[] Dendrochronology Program Library Run TSCA Program COF 15:15 Tue 23 Apr 2019 Page 1

[]

[] P R O G R A M C O F E C H A Version 6.06P 30795

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

QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: HHSC12F02\_TSCA\_corr4-50

File of DATED series: HHSC12F02\_TSCA\_corr4.txt FINAL

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 1868 to 2015 148 years

Continuous time span is 1868 to 2015 148 years

Portion with two or more series is 1871 to 2015 145 years

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

\*C\* Number of dated series 32 \*C\*

\*O\* Master series 1868 2015 148 yrs \*O\*

\*F\* Total rings in all series 3086 \*F\*

\*E\* Total dated rings checked 3083 \*E\*

\*C\* Series intercorrelation .512 \*C\*

\*H\* Average mean sensitivity .271 \*H\*

\*A\* Segments, possible problems 21 \*A\*

\*\*\* Mean length of series 96.4 \*\*\*

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

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

122A 1 absent rings: 1951

1 absent rings .032%

PART 2: TIME PLOT OF TREE-RING SERIES: HHSC12F02\_TSCA\_corr4-50 15:15 Tue 23 Apr 2019 Page 2

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

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

: : : : : : : : : : : : : : : : : : : : : -------- --- ---- ---- ----

. . . . . . . . . . . . . . . . . .<=========> . 119A 1 1911 2015 105

. . . . . . . . . . . . . . . . . . <=======> . 119B 2 1939 2015 77

. . . . . . . . . . . . . . . . . . <======> . 120A 3 1945 2015 71

. . . . . . . . . . . . . . . . . . <=====> . 120B 4 1951 2015 65

. . . . . . . . . . . . . . . . . <============> . 121B 5 1880 2015 136

. . . . . . . . . . . . . . . . . <==========> . 122A 6 1905 2015 111

. . . . . . . . . . . . . . . . . .<=========> . 122B 7 1914 2015 102

. . . . . . . . . . . . . . . . . . <=======> . 142A 8 1939 2015 77

. . . . . . . . . . . . . . . . . <==========> . 142B 9 1906 2015 110

. . . . . . . . . . . . . . . . . <=============> . 144A 10 1874 2015 142

. . . . . . . . . . . . . . . . .<==============> . 144B 11 1868 2015 148

. . . . . . . . . . . . . . . . . . <========> . 164A 12 1927 2015 89

. . . . . . . . . . . . . . . . . . <=======> . 164B 13 1933 2015 83

. . . . . . . . . . . . . . . . . . <=====> . 176B 14 1956 2015 60

. . . . . . . . . . . . . . . . . .<=========> . 177A 15 1915 2015 101

. . . . . . . . . . . . . . . . . . <========> . 177B 16 1927 2015 89

. . . . . . . . . . . . . . . . . .<=========> . 178A 17 1911 2015 105

. . . . . . . . . . . . . . . . . .<=========> . 178B 18 1913 2015 103

. . . . . . . . . . . . . . . . . . <======> . 181A 19 1946 2015 70

. . . . . . . . . . . . . . . . . . <========> . 181B 20 1926 2015 90

. . . . . . . . . . . . . . . . . <=============> . 184A 21 1872 2015 144

. . . . . . . . . . . . . . . . . <=============> . 184B 22 1871 2015 145

. . . . . . . . . . . . . . . . . <=============> . 185A 23 1872 2015 144

. . . . . . . . . . . . . . . . . <==========> . 185B 24 1901 2015 115

. . . . . . . . . . . . . . . . . . <=====> . 220A 25 1956 2015 60

. . . . . . . . . . . . . . . . . . .<====> . 220B 26 1961 2015 55

. . . . . . . . . . . . . . . . . . <=====> . 364A 27 1955 2015 61

. . . . . . . . . . . . . . . . . . <========> . 364B 28 1929 2015 87

. . . . . . . . . . . . . . . . . . <=======> . 365A 29 1934 2015 82

. . . . . . . . . . . . . . . . . . <=====> . 365B 30 1955 2015 61

. . . . . . . . . . . . . . . . . <==========> . 121A 31 1902 2015 114

. . . . . . . . . . . . . . . . . . <=======> . 176A 32 1932 2015 84

: : : : : : : : : : : : : : : : : : : : :

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: HHSC12F02\_TSCA\_corr4-50 15:15 Tue 23 Apr 2019 Page 3

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

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

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

1900 -.593 6 1950 -1.582 26 2000 .250 32

1901 .277 7 1951 -1.013 27 1 2001 -.852 32

1902 .830 8 1952 -1.077 27 2002 -1.395 32

1903 2.086 8 1953 -.703 27 2003 -2.323 32

1904 1.509 8 1954 1.203 27 2004 -.747 32

1905 1.455 9 1955 1.913 29 2005 1.061 32

1906 .613 10 1956 1.477 31 2006 -1.057 32

1907 -.280 10 1957 1.078 31 2007 -.173 32

1908 -.832 10 1958 .522 31 2008 .869 32

1909 -.435 10 1959 .327 31 2009 1.789 32

1910 -.824 10 1960 -.288 31 2010 1.757 32

1911 -.202 12 1961 1.046 32 2011 .087 32

1912 -.749 12 1962 -.263 32 2012 .351 32

1913 .001 13 1963 .443 32 2013 1.186 32

1914 .443 14 1964 -1.090 32 2014 -.066 32

1915 -.286 15 1965 -1.583 32 2015 -2.763 32

1916 1.527 15 1966 -.085 32

1917 1.048 15 1967 .193 32

1868 2.196 1 1918 -.605 15 1968 .241 32

1869 .673 1 1919 -2.282 15 1969 -.601 32

1870 2.463 1 1920 -1.371 15 1970 -1.390 32

1871 1.324 2 1921 -.766 15 1971 .354 32

1872 1.718 4 1922 -.769 15 1972 .685 32

1873 1.377 4 1923 -.167 15 1973 1.827 32

1874 1.021 5 1924 -.459 15 1974 -.122 32

1875 .612 5 1925 .485 15 1975 -.307 32

1876 .322 5 1926 .207 16 1976 -.380 32

1877 -.376 5 1927 .052 18 1977 -.735 32

1878 -.387 5 1928 -.346 18 1978 -.511 32

1879 -1.169 5 1929 .763 19 1979 -.369 32

1880 -.392 6 1930 .729 19 1980 -.555 32

1881 -1.799 6 1931 1.042 19 1981 -2.231 32

1882 -.884 6 1932 .592 20 1982 -.681 32

1883 .762 6 1933 .528 21 1983 .222 32

1884 -.258 6 1934 .271 22 1984 -1.052 32

1885 -.773 6 1935 1.018 22 1985 .619 32

1886 -1.124 6 1936 .265 22 1986 1.604 32

1887 -.609 6 1937 .328 22 1987 .876 32

1888 -1.403 6 1938 .099 22 1988 -.674 32

1889 -1.233 6 1939 -.027 24 1989 .426 32

1890 -1.191 6 1940 .196 24 1990 .756 32

1891 -.051 6 1941 -.323 24 1991 -.260 32

1892 .209 6 1942 -.655 24 1992 1.431 32

1893 -.792 6 1943 -.062 24 1993 -.202 32

1894 -1.451 6 1944 -.231 24 1994 .526 32

1895 .033 6 1945 .457 25 1995 -.338 32

1896 -1.145 6 1946 -.274 26 1996 1.531 32

1897 .281 6 1947 -.525 26 1997 .155 32

1898 1.633 6 1948 -.770 26 1998 .777 32

1899 .409 6 1949 -2.066 26 1999 -1.030 32

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

PART 4: Master Bar Plot: HHSC12F02\_TSCA\_corr4-50 15:15 Tue 23 Apr 2019 Page 4

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

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---b 1950f 2000------A

1901------A 1951-d 2001--c

1902--------C 1952-d 2002f

1903----------H 1953--c 2003i

1904----------F 1954---------E 2004--c

1905---------F 1955----------H 2005---------D

1906--------B 1956----------F 2006-d

1907----a 1957---------D 2007----a

1908--c 1958-------B 2008--------C

1909---b 1959------A 2009----------G

1910--c 1960----a 2010----------G

1911----a 1961---------D 2011-----@

1912--c 1962----a 2012-------A

1913-----@ 1963-------B 2013---------E

1914-------B 1964-d 2014-----@

1915----a 1965f 2015k

1916----------F 1966-----@

1917---------D 1967------A

1868----------I 1918--b 1968------A

1869--------C 1919i 1969---b

1870----------J 1920e 1970f

1871---------E 1921--c 1971-------A

1872----------G 1922--c 1972--------C

1873---------F 1923----a 1973----------G

1874---------D 1924---b 1974-----@

1875--------B 1925-------B 1975----a

1876------A 1926------A 1976---b

1877---b 1927-----@ 1977--c

1878---b 1928----a 1978---b

1879-e 1929--------C 1979---a

1880---b 1930--------C 1980---b

1881g 1931---------D 1981i

1882--d 1932-------B 1982--c

1883--------C 1933-------B 1983------A

1884----a 1934------A 1984-d

1885--c 1935---------D 1985--------B

1886-d 1936------A 1986----------F

1887--b 1937------A 1987--------D

1888f 1938------@ 1988--c

1889-e 1939-----@ 1989-------B

1890-e 1940------A 1990--------C

1891-----@ 1941----a 1991----a

1892------A 1942--c 1992---------F

1893--c 1943-----@ 1993----a

1894f 1944----a 1994-------B

1895-----@ 1945-------B 1995----a

1896-e 1946----a 1996----------F

1897------A 1947---b 1997------A

1898----------G 1948--c 1998--------C

1899-------B 1949h 1999-d

PART 5: CORRELATION OF SERIES BY SEGMENTS: HHSC12F02\_TSCA\_corr4-50 15:15 Tue 23 Apr 2019 Page 5

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

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 119A 1911 2015 .14B .22B .49 .65

2 119B 1939 2015 .55 .55 .61

3 120A 1945 2015 .43 .42 .47

4 120B 1951 2015 .53 .59

5 121B 1880 2015 .39 .53 .57 .64 .64

6 122A 1905 2015 .34B .41 .58 .62

7 122B 1914 2015 .52 .52 .67 .74

8 142A 1939 2015 .27B .33B .19B

9 142B 1906 2015 .14B .41 .44 .62

10 144A 1874 2015 .54 .54 .51 .40 .51 .61

11 144B 1868 2015 .43 .43 .43 .38 .55 .67

12 164A 1927 2015 .40 .48 .51

13 164B 1933 2015 .55 .72 .68

14 176B 1956 2015 .22A .32A

15 177A 1915 2015 .33 .29A .54 .60

16 177B 1927 2015 .54 .50 .55

17 178A 1911 2015 .25B .46 .63 .63

18 178B 1913 2015 .20B .30A .64 .67

19 181A 1946 2015 .60 .65 .71

20 181B 1926 2015 .37 .43 .71

21 184A 1872 2015 .39 .46 .44 .48 .45 .61

22 184B 1871 2015 .41 .42 .51 .46 .58 .73

23 185A 1872 2015 .19B .11B .12B .39 .41 .65

24 185B 1901 2015 .44B .58 .54 .55

25 220A 1956 2015 .54 .59

26 220B 1961 2015 .26A .33

27 364A 1955 2015 .44 .58

28 364B 1929 2015 .30B .23B .44

29 365A 1934 2015 .39 .39 .51

30 365B 1955 2015 .30A .55

31 121A 1902 2015 .48 .56 .71 .65

32 176A 1932 2015 .62 .70 .66

Av segment correlation .39 .39 .36 .44 .50 .58

PART 6: POTENTIAL PROBLEMS: HHSC12F02\_TSCA\_corr4-50 15:15 Tue 23 Apr 2019 Page 5

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

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

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

119A 1911 to 2015 105 years Series 1

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

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

1911 1960 1 -.24 .02 .09 .04 -.10 -.20 -.14 -.25 -.30 -.15 .14| .28\* .08 -.05 .13 -.05 -.11 -.01 .01 .13 .03

1925 1974 4 -.19 -.01 .18 .24 .01 -.16 -.23 -.27 -.18 -.18 .22|-.10 .20 .08 .25\* .12 -.04 .02 -.22 .05 .15

[B] Entire series, effect on correlation ( .487) is:

Lower 1926< -.022 1969> -.017 1919> -.016 1996< -.015 1952> -.013 1951> -.012 Higher 1981 .035 2015 .020

1911 to 1960 segment:

Lower 1952> -.035 1922> -.033 1926< -.033 1951> -.030 1919> -.023 1937< -.020 Higher 1916 .105 1954 .073

1925 to 1974 segment:

Lower 1969> -.053 1952> -.041 1951> -.037 1926< -.035 1937< -.020 1955< -.015 Higher 1973 .078 1954 .064

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

1981 -4.6 SD

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

119B 1939 to 2015 77 years Series 2

[B] Entire series, effect on correlation ( .614) is:

Lower 1984> -.026 1939> -.019 1969> -.015 1997> -.011 1999> -.010 1983< -.009 Higher 2006 .020 2015 .020

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

120A 1945 to 2015 71 years Series 3

[B] Entire series, effect on correlation ( .468) is:

Lower 1981> -.025 1976< -.021 1979< -.019 1988> -.013 1991> -.012 2000< -.012 Higher 2009 .015 1954 .015

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

120B 1951 to 2015 65 years Series 4

[B] Entire series, effect on correlation ( .591) is:

Lower 1981> -.046 1969< -.028 1984> -.027 1959< -.013 1967< -.009 1956< -.009 Higher 2015 .021 1986 .017

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

121B 1880 to 2015 136 years Series 5

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

Lower 1888> -.029 1981< -.016 1891< -.013 1990< -.009 1975> -.008 1936< -.006 Higher 2015 .014 1949 .011

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

1980 1981 -4.6 SD

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1888 +3.6 SD; 1981 -6.8 SD

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

122A 1905 to 2015 111 years Series 6

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

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

1905 1954 -1 .02 -.02 .11 -.07 -.15 -.06 .05 .23 .10 .42\* .34|-.09 .09 -.05 -.05 -.12 -.17 .01 .04 .06 .16

[B] Entire series, effect on correlation ( .533) is:

Lower 1954< -.018 1916< -.017 1984> -.017 2008< -.012 1926> -.012 1948> -.009 Higher 2015 .013 1981 .013

1905 to 1954 segment:

Lower 1954< -.058 1916< -.049 1926> -.030 1948> -.027 1912> -.025 1923> -.009 Higher 1919 .061 1949 .035

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

1951 -1.013 27 1

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

1981 -7.2 SD

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

122B 1914 to 2015 102 years Series 7

[B] Entire series, effect on correlation ( .656) is:

Lower 1916< -.016 1974> -.016 1926> -.014 1954< -.013 1922< -.013 1923> -.009 Higher 2015 .024 1919 .020

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

142A 1939 to 2015 77 years Series 8

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

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

1939 1988 2 .31 -.20 -.06 -.06 -.04 -.06 -.27 -.05 .01 -.03 .27| .05 .38\* .06 .13 .13 .05 -.13 -.07 .18 -.10

1950 1999 2 .34 -.07 -.21 -.06 -.01 -.19 -.14 .05 .01 -.23 .33|-.17 .43\*-.07 .20 .05 .23 -.06 .01 .28 -.10

1966 2015 -10 .30\*-.04 -.09 .04 -.03 -.25 -.13 .09 -.08 -.29 .19| - - - - - - - - - -

[B] Entire series, effect on correlation ( .251) is:

Lower 1972< -.072 1981> -.036 2010< -.033 2003> -.025 1988> -.019 2009< -.017 Higher 1973 .033 1954 .022

1939 to 1988 segment:

Lower 1972< -.129 1981> -.071 1988> -.033 1943< -.015 1964> -.014 1951> -.008 Higher 1973 .059 1954 .039

1950 to 1999 segment:

Lower 1972< -.123 1981> -.070 1988> -.033 1964> -.014 1995> -.011 1999> -.010 Higher 1973 .045 1954 .029

1966 to 2015 segment:

Lower 1972< -.090 1981> -.048 2010< -.040 2003> -.034 1988> -.025 2006> -.022 Higher 1973 .049 1986 .031

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

142B 1906 to 2015 110 years Series 9

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

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

1906 1955 1 .00 -.24 .09 .01 -.10 -.22 .01 -.28 -.07 -.11 .14| .21\*-.02 -.15 -.06 -.02 -.17 .07 .13 -.07 -.01

[B] Entire series, effect on correlation ( .435) is:

Lower 1981> -.045 1934< -.043 1926< -.017 1919> -.014 1923< -.013 1972< -.013 Higher 2015 .075 1916 .018

1906 to 1955 segment:

Lower 1934< -.073 1926< -.026 1915> -.024 1923< -.024 1914< -.020 1919> -.017 Higher 1916 .079 1954 .047

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

1980 1981 4.0 SD

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

1934 -4.7 SD

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

144A 1874 to 2015 142 years Series 10

[B] Entire series, effect on correlation ( .543) is:

Lower 1881> -.020 1986< -.013 1948> -.011 1971< -.010 1945< -.010 1940< -.009 Higher 1981 .024 1919 .022

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

144B 1868 to 2015 148 years Series 11

[\*] Early part of series cannot be checked from 1868 to 1870 -- not matched by another series

[B] Entire series, effect on correlation ( .515) is:

Lower 1881> -.040 1940< -.016 1875< -.013 1948> -.011 1932< -.010 1871< -.009 Higher 1981 .029 2015 .024

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

1881 +3.2 SD

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

164A 1927 to 2015 89 years Series 12

[B] Entire series, effect on correlation ( .494) is:

Lower 1975< -.063 1981> -.021 1987< -.016 2003> -.014 1982< -.014 1931< -.013 Higher 2015 .017 1973 .016

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

164B 1933 to 2015 83 years Series 13

[B] Entire series, effect on correlation ( .586) is:

Lower 1937< -.047 2003> -.041 1984> -.022 1941> -.007 1952> -.007 1948< -.006 Higher 1986 .015 1954 .014

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

2003 +3.1 SD

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

176B 1956 to 2015 60 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

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

1956 2005 0 -.10 -.19 -.18 -.03 .08 -.20 .11 -.08 -.01 -.32 .22\* .18 -.11 -.25 .08 -.10 .08 .06 .09 -.17 -.05

1966 2015 0 -.10 .03 .08 -.02 .08 -.12 .28 -.03 -.23 -.20 .32\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .314) is:

Lower 2003> -.046 2007< -.043 1970> -.033 1961< -.028 1973< -.025 1987< -.022 Higher 2015 .092 1964 .034

1956 to 2005 segment:

Lower 2003> -.057 1970> -.041 1961< -.040 1973< -.036 1987< -.028 1963< -.026 Higher 1964 .064 1996 .032

1966 to 2015 segment:

Lower 2007< -.058 2003> -.053 1970> -.038 1973< -.032 1987< -.029 1975> -.014 Higher 2015 .116 1996 .024

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1970 +3.2 SD; 2003 +3.6 SD

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

177A 1915 to 2015 101 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

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

1925 1974 0 .05 .17 -.07 -.01 -.03 -.04 -.30 -.20 -.01 -.03 .29\* .14 -.14 .04 -.08 .03 -.05 -.10 -.06 -.18 .15

[B] Entire series, effect on correlation ( .462) is:

Lower 1933< -.066 1981> -.031 1959< -.021 2006> -.013 1930< -.011 1953> -.010 Higher 2015 .026 1986 .019

1925 to 1974 segment:

Lower 1933< -.114 1959< -.030 1953> -.022 1930< -.021 1947> -.018 1960> -.016 Higher 1949 .064 1954 .034

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

177B 1927 to 2015 89 years Series 16

[B] Entire series, effect on correlation ( .551) is:

Lower 1981> -.071 2006> -.024 1930< -.023 2003> -.017 1954< -.013 1947> -.012 Higher 2015 .086 1949 .024

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

1981 +3.6 SD

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

178A 1911 to 2015 105 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

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

1911 1960 -2 -.07 .08 -.29 -.19 -.06 -.18 -.10 -.04 .30\* .27 .25| .24 .02 -.02 -.06 -.24 -.20 -.05 .00 -.16 -.15

[B] Entire series, effect on correlation ( .494) is:

Lower 1933< -.031 1921< -.030 2006> -.013 1986< -.013 1922> -.012 1947> -.011 Higher 2015 .029 2003 .014

1911 to 1960 segment:

Lower 1933< -.059 1921< -.047 1922> -.029 1947> -.025 1934< -.014 1927> -.011 Higher 1955 .049 1949 .047

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

2003 -5.0 SD

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

178B 1913 to 2015 103 years Series 18

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

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

1913 1962 2 .06 -.01 -.18 -.02 .00 -.03 -.03 .07 -.02 -.05 .20| .33 .40\*-.13 -.01 -.08 -.11 -.10 -.32 .01 -.16

1925 1974 0 -.14 -.05 -.35 -.19 .06 -.03 .09 -.15 .00 .17 .30\* .20 .17 -.05 -.09 -.09 -.16 -.11 -.27 -.25 -.17

[B] Entire series, effect on correlation ( .445) is:

Lower 1917< -.061 1925< -.038 1935< -.021 1919> -.020 1949> -.011 1944> -.010 Higher 1916 .022 1984 .017

1913 to 1962 segment:

Lower 1917< -.096 1925< -.067 1919> -.043 1935< -.039 1949> -.022 1944> -.016 Higher 1916 .080 1954 .046

1925 to 1974 segment:

Lower 1925< -.099 1935< -.056 1949> -.024 1944> -.024 1945< -.019 1942> -.018 Higher 1954 .045 1964 .039

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

181A 1946 to 2015 70 years Series 19

[B] Entire series, effect on correlation ( .678) is:

Lower 1984< -.028 1953< -.017 1947> -.014 2004< -.010 1976> -.007 1983< -.007 Higher 2015 .038 1981 .013

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

181B 1926 to 2015 90 years Series 20

[B] Entire series, effect on correlation ( .558) is:

Lower 1953< -.079 1955< -.023 2003> -.015 1974> -.014 1954< -.010 1929< -.007 Higher 2015 .053 2006 .015

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

1953 -4.9 SD

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

184A 1872 to 2015 144 years Series 21

[B] Entire series, effect on correlation ( .502) is:

Lower 1936< -.030 1874< -.022 1972< -.019 1996< -.017 1978< -.014 1876> -.011 Higher 2015 .039 1949 .016

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

1890 +3.0 SD

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

184B 1871 to 2015 145 years Series 22

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

Lower 1881< -.069 1873< -.010 1926> -.008 1951< -.008 1984> -.008 1937> -.007 Higher 2006 .014 2003 .012

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

1880 1881 -4.8 SD 1881 1882 5.3 SD

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

1881 -7.4 SD

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

185A 1872 to 2015 144 years Series 23

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

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

1872 1921 1 - - - - - - .17 .10 .06 -.12 .19| .56\* .08 .00 .04 .00 .02 -.01 .22 -.05 -.25

1875 1924 1 - - - .01 .04 .09 -.02 -.05 -.10 -.22 .11| .56\* .07 .03 .04 .04 .03 .12 .29 .00 -.25

1900 1949 1 -.14 -.20 -.23 -.01 .04 .04 -.02 -.06 -.11 -.09 .12| .38\* .28 .18 .18 -.04 .05 -.03 .10 .01 .03

[B] Entire series, effect on correlation ( .414) is:

Lower 1958< -.029 1900> -.019 1986< -.014 1939< -.013 1883< -.013 1911< -.011 Higher 2015 .053 1981 .019

1872 to 1921 segment:

Lower 1900> -.057 1883< -.033 1914< -.030 1911< -.029 1876< -.023 1906< -.020 Higher 1903 .052 1872 .041

1875 to 1924 segment:

Lower 1900> -.055 1883< -.033 1914< -.031 1911< -.028 1876< -.023 1906< -.021 Higher 1903 .065 1919 .037

1900 to 1949 segment:

Lower 1900> -.056 1914< -.029 1939< -.022 1911< -.020 1922> -.018 1906< -.017 Higher 1903 .056 1919 .040

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

185B 1901 to 2015 115 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

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

1901 1950 1 -.15 -.09 -.08 .18 .08 -.11 -.12 -.18 .09 .18 .44| .61\* .14 .18 .11 -.08 -.12 -.16 -.04 -.14 .05

[B] Entire series, effect on correlation ( .541) is:

Lower 1986< -.021 2006> -.021 1970> -.017 1910> -.017 1976> -.010 1906< -.010 Higher 2015 .025 1919 .015

1901 to 1950 segment:

Lower 1910> -.057 1906< -.031 1914< -.022 1909< -.015 1917< -.014 1922> -.013 Higher 1919 .074 1903 .036

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

220A 1956 to 2015 60 years Series 25

[B] Entire series, effect on correlation ( .608) is:

Lower 1981> -.057 2003> -.022 1986< -.015 1983< -.014 1993> -.014 1984< -.012 Higher 2015 .028 1996 .016

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

220B 1961 to 2015 55 years Series 26

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

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

1961 2010 0 -.14 -.07 -.13 .12 .10 -.21 .07 -.18 .00 -.06 .26\* .16 .10 .04 .03 .05 - - - - -

[B] Entire series, effect on correlation ( .326) is:

Lower 2006> -.061 1976< -.044 1987< -.030 1981> -.021 2000< -.021 1970> -.016 Higher 2015 .063 1964 .024

1961 to 2010 segment:

Lower 2006> -.070 1976< -.031 1987< -.028 1981> -.022 2000< -.022 1970> -.018 Higher 1964 .033 1988 .030

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

364A 1955 to 2015 61 years Series 27

[B] Entire series, effect on correlation ( .500) is:

Lower 1984> -.043 1962> -.041 1971< -.024 1964> -.021 1974> -.015 1988> -.012 Higher 1981 .032 2015 .027

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

1981 -5.5 SD

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

364B 1929 to 2015 87 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

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

1929 1978 2 .05 -.20 -.04 -.41 -.21 -.17 -.07 -.07 -.07 .00 .30| .43 .49\*-.02 -.06 -.01 .17 .12 -.13 -.16 -.40

1950 1999 7 .15 -.35 -.16 -.13 .01 -.18 .03 -.17 .03 -.04 .23| .17 .19 -.13 .10 -.11 .02 .24\* .14 -.01 -.52

[B] Entire series, effect on correlation ( .380) is:

Lower 1995< -.065 1935< -.022 1981> -.020 1965> -.017 1993> -.016 1988> -.016 Higher 2015 .030 1996 .023

1929 to 1978 segment:

Lower 1935< -.062 1965> -.049 1961< -.037 1963< -.021 1930< -.017 1940< -.014 Higher 1954 .046 1955 .045

1950 to 1999 segment:

Lower 1995< -.053 1965> -.023 1981> -.022 1961< -.022 1993> -.022 1994< -.022 Higher 1996 .046 1971 .027

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

1995 -6.6 SD

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

365A 1934 to 2015 82 years Series 29

[B] Entire series, effect on correlation ( .489) is:

Lower 1981> -.037 1984> -.028 1969< -.023 1951> -.020 1994< -.016 1938< -.011 Higher 2003 .022 1986 .021

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

1970 -5.0 SD

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

365B 1955 to 2015 61 years Series 30

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

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

1955 2004 0 .02 -.17 -.08 -.32 .04 -.24 .05 -.31 .00 .21 .30\* .21 .08 .05 .22 .06 -.09 -.12 .12 -.24 -.23

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

Lower 1984> -.034 1981> -.029 1988> -.026 1963< -.022 1961< -.021 1973< -.021 Higher 2015 .108 2003 .032

1955 to 2004 segment:

Lower 1984> -.045 1988> -.035 1981> -.034 1963< -.028 1962> -.027 1961< -.026 Higher 2003 .078 1955 .042

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

1972 +3.2 SD

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

121A 1902 to 2015 114 years Series 31

[B] Entire series, effect on correlation ( .616) is:

Lower 1904< -.022 1928< -.018 2003> -.013 1948> -.013 1911> -.010 1969> -.009 Higher 1981 .022 1919 .018

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

176A 1932 to 2015 84 years Series 32

[B] Entire series, effect on correlation ( .685) is:

Lower 1981> -.043 1932> -.012 1991< -.011 2015> -.009 1998< -.009 2001> -.006 Higher 2006 .016 1954 .011

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

PART 7: DESCRIPTIVE STATISTICS: HHSC12F02\_TSCA\_corr4-50 15:15 Tue 23 Apr 2019 Page 6

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

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 119A 1911 2015 105 4 2 .487 1.49 5.37 .824 .760 .198 2.59 .336 .004 1

2 119B 1939 2015 77 3 0 .614 2.29 6.13 1.145 .856 .195 2.58 .357 -.034 3

3 120A 1945 2015 71 3 0 .468 2.52 6.26 1.275 .852 .206 2.51 .518 -.066 2

4 120B 1951 2015 65 2 0 .591 3.16 7.56 1.413 .804 .203 2.81 .555 -.079 1

5 121B 1880 2015 136 5 0 .570 1.62 3.69 .801 .756 .295 2.44 .272 -.014 1

6 122A 1905 2015 111 4 1 .533 1.25 2.95 .666 .813 .301 2.43 .304 .014 1

7 122B 1914 2015 102 4 0 .656 1.28 4.36 .825 .885 .275 2.64 .479 -.072 1

8 142A 1939 2015 77 3 3 .251 2.57 4.94 1.207 .823 .231 2.85 .493 -.021 4

9 142B 1906 2015 110 4 1 .435 1.57 4.95 1.304 .923 .258 2.74 .489 -.102 1

10 144A 1874 2015 142 6 0 .543 .77 3.83 .629 .854 .292 2.67 .520 -.104 1

11 144B 1868 2015 148 6 0 .515 .94 4.56 .755 .867 .279 2.65 .476 -.010 2

12 164A 1927 2015 89 3 0 .494 1.72 4.11 .617 .646 .214 2.65 .418 .020 1

13 164B 1933 2015 83 3 0 .586 2.02 4.23 .847 .667 .253 2.98 .628 .056 1

14 176B 1956 2015 60 2 2 .314 2.63 6.88 1.164 .363 .354 2.91 .648 .119 1

15 177A 1915 2015 101 4 1 .462 1.60 3.50 .565 .555 .253 2.87 .482 -.029 1

16 177B 1927 2015 89 3 0 .551 1.78 4.29 .625 .584 .232 2.58 .423 .025 2

17 178A 1911 2015 105 4 1 .494 1.43 3.92 .607 .458 .346 2.61 .422 .019 2

18 178B 1913 2015 103 4 2 .445 1.35 4.26 .733 .568 .356 3.12 .522 -.075 1

19 181A 1946 2015 70 3 0 .678 1.52 2.77 .593 .525 .312 2.59 .462 .013 1

20 181B 1926 2015 90 3 0 .558 1.43 3.69 .658 .670 .290 2.61 .411 -.029 1

21 184A 1872 2015 144 6 0 .502 1.30 5.41 .890 .891 .252 2.79 .534 -.075 1

22 184B 1871 2015 145 6 0 .517 1.22 4.00 .760 .835 .274 2.54 .329 -.039 1

23 185A 1872 2015 144 6 3 .414 .77 2.23 .521 .843 .296 2.64 .514 -.033 2

24 185B 1901 2015 115 4 1 .541 1.62 3.83 .878 .843 .230 2.59 .396 -.030 1

25 220A 1956 2015 60 2 0 .608 2.15 4.73 .816 .551 .282 2.62 .489 -.020 1

26 220B 1961 2015 55 2 1 .326 2.47 4.78 .934 .478 .342 2.51 .498 .046 1

27 364A 1955 2015 61 2 0 .500 2.87 5.38 1.008 .631 .249 2.50 .352 .008 1

28 364B 1929 2015 87 3 2 .380 1.71 4.39 1.165 .812 .345 2.78 .358 .011 1

29 365A 1934 2015 82 3 0 .489 1.73 4.45 .892 .806 .252 2.80 .493 .105 2

30 365B 1955 2015 61 2 1 .477 2.09 8.69 1.271 .863 .205 3.06 .534 -.038 1

31 121A 1902 2015 114 4 0 .616 2.07 4.67 1.065 .760 .290 2.56 .394 -.009 1

32 176A 1932 2015 84 3 0 .685 1.41 3.78 .841 .753 .277 2.99 .598 -.045 2

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

Total or mean: 3086 116 21 .512 1.63 8.69 .852 .748 .271 3.12 .452 -.021

- = [ COFECHA TSCA COF ] = -