[] Dendrochronology Program Library Run FAGR Program COF 09:44 Thu 02 Nov 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30258

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: FAGR\_MMRB1400B\_CORR2-50

File of DATED series: FAGR\_MMRB1400B\_CORR2

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 Y

8 Parts printed 1234567

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

Time span of Master dating series is 1865 to 2015 151 years

Continuous time span is 1865 to 2015 151 years

Portion with two or more series is 1872 to 2015 144 years

>> 1110C 2007 absent in 1 of 27 series, but is not usually narrow: master index is .485

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

\*C\* Number of dated series 28 \*C\*

\*O\* Master series 1865 2015 151 yrs \*O\*

\*F\* Total rings in all series 2654 \*F\*

\*E\* Total dated rings checked 2647 \*E\*

\*C\* Series intercorrelation .447 \*C\*

\*H\* Average mean sensitivity .236 \*H\*

\*A\* Segments, possible problems 19 \*A\*

\*\*\* Mean length of series 94.8 \*\*\*

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

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

1110A1 1 absent rings: 1992

1110C 1 absent rings: 2007

2 absent rings .075%

1900 -.431 6 1950 .401 26 2000 .188 27

1901 -.295 6 1951 1.302 25 2001 .223 27

1902 .991 6 1952 .556 25 2002 .727 27

1903 .274 7 1953 .756 25 2003 .302 27

1904 -1.147 7 1954 .567 25 2004 1.580 27

1905 -.028 8 1955 -.142 25 2005 .914 27

1906 -.484 8 1956 -1.177 25 2006 1.017 27

1907 .791 8 1957 -1.945 25 2007 .485 27 1<<

1908 1.222 8 1958 .305 25 2008 .322 27

1909 1.449 10 1959 -.563 25 2009 -.511 27

1910 .677 10 1960 -1.315 25 2010 -1.745 27

1911 .083 10 1961 .096 25 2011 -.804 27

1912 .318 10 1962 -.777 25 2012 .463 27

1913 .698 13 1963 -.183 25 2013 -.540 27

1914 .339 13 1964 .820 25 2014 .849 27

1865 .697 1 1915 -.138 13 1965 1.273 25 2015 -1.147 27

1866 -1.727 1 1916 -.846 13 1966 -.168 26

1867 1.815 1 1917 -1.716 14 1967 .103 26

1868 -1.923 1 1918 -1.752 14 1968 -.432 26

1869 2.358 1 1919 -.397 14 1969 .579 26

1870 -.504 1 1920 .599 14 1970 1.138 27

1871 1.752 1 1921 1.346 14 1971 .841 27

1872 -.402 2 1922 .723 14 1972 .108 27

1873 1.056 2 1923 -.389 16 1973 -.391 27

1874 .056 2 1924 .093 17 1974 -.693 27

1875 1.243 2 1925 -.611 17 1975 -.648 27

1876 -1.342 2 1926 -.842 18 1976 -.691 27

1877 .886 2 1927 -.551 18 1977 .234 27

1878 .287 2 1928 .260 18 1978 1.088 27

1879 .893 2 1929 .630 19 1979 .229 27

1880 -.180 2 1930 .649 19 1980 .504 27

1881 .763 2 1931 1.643 19 1981 -.425 27

1882 -4.520 2 1932 1.682 21 1982 .861 27

1883 -2.390 2 1933 -.059 21 1983 -.272 27

1884 -1.370 2 1934 .541 21 1984 -.075 27

1885 .206 2 1935 1.151 21 1985 -.660 27

1886 .636 2 1936 -2.871 23 1986 -2.218 27

1887 1.148 2 1937 -.247 24 1987 -.335 27

1888 .679 2 1938 .136 24 1988 -.038 27

1889 .464 2 1939 .151 24 1989 -.384 27

1890 -1.334 2 1940 -.122 24 1990 .251 27

1891 -1.470 2 1941 -.477 24 1991 -.143 27

1892 -.356 2 1942 -.174 24 1992 -1.360 27 1

1893 -.581 2 1943 .331 24 1993 .174 27

1894 .867 4 1944 -.403 24 1994 .309 27

1895 1.853 4 1945 -.697 24 1995 .453 27

1896 1.773 5 1946 -1.314 26 1996 .196 27

1897 -.500 5 1947 -.061 26 1997 -.458 27

1898 -.747 5 1948 -.197 26 1998 -.132 27

1899 -1.298 5 1949 -.316 26 1999 1.158 27

PART 5: CORRELATION OF SERIES BY SEGMENTS: FAGR\_MMRB1400B\_CORR2-50 09:44 Thu 02 Nov 2017 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 105A 1872 2015 .46 .46 .54 .57 .34 .21A

2 105B 1900 2015 .64 .74 .50 .40

3 109A 1913 2015 .60 .64 .44 .48

4 109B 1913 2015 .37 .25B .43 .48

5 110A 1932 2015 .29B .40 .45

6 110B 1932 2015 .38 .53 .41

7 139A 1923 2015 .30A .30A .40B .36

8 139B 1923 2015 .35 .34 .42 .31A

9 1052A 1917 2015 .66 .63 .28A .47

10 1052B 1903 2015 .69 .74 .51 .54

11 1110A1 1970 2015 .33B

12 1110A2 1865 1950 .50 .49 .42 .43

13 1110B 1905 2015 .21A .35 .52 .54

14 1110C 1896 2015 .61 .49 .40 .23B .24A

15 1167A 1946 2015 .27A .35 .17B

16 1167B 1946 2015 .33B .43 .39

17 1168A 1924 2015 .63 .65 .36 .40

18 1168B 1926 2015 .60 .42 .39

19 1169A 1937 2015 .40 .48 .60

20 1169B 1913 2015 .44 .41 .44 .52

21 1170A 1894 2015 .60 .56 .60 .48 .53

22 1170B 1894 2015 .62 .60 .63 .48 .56

23 1171A 1966 2015 .39B

24 1171B 1929 2015 .21B .40 .47

25 1175A 1936 2015 .42 .36 .35

26 1175B 1936 2015 .30A .27B .35

27 1182A 1909 2015 .64 .61 .44 .36

28 1182B 1909 2015 .46 .44 .48 .45

Av segment correlation .48 .55 .51 .46 .41 .42

PART 6: POTENTIAL PROBLEMS: FAGR\_MMRB1400B\_CORR2-50 09:44 Thu 02 Nov 2017 Page 5

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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

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105A 1872 to 2015 144 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

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

1966 2015 0 -.19 -.04 -.22 -.22 .11 -.07 .08 .05 .18 -.03 .21\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .432) is:

Lower 1876> -.052 1947< -.016 2012< -.015 2004< -.014 1906< -.011 1879< -.011 Higher 1882 .121 1936 .062

1966 to 2015 segment:

Lower 2004< -.067 2012< -.067 2010> -.026 1997> -.025 1966> -.025 1991> -.022 Higher 1999 .064 1986 .039

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

1876 +3.7 SD

105A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1872 106 135 114 166 136 175 146 103

1880 87 101 32 59 72 76 78 86 88 88

1890 68 67 75 112 172 192 170 146 140 108

1900 140 161 157 164 128 98 66 170 169 225

1910 231 140 176 155 156 152 166 135 135 131

1920 170 186 149 127 139 123 124 134 132 167

1930 158 265 260 248 182 190 90 162 152 217

1940 171 142 137 184 166 159 138 104 142 135

1950 143 145 185 174 162 156 99 127 118 121

1960 86 175 158 148 150 164 193 201 177 228

1970 276 168 99 67 46 52 36 38 49 69

1980 64 57 113 91 104 84 73 88 102 128

1990 124 146 129 142 117 123 120 136 112 164

2000 133 124 128 131 108 119 127 113 103 96

2010 88 71 44 28 41 30

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105B 1900 to 2015 116 years Series 2

[B] Entire series, effect on correlation ( .554) is:

Lower 1907< -.031 2015> -.016 1963< -.015 1966> -.015 1911> -.014 1992> -.014 Higher 1936 .155 1986 .016

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

1936 -5.0 SD

105B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1900 162 153 149 166 92 86 75 54 149 175

1910 183 246 227 203 202 203 167 134 125 115

1920 166 172 129 100 95 86 118 140 135 178

1930 145 200 223 143 97 156 33 121 123 138

1940 114 104 111 139 127 102 93 90 104 94

1950 91 90 89 80 85 66 52 62 83 66

1960 60 97 70 46 82 104 116 77 74 110

1970 134 107 72 85 77 84 120 145 145 106

1980 73 77 113 54 73 65 42 88 69 86

1990 91 74 80 98 69 72 65 72 56 86

2000 72 95 77 83 94 74 60 63 63 48

2010 28 31 20 12 11 10

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109A 1913 to 2015 103 years Series 3

[B] Entire series, effect on correlation ( .560) is:

Lower 1992> -.029 1927> -.027 1931< -.020 2015> -.015 1917> -.014 1958< -.011 Higher 1936 .167 2004 .011

109A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1913 85 73 61 47 52 36 43

1920 44 62 50 51 61 47 39 70 58 45

1930 48 42 50 55 97 80 19 48 71 67

1940 76 58 41 50 35 40 38 187 189 190

1950 232 245 214 170 131 136 111 106 104 105

1960 77 143 174 206 228 295 243 246 181 238

1970 250 241 235 212 162 143 119 142 134 90

1980 74 67 74 62 48 54 46 62 57 72

1990 85 103 116 116 113 102 109 104 104 134

2000 121 123 131 99 159 122 174 154 117 53

2010 25 19 26 18 30 20

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

109B 1913 to 2015 103 years Series 4

[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 3 .05 .07 -.08 -.19 -.20 -.02 .13 .14 -.13 .06 .25|-.16 .05 .25\* .12 -.17 -.02 -.12 -.08 .14 -.06

[B] Entire series, effect on correlation ( .424) is:

Lower 1971< -.055 1936> -.028 1927< -.010 1937< -.010 1932< -.010 1966> -.009 Higher 1986 .027 1921 .014

1925 to 1974 segment:

Lower 1971< -.107 1937< -.019 1932< -.017 1927< -.016 1966> -.015 1948> -.013 Higher 1965 .024 1951 .023

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

1936 1937 -4.1 SD

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

1936 +3.0 SD

109B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1913 84 83 51 50 37 42 50

1920 57 81 52 55 52 49 49 34 43 37

1930 37 40 34 32 37 56 42 32 37 32

1940 35 42 41 50 39 40 22 102 175 118

1950 165 205 177 142 121 122 121 91 96 81

1960 74 189 198 202 179 279 252 268 204 234

1970 221 95 116 130 140 86 71 124 107 74

1980 68 41 62 35 51 40 32 58 55 66

1990 74 59 68 90 105 113 110 111 102 125

2000 120 147 151 106 179 158 194 206 122 72

2010 35 36 61 41 72 35

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

110A 1932 to 2015 84 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

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1932 1981 3 .23 -.24 .24 -.06 .00 -.22 -.01 -.01 -.18 -.01 .29|-.04 -.03 .52\*-.16 -.01 -.01 -.16 -.09 -.31 -.09

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

Lower 1936> -.094 1976> -.017 1970< -.014 1986> -.009 1948> -.009 1993< -.009 Higher 2015 .058 1932 .016

1932 to 1981 segment:

Lower 1936> -.147 1976> -.024 1970< -.021 1948> -.012 1941> -.011 1937< -.011 Higher 1932 .030 1946 .021

110A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 100 58 69 71 67 54 55 51

1940 47 62 58 69 35 52 27 70 92 77

1950 70 74 48 67 61 48 30 33 54 53

1960 46 63 52 64 143 174 144 150 114 112

1970 83 86 113 69 64 121 362 434 346 283

1980 257 238 246 201 225 208 213 195 223 212

1990 214 189 203 220 268 334 319 278 338 327

2000 324 324 339 361 352 311 346 337 304 306

2010 282 351 412 285 373 182

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110B 1932 to 2015 84 years Series 6

[B] Entire series, effect on correlation ( .385) is:

Lower 1936> -.077 2005< -.051 2010> -.013 1944< -.012 1963< -.012 1976> -.011 Higher 2015 .053 1992 .025

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

1936 +3.1 SD

110B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 107 61 83 146 107 101 98 94

1940 87 77 84 107 52 83 45 82 98 93

1950 91 111 71 85 90 66 42 46 62 64

1960 55 66 45 45 95 117 86 140 163 152

1970 148 155 145 130 124 203 379 463 468 300

1980 371 282 340 311 316 274 232 233 292 227

1990 232 219 182 277 291 305 320 291 364 309

2000 328 271 307 285 325 230 258 283 321 308

2010 283 226 275 266 308 182

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139A 1923 to 2015 93 years Series 7

[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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1923 1972 0 .20 -.12 -.02 .15 .05 -.20 -.06 .08 .01 -.05 .30\* .14 -.14 .15 -.08 -.11 -.09 -.16 -.19 -.06 .03

1925 1974 0 .19 -.14 .00 .15 .05 -.22 -.08 .08 .02 -.04 .30\* .15 -.13 .14 -.10 -.10 -.10 -.15 -.20 -.04 .02

1950 1999 -6 .12 -.24 .05 -.07 .40\*-.20 -.20 -.13 -.01 -.07 .40| .13 -.17 -.01 .06 .18 -.04 -.07 -.40 -.07 -.17

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

Lower 1936> -.078 1970< -.026 1947< -.025 2015> -.015 1998< -.015 1986> -.012 Higher 2010 .019 1992 .019

1923 to 1972 segment:

Lower 1936> -.155 1970< -.041 1947< -.039 1941> -.016 1960> -.010 1954< -.009 Higher 1956 .029 1931 .028

1925 to 1974 segment:

Lower 1936> -.158 1970< -.041 1947< -.039 1941> -.016 1960> -.011 1954< -.009 Higher 1931 .029 1956 .028

1950 to 1999 segment:

Lower 1970< -.056 1986> -.039 1998< -.026 1997> -.017 1976> -.017 1960> -.014 Higher 1992 .037 1956 .033

139A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1923 167 179 119 157 225 324 283

1930 260 288 279 175 196 200 178 162 159 135

1940 119 129 127 99 91 72 59 40 39 36

1950 45 47 34 54 37 29 17 29 64 53

1960 74 79 28 54 228 228 181 157 183 295

1970 171 229 188 197 174 224 304 411 390 299

1980 296 275 274 282 297 246 261 256 312 279

1990 329 261 212 226 203 242 199 202 150 228

2000 157 164 132 109 122 141 151 111 120 70

2010 46 40 91 59 62 41

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139B 1923 to 2015 93 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

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1966 2015 0 .08 -.03 -.07 -.14 .02 -.11 -.02 .25 -.10 .00 .31\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .320) is:

Lower 1936> -.096 2015> -.053 1989< -.053 1992> -.015 1939< -.009 1952< -.008 Higher 2010 .026 1986 .021

1966 to 2015 segment:

Lower 2015> -.109 1989< -.097 1992> -.029 1985> -.008 2000> -.008 1997> -.006 Higher 2010 .053 1986 .043

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

1935 1936 4.3 SD

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

1936 +3.3 SD; 1989 -4.6 SD

139B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1923 158 164 110 155 211 285 224

1930 254 305 238 152 171 177 167 122 105 70

1940 62 58 63 82 61 48 38 41 32 29

1950 39 37 23 46 40 23 27 26 95 68

1960 78 105 68 79 237 241 195 199 215 210

1970 278 255 171 230 227 205 222 347 328 246

1980 313 233 245 185 217 236 201 230 229 172

1990 202 213 235 239 271 264 283 260 241 273

2000 262 223 233 197 237 211 181 133 158 117

2010 38 25 40 25 31 24

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1052A 1917 to 2015 99 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

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1950 1999 0 .19 .01 -.01 -.11 -.05 .04 .02 .00 -.01 .07 .28\*-.30 -.11 -.17 -.35 .00 -.03 .08 -.24 .19 -.04

[B] Entire series, effect on correlation ( .584) is:

Lower 1964< -.022 1935< -.016 1977< -.013 1956> -.011 1961< -.011 1983> -.010 Higher 1936 .165 1986 .022

1950 to 1999 segment:

Lower 1964< -.051 1977< -.030 1961< -.025 1956> -.023 1983> -.022 1973> -.016 Higher 1986 .125 1957 .035

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

1936 -5.7 SD

1052A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1917 202 210 303

1920 318 387 366 311 315 266 251 195 226 272

1930 262 294 265 232 270 216 82 236 277 285

1940 307 282 331 297 289 220 198 254 274 256

1950 252 304 332 353 378 356 338 266 352 317

1960 290 250 267 300 232 237 206 223 204 212

1970 210 226 200 224 177 173 139 138 171 186

1980 196 190 187 199 194 170 110 192 206 156

1990 192 152 137 126 137 116 94 106 81 95

2000 86 73 95 101 114 113 86 59 63 44

2010 33 94 101 66 106 51

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1052B 1903 to 2015 113 years Series 10

[B] Entire series, effect on correlation ( .622) is:

Lower 1977< -.013 2006< -.013 1928< -.012 1918> -.012 1966> -.012 1909< -.010 Higher 1936 .130 1986 .019

1052B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 48 41 109 80 127 202 163

1910 148 175 165 203 179 156 219 224 280 344

1920 396 380 343 282 264 194 226 194 170 236

1930 238 264 306 255 248 252 105 263 270 226

1940 218 194 234 249 232 198 187 184 207 217

1950 213 240 237 231 205 187 197 147 195 175

1960 172 188 193 262 218 204 216 223 193 216

1970 214 199 159 143 120 129 113 104 148 149

1980 151 132 173 132 115 138 83 141 169 137

1990 156 144 121 137 156 118 91 116 98 111

2000 101 106 115 114 158 147 97 87 101 92

2010 58 131 150 130 157 90

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1110A1 1970 to 2015 46 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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1970 2015 -6 -.12 -.23 .07 -.06 .39\* .01 .07 .01 -.08 .02 .33| - - - - - - - - - -

[B] Entire series, effect on correlation ( .409) is:

Lower 1986> -.074 2004< -.041 1977< -.020 2010> -.018 1993< -.015 1983> -.014 Higher 1992 .081 2015 .064

1970 to 2015 segment:

Lower 1986> -.074 2004< -.041 1977< -.020 2010> -.018 1993< -.015 1983> -.014 Higher 1992 .081 2015 .064

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

1992 -1.360 27 1

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

1992 -4.8 SD

1110A1 Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1970 208 200 140 115 108 101 81 78 105 121

1980 114 112 129 151 191 163 180 148 233 160

1990 117 152 0 58 105 180 130 100 94 169

2000 143 166 237 145 123 187 170 168 152 133

2010 125 144 188 80 115 52

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1110A2 1865 to 1950 86 years Series 12

[\*] Early part of series cannot be checked from 1865 to 1871 -- not matched by another series

[B] Entire series, effect on correlation ( .461) is:

Lower 1876< -.050 1936> -.016 1947< -.015 1893< -.015 1879> -.014 1945> -.011 Higher 1882 .159 1931 .010

1110A2 Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1865 118 90 129 83 132

1870 91 117 97 109 92 89 49 70 64 99

1880 79 89 44 50 57 92 104 115 100 97

1890 73 74 99 72 79 98 103 63 73 85

1900 93 99 149 142 138 160 119 162 170 184

1910 150 141 153 184 165 173 93 65 104 147

1920 181 160 111 66 111 91 112 149 219 225

1930 274 345 348 253 200 265 214 216 231 267

1940 207 217 217 217 171 210 146 114 105 116

1950 138

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1110B 1905 to 2015 111 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

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1905 1954 0 -.20 -.20 .16 -.03 -.10 .02 .09 .00 .18 .11 .21\* .13 .01 -.07 -.26 -.13 -.07 -.09 .08 .06 .11

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

Lower 1947< -.081 1946> -.018 1906> -.011 1981> -.011 1997> -.009 1962> -.009 Higher 2015 .026 1986 .013

1905 to 1954 segment:

Lower 1947< -.132 1946> -.033 1906> -.021 1911> -.013 1919< -.012 1920< -.011 Higher 1936 .058 1931 .028

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

1946 1947 -4.7 SD

1110B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 136 156 166 144 151

1910 119 143 169 171 137 153 119 97 67 63

1920 77 108 143 99 132 108 70 145 250 289

1930 262 317 327 218 212 215 132 177 124 175

1940 103 80 131 143 91 102 133 44 44 71

1950 88 86 90 78 49 44 26 36 95 53

1960 29 50 75 99 103 119 71 65 68 105

1970 136 99 83 56 117 173 136 181 244 233

1980 216 227 181 109 117 71 49 102 96 92

1990 93 101 59 75 101 214 182 163 95 112

2000 77 108 150 90 111 120 100 95 86 82

2010 91 123 169 109 192 108

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1110C 1896 to 2015 120 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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1950 1999 -4 .05 -.19 -.01 -.07 .10 -.12 .24\* .12 -.21 .01 .23| .02 .10 .14 -.04 .08 -.18 .08 .14 -.29 .13

1966 2015 0 .11 -.14 .02 -.15 .21 -.01 .16 -.02 -.02 -.10 .24\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .356) is:

Lower 1952< -.034 2007< -.032 1993< -.012 1947< -.010 2010> -.008 1990< -.008 Higher 1897 .016 1931 .013

1950 to 1999 segment:

Lower 1952< -.076 1993< -.029 1990< -.021 1979> -.019 1986> -.017 1987< -.015 Higher 1960 .046 1956 .031

1966 to 2015 segment:

Lower 2007< -.048 1993< -.027 1990< -.019 2010> -.015 1979> -.015 1987< -.014 Higher 2015 .033 2013 .029

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

2007 .485 27 1 >> WARNING: Ring is not usually narrow

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

2007 -5.4 SD

1110C Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1896 122 70 84 79

1900 93 90 131 126 123 169 143 184 184 187

1910 185 139 141 162 176 189 149 121 87 140

1920 139 144 150 101 146 119 93 137 216 229

1930 269 371 342 247 205 293 189 232 269 307

1940 225 244 294 241 183 178 159 85 50 67

1950 122 169 53 115 128 124 69 81 112 101

1960 43 80 79 84 96 101 91 145 151 200

1970 165 122 89 72 90 127 90 87 101 141

1980 127 84 83 70 67 47 62 51 112 75

1990 55 75 78 56 85 69 98 96 158 151

2000 148 226 140 74 77 89 91 0 85 77

2010 85 109 160 56 112 63

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1167A 1946 to 2015 70 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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1946 1995 0 .02 .13 .07 .12 .12 -.31 -.12 -.12 -.04 -.21 .27\* .11 -.02 -.11 .08 .12 .22 -.03 -.20 -.08 -.18

1966 2015 -10 .20\* .12 .07 .06 .09 -.32 .02 -.21 -.02 -.22 .17| - - - - - - - - - -

[B] Entire series, effect on correlation ( .231) is:

Lower 1970< -.054 2015> -.043 1946> -.038 2007< -.034 1986> -.029 1994< -.012 Higher 1999 .027 1966 .025

1946 to 1995 segment:

Lower 1970< -.087 1946> -.062 1986> -.052 1994< -.019 1976> -.018 1960> -.018 Higher 1966 .034 1956 .034

1966 to 2015 segment:

Lower 1970< -.067 2015> -.055 2007< -.037 1986> -.037 1976> -.015 1994< -.014 Higher 1966 .043 1999 .039

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

1946 +3.3 SD

1167A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 78 43 30 27

1950 27 27 19 26 23 22 13 21 65 76

1960 90 103 80 111 169 192 132 152 175 173

1970 156 206 213 233 240 213 269 311 329 293

1980 287 273 306 281 252 232 271 272 301 301

1990 344 288 243 246 211 261 241 233 255 309

2000 212 228 185 187 151 185 187 62 40 17

2010 16 33 53 15 30 21

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

1167B 1946 to 2015 70 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

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

1946 1995 6 .01 -.07 .07 .08 .13 .10 -.38 -.11 .04 -.27 .33| .30 -.13 .06 -.01 .03 .35\*-.05 -.41 .01 -.20

[B] Entire series, effect on correlation ( .350) is:

Lower 1991< -.045 1946> -.043 1951< -.022 1981> -.016 1960> -.016 2014< -.012 Higher 1986 .040 2010 .032

1946 to 1995 segment:

Lower 1991< -.063 1946> -.062 1951< -.035 1981> -.023 1960> -.022 1976> -.013 Higher 1986 .062 1957 .030

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

1946 +3.1 SD

1167B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 111 67 62 56

1950 50 36 36 46 42 29 22 30 84 103

1960 109 104 73 94 131 153 136 159 178 175

1970 184 234 215 192 164 160 236 348 335 275

1980 246 278 288 252 269 264 227 292 330 336

1990 343 238 209 289 284 310 288 250 248 309

2000 221 227 221 272 254 338 334 217 226 178

2010 51 48 55 20 19 13

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1168A 1924 to 2015 92 years Series 17

[B] Entire series, effect on correlation ( .524) is:

Lower 2006< -.032 1986> -.027 1971< -.021 1992> -.020 2013> -.014 1925> -.011 Higher 1936 .124 2015 .031

1168A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 230 246 215 221 204 234

1930 229 298 261 173 126 113 13 46 69 57

1940 69 88 54 67 71 76 111 151 169 145

1950 131 210 214 169 203 182 148 85 123 105

1960 96 132 109 128 98 92 56 57 59 60

1970 87 51 36 31 32 43 44 50 63 56

1980 66 64 89 97 80 100 109 152 100 67

1990 79 91 123 172 222 191 194 124 153 156

2000 140 121 107 113 155 125 81 92 97 103

2010 48 108 122 139 170 85

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1168B 1926 to 2015 90 years Series 18

[B] Entire series, effect on correlation ( .510) is:

Lower 1935< -.035 1992> -.035 2013> -.026 1942< -.019 1999< -.017 1932< -.016 Higher 1936 .151 2010 .022

1168B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 273 201 220 238

1930 257 296 189 135 279 126 11 64 74 67

1940 99 66 21 37 54 63 57 89 82 66

1950 88 129 124 96 95 67 74 40 70 63

1960 74 82 76 65 98 90 64 69 70 101

1970 195 155 133 150 152 127 83 78 82 76

1980 90 43 81 79 85 98 83 131 93 93

1990 146 185 264 346 332 273 287 157 193 156

2000 157 184 201 139 188 133 198 195 191 159

2010 95 86 121 158 113 76

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1169A 1937 to 2015 79 years Series 19

[B] Entire series, effect on correlation ( .546) is:

Lower 1976> -.025 1956> -.021 2009> -.013 2001< -.013 1940> -.012 1974> -.011 Higher 2015 .057 1992 .021

1169A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 49 49 49

1940 79 60 55 83 84 55 44 104 124 136

1950 170 205 194 145 177 161 162 105 115 128

1960 78 80 63 81 124 187 162 158 102 186

1970 207 256 306 294 354 314 500 559 463 273

1980 353 297 271 213 253 242 189 222 195 206

1990 257 239 183 241 254 276 290 200 252 255

2000 193 162 168 212 280 257 282 234 212 221

2010 164 163 245 136 196 93

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1169B 1913 to 2015 103 years Series 20

[B] Entire series, effect on correlation ( .447) is:

Lower 1936> -.046 1986> -.020 2006< -.010 1992< -.009 2002< -.008 1989> -.008 Higher 2015 .045 2004 .022

1169B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1913 64 67 46 47 49 67 108

1920 119 157 154 140 172 134 102 129 200 184

1930 189 170 154 99 116 102 76 68 54 40

1940 34 23 33 44 86 98 83 176 121 93

1950 93 111 74 92 99 91 51 34 64 65

1960 73 65 44 65 84 131 134 153 151 194

1970 323 362 378 306 228 153 182 245 255 216

1980 302 272 246 226 235 256 251 264 207 243

1990 269 240 148 172 178 190 162 134 148 189

2000 172 179 156 162 246 196 155 166 145 135

2010 128 118 166 135 178 67

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1170A 1894 to 2015 122 years Series 21

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

Lower 1986< -.014 1955> -.013 1906> -.013 1992> -.012 1897> -.011 1910< -.009 Higher 1936 .084 2004 .013

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

1986 -6.5 SD

1170A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1894 61 78 84 59 38 31

1900 35 44 75 58 28 82 120 75 89 99

1910 30 34 52 75 51 67 64 56 94 229

1920 347 356 356 302 381 350 216 88 81 148

1930 177 168 176 134 162 178 48 161 188 194

1940 178 184 210 162 157 98 120 175 119 113

1950 101 161 122 126 137 189 160 104 156 110

1960 112 127 113 133 124 128 116 123 123 128

1970 189 144 153 136 112 99 65 80 104 104

1980 110 80 113 111 95 82 29 81 61 71

1990 81 80 87 96 83 76 82 78 95 110

2000 112 103 130 162 263 194 198 157 163 132

2010 63 98 107 132 261 141

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1170B 1894 to 2015 122 years Series 22

[B] Entire series, effect on correlation ( .561) is:

Lower 1995< -.024 1950< -.018 1906> -.017 1956> -.013 1928< -.013 1897> -.012 Higher 1936 .108 2015 .019

1170B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1894 63 77 77 55 43 36

1900 32 34 48 32 15 39 101 117 77 67

1910 12 22 24 18 21 28 40 29 54 125

1920 288 296 276 215 210 193 132 44 31 136

1930 99 132 151 93 147 170 55 122 122 202

1940 158 153 190 150 134 118 126 134 100 114

1950 93 136 158 155 187 187 167 115 165 118

1960 91 112 105 102 111 117 78 95 67 81

1970 113 91 96 66 51 69 61 49 88 65

1980 91 54 86 64 46 47 40 111 79 68

1990 88 86 71 118 110 67 72 84 117 130

2000 109 120 142 180 269 163 175 169 159 153

2010 166 218 307 324 296 106

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1171A 1966 to 2015 50 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

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1966 2015 -5 .07 -.22 .19 -.16 .19 .44\* .01 -.12 .18 -.18 .39| - - - - - - - - - -

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

Lower 1986> -.034 1981> -.034 1987< -.020 1975> -.019 1994< -.019 2009> -.017 Higher 2015 .153 2004 .029

1966 to 2015 segment:

Lower 1986> -.034 1981> -.034 1987< -.020 1975> -.019 1994< -.019 2009> -.017 Higher 2015 .153 2004 .029

1171A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1966 56 59 69 127

1970 136 170 106 117 190 260 217 257 206 138

1980 221 283 277 235 233 189 189 148 141 162

1990 168 155 170 184 155 174 198 157 253 277

2000 281 293 313 319 378 304 363 405 321 355

2010 325 260 401 349 424 181

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

1171B 1929 to 2015 87 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

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

1929 1978 -3 .01 -.21 .02 .19 .13 .03 .08 .24\*-.05 .20 .21|-.27 -.22 -.16 -.22 -.08 .08 .15 -.08 -.16 .01

[B] Entire series, effect on correlation ( .333) is:

Lower 1936> -.075 1987< -.022 1982< -.021 1929< -.015 2009> -.015 1933> -.015 Higher 2015 .076 1986 .020

1929 to 1978 segment:

Lower 1936> -.094 1929< -.035 1943< -.029 1933> -.025 1955> -.023 1947< -.015 Higher 1960 .032 1962 .022

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

1936 +3.4 SD

1171B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1929 132

1930 126 146 174 180 163 211 165 138 163 113

1940 111 94 79 39 35 32 33 14 21 7

1950 47 59 57 81 69 105 69 49 52 63

1960 20 34 10 51 114 131 87 52 32 78

1970 133 237 204 160 143 183 138 186 193 152

1980 169 161 125 106 140 144 121 104 144 188

1990 180 191 178 241 229 262 289 201 249 273

2000 237 199 265 220 255 221 250 253 231 273

2010 236 247 298 227 247 114

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1175A 1936 to 2015 80 years Series 25

[B] Entire series, effect on correlation ( .342) is:

Lower 2015> -.034 1986> -.024 1962> -.021 1987< -.019 2012< -.013 1958< -.012 Higher 1992 .018 1982 .017

1175A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1936 34 43 49 64

1940 111 78 75 99 79 106 77 249 255 174

1950 218 213 224 160 134 116 108 105 99 82

1960 86 200 287 297 281 265 184 230 214 222

1970 220 183 178 170 136 119 119 140 150 138

1980 151 137 195 185 211 175 171 141 149 148

1990 134 168 118 149 136 142 160 118 115 152

2000 169 159 189 188 221 181 217 123 111 45

2010 22 18 8 45 76 64

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1175B 1936 to 2015 80 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

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1936 1985 0 .12 -.02 -.10 -.18 .10 -.07 -.07 -.21 -.07 .19 .30\*-.18 .11 .25 .04 -.08 .00 -.01 .04 -.18 -.04

1950 1999 2 -.18 .16 -.24 -.06 .03 -.17 .12 -.07 -.06 -.03 .27|-.12 .27\* .18 -.19 -.02 -.02 -.06 .20 -.18 -.10

[B] Entire series, effect on correlation ( .321) is:

Lower 1942< -.037 1937< -.033 1990< -.030 1986> -.022 1962> -.022 1977< -.010 Higher 1936 .048 2010 .039

1936 to 1985 segment:

Lower 1942< -.057 1937< -.052 1962> -.034 1977< -.015 1945> -.014 1970< -.011 Higher 1936 .084 1982 .035

1950 to 1999 segment:

Lower 1990< -.060 1962> -.050 1986> -.049 1977< -.020 1995< -.016 1970< -.015 Higher 1992 .055 1982 .047

1175B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1936 42 42 63 75

1940 109 86 60 70 52 93 48 190 166 134

1950 196 155 130 108 64 60 41 45 64 64

1960 55 195 263 259 244 232 155 193 158 140

1970 120 116 98 75 99 110 101 107 129 129

1980 125 113 176 143 163 140 142 150 135 138

1990 125 156 136 169 178 167 267 220 221 249

2000 235 239 258 196 262 267 262 227 173 143

2010 38 41 32 44 82 47

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1182A 1909 to 2015 107 years Series 27

[B] Entire series, effect on correlation ( .504) is:

Lower 1948< -.039 2015> -.036 1977< -.017 1960> -.011 1996< -.011 1997> -.010 Higher 1936 .121 1986 .029

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

1946 -4.8 SD

1182A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 99

1910 123 77 70 58 80 84 60 52 67 90

1920 104 142 192 231 305 318 289 315 344 319

1930 287 390 405 298 346 339 201 284 294 274

1940 227 215 225 209 242 157 112 215 129 143

1950 177 215 177 196 228 220 199 172 277 260

1960 272 305 294 291 268 265 248 211 208 223

1970 271 270 266 255 219 148 101 63 120 114

1980 108 89 156 150 90 101 33 63 85 113

1990 175 135 88 105 115 86 50 98 97 105

2000 97 96 133 120 176 164 141 79 77 9

2010 19 13 37 19 13 15

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1182B 1909 to 2015 107 years Series 28

[B] Entire series, effect on correlation ( .451) is:

Lower 2015> -.032 1956> -.024 1997> -.015 1940< -.015 1960> -.014 2009< -.013 Higher 1986 .028 2004 .013

1182B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 96

1910 136 89 92 95 90 93 82 66 75 115

1920 170 193 208 136 113 169 147 172 239 263

1930 284 311 357 250 266 277 155 213 226 143

1940 78 84 138 127 139 93 101 154 102 88

1950 99 145 134 110 125 95 155 130 197 125

1960 157 186 141 150 159 181 120 117 88 138

1970 200 186 197 155 138 102 65 76 133 138

1980 90 69 107 98 85 72 49 75 98 75

1990 96 66 57 72 108 88 73 112 109 121

2000 99 99 119 90 126 108 73 52 65 20

2010 19 63 44 21 17 22

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PART 7: DESCRIPTIVE STATISTICS: FAGR\_MMRB1400B\_CORR2-50 09:44 Thu 02 Nov 2017 Page 6

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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 105A 1872 2015 144 6 1 .432 1.30 2.76 .490 .766 .195 2.71 .364 -.044 1

2 105B 1900 2015 116 4 0 .554 1.02 2.46 .473 .791 .228 2.34 .289 -.053 1

3 109A 1913 2015 103 4 0 .560 1.05 2.95 .667 .902 .227 2.58 .302 .003 1

4 109B 1913 2015 103 4 1 .424 .94 2.79 .615 .857 .242 2.78 .503 -.062 1

5 110A 1932 2015 84 3 1 .380 1.76 4.34 1.193 .918 .206 2.65 .431 -.153 1

6 110B 1932 2015 84 3 0 .385 1.90 4.68 1.111 .905 .206 2.69 .540 -.084 1

7 139A 1923 2015 93 4 3 .348 1.66 4.11 .952 .887 .232 2.76 .533 .034 1

8 139B 1923 2015 93 4 1 .320 1.61 3.47 .913 .896 .224 2.59 .380 .000 1

9 1052A 1917 2015 99 4 1 .584 2.08 3.87 .883 .895 .173 2.36 .294 .008 1

10 1052B 1903 2015 113 4 0 .622 1.78 3.96 .669 .831 .179 2.40 .298 -.069 1

11 1110A1 1970 2015 46 1 1 .409 1.36 2.37 .468 .415 .325 2.44 .393 -.009 1

12 1110A2 1865 1950 86 4 0 .461 1.37 3.48 .650 .863 .217 2.59 .536 -.004 1

13 1110B 1905 2015 111 4 1 .387 1.23 3.27 .601 .774 .281 2.66 .390 .008 1

14 1110C 1896 2015 120 5 2 .356 1.31 3.71 .668 .794 .286 2.57 .420 -.068 1

15 1167A 1946 2015 70 3 2 .231 1.62 3.44 1.054 .948 .233 2.66 .527 -.017 1

16 1167B 1946 2015 70 3 1 .350 1.81 3.48 1.042 .916 .196 2.59 .455 .014 2

17 1168A 1924 2015 92 4 0 .524 1.19 2.98 .607 .847 .241 2.54 .469 -.001 1

18 1168B 1926 2015 90 3 0 .510 1.28 3.46 .730 .800 .286 2.68 .421 .054 1

19 1169A 1937 2015 79 3 0 .546 1.95 5.59 1.007 .856 .216 2.70 .572 -.078 1

20 1169B 1913 2015 103 4 0 .447 1.47 3.78 .773 .879 .212 2.70 .341 .036 1

21 1170A 1894 2015 122 5 0 .528 1.26 3.81 .705 .799 .264 2.52 .299 -.047 1

22 1170B 1894 2015 122 5 0 .561 1.12 3.23 .667 .796 .294 2.66 .372 -.027 1

23 1171A 1966 2015 50 1 1 .388 2.27 4.24 .929 .786 .193 2.41 .449 -.085 1

24 1171B 1929 2015 87 3 1 .333 1.45 2.98 .789 .885 .290 2.49 .384 -.042 1

25 1175A 1936 2015 80 3 0 .342 1.46 2.97 .654 .816 .221 2.64 .372 -.124 1

26 1175B 1936 2015 80 3 2 .321 1.37 2.67 .692 .832 .230 3.07 .567 .034 4

27 1182A 1909 2015 107 4 0 .504 1.70 4.05 .961 .905 .245 2.55 .435 -.027 1

28 1182B 1909 2015 107 4 0 .451 1.24 3.57 .634 .828 .256 2.66 .484 .081 1

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Total or mean: 2654 102 19 .447 1.45 5.59 .754 .839 .236 3.07 .413 -.025

- = [ COFECHA FAGR COF ] = -