[] Dendrochronology Program Library Run FRAM Program COF 10:41 Fri 04 Sep 2020 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 31295

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: SCBI\_fram.rwl

CONTENTS:

Part 1: Title page, options selected, summary, absent rings by series

Part 2: Histogram of time spans

Part 3: Master series with sample depth and absent rings by year

Part 4: Bar plot of Master Dating Series

Part 5: Correlation by segment of each series with Master

Part 6: Potential problems: low correlation, divergent year-to-year changes, absent rings, outliers

Part 7: Descriptive statistics

RUN CONTROL OPTIONS SELECTED VALUE

1 Cubic smoothing spline 50% wavelength cutoff for filtering

32 years

2 Segments examined are 50 years lagged successively by 25 years

3 Autoregressive model applied A Residuals are used in master dating series and testing

4 Series transformed to logarithms Y Each series log-transformed for master dating series and testing

5 CORRELATION is Pearson (parametric, quantitative)

Critical correlation, 99% confidence level .3281

6 Master dating series saved N

7 Ring measurements listed N

8 Parts printed 1234567

9 Absent rings are omitted from master series and segment correlations (Y)

Time span of Master dating series is 1869 to 2017 149 years

Continuous time span is 1869 to 2017 149 years

Portion with two or more series is 1870 to 2017 148 years

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*C\* Number of dated series 69 \*C\*

\*O\* Master series 1869 2017 149 yrs \*O\*

\*F\* Total rings in all series 5604 \*F\*

\*E\* Total dated rings checked 5603 \*E\*

\*C\* Series intercorrelation .391 \*C\*

\*H\* Average mean sensitivity .230 \*H\*

\*A\* Segments, possible problems 59 \*A\*

\*\*\* Mean length of series 81.2 \*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

ABSENT RINGS listed by SERIES: (See Master Dating Series for absent rings listed by year)

121455 1 absent rings: 1930

102453 1 absent rings: 1956

2 absent rings .036%

PART 2: TIME PLOT OF TREE-RING SERIES: 10:41 Fri 04 Sep 2020 Page 2

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1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 Ident Seq Time-span Yrs

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. . . . . . . . . . . . . . . . .<=============> . 41006A 1 1869 2001 133

. . . . . . . . . . . . . . . . . <============> . 161024 2 1870 2009 140

. . . . . . . . . . . . . . . . . <============> . 202379 3 1870 2007 138

. . . . . . . . . . . . . . . . . <=============> . 192154 4 1879 2016 138

. . . . . . . . . . . . . . . . . <===========> . 10539 5 1882 2009 128

. . . . . . . . . . . . . . . . . <============> . 201248 6 1885 2013 129

. . . . . . . . . . . . . . . . . <===========> . 202775 7 1885 2009 125

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. . . . . . . . . . . . . . . . . <==========> . 142178 9 1893 2009 117

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. . . . . . . . . . . . . . . . . <==========> . 101292 12 1896 2007 112

. . . . . . . . . . . . . . . . . <===========> . 111290 13 1899 2014 116

. . . . . . . . . . . . . . . . . .<=========> . 12234A 14 1910 2016 107

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. . . . . . . . . . . . . . . . . . <=======> . 30109 35 1936 2015 80

. . . . . . . . . . . . . . . . . . <=======> . 172565 36 1936 2013 78

. . . . . . . . . . . . . . . . . . <=======> . 162591 37 1937 2016 80

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. . . . . . . . . . . . . . . . . . <=======> . 190735 39 1937 2017 81

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. . . . . . . . . . . . . . . . . . <======> . 152659 41 1938 2006 69

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. . . . . . . . . . . . . . . . . . <======> . 30039A 43 1940 2015 76

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. . . . . . . . . . . . . . . . . . <=====> . 40934A 47 1943 2009 67

. . . . . . . . . . . . . . . . . . <======> . 192260 48 1944 2016 73

. . . . . . . . . . . . . . . . . . <=====> . 140939 49 1945 2007 63

. . . . . . . . . . . . . . . . . . <=====> . 12303 50 1946 2009 64

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1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050

PART 2: TIME PLOT OF TREE-RING SERIES: 10:41 Fri 04 Sep 2020 Page 3

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1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 Ident Seq Time-span Yrs

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. . . . . . . . . . . . . . . . . . . <==> . 12267 66 1974 2007 34

. . . . . . . . . . . . . . . . . . . <===> . 182374 67 1974 2017 44

. . . . . . . . . . . . . . . . . . . <==> . 160001 68 1983 2015 33

. . . . . . . . . . . . . . . . . . . <=> . 192592 69 1990 2017 28

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1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050

PART 3: Master Dating Series: 10:41 Fri 04 Sep 2020 Page 4

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Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab

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1900 -.252 13 1950 .891 53 2000 .810 68

1901 1.759 13 1951 .980 54 2001 .888 67

1902 .698 13 1952 .120 54 2002 1.533 66

1903 2.424 13 1953 .706 55 2003 1.478 66

1904 1.434 13 1954 .411 58 2004 -.361 66

1905 -.244 13 1955 .974 58 2005 -.126 64

1906 -.658 13 1956 -.571 60 1 2006 -.118 64

1907 .586 13 1957 .499 61 2007 .797 63

1908 -1.177 13 1958 1.582 63 2008 -.244 57

1909 -.697 13 1959 .523 63 2009 -1.067 57

1910 .496 14 1960 -.280 64 2010 -.925 39

1911 -2.764 14 1961 .127 65 2011 -.246 38

1912 .912 14 1962 -2.044 65 2012 -.546 34

1913 .482 14 1963 -.668 65 2013 .300 29

1914 -.355 15 1964 -1.545 65 2014 .625 22

1915 -.378 16 1965 -1.687 65 2015 -.257 20

1916 .825 17 1966 -1.433 65 2016 .796 14

1917 .734 17 1967 .114 65 2017 .327 5

1918 .043 18 1968 .364 65

1869 1.028 1 1919 -.263 18 1969 .015 65

1870 -2.407 3 1920 -.512 19 1970 .705 65

1871 1.042 3 1921 -.081 19 1971 1.254 65

1872 1.135 3 1922 -1.674 21 1972 1.430 65

1873 1.194 3 1923 -2.972 21 1973 1.374 65

1874 .743 3 1924 -.345 21 1974 -.214 67

1875 -.265 3 1925 -.485 22 1975 .353 67

1876 .778 3 1926 -.224 23 1976 .212 67

1877 -1.778 3 1927 1.788 23 1977 -2.019 67

1878 .081 3 1928 1.830 24 1978 -1.228 67

1879 -.236 4 1929 .753 26 1979 -.795 67

1880 -2.442 4 1930 -.883 26 1 1980 .140 67

1881 .717 4 1931 -.006 27 1981 .324 67

1882 .064 5 1932 .038 27 1982 .267 67

1883 .108 5 1933 .622 29 1983 1.042 68

1884 .572 5 1934 1.214 32 1984 1.126 68

1885 -.793 7 1935 .743 34 1985 1.156 68

1886 1.650 7 1936 -.699 36 1986 .798 68

1887 -.441 7 1937 -.639 40 1987 -1.045 68

1888 -1.425 7 1938 1.532 41 1988 -.195 68

1889 1.504 7 1939 -.699 41 1989 .296 68

1890 .380 7 1940 -.371 43 1990 -.302 69

1891 1.059 7 1941 -.242 43 1991 -2.118 69

1892 1.027 8 1942 .483 46 1992 -.433 69

1893 -.930 9 1943 .238 47 1993 -.417 69

1894 -.355 9 1944 -.524 48 1994 -.080 69

1895 -1.204 10 1945 .665 49 1995 .478 69

1896 -1.179 12 1946 -.255 50 1996 -1.048 69

1897 -.342 12 1947 -1.999 50 1997 -.616 69

1898 -.763 12 1948 -.870 51 1998 -.187 69

1899 -.700 13 1949 -.703 53 1999 -.151 69

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PART 4: Master Bar Plot: 10:41 Fri 04 Sep 2020 Page 5

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Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value

1900----a 1950--------D 2000--------C

1901----------G 1951---------D 2001--------D

1902--------C 1952-----@ 2002----------F

1903----------J 1953--------C 2003----------F

1904----------F 1954------B 2004---a

1905----a 1955---------D 2005----a

1906--c 1956--b 2006----@

1907-------B 1957-------B 2007--------C

1908-e 1958----------F 2008----a

1909--c 1959-------B 2009-d

1910-------B 1960----a 2010-d

1911k 1961-----A 2011----a

1912--------D 1962h 2012--b

1913-------B 1963--c 2013------A

1914---a 1964f 2014-------B

1915---b 1965g 2015----a

1916--------C 1966-f 2016--------C

1917--------C 1967-----@ 2017------A

1918-----@ 1968------A

1869---------D 1919----a 1969-----@

1870j 1920--b 1970--------C

1871---------D 1921-----@ 1971---------E

1872---------E 1922g 1972----------F

1873---------E 1923l 1973----------E

1874--------C 1924---a 1974----a

1875----a 1925---b 1975------A

1876--------C 1926----a 1976------A

1877g 1927----------G 1977h

1878-----@ 1928----------G 1978-e

1879----a 1929--------C 1979--c

1880j 1930-d 1980-----A

1881--------C 1931-----@ 1981------A

1882-----@ 1932-----@ 1982------A

1883-----@ 1933-------B 1983---------D

1884-------B 1934---------E 1984---------E

1885--c 1935--------C 1985---------E

1886----------G 1936--c 1986--------C

1887---b 1937--c 1987-d

1888-f 1938----------F 1988----a

1889----------F 1939--c 1989------A

1890------B 1940---a 1990----a

1891---------D 1941----a 1991h

1892---------D 1942-------B 1992---b

1893-d 1943------A 1993---b

1894---a 1944--b 1994-----@

1895-e 1945-------C 1995-------B

1896-e 1946----a 1996-d

1897---a 1947h 1997--b

1898--c 1948-c 1998----a

1899--c 1949--c 1999----a

PART 5: CORRELATION OF SERIES BY SEGMENTS: 10:41 Fri 04 Sep 2020 Page 5

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Correlations of 50-year dated segments, lagged 25 years

Flags: A = correlation under .3281 but highest as dated; B = correlation higher at other than dated position

Seq Series Time\_span 1850 1875 1900 1925 1950 1975

1899 1924 1949 1974 1999 2024

--- -------- --------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----

1 41006A 1869 2001 .47 .49 .47 .55 .53 .51

2 161024 1870 2009 .34 .38 .65 .56 .56 .62

3 202379 1870 2007 .35 .44 .40 .51 .24A .22B

4 192154 1879 2016 .58 .48 .38 .47 .54

5 10539 1882 2009 .31A .48 .65 .59 .56

6 201248 1885 2013 .46 .43 .37 .49 .45

7 202775 1885 2009 .53 .60 .64 .52 .47

8 40131 1892 2009 .53 .58 .68 .67 .65

9 142178 1893 2009 .57 .57 .48 .54 .41

10 182396 1895 2009 .20A .23A .40 .51 .57

11 101259 1896 2000 .42 .50 .29B .26A .32A

12 101292 1896 2007 .57 .61 .50 .44 .48

13 111290 1899 2014 .32A .33 .45 .45 .40

14 12234A 1910 2016 .27A .28A .41 .39

15 140881 1914 2009 .38 .46 .28B .23B

16 192641 1915 2009 .40 .45 .06B .16B

17 121455 1916 2016 .25A .13B .47 .21A

18 41025A 1918 2011 .40 .41 .43 .44

19 40935A 1920 2015 .22B .28A .44 .45

20 40853A 1922 2016 .61 .59 .35 .23A

21 171421 1922 2007 .63 .63 .54 .38

22 132525 1925 2009 .47 .58 .54

23 202536 1926 2009 .51 .54 .56

24 192552 1928 2017 .27B .26A .19B

25 172542 1929 2009 .29B .34 .30A

26 192583 1929 2012 .58 .62 .48

27 182678 1931 2009 .45 .55 .51

28 102453 1933 2014 .43 .28A .19B

29 162458 1933 2013 .32A .59 .67

30 162470 1934 2013 .62 .65 .44

31 172575 1934 1999 .41 .53

32 192666 1934 2013 .27A .30A .34

33 192707 1935 2009 .20A .21A .29A

34 202528 1935 2011 .30A .35 .28A

35 30109 1936 2015 .35 .36 .36

36 172565 1936 2013 .67 .66 .50

37 162591 1937 2016 .64 .56 .41

38 182455 1937 2016 .54 .40 .35

39 190735 1937 2017 .35 .31A .16A

40 192697 1937 2009 .29A .45 .43

41 152659 1938 2006 .38 .30A .34

42 20432A 1940 2011 .34 .40 .34

43 30039A 1940 2015 .62 .50 .53

44 30062 1942 2009 .29A .31A .26A

45 172493 1942 2004 .35 .26A .24B

46 192683 1942 2012 .53 .65 .50

47 40934A 1943 2009 .36 .39 .38

48 192260 1944 2016 .35 .36 .24A

49 140939 1945 2007 .35 .34 .40

50 12303 1946 2009 .43 .37 .35

51 142703 1948 2004 .49 .49 .45

52 141124 1949 2007 .30A .29B .34

53 192568 1949 2016 .57 .58 .53

54 150776 1951 2011 .31A .24A

55 192594 1953 2016 .28A .38

56 30174A 1954 2015 .47 .32A

57 70599A 1954 2013 .44 .43

58 172091 1954 2012 .48 .33

59 20040A 1956 2012 .42 .47

60 80481A 1956 2013 .31A .33

61 050025 1957 2012 .44 .28A

62 171358 1958 2009 .42 .43

63 200578 1958 2017 .61 .48

64 141255 1960 2015 .45 .31A

65 202933 1961 2010 .20B

66 12267 1974 2007 .28B

67 182374 1974 2017 .20A

68 160001 1983 2015 .45

69 192592 1990 2017 .27A

Av segment correlation .39 .45 .45 .43 .42 .39

PART 6: POTENTIAL PROBLEMS: 10:41 Fri 04 Sep 2020 Page 6

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For each series with potential problems the following diagnostics may appear:

[A] Correlations with master dating series of flagged 50-year segments of series filtered with 32-year spline,

at every point from ten years earlier (-10) to ten years later (+10) than dated

[B] Effect of those data values which most lower or raise correlation with master series

Symbol following year indicates value in series is greater (>) or lesser (<) than master series value

[C] Year-to-year changes very different from the mean change in other series

[D] Absent rings (zero values)

[E] Values which are statistical outliers from mean for the year

====================================================================================================================================

41006A 1869 to 2001 133 years Series 1

[\*] Early part of series cannot be checked from 1869 to 1869 -- not matched by another series

[B] Entire series, effect on correlation ( .499) is:

Lower 1911> -.028 1996> -.017 1939> -.013 1978< -.011 1979> -.010 1893> -.010 Higher 1991 .027 1922 .014

====================================================================================================================================

161024 1870 to 2009 140 years Series 2

[B] Entire series, effect on correlation ( .480) is:

Lower 1877> -.046 1885> -.018 1931< -.016 1880> -.014 1876< -.014 1889< -.011 Higher 1991 .025 1923 .022

[C] Year-to-year changes diverging by over 4.0 std deviations:

1876 1877 4.2 SD

====================================================================================================================================

202379 1870 to 2007 138 years Series 3

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1950 1999 0 -.08 -.02 -.22 .12 -.03 .19 .19 .08 .12 .05 .24\*-.21 -.21 .05 -.28 -.16 .15 -.19 .20 .08 .13

1958 2007 10 -.28 -.06 .05 .09 .04 .15 .11 .08 -.09 .07 .22|-.12 -.20 -.15 -.21 .01 .00 -.01 .23 -.05 .25\*

[B] Entire series, effect on correlation ( .322) is:

Lower 1872< -.023 1991> -.014 1977> -.012 1870> -.012 1936> -.011 1875> -.010 Higher 1877 .017 1911 .015

1950 to 1999 segment:

Lower 1991> -.051 1977> -.042 1983< -.027 1980< -.023 1981< -.020 1953< -.020 Higher 1958 .049 1956 .040

1958 to 2007 segment:

Lower 1991> -.053 1977> -.045 2002< -.027 1983< -.023 1980< -.020 2005< -.017 Higher 2004 .061 1958 .050

[C] Year-to-year changes diverging by over 4.0 std deviations:

1870 1871 -4.2 SD 1946 1947 -5.1 SD 1947 1948 5.3 SD

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1947 -7.6 SD

====================================================================================================================================

192154 1879 to 2016 138 years Series 4

[B] Entire series, effect on correlation ( .490) is:

Lower 1916< -.023 1922> -.021 1954< -.021 1941< -.013 1939> -.012 2012> -.009 Higher 1911 .047 1923 .018

====================================================================================================================================

10539 1882 to 2009 128 years Series 5

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1882 1931 0 -.08 -.04 .16 -.05 .03 -.10 -.09 .22 -.04 .06 .31\*-.07 -.05 -.04 -.32 .06 -.12 .16 -.01 -.05 .07

[B] Entire series, effect on correlation ( .458) is:

Lower 1893> -.020 1886< -.018 2006< -.016 1900< -.014 1888< -.011 1905> -.009 Higher 1927 .015 1947 .012

1882 to 1931 segment:

Lower 1893> -.041 1886< -.039 1900< -.035 1888< -.028 1905> -.019 1890> -.018 Higher 1927 .049 1911 .043

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201248 1885 to 2013 129 years Series 6

[B] Entire series, effect on correlation ( .406) is:

Lower 1922> -.033 1891< -.019 1954< -.019 1947> -.018 1991> -.014 1885> -.013 Higher 1911 .046 1977 .029

====================================================================================================================================

202775 1885 to 2009 125 years Series 7

[B] Entire series, effect on correlation ( .522) is:

Lower 1914< -.041 1890< -.022 1987> -.016 1895> -.016 2004> -.016 1985< -.014 Higher 1911 .042 1977 .023

====================================================================================================================================

40131 1892 to 2009 118 years Series 8

[B] Entire series, effect on correlation ( .606) is:

Lower 1911> -.015 1983< -.015 1936> -.013 1910< -.012 1906> -.009 1990> -.009 Higher 1977 .026 1991 .025

====================================================================================================================================

142178 1893 to 2009 117 years Series 9

[B] Entire series, effect on correlation ( .476) is:

Lower 2001< -.046 1962> -.014 1974< -.013 2004> -.012 1977> -.011 1945< -.011 Higher 1991 .031 1922 .019

====================================================================================================================================

182396 1895 to 2009 115 years Series 10

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1895 1944 0 .13 .11 .06 .15 -.03 .09 -.13 -.04 .05 -.31 .20\*-.12 -.07 .15 .06 .04 .04 .01 -.26 .15 .07

1900 1949 0 .11 .12 .10 .03 .00 .09 -.12 .03 .06 -.22 .23\*-.15 -.06 .09 -.01 -.05 -.02 .01 -.28 .17 .03

[B] Entire series, effect on correlation ( .363) is:

Lower 1901< -.055 1962> -.019 1927< -.019 1902< -.014 1921< -.010 1908> -.010 Higher 1991 .034 1996 .020

1895 to 1944 segment:

Lower 1901< -.120 1927< -.037 1902< -.028 1921< -.022 1908> -.017 1915> -.015 Higher 1938 .054 1912 .035

1900 to 1949 segment:

Lower 1901< -.111 1927< -.032 1902< -.026 1908> -.020 1921< -.020 1915> -.017 Higher 1938 .050 1947 .034

[C] Year-to-year changes diverging by over 4.0 std deviations:

1900 1901 -4.3 SD

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101259 1896 to 2000 105 years Series 11

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1925 1974 -1 -.01 -.19 .07 .18 -.34 -.24 .07 .04 .05 .42\* .29| .04 -.07 .01 -.23 -.16 .06 -.02 -.20 .04 .02

1950 1999 0 .22 -.01 -.21 -.08 -.08 -.24 -.02 .02 -.08 .24 .26\* .05 -.02 .12 .06 -.12 .04 -.17 -.02 -.08 -.07

1951 2000 0 .21 -.07 -.19 -.08 -.09 -.20 -.07 -.04 -.08 .23 .32\* .08 .00 .16 .03 -.09 .02 -.13 .00 -.10 -.10

[B] Entire series, effect on correlation ( .382) is:

Lower 1962> -.038 1983< -.027 1939> -.026 1916< -.024 1950< -.021 1917< -.014 Higher 1911 .057 1947 .037

1925 to 1974 segment:

Lower 1962> -.080 1939> -.055 1950< -.050 1974> -.026 1952> -.018 1959< -.011 Higher 1947 .127 1956 .027

1950 to 1999 segment:

Lower 1962> -.081 1983< -.056 1950< -.044 1974> -.026 1952> -.016 1976< -.014 Higher 1991 .075 1987 .067

1951 to 2000 segment:

Lower 1962> -.084 1983< -.062 1974> -.025 1976< -.017 1952> -.016 1985< -.014 Higher 1991 .072 1987 .062

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101292 1896 to 2007 112 years Series 12

[B] Entire series, effect on correlation ( .517) is:

Lower 1939> -.019 1915< -.018 1999< -.015 1979> -.013 1896> -.009 1981< -.009 Higher 1911 .058 1991 .037

====================================================================================================================================

111290 1899 to 2014 116 years Series 13

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1899 1948 0 -.05 -.01 -.17 -.10 .07 -.02 -.11 -.07 .18 .06 .32\* .16 .20 -.12 -.13 -.10 .10 -.05 -.38 .04 -.11

[B] Entire series, effect on correlation ( .377) is:

Lower 1977> -.037 1911> -.029 1936> -.014 2012< -.013 1971< -.011 1914> -.011 Higher 1991 .042 1962 .019

1899 to 1948 segment:

Lower 1911> -.048 1936> -.034 1941< -.027 1921< -.027 1914> -.027 1917< -.022 Higher 1903 .051 1947 .050

====================================================================================================================================

12234A 1910 to 2016 107 years Series 14

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1910 1959 0 -.14 -.01 -.17 -.11 -.03 .17 -.07 .23 -.05 -.03 .27\* .06 -.04 -.01 -.16 -.09 -.36 -.01 -.02 -.15 .21

1925 1974 0 .03 -.05 -.21 -.22 .14 .08 -.12 .14 .11 .01 .28\* .04 .09 .05 -.10 -.10 -.20 .03 -.09 -.27 .07

[B] Entire series, effect on correlation ( .367) is:

Lower 2000< -.027 1934< -.024 1930> -.021 1957< -.019 1912< -.018 1971< -.017 Higher 1962 .055 1977 .042

1910 to 1959 segment:

Lower 1934< -.044 1930> -.041 1957< -.035 1912< -.031 1956> -.020 1915> -.019 Higher 1911 .069 1922 .050

1925 to 1974 segment:

Lower 1930> -.045 1934< -.043 1957< -.033 1971< -.030 1965> -.024 1956> -.022 Higher 1962 .160 1938 .033

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140881 1914 to 2009 96 years Series 15

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1950 1999 -3 -.17 -.15 -.04 .05 .05 -.07 .11 .29\* .10 .14 .28|-.05 .12 .03 -.14 -.01 -.21 -.28 -.14 -.15 .15

1960 2009 -3 -.20 -.19 -.01 .00 .03 -.14 .07 .35\* .08 .14 .23|-.01 .12 .01 -.11 .10 -.24 -.26 -.16 - -

[B] Entire series, effect on correlation ( .287) is:

Lower 1994< -.076 2007< -.023 1915> -.019 1996> -.017 1933< -.015 1977> -.012 Higher 1947 .020 1938 .020

1950 to 1999 segment:

Lower 1994< -.168 1996> -.030 1977> -.022 1987> -.012 1968< -.011 1986< -.011 Higher 1958 .029 1962 .020

1960 to 2009 segment:

Lower 1994< -.139 2007< -.040 1996> -.029 1977> -.021 1987> -.013 1968< -.011 Higher 2002 .028 1984 .019

[C] Year-to-year changes diverging by over 4.0 std deviations:

1993 1994 -4.4 SD 1994 1995 4.2 SD

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1994 -5.8 SD

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192641 1915 to 2009 95 years Series 16

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1950 1999 2 -.12 -.18 -.24 -.11 .13 -.01 .05 -.05 .17 .06 .06|-.13 .21\* .04 .15 .11 -.07 .10 .01 -.06 -.07

1960 2009 2 -.10 -.24 -.13 -.09 .05 .09 .00 -.07 .05 .00 .16|-.13 .17\*-.06 .12 .12 .06 .08 .09 - -

[B] Entire series, effect on correlation ( .255) is:

Lower 1977> -.035 1989< -.034 1996> -.028 1983< -.025 1930> -.020 1991> -.014 Higher 1947 .058 1962 .039

1950 to 1999 segment:

Lower 1977> -.052 1989< -.052 1996> -.049 1983< -.045 1972< -.014 1978> -.014 Higher 1962 .116 1973 .032

1960 to 2009 segment:

Lower 1977> -.063 1989< -.056 1996> -.051 1983< -.043 1991> -.025 1978> -.014 Higher 1962 .079 2004 .048

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121455 1916 to 2016 101 years Series 17

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1916 1965 0 -.15 .16 -.10 -.02 -.13 .01 .09 -.05 -.07 .22 .25\* .08 .03 .03 -.22 -.16 -.01 .09 -.08 .04 -.04

1925 1974 1 -.04 .10 -.09 -.02 -.11 -.10 .04 -.13 -.03 .06 .13| .26\* .02 .12 -.02 .00 .14 -.07 -.09 -.02 -.19

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1967 2016 0 .14 .11 -.28 -.10 .11 .19 .03 -.14 .04 .03 .21\* .03 - - - - - - - - -

[B] Entire series, effect on correlation ( .268) is:

Lower 1947> -.038 1939> -.034 1928< -.018 1922> -.016 1936> -.013 1955< -.010 Higher 1923 .064 1930 .030

1916 to 1965 segment:

Lower 1947> -.066 1939> -.056 1922> -.031 1928< -.027 1936> -.022 1955< -.015 Higher 1923 .094 1930 .048

1925 to 1974 segment:

Lower 1947> -.074 1939> -.065 1928< -.027 1936> -.026 1955< -.015 1934< -.013 Higher 1930 .109 1964 .021

1967 to 2016 segment:

Lower 2000< -.028 2002< -.028 1992< -.026 2008> -.023 2012> -.022 1972< -.021 Higher 1977 .088 1996 .054

[C] Year-to-year changes diverging by over 4.0 std deviations:

1930 1931 4.3 SD

[D] 1 Absent rings: Year Master N series Absent

1930 -.883 26 1

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1930 -7.1 SD

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41025A 1918 to 2011 94 years Series 18

[B] Entire series, effect on correlation ( .423) is:

Lower 1990< -.031 1923> -.024 1928< -.020 1984< -.019 1962> -.016 2000< -.015 Higher 1991 .036 1977 .030

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40935A 1920 to 2015 96 years Series 19

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1920 1969 1 .02 -.34 .08 -.15 -.17 .18 .10 .18 .23 .04 .22| .23\*-.05 -.19 -.01 .10 -.19 -.25 -.08 -.24 -.27

1925 1974 0 -.02 -.37 .01 -.19 -.19 .16 .10 .20 .22 .03 .28\* .26 .03 -.13 -.01 .12 -.28 -.32 -.13 -.21 -.18

[B] Entire series, effect on correlation ( .327) is:

Lower 1951< -.039 1930> -.029 1977> -.016 1939> -.014 1925< -.012 1924< -.011 Higher 1987 .036 1947 .025

1920 to 1969 segment:

Lower 1951< -.081 1930> -.050 1925< -.023 1924< -.022 1939> -.021 1928< -.021 Higher 1947 .061 1958 .037

1925 to 1974 segment:

Lower 1951< -.083 1930> -.059 1939> -.025 1928< -.023 1925< -.020 1956> -.015 Higher 1947 .068 1964 .037

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

2000 +3.1 SD

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40853A 1922 to 2016 95 years Series 20

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1967 2016 0 -.03 -.22 -.25 -.10 -.06 -.02 .19 -.01 .19 .19 .23\* .17 - - - - - - - - -

[B] Entire series, effect on correlation ( .417) is:

Lower 1992< -.050 2003< -.020 1987> -.019 2014< -.014 1968< -.012 1961< -.011 Higher 1991 .021 1947 .018

1967 to 2016 segment:

Lower 1992< -.066 1987> -.034 2003< -.032 2014< -.023 1968< -.019 1979> -.016 Higher 1991 .063 2002 .046

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171421 1922 to 2007 86 years Series 21

[B] Entire series, effect on correlation ( .477) is:

Lower 2000< -.019 2005> -.016 2002< -.015 1996> -.015 2004> -.013 1967< -.012 Higher 1962 .058 1947 .033

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132525 1925 to 2009 85 years Series 22

[B] Entire series, effect on correlation ( .509) is:

Lower 2000< -.027 1936> -.026 1945< -.021 1928< -.019 1958< -.018 1929< -.013 Higher 1991 .063 1947 .022

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202536 1926 to 2009 84 years Series 23

[B] Entire series, effect on correlation ( .486) is:

Lower 1932< -.082 1977> -.032 1980< -.012 1961< -.009 1972< -.008 1947> -.008 Higher 1962 .047 2002 .010

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192552 1928 to 2017 90 years Series 24

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1928 1977 8 -.24 .09 .02 .21 -.10 .11 .11 .05 -.08 -.06 .27|-.06 -.17 -.05 -.12 .18 -.24 -.11 .30\*-.02 .15

1950 1999 0 -.01 .00 -.02 .09 -.08 .20 .15 .07 -.03 .03 .26\* .06 -.17 -.12 -.04 -.07 -.28 -.16 .05 .19 -.07

1968 2017 -4 -.07 .01 -.06 .04 -.03 .09 .21\* .04 -.07 .15 .19| - - - - - - - - - -

[B] Entire series, effect on correlation ( .280) is:

Lower 1969< -.052 1930> -.031 1996> -.016 2015> -.014 1995< -.012 1962> -.011 Higher 1939 .025 1964 .024

1928 to 1977 segment:

Lower 1969< -.085 1930> -.051 1962> -.021 1947> -.016 1973< -.016 1934< -.013 Higher 1939 .038 1964 .037

1950 to 1999 segment:

Lower 1969< -.092 1996> -.029 1962> -.022 1995< -.017 1973< -.016 1991> -.015 Higher 1964 .039 1958 .034

1968 to 2017 segment:

Lower 1969< -.065 1996> -.029 2015> -.026 1995< -.017 1973< -.017 2009> -.014 Higher 1987 .037 2010 .024

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172542 1929 to 2009 81 years Series 25

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1929 1978 -10 .31\* .23 .03 -.08 -.15 -.31 -.27 .24 .02 .16 .29|-.11 -.03 .08 -.08 -.08 .03 -.01 .06 -.08 -.11

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1960 2009 0 .27 .15 .05 -.06 -.05 -.03 -.19 .07 -.15 .01 .30\* .00 -.18 .23 .10 -.12 -.03 -.11 -.03 - -

[B] Entire series, effect on correlation ( .236) is:

Lower 1991> -.047 2001< -.043 1950< -.025 1957< -.025 1930> -.023 1936> -.018 Higher 1987 .053 1947 .040

1929 to 1978 segment:

Lower 1957< -.052 1950< -.050 1930> -.041 1936> -.032 1958< -.028 1963< -.024 Higher 1947 .071 1977 .062

1960 to 2009 segment:

Lower 2001< -.076 1991> -.071 2004> -.024 1963< -.018 2008> -.017 1983< -.016 Higher 1987 .070 1962 .045

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192583 1929 to 2012 84 years Series 26

[B] Entire series, effect on correlation ( .512) is:

Lower 1943< -.023 1946< -.018 2007< -.017 2003< -.014 1973< -.013 1991> -.011 Higher 1939 .020 2002 .014

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182678 1931 to 2009 79 years Series 27

[B] Entire series, effect on correlation ( .475) is:

Lower 1938< -.037 1947> -.028 1977> -.026 1971< -.020 1976< -.015 1993> -.011 Higher 1962 .084 1958 .015

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102453 1933 to 2014 82 years Series 28

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1950 1999 0 -.23 -.03 -.08 -.13 .09 .11 -.16 .05 .23 .08 .28\* .06 .01 .17 .19 -.13 -.21 -.14 -.02 -.27 -.23

1965 2014 3 -.12 -.05 -.09 -.09 .05 .09 -.12 .03 .08 -.14 .19|-.02 .03 .24\* - - - - - - -

[B] Entire series, effect on correlation ( .302) is:

Lower 1991> -.024 1983< -.022 1947> -.018 1978> -.012 2003< -.011 1938< -.009 Higher 1962 .017 1950 .016

1950 to 1999 segment:

Lower 1991> -.038 1983< -.030 1978> -.017 1987> -.014 1997> -.012 1992< -.011 Higher 1950 .024 1962 .021

1965 to 2014 segment:

Lower 1983< -.048 1991> -.036 2003< -.025 1978> -.025 1992< -.018 1997> -.017 Higher 2004 .030 1977 .027

[D] 1 Absent rings: Year Master N series Absent

1956 -.571 60 1

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1956 -6.7 SD

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162458 1933 to 2013 81 years Series 29

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1933 1982 0 -.09 .05 -.01 -.20 -.26 -.02 .00 -.10 .22 -.04 .32\* .21 .11 -.13 .03 .15 -.20 -.26 .14 -.14 .01

[B] Entire series, effect on correlation ( .498) is:

Lower 1934< -.033 1947> -.025 1985< -.018 1961< -.018 1945< -.011 1972< -.011 Higher 1991 .053 1996 .023

1933 to 1982 segment:

Lower 1934< -.057 1961< -.031 1947> -.025 1945< -.019 1967< -.019 1972< -.018 Higher 1977 .059 1962 .050

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162470 1934 to 2013 80 years Series 30

[B] Entire series, effect on correlation ( .459) is:

Lower 2012< -.046 1947> -.028 2004> -.026 2002< -.026 1985< -.019 2009> -.013 Higher 1977 .032 1939 .020

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172575 1934 to 1999 66 years Series 31

[B] Entire series, effect on correlation ( .400) is:

Lower 1947> -.035 1938< -.027 1991> -.016 1986< -.015 1948> -.012 1939> -.011 Higher 1996 .029 1962 .024

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192666 1934 to 2013 80 years Series 32

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1934 1983 0 .09 -.16 -.10 -.02 -.07 .08 -.28 .10 -.14 -.32 .27\* .11 .14 .06 .03 -.02 -.30 -.06 -.19 .03 .15

1950 1999 0 -.23 -.01 -.08 -.19 -.09 .17 -.08 .01 -.16 -.15 .30\* .12 .04 .12 .02 -.04 -.30 -.31 -.10 .01 .07

[B] Entire series, effect on correlation ( .299) is:

Lower 1962> -.021 1948> -.021 1955< -.014 2003< -.013 2010< -.012 1973< -.012 Higher 1996 .029 1938 .024

1934 to 1983 segment:

Lower 1948> -.044 1962> -.033 1955< -.024 1956> -.021 1973< -.020 1935< -.019 Higher 1938 .046 1977 .045

1950 to 1999 segment:

Lower 1962> -.033 1955< -.027 1973< -.022 1982< -.021 1953< -.021 1956> -.021 Higher 1996 .057 1977 .048

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1948 +3.5 SD

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192707 1935 to 2009 75 years Series 33

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1935 1984 0 -.05 .10 .02 .10 -.19 -.09 .08 -.07 .15 -.03 .20\* .07 -.09 .08 -.21 -.14 -.11 -.28 -.08 .10 .11

1950 1999 0 .06 .06 .00 -.03 -.15 .04 .09 -.18 .19 -.04 .21\* .11 -.01 -.09 -.10 -.18 -.24 -.14 -.14 .12 .01

1960 2009 0 .11 .04 .07 -.12 -.23 .02 -.03 -.24 .20 .02 .29\* .08 .02 -.15 -.04 -.14 -.10 -.02 -.11 - -

[B] Entire series, effect on correlation ( .225) is:

Lower 1989< -.042 1947> -.042 1938< -.022 1951< -.020 1936> -.018 1965> -.018 Higher 1962 .034 1996 .025

1935 to 1984 segment:

Lower 1947> -.062 1938< -.032 1951< -.030 1936> -.028 1965> -.027 1953< -.026 Higher 1962 .058 1964 .039

1950 to 1999 segment:

Lower 1989< -.054 1965> -.027 1951< -.026 1991> -.025 1953< -.022 1973< -.019 Higher 1962 .048 1996 .036

1960 to 2009 segment:

Lower 1989< -.069 1991> -.030 1965> -.027 1973< -.023 1971< -.022 1977> -.016 Higher 1962 .041 1996 .032

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202528 1935 to 2011 77 years Series 34

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1935 1984 0 .08 -.12 -.09 .03 -.21 -.26 .21 -.07 .17 .04 .30\*-.02 -.10 .09 -.06 -.10 .02 -.12 .05 -.14 .13

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1962 2011 0 .26 -.03 -.15 -.21 -.21 -.11 .08 -.10 .21 .09 .28\*-.02 .02 .24 .10 -.03 -.09 - - - -

[B] Entire series, effect on correlation ( .216) is:

Lower 1947> -.049 1950< -.039 1955< -.036 2010> -.028 2008> -.017 1965> -.015 Higher 1987 .031 1962 .027

1935 to 1984 segment:

Lower 1947> -.075 1950< -.058 1955< -.053 1965> -.023 1939> -.012 1974> -.011 Higher 1962 .032 1964 .026

1962 to 2011 segment:

Lower 2010> -.043 2008> -.026 1965> -.023 1966< -.023 2002< -.022 2007< -.014 Higher 1987 .043 1962 .038

[C] Year-to-year changes diverging by over 4.0 std deviations:

1965 1966 -4.3 SD

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30109 1936 to 2015 80 years Series 35

[B] Entire series, effect on correlation ( .265) is:

Lower 2001< -.046 2003< -.036 1962> -.036 1964> -.034 1957< -.025 1954< -.017 Higher 1977 .102 1991 .031

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172565 1936 to 2013 78 years Series 36

[B] Entire series, effect on correlation ( .575) is:

Lower 2002< -.067 2012> -.022 1939> -.011 1956> -.010 1950< -.010 1937> -.010 Higher 1947 .041 1962 .032

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162591 1937 to 2016 80 years Series 37

[B] Entire series, effect on correlation ( .528) is:

Lower 1952< -.025 2016< -.022 1947> -.016 1991> -.014 1988< -.013 1998< -.011 Higher 1962 .070 1939 .016

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182455 1937 to 2016 80 years Series 38

[B] Entire series, effect on correlation ( .388) is:

Lower 1996> -.038 1956> -.027 2000< -.025 2007< -.021 1987> -.018 2008> -.017 Higher 1977 .105 1962 .029

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190735 1937 to 2017 81 years Series 39

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1950 1999 0 .02 .09 .04 -.12 -.02 -.02 -.16 .24 .14 .03 .31\*-.03 -.26 -.36 -.07 -.17 -.05 -.02 -.09 .26 .20

1968 2017 0 -.03 -.06 .10 -.06 .02 .00 -.05 .11 .12 .07 .16\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .189) is:

Lower 2002< -.040 2009> -.027 1939> -.021 2004> -.019 2016< -.019 1958< -.018 Higher 1977 .088 1987 .039

1950 to 1999 segment:

Lower 1958< -.032 1996> -.031 1974> -.026 1964> -.023 1955< -.023 1960> -.022 Higher 1977 .120 1987 .052

1968 to 2017 segment:

Lower 2002< -.068 2009> -.050 2004> -.035 1996> -.033 2016< -.030 1974> -.030 Higher 1977 .183 1987 .079

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192697 1937 to 2009 73 years Series 40

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1937 1986 0 -.05 -.19 -.15 .00 -.23 .00 -.11 .20 .00 .03 .29\*-.02 .08 .15 -.05 .04 .05 -.05 -.21 -.15 .16

[B] Entire series, effect on correlation ( .348) is:

Lower 1942< -.076 1985< -.034 1981< -.028 1984< -.020 1995< -.016 1939> -.016 Higher 1991 .040 2002 .018

1937 to 1986 segment:

Lower 1942< -.092 1985< -.040 1981< -.032 1984< -.023 1939> -.023 1961< -.017 Higher 1956 .023 1962 .022

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152659 1938 to 2006 69 years Series 41

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1950 1999 0 .19 .08 .06 -.22 -.03 .03 -.14 -.08 -.32 -.16 .30\*-.13 .05 .13 .14 .06 -.04 -.14 .02 .05 -.22

[B] Entire series, effect on correlation ( .405) is:

Lower 1964> -.029 1965> -.024 1946> -.020 1982< -.019 1973< -.016 1975< -.009 Higher 1947 .053 1962 .037

1950 to 1999 segment:

Lower 1964> -.041 1965> -.035 1982< -.028 1973< -.024 1975< -.013 1951< -.012 Higher 1962 .077 1971 .021

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20432A 1940 to 2011 72 years Series 42

[B] Entire series, effect on correlation ( .291) is:

Lower 2004> -.032 1946> -.023 1973< -.023 1964> -.022 1996> -.019 1966> -.016 Higher 1977 .064 1991 .060

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30039A 1940 to 2015 76 years Series 43

[B] Entire series, effect on correlation ( .534) is:

Lower 1991> -.083 1962> -.041 1982< -.023 2015> -.013 1944> -.011 1979> -.009 Higher 1977 .053 1947 .028

[C] Year-to-year changes diverging by over 4.0 std deviations:

1990 1991 4.6 SD

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30062 1942 to 2009 68 years Series 44

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1942 1991 0 .25 -.03 .06 -.01 -.32 -.17 -.20 -.12 -.27 .06 .29\*-.03 -.01 .23 .10 .09 -.02 -.05 .03 .20 -.07

1950 1999 0 .25 .10 .04 -.09 -.27 -.12 -.30 -.09 -.22 .04 .31\*-.07 -.03 .21 .03 .14 -.04 -.03 .09 .16 -.05

1960 2009 0 .14 .12 -.01 -.11 -.25 -.12 -.14 .02 -.14 .00 .26\* .01 -.02 .17 .10 .00 -.30 -.20 .03 - -

[B] Entire series, effect on correlation ( .226) is:

Lower 1962> -.062 1957< -.046 1964> -.036 2004> -.033 2007< -.027 2000< -.025 Higher 1977 .170 1987 .037

1942 to 1991 segment:

Lower 1962> -.083 1957< -.061 1964> -.047 1991> -.035 1984< -.021 1961< -.013 Higher 1977 .193 1987 .041

1950 to 1999 segment:

Lower 1962> -.092 1957< -.064 1964> -.051 1991> -.040 1984< -.022 1961< -.014 Higher 1977 .203 1987 .043

1960 to 2009 segment:

Lower 1962> -.082 1964> -.046 2004> -.041 2007< -.039 2000< -.037 1991> -.032 Higher 1977 .223 1987 .046

====================================================================================================================================

172493 1942 to 2004 63 years Series 45

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1950 1999 0 .26 .09 -.05 -.16 -.12 -.02 -.15 -.16 -.02 -.02 .26\* .09 .18 .21 .24 .05 -.25 -.18 -.22 -.17 -.02

1955 2004 2 .19 .08 -.09 -.17 -.01 -.07 -.22 -.16 .00 .06 .24| .08 .24\* .23 .19 -.05 -.21 -.15 -.28 -.16 .01

[B] Entire series, effect on correlation ( .258) is:

Lower 1991> -.070 1996> -.036 2004> -.028 1961< -.021 1995< -.018 1986< -.017 Higher 1987 .055 1962 .041

1950 to 1999 segment:

Lower 1991> -.092 1996> -.048 1961< -.026 1995< -.022 1986< -.022 1951< -.020 Higher 1987 .070 1962 .051

1955 to 2004 segment:

Lower 1991> -.083 1996> -.043 2004> -.033 1961< -.026 1995< -.022 1986< -.022 Higher 1987 .071 1962 .055

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192683 1942 to 2012 71 years Series 46

[B] Entire series, effect on correlation ( .448) is:

Lower 1947> -.039 2010> -.028 1983< -.025 1946> -.025 2011< -.023 2002< -.022 Higher 1991 .069 1962 .056

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40934A 1943 to 2009 67 years Series 47

[B] Entire series, effect on correlation ( .324) is:

Lower 1986< -.041 2004> -.026 1945< -.024 1947> -.020 1966> -.019 1984< -.015 Higher 1962 .062 1991 .034

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192260 1944 to 2016 73 years Series 48

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1967 2016 0 -.15 -.13 -.16 -.18 .17 .16 -.05 .18 .11 -.05 .24\*-.09 - - - - - - - - -

[B] Entire series, effect on correlation ( .310) is:

Lower 1974> -.025 2009> -.021 2007< -.019 1964> -.019 1955< -.018 1957< -.018 Higher 1962 .077 1996 .052

1967 to 2016 segment:

Lower 1974> -.038 2009> -.031 2007< -.027 1980< -.024 1970< -.018 2014< -.017 Higher 1996 .119 1991 .030

====================================================================================================================================

140939 1945 to 2007 63 years Series 49

[B] Entire series, effect on correlation ( .369) is:

Lower 1985< -.090 1972< -.023 1978> -.023 1983< -.022 1946> -.019 1987> -.017 Higher 1977 .093 1991 .062

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12303 1946 to 2009 64 years Series 50

[B] Entire series, effect on correlation ( .428) is:

Lower 1965> -.051 1964> -.032 1973< -.027 1970< -.026 1969< -.021 1971< -.011 Higher 1991 .094 1947 .046

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1965 +3.0 SD

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142703 1948 to 2004 57 years Series 51

[B] Entire series, effect on correlation ( .467) is:

Lower 1974> -.040 2004> -.029 1971< -.025 1966> -.018 1973< -.016 2001< -.016 Higher 1962 .128 1977 .046

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141124 1949 to 2007 59 years Series 52

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1949 1998 0 -.21 -.20 -.20 -.21 -.20 .15 .14 .00 .29 .24 .30\* .22 -.04 -.18 -.18 -.22 -.25 -.24 .06 -.10 .14

1950 1999 -2 -.22 -.20 -.21 -.20 -.20 .15 .15 -.02 .30\* .24 .29| .23 -.03 -.16 -.16 -.23 -.24 -.25 .07 -.10 .13

[B] Entire series, effect on correlation ( .322) is:

Lower 1962> -.088 1977> -.038 1956> -.029 1981< -.018 1955< -.018 2001< -.012 Higher 1996 .054 2004 .036

1949 to 1998 segment:

Lower 1962> -.097 1977> -.039 1956> -.031 1981< -.024 1955< -.023 1992< -.014 Higher 1996 .064 1964 .036

1950 to 1999 segment:

Lower 1962> -.096 1977> -.038 1956> -.031 1981< -.024 1955< -.023 1980< -.014 Higher 1996 .065 1964 .036

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192568 1949 to 2016 68 years Series 53

[B] Entire series, effect on correlation ( .570) is:

Lower 1951< -.040 1987> -.026 1975< -.020 1995< -.018 2013< -.014 2015> -.010 Higher 1962 .061 1977 .020

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150776 1951 to 2011 61 years Series 54

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1951 2000 0 -.18 -.17 .12 -.25 .00 -.09 .02 .18 .17 .03 .31\* .17 .02 -.39 -.04 -.18 -.19 -.15 -.26 .11 .22

1962 2011 0 -.01 -.22 .02 -.12 -.04 -.10 -.03 .02 .14 -.05 .24\* .20 .09 -.18 -.20 .13 .02 - - - -

[B] Entire series, effect on correlation ( .201) is:

Lower 2003< -.099 1996> -.041 1968< -.030 1955< -.026 1972< -.024 2008> -.022 Higher 1977 .085 1964 .036

1951 to 2000 segment:

Lower 1996> -.059 1968< -.049 1955< -.039 1972< -.036 1958< -.025 1966> -.020 Higher 1977 .103 1964 .041

1962 to 2011 segment:

Lower 2003< -.130 1996> -.049 1968< -.039 1972< -.030 2008> -.025 1966> -.016 Higher 1977 .092 1964 .037

====================================================================================================================================

192594 1953 to 2016 64 years Series 55

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1953 2002 0 -.08 -.01 -.16 .01 -.07 -.16 .07 .04 -.02 .18 .28\* .25 -.14 .16 -.28 -.21 -.19 -.17 -.31 .10 -.02

[B] Entire series, effect on correlation ( .239) is:

Lower 1953< -.143 2004> -.045 1962> -.036 1987> -.029 2003< -.018 1984< -.015 Higher 1958 .038 1991 .037

1953 to 2002 segment:

Lower 1953< -.189 1962> -.048 1987> -.037 1984< -.018 1973< -.018 1955< -.012 Higher 1958 .042 1991 .041

[C] Year-to-year changes diverging by over 4.0 std deviations:

1953 1954 4.2 SD

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30174A 1954 to 2015 62 years Series 56

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1966 2015 0 .08 -.01 -.14 .02 -.13 -.32 -.23 .03 -.07 .07 .32\* .27 .04 - - - - - - - -

[B] Entire series, effect on correlation ( .364) is:

Lower 2007< -.113 1962> -.042 1984< -.031 1996> -.018 2010> -.012 1986< -.012 Higher 1964 .037 1991 .022

1966 to 2015 segment:

Lower 2007< -.173 1984< -.045 1996> -.022 1986< -.017 2010> -.016 2012> -.012 Higher 1977 .045 1991 .044

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70599A 1954 to 2013 60 years Series 57

[B] Entire series, effect on correlation ( .387) is:

Lower 2010> -.057 1999< -.041 1956> -.026 1993< -.020 1991> -.018 1962> -.017 Higher 1977 .063 1987 .029

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172091 1954 to 2012 59 years Series 58

[B] Entire series, effect on correlation ( .388) is:

Lower 1986< -.049 1991> -.046 2004> -.037 2012> -.028 1958< -.023 1974> -.018 Higher 1977 .114 1962 .032

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20040A 1956 to 2012 57 years Series 59

[B] Entire series, effect on correlation ( .400) is:

Lower 1971< -.045 1958< -.038 1964> -.029 1956> -.028 1966> -.021 2001< -.016 Higher 1977 .165 1987 .023

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80481A 1956 to 2013 58 years Series 60

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1956 2005 0 .08 -.05 .08 -.28 -.25 -.14 -.07 .00 .14 .13 .31\* .19 -.07 .04 -.01 -.07 -.23 -.33 .03 -.13 -.12

[B] Entire series, effect on correlation ( .270) is:

Lower 2000< -.042 1956> -.041 1996> -.035 2012> -.025 2010> -.025 1995< -.022 Higher 2004 .044 1977 .043

1956 to 2005 segment:

Lower 1956> -.049 2000< -.044 1996> -.042 1995< -.023 1991> -.021 1957< -.021 Higher 2004 .044 1977 .042

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050025 1957 to 2012 56 years Series 61

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1963 2012 0 .13 .05 .03 -.16 -.32 -.32 -.26 -.34 -.12 .21 .28\* .14 .15 .13 .10 .09 - - - - -

[B] Entire series, effect on correlation ( .392) is:

Lower 1996> -.040 1985< -.020 2007< -.018 1988< -.018 1965> -.016 1976< -.016 Higher 1962 .113 1977 .033

1963 to 2012 segment:

Lower 1996> -.046 1985< -.028 2007< -.025 1988< -.024 1976< -.021 1975< -.020 Higher 1977 .068 2002 .033

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171358 1958 to 2009 52 years Series 62

[B] Entire series, effect on correlation ( .422) is:

Lower 1977> -.109 1976< -.030 1980< -.029 2001< -.025 1981< -.023 1964> -.022 Higher 1991 .091 1962 .035

[C] Year-to-year changes diverging by over 4.0 std deviations:

1976 1977 4.2 SD

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200578 1958 to 2017 60 years Series 63

[B] Entire series, effect on correlation ( .556) is:

Lower 1972< -.026 2015> -.018 2010> -.017 2012< -.017 1975< -.015 1968< -.012 Higher 1962 .052 1991 .025

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141255 1960 to 2015 56 years Series 64

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1966 2015 0 -.16 .03 -.04 -.15 -.15 .01 -.15 .28 -.03 -.08 .31\* .08 .02 - - - - - - - -

[B] Entire series, effect on correlation ( .384) is:

Lower 1991> -.066 2015< -.035 2010> -.026 1987> -.022 1994< -.020 1967< -.020 Higher 1962 .095 1977 .066

1966 to 2015 segment:

Lower 1991> -.080 2010> -.033 1987> -.026 2015< -.025 1967< -.021 1994< -.019 Higher 1977 .100 2004 .045

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202933 1961 to 2010 50 years Series 65

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1961 2010 4 .14 .02 .10 -.17 -.07 -.06 -.18 .06 -.16 .09 .20|-.07 .04 -.09 .28\*-.07 .03 .01 - - -

[B] Entire series, effect on correlation ( .202) is:

Lower 1964> -.051 1977> -.041 1973< -.038 2010> -.024 1972< -.016 1975< -.015 Higher 2004 .065 1965 .044

1961 to 2010 segment:

Lower 1964> -.051 1977> -.041 1973< -.038 2010> -.024 1972< -.016 1975< -.015 Higher 2004 .065 1965 .044

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1964 +3.1 SD

====================================================================================================================================

12267 1974 to 2007 34 years Series 66

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1974 2007 8 .20 -.03 -.09 -.08 -.21 .20 -.15 -.13 .17 -.16 .28|-.11 -.17 .03 -.07 .23 .02 .15 .35\*-.06 -.21

[B] Entire series, effect on correlation ( .282) is:

Lower 1977> -.142 1979< -.038 2001< -.032 1986< -.032 2003< -.027 1984< -.015 Higher 1991 .132 2004 .040

1974 to 2007 segment:

Lower 1977> -.142 1979< -.038 2001< -.032 1986< -.032 2003< -.027 1984< -.015 Higher 1991 .132 2004 .040

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182374 1974 to 2017 44 years Series 67

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1974 2017 0 .07 .09 .07 -.12 .15 .18 -.07 -.09 -.23 .12 .20\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .200) is:

Lower 2008> -.035 2000< -.029 1990> -.024 1985< -.021 1980< -.018 1983< -.015 Higher 2009 .047 1996 .036

1974 to 2017 segment:

Lower 2008> -.035 2000< -.029 1990> -.024 1985< -.021 1980< -.018 1983< -.015 Higher 2009 .047 1996 .036

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160001 1983 to 2015 33 years Series 68

[B] Entire series, effect on correlation ( .452) is:

Lower 1991> -.098 1985< -.031 2004> -.024 2000< -.021 1997> -.016 1990< -.016 Higher 1996 .057 1987 .038

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192592 1990 to 2017 28 years Series 69

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1990 2017 0 -.30 .17 .09 -.08 .19 .19 -.07 -.29 -.32 .01 .27\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .272) is:

Lower 2017< -.079 2002< -.072 2016< -.056 2010> -.037 2005< -.017 1990> -.016 Higher 1996 .148 2009 .048

1990 to 2017 segment:

Lower 2017< -.079 2002< -.072 2016< -.056 2010> -.037 2005< -.017 1990> -.016 Higher 1996 .148 2009 .048

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Corr //-------- Unfiltered --------\\ //---- Filtered -----\\

No. No. No. with Mean Max Std Auto Mean Max Std Auto AR

Seq Series Interval Years Segmt Flags Master msmt msmt dev corr sens value dev corr ()

--- -------- --------- ----- ----- ----- ------ ----- ----- ----- ----- ----- ----- ----- ----- --

1 41006A 1869 2001 133 6 0 .499 1.69 6.45 1.051 .763 .244 2.77 .564 -.004 1

2 161024 1870 2009 140 6 0 .480 1.53 4.21 .548 .653 .175 2.88 .476 .009 1

3 202379 1870 2007 138 6 2 .322 1.30 4.41 .812 .884 .185 2.45 .245 -.031 1

4 192154 1879 2016 138 5 0 .490 1.73 7.28 1.150 .816 .229 2.90 .525 -.012 1

5 10539 1882 2009 128 5 1 .458 1.37 3.40 .570 .726 .191 2.74 .435 -.061 1

6 201248 1885 2013 129 5 0 .406 2.23 4.24 .708 .745 .167 2.82 .479 -.080 3

7 202775 1885 2009 125 5 0 .522 2.50 5.22 .562 .528 .151 2.73 .460 -.085 1

8 40131 1892 2009 118 5 0 .606 2.09 4.94 .788 .751 .182 2.72 .484 -.028 1

9 142178 1893 2009 117 5 0 .476 1.88 7.01 1.087 .820 .245 2.61 .485 -.056 1

10 182396 1895 2009 115 5 2 .363 1.08 1.98 .357 .720 .202 2.70 .403 .005 1

11 101259 1896 2000 105 5 3 .382 1.30 4.60 .933 .907 .196 2.75 .607 .061 1

12 101292 1896 2007 112 5 0 .517 2.04 5.19 .925 .858 .170 2.54 .381 -.076 1

13 111290 1899 2014 116 5 1 .377 1.23 4.07 .666 .913 .142 2.74 .440 -.007 1

14 12234A 1910 2016 107 4 2 .367 .92 2.57 .460 .780 .238 2.73 .510 -.040 1

15 140881 1914 2009 96 4 2 .287 2.37 8.73 1.583 .773 .208 2.69 .370 .058 1

16 192641 1915 2009 95 4 2 .255 .94 2.36 .558 .695 .254 2.80 .577 -.023 4

17 121455 1916 2016 101 4 3 .268 .71 2.16 .436 .799 .312 2.42 .299 -.035 3

18 41025A 1918 2011 94 4 0 .423 1.49 4.08 .666 .813 .175 2.73 .463 .050 1

19 40935A 1920 2015 96 4 2 .327 1.21 2.88 .545 .799 .183 3.01 .465 .058 2

20 40853A 1922 2016 95 4 1 .417 1.02 3.04 .633 .896 .201 3.15 .528 .080 1

21 171421 1922 2007 86 4 0 .477 1.34 2.74 .537 .616 .266 2.94 .501 -.025 1

22 132525 1925 2009 85 3 0 .509 2.10 5.34 1.014 .877 .150 2.66 .377 -.050 1

23 202536 1926 2009 84 3 0 .486 1.75 4.67 .807 .767 .217 2.51 .458 -.068 1

24 192552 1928 2017 90 3 3 .280 .67 1.89 .429 .770 .277 2.67 .397 -.055 1

25 172542 1929 2009 81 3 2 .236 .70 1.37 .213 .617 .187 2.54 .529 -.036 1

26 192583 1929 2012 84 3 0 .512 1.53 4.15 .686 .321 .347 2.91 .583 -.025 1

27 182678 1931 2009 79 3 0 .475 .88 2.00 .314 .380 .271 2.85 .410 .006 1

28 102453 1933 2014 82 3 2 .302 1.01 2.34 .469 .737 .247 2.39 .306 -.022 1

29 162458 1933 2013 81 3 1 .498 1.46 4.95 1.182 .892 .247 2.77 .490 -.004 1

30 162470 1934 2013 80 3 0 .459 4.85 12.83 3.690 .962 .214 2.44 .402 -.096 2

31 172575 1934 1999 66 2 0 .400 1.39 3.12 .538 .427 .225 2.92 .538 -.087 1

32 192666 1934 2013 80 3 2 .299 .50 1.58 .279 .640 .231 2.83 .392 .036 1

33 192707 1935 2009 75 3 3 .225 1.48 4.29 .854 .841 .213 2.88 .524 -.055 1

34 202528 1935 2011 77 3 2 .216 .90 2.06 .599 .878 .265 2.65 .427 .004 2

35 30109 1936 2015 80 3 0 .265 5.54 10.68 2.015 .482 .265 2.73 .519 -.024 1

36 172565 1936 2013 78 3 0 .575 1.46 6.57 1.373 .966 .168 2.71 .498 .007 1

37 162591 1937 2016 80 3 0 .528 1.19 2.54 .578 .869 .184 2.53 .377 -.034 1

38 182455 1937 2016 80 3 0 .388 .91 2.36 .500 .650 .265 2.67 .420 .015 2

39 190735 1937 2017 81 3 2 .189 .80 1.94 .509 .895 .254 2.68 .547 -.011 1

40 192697 1937 2009 73 3 1 .348 1.78 3.55 .649 .625 .194 2.80 .526 -.089 1

41 152659 1938 2006 69 3 1 .405 .94 2.66 .486 .780 .211 2.69 .492 -.012 1

42 20432A 1940 2011 72 3 0 .291 2.98 6.06 1.066 .793 .184 2.70 .486 -.025 1

43 30039A 1940 2015 76 3 0 .534 2.84 5.16 1.097 .758 .208 2.63 .666 .030 1

44 30062 1942 2009 68 3 3 .226 .83 2.68 .482 .703 .317 2.43 .415 .017 1

45 172493 1942 2004 63 3 2 .258 .70 2.61 .455 .847 .203 2.86 .644 .086 2

46 192683 1942 2012 71 3 0 .448 .84 2.86 .486 .721 .273 2.85 .584 .082 1

47 40934A 1943 2009 67 3 0 .324 .89 2.30 .601 .870 .272 2.89 .597 -.047 1

48 192260 1944 2016 73 3 1 .310 2.92 7.52 1.564 .620 .354 2.96 .465 .008 1

PART 7: DESCRIPTIVE STATISTICS: 10:41 Fri 04 Sep 2020 Page 8

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Corr //-------- Unfiltered --------\\ //---- Filtered -----\\

No. No. No. with Mean Max Std Auto Mean Max Std Auto AR

Seq Series Interval Years Segmt Flags Master msmt msmt dev corr sens value dev corr ()

--- -------- --------- ----- ----- ----- ------ ----- ----- ----- ----- ----- ----- ----- ----- --

49 140939 1945 2007 63 3 0 .369 .46 1.40 .325 .702 .412 2.72 .564 -.120 2

50 12303 1946 2009 64 3 0 .428 1.98 3.72 .709 .785 .188 2.65 .482 .046 1

51 142703 1948 2004 57 3 0 .467 1.52 5.17 .887 .663 .261 2.50 .403 .039 1

52 141124 1949 2007 59 3 2 .322 1.15 3.60 .625 .509 .336 2.95 .656 -.019 1

53 192568 1949 2016 68 3 0 .570 .74 1.59 .400 .825 .222 2.85 .604 .008 1

54 150776 1951 2011 61 2 2 .201 .66 1.71 .395 .858 .237 2.64 .536 -.009 1

55 192594 1953 2016 64 2 1 .239 1.98 4.64 1.196 .897 .214 2.67 .414 -.066 1

56 30174A 1954 2015 62 2 1 .364 .45 1.84 .259 .525 .287 2.69 .539 .105 2

57 70599A 1954 2013 60 2 0 .387 .46 1.55 .362 .666 .379 3.03 .604 .032 1

58 172091 1954 2012 59 2 0 .388 6.39 13.77 3.004 .787 .224 2.65 .538 -.033 1

59 20040A 1956 2012 57 2 0 .400 1.84 5.94 1.670 .933 .168 2.47 .365 -.047 1

60 80481A 1956 2013 58 2 1 .270 .61 1.49 .281 .755 .253 2.58 .487 -.009 1

61 050025 1957 2012 56 2 1 .392 1.21 2.30 .599 .747 .314 2.68 .540 -.089 1

62 171358 1958 2009 52 2 0 .422 1.77 3.59 .426 .469 .166 2.83 .628 -.074 1

63 200578 1958 2017 60 2 0 .556 1.32 5.03 1.020 .648 .380 2.88 .586 -.100 1

64 141255 1960 2015 56 2 1 .384 1.02 1.61 .274 .520 .199 2.56 .573 -.008 1

65 202933 1961 2010 50 1 1 .202 1.62 4.19 .930 .865 .227 2.51 .456 .020 1

66 12267 1974 2007 34 1 1 .282 2.04 4.72 .906 .694 .237 2.74 .560 .011 1

67 182374 1974 2017 44 1 1 .200 .81 2.55 .543 .697 .315 2.72 .487 .016 1

68 160001 1983 2015 33 1 0 .452 .76 1.43 .325 .333 .408 2.61 .640 -.092 3

69 192592 1990 2017 28 1 1 .272 2.00 4.18 .553 .360 .207 3.08 .656 .038 1

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Total or mean: 5604 222 59 .391 1.56 13.77 .790 .741 .230 3.15 .483 -.016

- = [ COFECHA FRAM COF ] = -