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# A Revision of the US Business-Cycles Chronology 1790–1928

Amélie CHARLES\*, Olivier DARNÉ† and Claude DIEBOLT‡

## Abstract

This article extends earlier efforts at redating the US business cycles for the 1790–1928 period using the real Gross Domestic Product (GDP) constructed by Johnson and Williamson (2007). We compare the alternative chronology with those of the NBER and Davis (2006) as well as Romer (1994) for the postbellum period. The resulting chronology alters more than 50% percent of the peaks and troughs identified by the NBER and Davis’s chronologies, especially during the antebellum period, and removes those cycles long considered the most questionable, as growth or industrial cycles. An important result of the new chronology is the lack of discernible differences in the frequency and duration of US business cycles among the antebellum and postbellum periods. We also find that the average frequency and duration of contractions are less important than those of expansions.

*Keywords:* Business cycle; Dating chronology.

*JEL Classification:* C22; E32.

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# 1 Introduction

In their seminal contribution to the classical business cycle literature, Burns and Mitchell (1946) define business cycles as follows:

*Business cycles are a type of fluctuations found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own (Burns and Mitchell, 1946, p.3).*

These rules on the business cycles are the basis of the methodology employed by the National Bureau of Economic Research (NBER) for producing the business cycle reference dates for the United States, which show the peaks and troughs of economic activity from the mid-1800s to today. Nevertheless, some researchers question the accuracy of the NBER reference dates and particularly the consistency of these dates over time. For example, Diebold and Rudebusch (1992) state:

*All of the researchers who have designated NBER turning points have cautioned that there is some uncertainty about the precise timing of the general turns in business activity. One indication of the uncertainty associated with the official dates is the discrepancy between these dates and a number of alternative dates that have been suggested by NBER researchers and by independent observer (Diebold and Rudebusch, 1992, p.996).*

Furthermore, even Burns and Michell (1946) state:

*This is not to say that the reference dates must remain in their present state of rough approximation. Most of them were originally fixed in something of a hurry; revisions have been confined mainly to large and conspicuous errors, and no revision has been made for several years. Surely, the time is ripe for a thorough review that would take account of extensive new statistical materials, and of the knowledge gained about business cycles and the mechanics of setting reference dates since the present chronology was worked out (Burns and Mitchell, 1946, p.95).*

Although the general dating procedures employed in the NBER have not changed, both the number and quality of the underlying individual series examined have greatly increased over time as well as statistical techniques and the understanding of economic fluctuation. Indeed, the increase in the number of underlying individual series used by the NBER was accompanied by an increase in the quality of most series, implying an increased reliability of the NBER dates, especially in the post World War II [WWII, thereafter] period. Nevertheless, some researchers have some uncertainty about some of the pre-WWII NBER dates due to the varying quality of the data. More precisely, the turning-point dates before World War I [WWI, thereafter] seem to be more questionable than those in the interwar period (1918-1940). Romer (1994) show that the methods used to date the early cycles are quite different from those used in the postwar era. The most important difference between the early and modern methods is that the business cycle reference dates before 1927 appear to be derived primarily from detrended data, whereas the dates after 1927 are based on data that include the secular trend. This difference can lead to (i) the misclassification of growth recessions as genuine business cycles in the pre-1927 era, which can cause more cycles to be identified in the early period than in the post-WWII; (ii) the misidentification of business cycle dates, which can affect the duration of the contractions and expansions between two periods.

In this article, we propose an alternative set of annual peaks and troughs between 1790 and 1928 by mapping to the absolute peaks and troughs in a new dataset: the real Gross Domestic Product (GDP) constructed by Johnson and Williamson (2007). The resulting chronology alters more than 50% percent of the peaks and troughs identified by the NBER and Davis's chronologies, especially during the antebellum period, and removes those cycles long considered the most questionable, as growth or industrial cycles. An important result of the new chronology is the lack of discernible differences in the frequency and duration of US business cycles among the antebellum and postbellum periods. We also find that the average frequency and duration of contractions are less important than those of expansions.

## **2 Dating**

The alternative chronology is based upon a new annual dataset on U.S. real GDP constructed by Johnson and Williamson (2007). The construction of the GDP series before 1909 is first based on an estimate of the observation for each benchmark year (1793–1829; 1839–1859; 1869–1909). Then, the values for the years between

benchmark years are computed by interpolation based on ever annual observations of related series or an assumption of constant growth.

Benchmarks observations for the 1793–1829 period are from McCusker (2000) for 1793 and Weiss (1993) for 1799, 1809, 1819, and 1829. Benchmarks observations for the 1839–1859 and 1869–1909 periods are based on Gallman’s (1966) GNP numbers for 1839, 1849, 1859, 1869, 1879, 1889, 1899 and 1909. These GNP numbers are adjusted for the flow of services to consumers using data from Weiss (1975). They are also adjusted for the flow of government purchases using data from Weiss (1975) and Trescott (1960) in the 1839–1869 period, for 1879 to 1899 using data from Weiss (1975) and Kendrick (1961), and for 1909, from Kendrick (1961). NFI are from North (1960) for the 1839–1859 period and from North (1960) for the 1869–1909 period. These observation are also adjusted for the flow of consumer durables from Olney (1989) in the 1869–1909 period. Note that the all the data are deflated by Gallman’s GNP deflator, except for NFI by the terms of trade from North (1961) and Simon (1960).

The values for the years between benchmark years are computed by interpolation. For 1790 to 1908, agricultural output, the value of shelter, government purchases and net factor income are subtracted from the real GDP benchmarks described above. Annual observations of the residual are created by interpolation using Davis (2004). The annual real GDP is then the sum of this residual, federal government purchases and net factor income, and computed values of agricultural and shelter components that are assumed to grow at constant rates between each of the benchmarks years. Note that the consumer durables purchases are added to the annual real GDP in the 1869–1908 period. Finally, the annual observations for the 1909–1928 period are based on Kendrick (1961).

We employed the dating algorithm suggested by Davis (2006), which based on the Romer’s algorithm, to develop an alternative prewar chronology of annual peaks and troughs for the U.S. real GDP. Because we examine annual data to date peaks and troughs, the methodology is quite simple: A year immediately preceding an absolute decline in the level of GDP defines a peak, and the last consecutive decline following a peak defines a trough. The new, alternative prewar chronology is listed in the middle columns of Table 3.

We compare our alternative annual chronology with those proposed by the NBER and Davis (2006). Davis proposes an annual chronology of US business cycles for the 1796-1914 period, using his new annual industrial production index (Davis, 2004).

We also compare the revised chronology with that of Romer (1994) on the postbellum period. Her chronology is based on the monthly industrial production index proposed by Miron and Romer (1990). Davis's and Romer's chronology are based on the same dating algorithm.

Table 3 reveals important similarities but also key differences between the NBER, Davis and Romer dates and our alternative dates. The annual real GDP series does not generate any false signals by furnishing a cycle that has not previously been identified by the NBER and Davis's chronologies. Rather, all the cycles in our revised chronology correspond exactly with the incidence of the NBER and Davis cycles.

The revised business-cycle dates are notably more selective in isolating genuine contractions. The new chronology dismisses several NBER and Davis recessions as merely growth or industrial cycles. Overall, our new set of peaks and troughs removes nineteen and eleven out of the twenty nine and twenty one prewar NBER and Davis recessions, respectively, especially in the antebellum period. The revised dating removes one cycle from both the NBER and Davis chronologies in the Civil war period, and five and one cycles from the NBER and Davis chronologies, respectively, in the postbellum period.

For the antebellum period, the revised dates find only two cycles out of the fifteen and eleven NBER and Davis cycles. A possible explanation of these strong differences is that the most cycles identified by the NBER are growth cycles rather than business cycles. In order to identify the growth cycles, we detrended the GNP series from a band-pass filter developed by Baxter and King (1999). The results given in Table 3 confirm this idea.<sup>1</sup> The difference with Davis's dates can be explained by the fact that the business-cycle dates is, as mentioned by Davis, "*relied on industrial production rather than a more comprehensive output measure such as GDP*" (2006, p. 107) and therefore, he seems to identify industrial cycles rather than business cycles. **(voir aussi avec la construction de la série, série plus fluctuante...)**.

For the Civil war period, the alternative chronology defined the 1860–1861 recession rather as a growth recession. **(a développer)**

The new chronology identifies five spurious business-cycle recessions from the NBER references and only one from the Davis's chronology for the postbellum period. As suggested in Davis (2006) and in Table 3, the 1869–1870, 1887–1888, 1890–1891 and

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<sup>1</sup>We also applied the band-pass filters suggested by Christiano and Fitzgerald (2003) and we obtained the same results. Note that Davis (2006) also found that the NBER 1825–1826, 1847–1848 and 1853–1855 recessions should be defined as growth recessions.

1899–1900 recessions can be seen as growth cycles. Indeed, Thorp (1926) affixed the word “brief” in front of each of these contractions. More precisely, Burns and Mitchell (1946) ranked the 1887–1888 contraction as the mildest of the prewar period. Fels (1959) went further in stating that “*the only difference of opinion to be found in the literature is whether it should be recognized as a cyclical contraction at all.*”

Table 1: Dates of prewar peaks and troughs, 1790–1928.

| NBER chronology          |        | Davis chronology |        | Alternative chronology |        | Growth chronology |        | Romer chronology |        |
|--------------------------|--------|------------------|--------|------------------------|--------|-------------------|--------|------------------|--------|
| Peak                     | Trough | Peak             | Trough | Peak                   | Trough | Peak              | Trough | Peak             | Trough |
| <i>Antebellum cycles</i> |        |                  |        |                        |        |                   |        |                  |        |
| 1796                     | 1799   | 1796             | 1798   |                        |        | 1795              | 1798   | –                | –      |
| 1802                     | 1804   | 1802             | 1803   |                        |        | 1800              | 1803   | –                | –      |
| 1807                     | 1810   | 1807             | 1808   | 1806                   | 1807   | 1806              | 1808   | –                | –      |
| 1811                     | 1812   | 1811             | 1812   |                        |        | 1810              | 1812   | –                | –      |
| 1815                     | 1821   | 1815             | 1816   | 1815                   | 1816   | 1814              | 1816   | –                | –      |
|                          |        |                  |        |                        |        | 1818              | 1820   | –                | –      |
| 1822                     | 1823   | 1822             | 1823   |                        |        | 1821              | 1823   | –                | –      |
| 1825                     | 1826   |                  |        |                        |        | 1824              | 1825   | –                | –      |
| 1828                     | 1829   | 1828             | 1829   |                        |        | 1826              | 1829   | –                | –      |
| 1833                     | 1834   | 1833             | 1834   |                        |        | 1832              | 1834   | –                | –      |
| 1836                     | 1838   | 1836             | 1837   |                        |        | 1835              | 1837   | –                | –      |
| 1839                     | 1843   | 1839             | 1840   |                        |        | 1839              | 1842   | –                | –      |
| 1845                     | 1846   |                  |        |                        |        |                   |        | –                | –      |
| 1847                     | 1848   |                  |        |                        |        | 1847              | 1850   | –                | –      |
| 1853                     | 1854   |                  |        |                        |        | 1853              | 1857   | –                | –      |
| 1857                     | 1858   | 1856             | 1858   |                        |        |                   |        | –                | –      |
| <i>Civil war cycles</i>  |        |                  |        |                        |        |                   |        |                  |        |
| 1860                     | 1861   | 1860             | 1861   |                        |        | 1859              | 1861   | –                | –      |
| 1865                     | 1867   | 1864             | 1865   | 1865                   | 1866   | 1865              | 1866   | –                | –      |
| <i>Postbellum cycles</i> |        |                  |        |                        |        |                   |        |                  |        |
| 1869                     | 1870   |                  |        |                        |        | 1868              | 1871   | –                | –      |
| 1873                     | 1879   | 1873             | 1875   | 1874                   | 1875   | 1873              | 1875   | –                | –      |
|                          |        |                  |        |                        |        | 1877              | 1878   | –                | –      |
| 1882                     | 1885   | 1883             | 1885   | 1883                   | 1884   | 1881              | 1885   | –                | –      |
| 1887                     | 1888   |                  |        |                        |        | 1888              | 1889   | 1887             | 1888   |
| 1890                     | 1891   |                  |        |                        |        |                   |        | –                | –      |
| 1893                     | 1894   | 1892             | 1894   | 1892                   | 1894   | 1892              | 1894   | 1893             | 1894   |
| 1895                     | 1897   | 1895             | 1896   | 1895                   | 1896   | 1895              | 1897   | 1896             | 1897   |
| 1899                     | 1900   |                  |        |                        |        | 1899              | 1900   | 1900             | 1900   |
| 1902                     | 1904   | 1903             | 1904   | 1903                   | 1904   | 1902              | 1904   | 1903             | 1904   |
| 1907                     | 1908   | 1907             | 1908   | 1907                   | 1908   | 1907              | 1908   | 1907             | 1908   |
| 1910                     | 1912   | 1910             | 1911   |                        |        | 1909              | 1910   | 1910             | 1911   |
| 1913                     | 1914   | 1913             | 1914   | 1913                   | 1914   | 1913              | 1914   | 1914             | 1914   |
|                          |        | –                | –      | 1916                   | 1917   | 1916              | 1917   | 1916             | 1917   |
| 1918                     | 1919   | –                | –      |                        |        |                   |        | 1918             | 1919   |
| 1920                     | 1921   | –                | –      | 1919                   | 1921   | 1918              | 1921   | 1920             | 1921   |
| 1923                     | 1924   | –                | –      |                        |        | 1923              | 1925   | 1923             | 1924   |
| 1926                     | 1927   | –                | –      |                        |        | 1926              | 1927   | 1927             | 1927   |

Notes: Zarnowitz (1992) summarized the annual NBER peak-trough chronology from 1790 in Glasner (1997, pp. 731–33, Tables 1–2). For the prewar era, the annual chronology ultimately corresponds to Thorp (1926)’s verbal assessment (pp. 113–45) later summarized in Burns and Mitchell (1946, p. 78, Table 16) and Moore and Zarnowitz (1986, p. 746, table A.2.). The Davis business cycle chronology is from Davis (2006). The Romer business cycle chronology is from Romer (1994).



## 2.1 Peaks–troughs dating comparisons

We propose to examine the differences between the common cycles from the NBER, Davis and alternative chronologies. The characteristics of the revisions in the peaks and troughs are given in Table 2. The most salient feature of the revised chronology is that troughs are consistently dated earlier than those inferred from the NBER references. Indeed, of the ten common troughs, the revised chronology predates six troughs. Nevertheless, 50% of the revised peaks correspond with those of the NBER references. On the contrary, the revised peaks and troughs are agree with the most of the peaks and troughs proposed by the Davis’s chronology.

Table 2: Differences in the US cycle chronologies, 1790–1914.

| Sample         | NBER   | Revised | Revised peaks |      |       | Revised troughs |      |       |
|----------------|--------|---------|---------------|------|-------|-----------------|------|-------|
|                | cycles | cycles  | Earlier       | Same | Later | Earlier         | Same | Later |
| All era        | 29     | 10      | 2             | 5    | 3     | 6               | 4    | 0     |
| Antebellum era | 15     | 2       | 1             | 1    | 0     | 2               | 0    | 0     |
| Civil war era  | 2      | 1       | 0             | 1    | 0     | 1               | 0    | 0     |
| Postbellum era | 12     | 7       | 1             | 3    | 3     | 3               | 4    | 0     |

  

| Sample         | Davis’s | Revised | Revised peaks |      |       | Revised troughs |      |       |
|----------------|---------|---------|---------------|------|-------|-----------------|------|-------|
|                | cycles  | cycles  | Earlier       | Same | Later | Earlier         | Same | Later |
| All era        | 21      | 10      | 1             | 7    | 2     | 1               | 8    | 1     |
| Antebellum era | 11      | 2       | 1             | 1    | 0     | 1               | 1    | 0     |
| Civil war era  | 2       | 1       | 0             | 0    | 1     | 0               | 0    | 1     |
| Postbellum era | 8       | 7       | 0             | 6    | 1     | 0               | 7    | 0     |

Notes: Antebellum period: 1790–1860, Civil war period: 1861–1865, Postbellum period: 1866–1914. The NBER business cycle chronology is from Diebold and Rudebusch (1992). The Romer business cycle chronology is from Romer (1994).

Finally, we compare the NBER and revised business-cycle chronologies in the postbellum period with dates obtained from the 1869–1929 real GNP series constructed by Balke and Fomby (1989) and Romer (1989). These authors developed new estimates of real GNP for the 1869–1928 period to improve the traditional series build on the pioneering methodology of Kuznets (1941, 1946, 1961) and the extensions made by Kendrick (1961) and Gallman (1966). Balke and Fomby (1989) used new data sources of output in the transportation, communications, and construction sectors and estimates of the consumer price index whereas Romer (1989) employed an (time-varying) estimate of the actual relationship between GNP and commodity output to convert pre-1909 data on commodity output into estimates of GNP for 1869–1908. We applied on these two GNP series the same algorithm employed for dating our alternative chronology.

The chronology based on the Balke and Fomby’s data identifies 78% of the peaks and troughs suggested by our dating and 67% for the NBER chronology, whereas only 56% and 50%, respectively, for the dating based the Romer’s data. The differences between Balke-Fomby’s and Romer’s chronology can be explained by the differing assumptions underlying their construction. Indeed, Balke and Gordon (1989) used more indicators than Romer (1989) to backcast GNP, and this procedure tends to accentuate the fluctuations of the output.<sup>2</sup> Therefore, it appears that the Balke-Fomby’s GNP series is less smooth than the Romer’s GNP series for the period 1869–1929 and can explain that more cycles are detected. Moreover, the peaks and troughs obtained after 1908 from Romer’s and Balke-Fomby’s datasets are similar to those of our alternative chronology.

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<sup>2</sup>Romer (1989) criticized the Kuznets (1961) prewar series to overstate cyclical volatility, while Balke and Gordon (1989) found that their series is as volatile on average over the business cycle as the Kendrick’s series but dampen the amplitude of some cycles and raising the amplitude of others.

Table 3: Dates of postbellum peaks and troughs – 1869–1928.

| NBER chronology |        | Alternative chronology |        | Balke-Gordon chronology |        | Romer chronology |        |
|-----------------|--------|------------------------|--------|-------------------------|--------|------------------|--------|
| Peak            | Trough | Peak                   | Trough | Peak                    | Trough | Peak             | Trough |
| 1873            | 1879   | 1874                   | 1875   | 1873                    | 1874   |                  |        |
| 1882            | 1885   | 1883                   | 1884   |                         |        |                  |        |
| 1887            | 1888   |                        |        | 1887                    | 1888   | 1887             | 1888   |
| 1890            | 1891   |                        |        |                         |        |                  |        |
| 1893            | 1894   | 1892                   | 1894   | 1892                    | 1894   | 1892             | 1894   |
| 1895            | 1897   | 1895                   | 1896   | 1895                    | 1896   |                  |        |
| 1902            | 1904   | 1903                   | 1904   |                         |        |                  |        |
| 1907            | 1908   | 1907                   | 1908   | 1906                    | 1908   | 1907             | 1908   |
| 1910            | 1912   |                        |        |                         |        |                  |        |
| 1913            | 1914   | 1913                   | 1914   | 1913                    | 1914   | 1913             | 1914   |
| 1918            | 1919   | 1916                   | 1917   | 1916                    | 1917   | 1916             | 1917   |
| 1920            | 1921   | 1919                   | 1921   | 1919                    | 1921   | 1919             | 1921   |

Notes: The NBER business cycle chronology is from Diebold and Rudebusch (1992). The Balke-Gordon and Romer chronology are obtained from Balke and Fomby's (1989) and Romer's (1989) GNP series.

## **2.2 Antebellum and Postbellum Comparisons**

The differences between the NBER and Davis's chronology and the alternative chronology should alter the characteristics of US business cycles, namely the frequency and duration, especially during the antebellum period. Table 4 shows the cycle characteristics on the antebellum (1790–1860) and postbellum (1866–1914) periods for the NBER, Davis's and alternative chronologies. First, it seems that the frequency and duration of antebellum and postbellum business cycles are analogous from the three chronologies. Second, the revised chronology displays an average frequency of contractions more important than that of expansions during the two periods, as found from the Davis's chronology, but in contradiction with the NBER chronology. Third, the average duration of contractions are less important for the alternative and Davis's chronologies than the NBER chronology whereas the average length of expansions are higher (more than two times).

Table 4: Frequency and duration of US business cycles, 1790–1914.

| Cycles              | Sample size |            | Average frequency |            | Average duration |            | Test     |                 |
|---------------------|-------------|------------|-------------------|------------|------------------|------------|----------|-----------------|
|                     | Antebellum  | Postbellum | Antebellum        | Postbellum | Antebellum       | Postbellum | Wilcoxon | <i>p</i> -value |
| <i>Contractions</i> |             |            |                   |            |                  |            |          |                 |
| NBER cycles         | 15          | 12         | 52.5              | 48.9       | 1.93             | 1.47       | 28.5     | 0.91            |
| Davis cycles        | 11          | 8          | 21.0              | 26.8       | 1.18             | 1.38       | 24.5     | 0.49            |
| Revised cycles      | 2           | 7          | 20.0              | 20.0       | 1.00             | 1.14       | 20.0     | 0.65            |
| <i>Expansions</i>   |             |            |                   |            |                  |            |          |                 |
| NBER cycles         | 15          | 12         | 47.6              | 51.1       | 2.29             | 2.09       | 16.0     | 0.61            |
| Davis cycles        | 11          | 8          | 79.0              | 73.2       | 4.90             | 4.29       | 31.0     | 0.41            |
| Revised cycles      | 2           | 7          | 80.0              | 80.0       | 8.00             | 5.33       | 22.0     | 0.52            |

Notes: Antebellum period: 1790–1860, Postbellum period: 1866–1914. Average frequency is given in percentage. Average duration and Wilcoxon statistic are given in months.

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