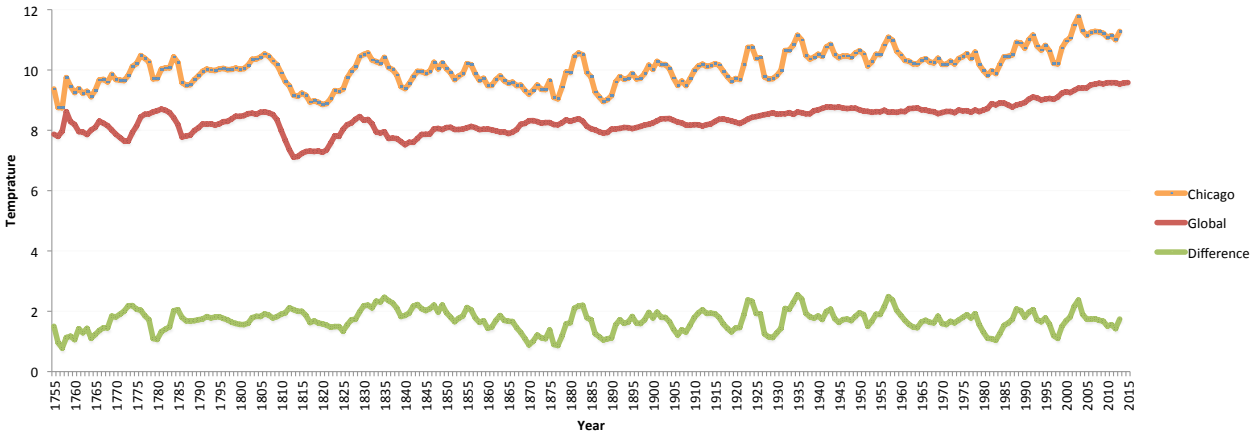
## Line Chart & Observations



(Line Chart PDF also attached)

1. The moving average temperature of Chicago is always higher than the moving average of Global temperature, but the difference has not been consistent over time, as the Difference line shows fluctuation.
2. From 1750 to 1840, the trends between Chicago and Global are similar, especially between 1790 and 1810, both have stable and slow increasing trends and then experiencing a sharp decline around 1810-1813, which is also reflected as the flatter Difference line during that period.
3. After 1840, the two lines demonstrate different volatility. The moving average temperature of Chicago is more volatile than the Global.
4. Overall, both Chicago and Global lines show an increasing trend, which represents an overall hotter environment. However, the increasing trend is not consistent all the time. After 1980, both Chicago and Global temperatures started to quickly increase in a short time, which are reflected as the steeper lines after 1980.

Chicago v.s. Global Temperature Trend



year	city	country	city_avg_temp	5-year average	year	global_avg_temp	5-year average	Difference
1743	Chicago	United States	5.44					
1744	Chicago	United States	11.73					
1745	Chicago	United States	1.8					
1746	Chicago	United States						
1747	Chicago	United States						
1748	Chicago	United States						
1749	Chicago	United States						
1750	Chicago	United States	10.49		1750	8.72		
1751	Chicago	United States	11.19		1751	7.98		
1752	Chicago	United States	4.5		1752	5.78		
1753	Chicago	United States	10.04		1753	8.39		
1754	Chicago	United States	10.64		1754	8.47		
1755	Chicago	United States	7.41	9.372	1755	8.36	7.868	1.504
1756	Chicago	United States	11.15	8.756	1756	8.85	7.796	0.96
1757	Chicago	United States	9.5	8.748	1757	9.02	7.97	0.778
1758	Chicago	United States	8.61	9.748	1758	6.74	8.618	1.13
1759	Chicago	United States	9.59	9.462	1759	7.99	8.288	1.174
1760	Chicago	United States	8.05	9.252	1760	7.19	8.192	1.06
1761	Chicago	United States	10.4	9.38	1761	8.77	7.958	1.422
1762	Chicago	United States	9.82	9.23	1762	8.61	7.942	1.288
1763	Chicago	United States	7.72	9.294	1763	7.5	7.86	1.434
1764	Chicago	United States	10.63	9.116	1764	8.4	8.012	1.104
1765	Chicago	United States	9.78	9.324	1765	8.25	8.094	1.23
1766	Chicago	United States	10.49	9.67	1766	8.41	8.306	1.364
1767	Chicago	United States	9.41	9.688	1767	8.22	8.234	1.454
1768	Chicago	United States	8.95	9.606	1768	6.78	8.156	1.45
1769	Chicago	United States	9.79	9.852	1769	7.69	8.012	1.84
1770	Chicago	United States	9.66	9.684	1770	7.69	7.87	1.814
1771	Chicago	United States	10.44	9.66	1771	7.85	7.758	1.902
1772	Chicago	United States	10.27	9.65	1772	8.19	7.646	2.004
1773	Chicago	United States	10.42	9.822	1773	8.22	7.64	2.182
1774	Chicago	United States	10.27	10.116	1774	8.77	7.928	2.188
1775	Chicago	United States	10.99	10.212	1775	9.18	8.144	2.068
1776	Chicago	United States	9.98	10.478	1776	8.3	8.442	2.036
1777	Chicago	United States	9.67	10.386	1777	8.26	8.532	1.854
1778	Chicago	United States	7.63	10.266	1778	8.54	8.546	1.72
1779	Chicago	United States	10.32	9.708	1779	8.98	8.61	1.098
1780	Chicago	United States	12.54	9.718	1780	9.43	8.652	1.066
1781	Chicago	United States	10.18	10.028	1781	8.1	8.702	1.326
1782	Chicago	United States	9.69	10.068	1782	7.9	8.662	1.406
1783	Chicago	United States	9.44	10.072	1783	7.68	8.59	1.482
1784	Chicago	United States	9.4	10.434	1784	7.86	8.418	2.016
1785	Chicago	United States	9.2	10.25	1785	7.36	8.194	2.056
1786	Chicago	United States	9.75	9.582	1786	8.26	7.78	1.802
1787	Chicago	United States	9.78	9.496	1787	8.03	7.812	1.684
1788	Chicago	United States	10.28	9.514	1788	8.45	7.838	1.676
1789	Chicago	United States	10.03	9.682	1789	8.33	7.992	1.69
1790	Chicago	United States	9.93	9.808	1790	7.98	8.086	1.722
1791	Chicago	United States	10.12	9.954	1791	8.23	8.21	1.744
1792	Chicago	United States	9.62	10.028	1792	8.09	8.204	1.824
1793	Chicago	United States	10.2	9.996	1793	8.23	8.216	1.78
1794	Chicago	United States	10.3	9.98	1794	8.53	8.172	1.808
1795	Chicago	United States	10.01	10.034	1795	8.35	8.212	1.822
1796	Chicago	United States	9.92	10.05	1796	8.27	8.286	1.764
1797	Chicago	United States	9.66	10.01	1797	8.51	8.294	1.716

1798	Chicago	United States	10.43	10.018	1798	8.67	8.378	1.64
1799	Chicago	United States	10.11	10.064	1799	8.51	8.466	1.598
1800	Chicago	United States	10.11	10.026	1800	8.48	8.462	1.564
1801	Chicago	United States	10.47	10.046	1801	8.59	8.488	1.558
1802	Chicago	United States	10.66	10.156	1802	8.58	8.552	1.604
1803	Chicago	United States	10.48	10.356	1803	8.5	8.566	1.79
1804	Chicago	United States	10.41	10.366	1804	8.84	8.532	1.834
1805	Chicago	United States	10.63	10.426	1805	8.56	8.598	1.828
1806	Chicago	United States	10.1	10.53	1806	8.43	8.614	1.916
1807	Chicago	United States	9.88	10.456	1807	8.28	8.582	1.874
1808	Chicago	United States	9.84	10.3	1808	7.63	8.522	1.778
1809	Chicago	United States	9.04	10.172	1809	7.08	8.348	1.824
1810	Chicago	United States	9.22	9.898	1810	6.92	7.996	1.902
1811	Chicago	United States	9.37	9.616	1811	6.86	7.668	1.948
1812	Chicago	United States	8.34	9.47	1812	7.05	7.354	2.116
1813	Chicago	United States	9.67	9.162	1813	7.74	7.108	2.054
1814	Chicago	United States	9.55	9.128	1814	7.59	7.13	1.998
1815	Chicago	United States	8.86	9.23	1815	7.24	7.232	1.998
1816	Chicago	United States	8.27	9.158	1816	6.94	7.296	1.862
1817	Chicago	United States	8.54	8.938	1817	6.98	7.312	1.626
1818	Chicago	United States	9.42	8.978	1818	7.83	7.298	1.68
1819	Chicago	United States	9.19	8.928	1819	7.37	7.316	1.612
1820	Chicago	United States	9.02	8.856	1820	7.62	7.272	1.584
1821	Chicago	United States	9.08	8.888	1821	8.09	7.348	1.54
1822	Chicago	United States	9.87	9.05	1822	8.19	7.578	1.472
1823	Chicago	United States	9.31	9.316	1823	7.72	7.82	1.496
1824	Chicago	United States	9.57	9.294	1824	8.55	7.798	1.496
1825	Chicago	United States	10.87	9.37	1825	8.39	8.034	1.336
1826	Chicago	United States	10.19	9.74	1826	8.36	8.188	1.552
1827	Chicago	United States	10.58	9.962	1827	8.81	8.242	1.72
1828	Chicago	United States	11	10.104	1828	8.17	8.366	1.738
1829	Chicago	United States	9.94	10.442	1829	7.94	8.456	1.986
1830	Chicago	United States	11.11	10.516	1830	8.52	8.334	2.182
1831	Chicago	United States	9.02	10.564	1831	7.64	8.36	2.204
1832	Chicago	United States	10.33	10.33	1832	7.45	8.216	2.114
1833	Chicago	United States	10.7	10.28	1833	8.01	7.944	2.336
1834	Chicago	United States	10.92	10.22	1834	8.15	7.912	2.308
1835	Chicago	United States	9.44	10.416	1835	7.39	7.954	2.462
1836	Chicago	United States	8.68	10.082	1836	7.7	7.728	2.354
1837	Chicago	United States	9.42	10.014	1837	7.38	7.74	2.274
1838	Chicago	United States	8.81	9.832	1838	7.51	7.726	2.106
1839	Chicago	United States	10.57	9.454	1839	7.63	7.626	1.828
1840	Chicago	United States	10.24	9.384	1840	7.8	7.522	1.862
1841	Chicago	United States	9.83	9.544	1841	7.69	7.604	1.94
1842	Chicago	United States	10.32	9.774	1842	8.02	7.602	2.172
1843	Chicago	United States	8.78	9.954	1843	8.17	7.73	2.224
1844	Chicago	United States	10.28	9.948	1844	7.65	7.862	2.086
1845	Chicago	United States	10.6	9.89	1845	7.85	7.866	2.024
1846	Chicago	United States	11.29	9.962	1846	8.55	7.876	2.086
1847	Chicago	United States	9.23	10.254	1847	8.09	8.048	2.206
1848	Chicago	United States	9.77	10.036	1848	7.98	8.062	1.974
1849	Chicago	United States	9.34	10.234	1849	7.98	8.024	2.21
1850	Chicago	United States	9.89	10.046	1850	7.9	8.09	1.956
1851	Chicago	United States	10.17	9.904	1851	8.18	8.1	1.804
1852	Chicago	United States	9.82	9.68	1852	8.1	8.026	1.654
1853	Chicago	United States	10.21	9.798	1853	8.04	8.028	1.77

1854	Chicago	United States	10.96	9.886	1854	8.21	8.04	1.846
1855	Chicago	United States	9.71	10.21	1855	8.11	8.086	2.124
1856	Chicago	United States	8.66	10.174	1856	8	8.128	2.046
1857	Chicago	United States	8.76	9.872	1857	7.76	8.092	1.78
1858	Chicago	United States	10.53	9.66	1858	8.1	8.024	1.636
1859	Chicago	United States	9.76	9.724	1859	8.25	8.036	1.688
1860	Chicago	United States	9.75	9.484	1860	7.96	8.044	1.44
1861	Chicago	United States	9.62	9.492	1861	7.85	8.014	1.478
1862	Chicago	United States	9.36	9.684	1862	7.56	7.984	1.7
1863	Chicago	United States	9.73	9.804	1863	8.11	7.944	1.86
1864	Chicago	United States	9.35	9.644	1864	7.98	7.946	1.698
1865	Chicago	United States	9.92	9.562	1865	8.18	7.892	1.67
1866	Chicago	United States	9.05	9.596	1866	8.29	7.936	1.66
1867	Chicago	United States	9.43	9.482	1867	8.44	8.024	1.458
1868	Chicago	United States	8.88	9.496	1868	8.25	8.2	1.296
1869	Chicago	United States	8.73	9.326	1869	8.43	8.228	1.098
1870	Chicago	United States	10.55	9.202	1870	8.2	8.318	0.884
1871	Chicago	United States	9.91	9.328	1871	8.12	8.322	1.006
1872	Chicago	United States	8.72	9.5	1872	8.19	8.288	1.212
1873	Chicago	United States	8.84	9.358	1873	8.35	8.238	1.12
1874	Chicago	United States	10.18	9.35	1874	8.43	8.258	1.092
1875	Chicago	United States	7.8	9.64	1875	7.86	8.258	1.382
1876	Chicago	United States	9.69	9.09	1876	8.08	8.19	0.9
1877	Chicago	United States	10.68	9.046	1877	8.54	8.182	0.864
1878	Chicago	United States	11.31	9.438	1878	8.83	8.252	1.186
1879	Chicago	United States	10.11	9.932	1879	8.17	8.348	1.584
1880	Chicago	United States	10.46	9.918	1880	8.12	8.296	1.622
1881	Chicago	United States	10.25	10.45	1881	8.27	8.348	2.102
1882	Chicago	United States	10.38	10.562	1882	8.13	8.386	2.176
1883	Chicago	United States	8.42	10.502	1883	7.98	8.304	2.198
1884	Chicago	United States	9.35	9.924	1884	7.77	8.134	1.79
1885	Chicago	United States	7.96	9.772	1885	7.92	8.054	1.718
1886	Chicago	United States	9.4	9.272	1886	7.95	8.014	1.258
1887	Chicago	United States	9.64	9.102	1887	7.91	7.95	1.152
1888	Chicago	United States	8.74	8.954	1888	8.09	7.906	1.048
1889	Chicago	United States	10.02	9.018	1889	8.32	7.928	1.09
1890	Chicago	United States	10.21	9.152	1890	7.97	8.038	1.114
1891	Chicago	United States	10.29	9.602	1891	8.02	8.048	1.554
1892	Chicago	United States	9.21	9.78	1892	8.07	8.062	1.718
1893	Chicago	United States	8.91	9.694	1893	8.06	8.094	1.6
1894	Chicago	United States	10.79	9.728	1894	8.16	8.088	1.64
1895	Chicago	United States	9.32	9.882	1895	8.15	8.056	1.826
1896	Chicago	United States	10.39	9.704	1896	8.21	8.092	1.612
1897	Chicago	United States	10.05	9.724	1897	8.29	8.13	1.594
1898	Chicago	United States	10.24	9.892	1898	8.18	8.174	1.718
1899	Chicago	United States	10.12	10.158	1899	8.4	8.198	1.96
1900	Chicago	United States	10.63	10.024	1900	8.5	8.246	1.778
1901	Chicago	United States	9.87	10.286	1901	8.54	8.316	1.97
1902	Chicago	United States	10.04	10.182	1902	8.3	8.382	1.8
1903	Chicago	United States	9.57	10.18	1903	8.22	8.384	1.796
1904	Chicago	United States	8.56	10.046	1904	8.09	8.392	1.654
1905	Chicago	United States	9.42	9.734	1905	8.23	8.33	1.404
1906	Chicago	United States	10.56	9.492	1906	8.38	8.276	1.216
1907	Chicago	United States	9.32	9.63	1907	7.95	8.244	1.386
1908	Chicago	United States	10.68	9.486	1908	8.19	8.174	1.312
1909	Chicago	United States	9.89	9.708	1909	8.18	8.168	1.54

1910	Chicago	United States	10.2	9.974	1910	8.22	8.186	1.788
1911	Chicago	United States	10.87	10.13	1911	8.18	8.184	1.946
1912	Chicago	United States	8.95	10.192	1912	8.17	8.144	2.048
1913	Chicago	United States	10.83	10.118	1913	8.3	8.188	1.93
1914	Chicago	United States	10.2	10.148	1914	8.59	8.21	1.938
1915	Chicago	United States	9.98	10.21	1915	8.59	8.292	1.918
1916	Chicago	United States	9.84	10.166	1916	8.23	8.366	1.8
1917	Chicago	United States	8.06	9.96	1917	8.02	8.376	1.584
1918	Chicago	United States	10.06	9.782	1918	8.13	8.346	1.436
1919	Chicago	United States	10.64	9.628	1919	8.38	8.312	1.316
1920	Chicago	United States	9.83	9.716	1920	8.36	8.27	1.446
1921	Chicago	United States	12.28	9.686	1921	8.57	8.224	1.462
1922	Chicago	United States	10.92	10.174	1922	8.41	8.292	1.882
1923	Chicago	United States	10.12	10.746	1923	8.42	8.37	2.376
1924	Chicago	United States	8.77	10.758	1924	8.51	8.428	2.33
1925	Chicago	United States	9.93	10.384	1925	8.53	8.454	1.93
1926	Chicago	United States	9.12	10.404	1926	8.73	8.488	1.916
1927	Chicago	United States	10.54	9.772	1927	8.52	8.52	1.252
1928	Chicago	United States	10.21	9.696	1928	8.63	8.542	1.154
1929	Chicago	United States	9.28	9.714	1929	8.24	8.584	1.13
1930	Chicago	United States	10.79	9.816	1930	8.63	8.53	1.286
1931	Chicago	United States	12.39	9.988	1931	8.72	8.55	1.438
1932	Chicago	United States	10.61	10.642	1932	8.71	8.548	2.094
1933	Chicago	United States	11.09	10.656	1933	8.34	8.586	2.07
1934	Chicago	United States	10.87	10.832	1934	8.63	8.528	2.304
1935	Chicago	United States	10.01	11.15	1935	8.52	8.606	2.544
1936	Chicago	United States	9.86	10.994	1936	8.55	8.584	2.41
1937	Chicago	United States	9.99	10.488	1937	8.7	8.55	1.938
1938	Chicago	United States	11.4	10.364	1938	8.86	8.548	1.816
1939	Chicago	United States	11.35	10.426	1939	8.76	8.652	1.774
1940	Chicago	United States	9.67	10.522	1940	8.76	8.678	1.844
1941	Chicago	United States	11.41	10.454	1941	8.77	8.726	1.728
1942	Chicago	United States	10.41	10.764	1942	8.73	8.77	1.994
1943	Chicago	United States	9.72	10.848	1943	8.76	8.776	2.072
1944	Chicago	United States	10.82	10.512	1944	8.85	8.756	1.756
1945	Chicago	United States	9.96	10.406	1945	8.58	8.774	1.632
1946	Chicago	United States	11.4	10.464	1946	8.68	8.738	1.726
1947	Chicago	United States	10.22	10.462	1947	8.8	8.72	1.742
1948	Chicago	United States	10.41	10.424	1948	8.75	8.734	1.69
1949	Chicago	United States	11.18	10.562	1949	8.59	8.732	1.83
1950	Chicago	United States	9.43	10.634	1950	8.37	8.68	1.954
1951	Chicago	United States	9.42	10.528	1951	8.63	8.638	1.89
1952	Chicago	United States	10.91	10.132	1952	8.64	8.628	1.504
1953	Chicago	United States	11.67	10.27	1953	8.87	8.596	1.674
1954	Chicago	United States	11.11	10.522	1954	8.56	8.62	1.902
1955	Chicago	United States	11.01	10.508	1955	8.63	8.614	1.894
1956	Chicago	United States	10.72	10.824	1956	8.28	8.666	2.158
1957	Chicago	United States	10.42	11.084	1957	8.73	8.596	2.488
1958	Chicago	United States	9.9	10.986	1958	8.77	8.614	2.372
1959	Chicago	United States	10.43	10.632	1959	8.73	8.594	2.038
1960	Chicago	United States	10.11	10.496	1960	8.58	8.628	1.868
1961	Chicago	United States	10.58	10.316	1961	8.8	8.618	1.698
1962	Chicago	United States	9.99	10.288	1962	8.75	8.722	1.566
1963	Chicago	United States	9.89	10.202	1963	8.86	8.726	1.476
1964	Chicago	United States	11.06	10.2	1964	8.41	8.744	1.456
1965	Chicago	United States	10.34	10.326	1965	8.53	8.68	1.646

1966	Chicago	United States	10.05	10.372	1966	8.6	8.67	1.702
1967	Chicago	United States	9.84	10.266	1967	8.7	8.63	1.636
1968	Chicago	United States	10.66	10.236	1968	8.52	8.62	1.616
1969	Chicago	United States	10.03	10.39	1969	8.6	8.552	1.838
1970	Chicago	United States	10.34	10.184	1970	8.7	8.59	1.594
1971	Chicago	United States	10.58	10.184	1971	8.6	8.624	1.56
1972	Chicago	United States	9.39	10.29	1972	8.5	8.624	1.666
1973	Chicago	United States	11.55	10.2	1973	8.95	8.584	1.616
1974	Chicago	United States	10.35	10.378	1974	8.47	8.67	1.708
1975	Chicago	United States	10.82	10.442	1975	8.74	8.644	1.798
1976	Chicago	United States	9.79	10.538	1976	8.35	8.652	1.886
1977	Chicago	United States	10.46	10.38	1977	8.85	8.602	1.778
1978	Chicago	United States	9.46	10.594	1978	8.69	8.672	1.922
1979	Chicago	United States	9.37	10.176	1979	8.73	8.62	1.556
1980	Chicago	United States	10.05	9.98	1980	8.98	8.672	1.308
1981	Chicago	United States	10.54	9.826	1981	9.17	8.72	1.106
1982	Chicago	United States	9.99	9.976	1982	8.64	8.884	1.092
1983	Chicago	United States	10.94	9.882	1983	9.03	8.842	1.04
1984	Chicago	United States	10.66	10.178	1984	8.69	8.91	1.268
1985	Chicago	United States	10.11	10.436	1985	8.66	8.902	1.534
1986	Chicago	United States	10.82	10.448	1986	8.83	8.838	1.61
1987	Chicago	United States	12.04	10.504	1987	8.99	8.77	1.734
1988	Chicago	United States	10.86	10.914	1988	9.2	8.84	2.074
1989	Chicago	United States	9.8	10.898	1989	8.92	8.874	2.024
1990	Chicago	United States	11.5	10.726	1990	9.23	8.92	1.806
1991	Chicago	United States	11.58	11.004	1991	9.18	9.034	1.97
1992	Chicago	United States	10.24	11.156	1992	8.84	9.104	2.052
1993	Chicago	United States	10.18	10.796	1993	8.87	9.074	1.722
1994	Chicago	United States	10.56	10.66	1994	9.04	9.008	1.652
1995	Chicago	United States	10.57	10.812	1995	9.35	9.032	1.78
1996	Chicago	United States	9.56	10.626	1996	9.04	9.056	1.57
1997	Chicago	United States	10.14	10.222	1997	9.2	9.028	1.194
1998	Chicago	United States	12.81	10.202	1998	9.52	9.1	1.102
1999	Chicago	United States	11.72	10.728	1999	9.29	9.23	1.498
2000	Chicago	United States	11.09	10.96	2000	9.2	9.28	1.68
2001	Chicago	United States	11.7	11.064	2001	9.41	9.25	1.814
2002	Chicago	United States	11.53	11.492	2002	9.57	9.324	2.168
2003	Chicago	United States	10.48	11.77	2003	9.53	9.398	2.372
2004	Chicago	United States	10.94	11.304	2004	9.32	9.4	1.904
2005	Chicago	United States	11.58	11.148	2005	9.7	9.406	1.742
2006	Chicago	United States	11.87	11.246	2006	9.53	9.506	1.74
2007	Chicago	United States	11.45	11.28	2007	9.73	9.53	1.75
2008	Chicago	United States	10.24	11.264	2008	9.43	9.562	1.702
2009	Chicago	United States	10.3	11.216	2009	9.51	9.542	1.674
2010	Chicago	United States	11.82	11.088	2010	9.7	9.58	1.508
2011	Chicago	United States	11.21	11.136	2011	9.52	9.58	1.556
2012	Chicago	United States	12.82	11.004	2012	9.51	9.578	1.426
2013	Chicago	United States	11.59	11.278	2013	9.61	9.534	1.744
					2014	9.57	9.57	
					2015	9.83	9.582	