5

Metrics and Turning Points of Cycles 1660–2018

In this chapter we apply some of the methods discussed in Chapter 3 to the composite GDP data series discussed in Chapter 4. This is to draw out some basic metrics on business and credit cycles based on the existing data. We first consider some of the key metrics using classical business cycle analysis, drawing heavily on Chadha et al. (2019), before going on to look at growth cycles under various methods of de-trending discussed in Chapter 3. We look at annual data from 1660 and quarterly data from 1920 with the break-in World War 2 that was discussed in Chapter 4.

5.1 Classical Cycle Metrics

We first consider classical business cycle dating on annual data from 1660, adopting the simple algorithm from Chapter 3 where we identify expansions and contractions in GDP and GDP per capita. Table 5.1 summarises the annual turning points in chronological order. Chart 5.1 shows this graphically. It charts log levels of GDP over the period with contraction periods marked in grey.

N. Dimsdale and R. Thomas,
UK Business and Financial Cycles Since 1660,
https://doi.org/10.1007/978-3-030-26346-1_5

Table 5.1 Classical cycle peaks and troughs

GDP		Per capita		GDP		Per capita	
Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
1663	1664	1663	1664	1796	1797	1796	1798
1667	1668	1667	1668	1802	1804	1802	1804
1669	1672	1669	1672	1805	1806	1805	1806
1673	1674	1673	1674	1807	1808	1807	1808
1676	1677	1676	1677	1810	1812	1810	1812
1678	1679	1678	1679	1813	1814	1813	1814
1680	1681	1680	1681	1815	1816	1815	1816
1683	1684	1683	1684	1817	1819	1817	1819
1685	1686	1685	1686	1825	1826	1825	1826
1688	1689	1688	1689			1827	1829
1692	1693	1692	1693			1831	1832
1694	1697	1694	1697	1836	1837	1836	1837
1698	1699	1698	1699	1838	1839		
1701	1703	1701	1703			1839	1842
1704	1706	1704	1706	1840	1842		
1708	1710	1708	1710	1845	1847		
1711	1713	1712	1713			1846	1847
1714	1715	1714	1715	1849	1850	1849	1850
1718	1719	1718	1719	1854	1855	1854	1855
1720	1721	1720	1721			1856	1858
1722	1724	1722	1724	1857	1858		
1725	1727	1725	1727	1860	1862		
1728	1729	1728	1729			1861	1862
1730	1731	1730	1731			1866	1867
1733	1735	1733	1735			1871	1873
1736	1737	1736	1737			1874	1879
1738	1740	1738	1740	1878	1879		
1742	1744	1742	1744	1883	1885	1883	1886
1747	1749	1747	1749			1889	1890
1750	1751	1750	1751	1891	1893	1891	1893
1753	1754	1753	1754	1899	1900	1899	1900
1755	1756	1755	1756	1902	1903	1902	1903
1761	1765	1761	1765	1907	1908	1907	1908
1769	1770	1769	1770			1916	1917
1771	1772	1771	1772	1918	1921	1918	1921
1773	1774	1773	1774	1925	1926	1925	1926
1777	1779	1777	1779	1929	1931	1929	1932
1781	1783	1781	1785	1943	1947	1943	1947
1784	1785			1973	1975	1973	1975
1786	1788	1786	1788	1979	1981	1979	1981
		1790	1791	1990	1991	1990	1991
1792	1794	1792	1794	2007	2009	2007	2009

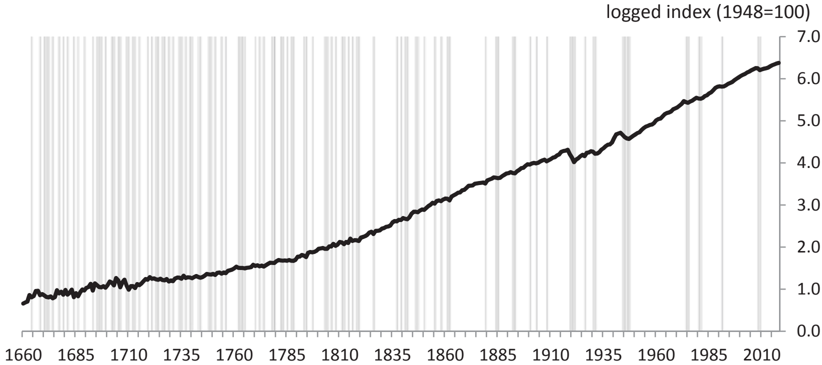

Chart 5.1 Expansions and contractions in GDP

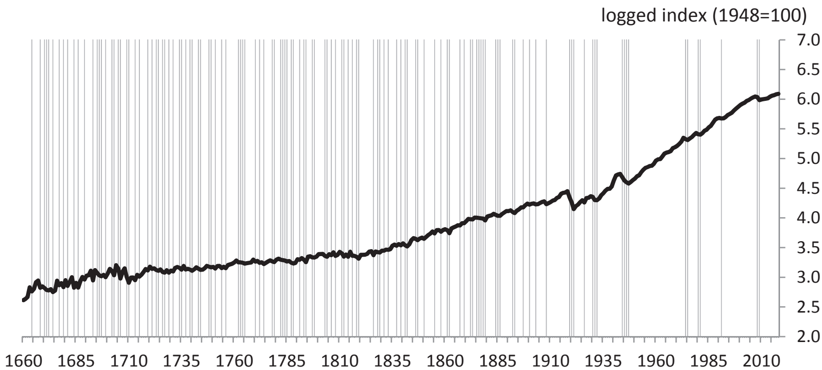

Chart 5.2 Expansions and contractions in GDP per capita

The chart suggests that for GDP there have been 72 cycles between the peak of 1663 and the trough of 2009 using a simple rule based on annual turning points. For GDP per capita there have been 78 cycles. A comparison of Charts 5.1 and 5.2 shows that many of the differences occur during the mid-late C19th when population growth rates were relatively large and positive implying many more contractions in GDP per capita.

Tables 5.2 and 5.3 ranks these cycles in terms of the size of the contraction in GDP from peak to trough and looks at the frequency and amplitude of cycles over time. Prior to 1825 the economy was in

Table 5.2 Ranking of individual annual contractions

Rank	Peak	Trough	Duration	Output loss (% of GDP)
1	1918	1921	3	−25.4
2	1708	1710	2	−21.2
3	1704	1706	2	−19.6
4	1683	1684	1	−16.4
5	1692	1693	1	−14.9
6	1943	1947	4	−13.7
7	1680	1681	1	−10.3
8	1667	1668	1	−9.9
9	1694	1697	3	−9.0
10	1701	1703	2	−8.8
11	1669	1672	3	−7.6
12	1676	1677	1	−7.2
13	1685	1686	1	−7.2
14	1678	1679	1	−6.9
15	1929	1931	2	−5.8
16	1728	1729	1	−5.6
17	1825	1826	1	−5.4
18	1736	1737	1	−5.4
19	1663	1664	1	−5.3
20	1815	1816	1	−5.3
21	1810	1812	2	−5.1
22	1792	1794	2	−4.8
23	1807	1808	1	−4.7
24	1673	1674	1	−4.5
25	2007	2009	2	−4.5
26	1711	1713	2	−4.4
27	1860	1862	2	−4.2
28	1761	1765	4	−3.9
29	1720	1721	1	−3.9
30	1907	1908	1	−3.8
31	1742	1744	2	−3.7
32	1725	1727	2	−3.7
33	1973	1975	2	−3.7
34	1698	1699	1	−3.6
35	1722	1724	2	−3.4
36	1925	1926	1	−3.3
37	1840	1842	2	−2.9
38	1714	1715	1	−2.8
39	1753	1754	1	−2.8
40	1891	1893	2	−2.8
41	1769	1770	1	−2.7
42	1733	1735	2	−2.7
43	1771	1772	1	−2.6

(continued)

Table 5.2 (continued)

Rank	Peak	Trough	Duration	Output loss (% of GDP)
44	1979	1981	2	−2.5
45	1688	1689	1	−2.4
46	1738	1740	2	−2.3
47	1854	1855	1	−2.3
48	1773	1774	1	−2.2
49	1813	1814	1	−2.2
50	1802	1804	2	−2.2
51	1878	1879	1	−2.2
52	1750	1751	1	−2.2
53	1786	1788	2	−1.9
54	1857	1858	1	−1.8
55	1718	1719	1	−1.8
56	1817	1819	2	−1.8
57	1883	1885	2	−1.7
58	1755	1756	1	−1.7
59	1747	1749	2	−1.7
60	1730	1731	1	−1.6
61	1781	1783	2	−1.5
62	1845	1847	2	−1.2
63	1777	1779	2	−1.0
64	1902	1903	1	−0.9
65	1849	1850	1	−0.9
66	1836	1837	1	−0.9
67	1796	1797	1	−0.7
68	1784	1785	1	−0.7
69	1990	1991	1	−0.7
70	1838	1839	1	−0.6
71	1899	1900	1	−0.6
72	1805	1806	1	−0.4

contraction for just under half of the time. After 1825 this drops to around a quarter of time for the next century or so before falling to around 10%. This can be seen visually in Charts 5.1 and 5.2. So it is the infrequency of large contractions that underpins the underlying shift in the growth rate of per capita incomes noted in Chapter 4. Contractions however have lengthened over time, with C20th recessions lasting longer than those in earlier centuries. Expansions have generally lengthened and increased in size during the C20th. The length of the classical cycle as a whole, measured as the sum of expansion and contraction periods, has increased fivefold since the late C17th.

Table 5.3 Summary statistics on cycles

	1659–1721	1721–1826	1826–1908	1908–1947	1947–2009	**1659–2009**
Contractions (Peak to trough)						
Number	20	30	14	4	4	**72**
Average length (years)	1.4	1.5	1.4	2.5	1.8	**1.5**
Average frequency (%)	45.2	43.8	23.2	25.6	11.3	**31.4**
Average amplitude (%)	−8.4	−2.9	−2.5	−12.0	−2.8	**−4.7**
Expansions (Trough to peak)						
Number	20	30	14	4	4	**72**
Average length (years)	1.7	2.0	4.5	7.3	13.8	**3.3**
Average frequency (%)	54.8	56.2	76.8	74.4	88.7	**68.6**
Average amplitude (%)	13.4	6.8	10.0	32.0	61.8	**14.9**
Total cycle (Peak to peak)						
Number	20	30	14	4	4	**72**
Average length (years)	3.3	3.5	5.9	9.0	16.0	**4.9**

Note The bold signifies results for the whole period 1659–2009

Table 5.2 ranks individual annual contractions in terms of output loss. The worst historical contractions largely occurred in the late C17th and early C18th. However the worst fall in output occurred after the end of World War 1 from a peak in 1918 to the trough in 1921, when GDP fell by a quarter over three years. Another large fall occurs at the end of World War 2 when output falls by 14%. By contrast the Great Depression and the Great Recession rank 15th and 25th on the all-time list of contractions. The recession after the South Sea Bubble in 1720 ranks 29th on the list while that in the early years of Mrs. Thatcher's government is 44th.

Table 5.4 provides a summary of recovery periods following recessions documenting how long it takes for output to recover to its previous peak. The length of recovery is measured from peak to peak rather

Table 5.4 Contractions ordered by length of time taken to recover to previous peak

Peak	Length of recovery	Cumulative loss (% of GDP)
1704	16	−204.4
1918	16	−187.7
1720	16	−77.3
1736	11	−34.7
1943	9	−67.5
1761	8	−18.9
1781	8	−9.3
1694	7	−43.7
1769	7	−13.8
2007	6	−8.8
1683	5	−48.4
1815	5	−18.5
1747	5	−5.4
1973	4	−7.1
1979	4	−4.8
1883	4	−3.6
1680	3	−17.6
1701	3	−11.8
1792	3	−6.6
1807	3	−6.5
1810	3	−6.3
1907	3	−5.0
1891	3	−4.9
1840	3	−4.9

(continued)

Table 5.4 (continued)

Peak	Length of recovery	Cumulative loss (% of GDP)
1860	3	−4.6
1802	3	−4.4
1777	3	−1.7
1845	3	−1.2
1990	3	−0.9
1692	2	−16.2
1920	2	−5.5
1753	2	−2.8
1688	2	−2.4
1854	2	−2.3
1813	2	−2.2
1878	2	−2.2
1857	2	−1.8
1755	2	−1.7
1902	2	−0.9
1849	2	−0.9
1836	2	−0.9
1796	2	−0.7
1838	2	−0.6
1899	2	−0.6
1805	2	−0.4

than trough to peak given that many recoveries were interrupted by ups and downs in output. So it is defined as the length of time it takes output to recover from the start of the recession in that year. The table also documents the cumulative loss in output (relative to its previous peak) in percentage terms.

The recovery from the 1704–1705 recession represents the longest and most costly length of time that output took to return to its previous peak. So on this metric it outscores the fall in output at the end of WW1 in terms of cumulative loss, even though it took 16 years in both cases for output to recover. The third row of the table shows that no sooner had output returned to its 1704 peak in 1720 then another recession occurred around the same time as the South Sea Bubble and again it took another 16 years for the level of output to recover. Note that in all these 16 year periods, the recovery was interrupted by several contractions in output most notably by the Great Depression in the case of the recovery following the contraction in output at the end of

World War 1. Output in 1929 was still 3% below its 1918 level when the Wall Street Crash hit.

Charts 5.3 and 5.4 together with Table 5.5 show quarterly turning points over the 1920–1938 and 1955–2018 periods based on the rule that a technical recession should involve at least two consecutive quarters of negative growth. It reveals subtleties about certain recessions that are masked by the annual data. In particular it reveals the double-dip recessions in the Great Depression and in the mid-1970s which we will

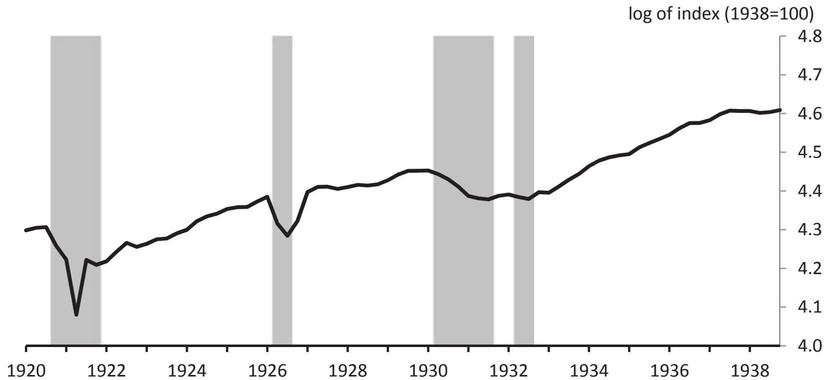

Chart 5.3 Quarterly expansions and contractions (2 quarter rule) 1920–1938 (*Notes* Recession periods are shaded)

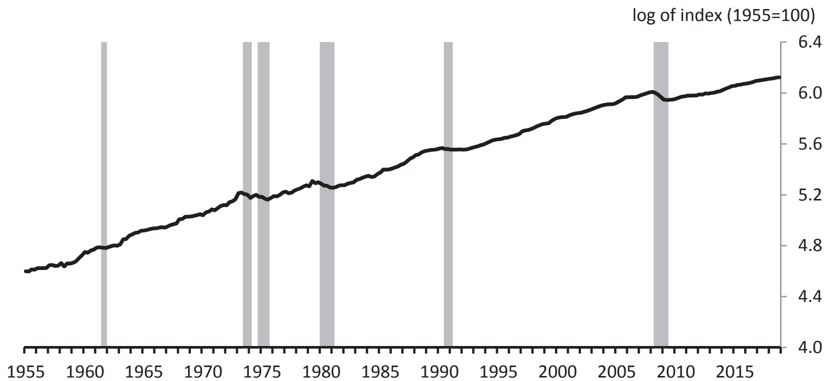

Chart 5.4 Quarterly expansions and contractions (2 quarter rule) 1955–2018 (*Notes* Recession periods are shaded)

Table 5.5 Quarterly turning points in the United Kingdom, 1920–1938/1955–2018

Peak	Trough
1920Q3	1921Q2/Q4
1926Q1	1926Q3
1930Q1	1931Q3
1932Q1	1932Q3
1961Q2	1961Q4
1973Q2	1974Q1
1974Q3	1975Q3
1979Q2	1981Q1
1990Q2	1991Q1
2008Q1	2009Q2

return to in the narrative chapter. There is also an issue about the timing of the trough in 1921 which is affected by the miner's strike between 3rd of April and 28th June of that year as discussed in Mitchell et al. (2012) and can be seen clearly in Chart 5.3 with a large dip and recovery in 1921Q2 and Q3. This also affects the assessment about the size of the contraction in 1921 which is based on total output produced over the year. Note that in this case, where we have no quarterly data for 1918 and 1919, the 1930s recovery would be separate from that after 1920Q3 where output had returned to its previous "peak" by mid-1924. So the treatment of World War 1 matters quite a bit for this type of metric.

To complete our analysis of classical economic cycles we also estimate a simple two-regime Markov Switching model in order to determine contraction periods, using Hamilton's (1989) method that was discussed in Chapter 3. The results on annual and quarterly data are shown in Tables 5.6 and 5.7. The annual model suggests an expansion growth regime of just under 2% a year and a contraction regime of a 9% fall in output. As Chart 5.5 shows the model is able to detect turning points in large recessions but some contractions, such as the Great Depression of 1931, shows a probability of under 0.5 of being such a regime reflecting the relative mildness of that recession in output terms (although as we will see not in unemployment terms). The quarterly model shown in Chart 5.6 is able to pick out the key C20th recessions very well with all the major contractions showing a conditional probability of >0.5 of being in a contractionary state with the exception of the early 1990s recession.

Table 5.6 Markov-Switching model results—annual data 1660–2018

Variable	Coefficient	Std. error
Contraction regime		
μ_1	−0.091298	0.012901
Expansion regime		
μ_2	0.019634	0.001807
Autoregressive coefficients		
ϕ_1	−0.296041	0.062804
ϕ_2	−0.094423	0.062223
ϕ_3	0.114245	0.062140
ϕ_4	0.113993	0.065220

Table 5.7 Markov-Switching model results—quarterly data 1955–2018

Variable	Coefficient	Std. error
Contraction regime		
μ_1	−0.011831	0.002468
Expansion regime		
μ_2	0.007409	0.000727
Autoregressive coefficients		
ϕ_1	−0.038421	0.073830
ϕ_2	0.144159	0.076249
ϕ_3	0.109879	0.070418
ϕ_4	0.016628	0.068886

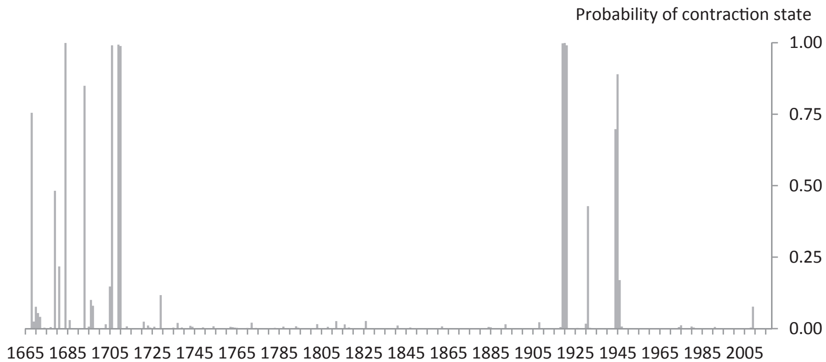

Chart 5.5 Annual turning points 1660–2018: Markov-Switching model

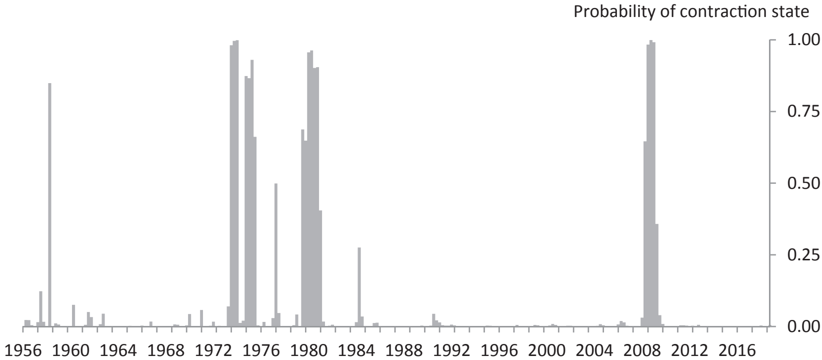

Chart 5.6 Quarterly turning points 1955Q1 to 2018Q4: Markov-Switching model

5.2 Growth Cycle Metrics

For growth cycle metrics we derive de-trended measures using the various methods discussed in Chapter 3. We estimate the following models on annual data:

- Hodrick Prescott filtered (HP) estimates using the "standard" lambda parameter of 100.
- A Band-pass filter (BP) based on the Christiano-Fitzgerald asymmetric approach where the lower and upper bands are set at 2 and 8 years.
- An Unobserved Components (UC) model based on the local-linear trends model of Chapter 3. The cycle is modelled as an AR(2) process so that the data can determine whether the roots are complex or not, rather than impose the complex roots via specifying an explicit trigonometric cycle.
- A segmented-trend model (ST) where the cycle is backed out by removing a series of split-deterministic time trends. We use GDP per capita for the data here so implicitly the trends relate to labour productivity and the employment ratio. The time trends are linear.
- A Beveridge-Nelson (BN) decomposition derived from an ARIMA(2,1) model.

For each model we chart the implied cycles in Charts 5.7, 5.8, 5.9, and 5.10. In each case the Hodrick Prescott filter is used as a benchmark for comparisons. We then derive peak and trough points under each approach based on the deviation of each cycle from trend. As discussed in Chapter 3, we apply censoring rules to ensure that troughs represent negative deviations from trend and peaks are positive, in order to avoid mini-peaks and troughs. We also ensure that peaks and troughs alternate making judgements about where the peak or trough lies depending

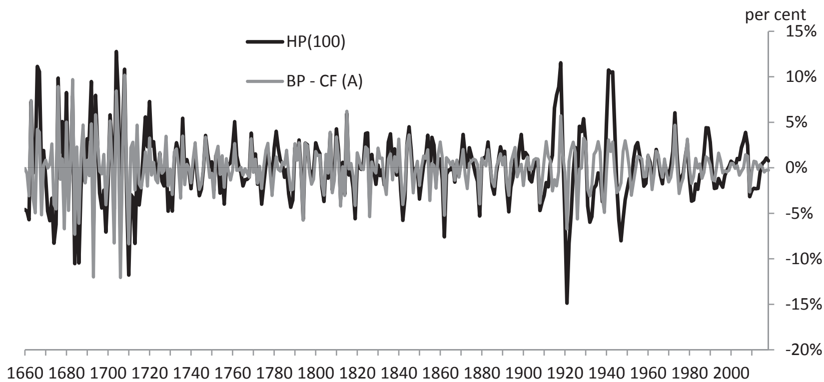

Chart 5.7 Cycles based on Hodrick Prescott filter and band-pass filter

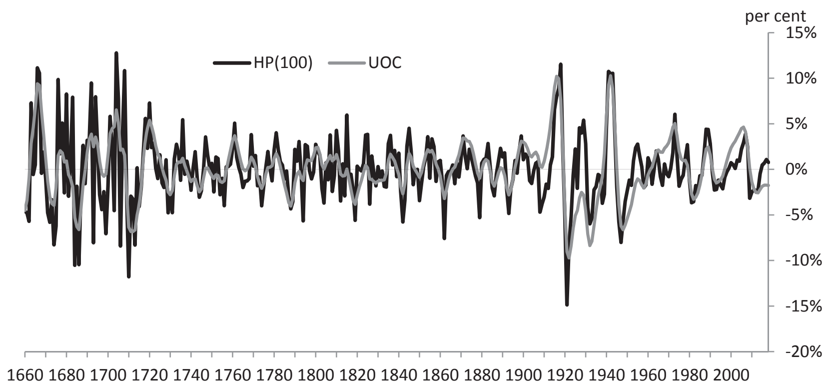

Chart 5.8 Cycles based on Hodrick Prescott filter and unobserved component model

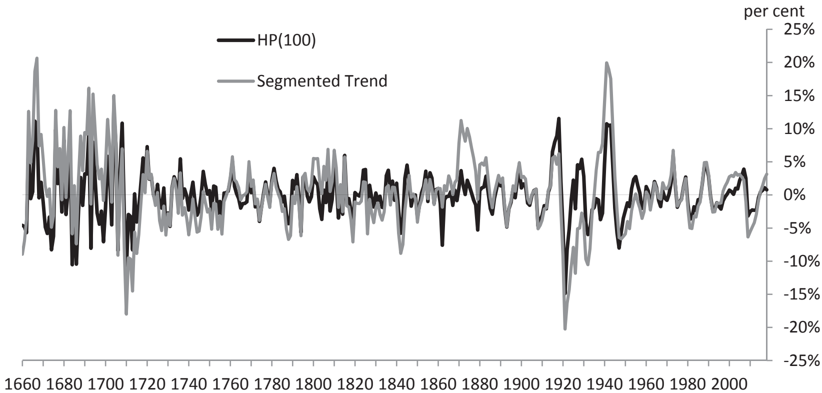

Chart 5.9 Cycles based on Hodrick Prescott filter and segmented trend model

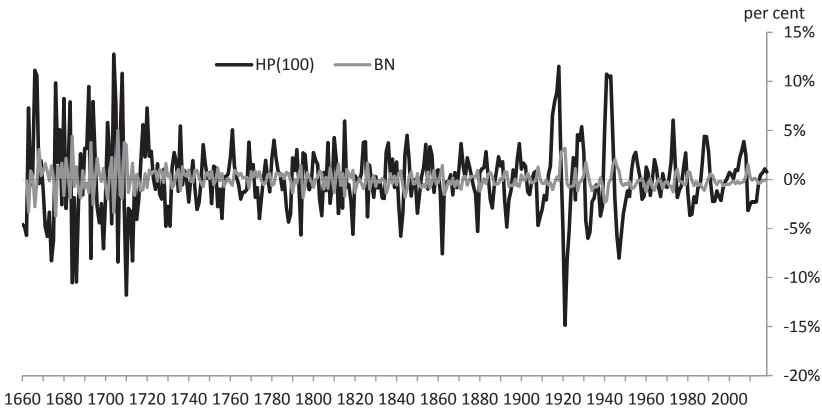

Chart 5.10 Cycles based on Hodrick Prescott filter and Beveridge Nelson decomposition

on the pattern of observations. This allows us to derive the metrics about the timing, length and amplitude of cycles which are shown in Tables 5.8, 5.9, 5.10, 5.11, 5.12, and 5.13.

The results of applying the different de-trending methods are largely what would be expected from our discussion in Chapter 3. Upturns and downturns are more symmetric than classical cycles. The Band-pass filter delivers cycles that are slightly less volatile than the HP filter and slightly shorter, though peaks and troughs are fairly coincident.

Table 5.8 Classical versus growth cycle dating

Classical		HP		UC	
Peak	Trough	Peak	Trough	Peak	Trough
1663	1664	1663	1664		
1667	1668	1666	1668	1666	1674
1669	1672	1669	1674		
1673	1674				
1676	1677	1676	1679	1677	1686
1678	1679				
1680	1681	1680	1681		
1683	1684	1683	1684		
1685	1686				
1688	1689	1688	1689		
1692	1693	1692	1693	1692	1698
1694	1697	1694	1699		
1698	1699				
1701	1703	1701	1703		
1704	1706	1704	1706	1704	1711
1708	1710	1708	1710		
1711	1713				
1714	1715	1714	1715		
1718	1719				
1720	1721	1720	1724	1720	1730
1722	1724				
1725	1727	1725	1727		
1728	1729	1728	1729		
1730	1731				
1733	1735	1733	1735		
1736	1737	1736	1737	1736	1744
1738	1740	1738	1740		
1742	1744	1742	1744		
1747	1749	1747	1751	1748	1755
1750	1751				
1753	1754	1752	1756		
1755	1756	1761	1765		
1761	1765	1769	1774	1761	1766
1769	1770			1769	1774
1771	1772				
1773	1774				
1777	1779	1777	1779		
1781	1783	1781	1788	1781	1788
1784	1785				
1786	1788				
1792	1794	1792	1794		
1796	1797	1795	1798		

(continued)

Table 5.8 (continued)

Classical		HP		UC	
Peak	Trough	Peak	Trough	Peak	Trough
1802	1804	1800	1804	1801	1804
1805	1806	1805	1806		
1807	1808	1807	1808		
1810	1812	1810	1812	1810	1813
1813	1814	1813	1814		
1815	1816	1815	1819	1815	1819
1817	1819				
		1820	1822		
1825	1826	1825	1826	1824	1829
		1827	1829		
		1830	1834		
1836	1837	1836	1839	1836	1842
1838	1839				
1840	1842	1840	1842		
1845	1847	1845	1850	1845	1850
1849	1850				
1854	1855	1854	1855	1854	1862
1857	1858	1856	1858		
1860	1862	1860	1862		
		1866	1867		
		1868	1869		
1878	1879	1871	1879	1871	1879
1883	1885	1883	1886	1882	1886
1891	1893	1889	1893	1889	1893
		1896	1897		
1899	1900	1899	1904		
1902	1903				
1907	1908	1907	1908	1906	1909
1918	1921	1918	1921	1916	1922
1925	1926	1925	1926		
1929	1931	1929	1932	1929	1932
1943	1947	1943	1947	1942	1948
		1955	1958		
		1960	1962		
		1964	1967		
		1968	1970		
1973	1975	1973	1975	1973	1982
1979	1981	1979	1981		
1990	1991	1988	1992	1989	1993
2007	2009	2007	2009	2006	2013

Table 5.9 Growth cycles—HP filter ($\lambda = 100$)

Period	Number	Average length of cycle (years)			Amplitude (%)	
	Std Dev	Downturn	Upturn	Total	Downturn	Upturn
1663–1720	13	2.08	2.31	4.38	−5.45	7.37
1720–1781	12	2.75	2.33	5.08	−2.38	2.77
1781–1825	10	2.70	1.70	4.40	−3.04	2.79
1825–1874	11	2.18	2.00	4.18	−2.72	2.22
1874–1918	6	3.67	4.17	7.83	−3.28	3.68
1918–1943	3	2.33	6.00	8.33	−7.64	6.04
1943–1973	5	2.80	3.20	6.00	−2.84	2.53
1973–2007	3	2.67	7.25	9.92	−2.59	4.25
2008+	1	2.00			−3.17	

Table 5.10 Growth cycles—band-pass filter

Period	Number	Average length of cycle (years)			Amplitude (%)	
		Downturn	Upturn	Total	Downturn	Upturn
1663–1720	14	1.86	2.21	4.07	−5.66	5.93
1720–1781	14	2.21	2.14	4.36	−1.80	2.19
1781–1825	11	2.18	1.82	4.00	−2.59	2.50
1825–1874	11	2.45	1.73	4.18	−2.59	1.93
1874–1918	8	2.88	3.00	5.88	−2.03	2.17
1918–1943	4	2.50	3.75	6.25	−5.07	2.74
1943–1973	5	2.80	3.20	6.00	−1.90	2.09
1973–2007	4	2.75	5.20	7.95	−1.80	2.42
2008+	1	2.00			−2.65	

Table 5.11 Growth cycles—unobserved components model

Period	Number	Average length of cycle (years)			Amplitude (%)	
		Downturn	Upturn	Total	Downturn	Upturn
1663–1720	4	7.50	5.40	12.90	−4.54	5.44
1720–1781	5	7.00	5.20	12.20	−1.79	1.63
1781–1825	4	4.25	6.50	10.75	−2.15	1.13
1825–1874	4	6.00	5.75	11.75	−2.07	2.24
1874–1918	4	4.75	6.50	11.25	−1.35	3.34
1918–1943	2	4.50	8.50	13.00	−9.05	3.72
1943–1973	1	6.00	25.00	31.00	−6.63	5.03
1973–2007	2	6.50	15.00	21.50	−2.38	4.04
2008+	1	7.00			−2.57	

Table 5.12 Growth cycles—segmented trend

Period	Number	Average length of cycle (years)			Amplitude (%)	
		Downturn	Upturn	Total	Downturn	Upturn
1663–1720	11	2.18	2.75	4.93	−4.53	10.82
1720–1781	8	4.25	3.38	7.63	−3.60	2.78
1781–1825	5	3.80	4.80	8.60	−4.88	3.47
1825–1874	7	2.29	4.43	6.71	−3.46	3.19
1874–1918	5	4.20	5.20	9.40	−2.75	4.10
1918–1943	2	3.00	8.50	11.50	−15.38	8.60
1943–1973	4	3.75	4.25	8.00	−3.27	2.29
1973–2007	3	2.67	7.00	9.67	−3.12	4.38
2008+	1	6.00			−6.33	

Table 5.13 Growth cycles—Beveridge Nelson decomposition

Period	Number	Average length of cycle (years)			Amplitude (%)	
		Downturn	Upturn	Total	Downturn	Upturn
1664–1719	15	2.13	1.50	3.63	−1.76	2.23
1719–1779	13	2.38	2.23	4.62	−0.59	0.84
1779–1826	11	1.91	2.36	4.27	−1.13	0.92
1826–1873	12	1.50	2.42	3.92	−0.92	0.61
1873–1917	9	2.56	2.33	4.89	−0.55	0.59
1917–1945	5	2.20	3.40	5.60	−1.04	1.65
1945–1975	4	4.75	2.75	7.50	−1.14	0.31
1975–2009	3	6.00	5.33	11.33	−0.75	0.96
2009+	2	2.00	1.00	3.00	−0.24	0.13

The UC model filters out more of the fluctuations in output as noise and delivers fewer and longer, more persistent cycles. However the roots of the estimated AR(2) component are real rather than complex so there is no periodic cycle underlying the generated cycle. Charts 5.11, 5.12, and 5.13 summarise the AR(2) trend, cyclical and noise components.

The segmented trend model has the least volatile trend and unsurprisingly leads to cycles that are generally larger in amplitude, although again the turning points in the growth cycle are very similar. The Beveridge Nelson has the most volatile trends and leads to very noisy cycles with little amplitude. The predicted turning points are also very different.

After applying the censoring rules most of the approaches suggest a narrowed-down set of turning points (Table 5.8) and, overall, they suggest that the length of growth cycles increases after 1870

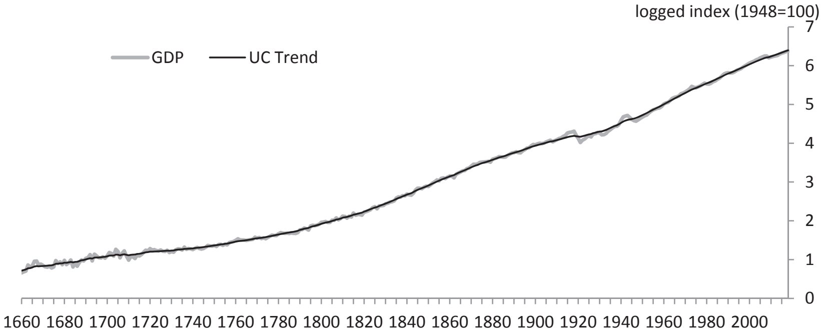

Chart 5.11 Unobserved components model—trend

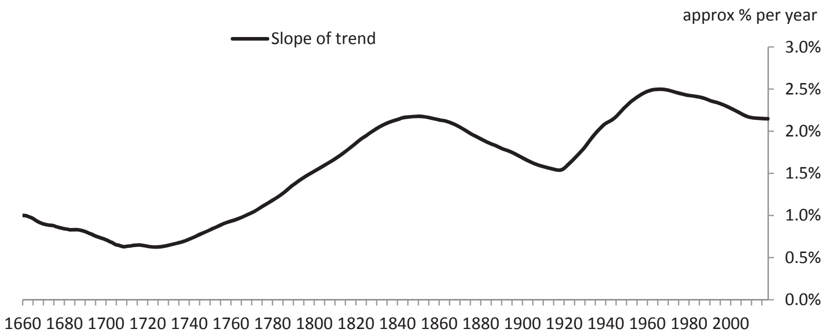

Chart 5.12 Unobserved components model—slope of trend

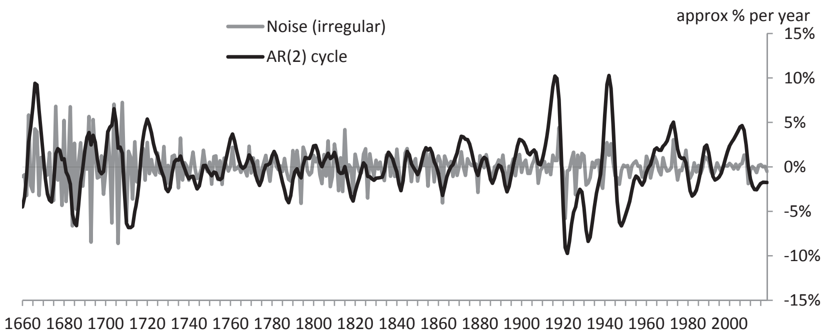

Chart 5.13 Unobserved components model—noise and AR(2) cycle

(Tables 5.9, 5.10, 5.11, 5.12, and 5.13). The HP and BP models suggest that the business cycle lengthens from around 4–5 years to between 6 and 9 years. The UC model however appears to show that cycles mostly increase in length after World War 2, with a total cycle duration of 11–13 years between 1663 and 1943. The interwar periods and the 1660–1720 period show the greatest amplitude which is unsurprising given these contain the deepest recessions.

Overall the tables show quite a range in business cycle metrics, suggesting deriving stylised facts on the business cycle is difficult and very dependent on the method used. The BN decompositions in particular suggest that most of the fluctuations in GDP can be attributed to the trend component and that the cyclical component is noisy with low duration and amplitude. That would imply that many shocks lead to permanent shifts in output either because they reflect supply shocks as in the real business cycle model or demand shocks that have hysteretic effects on potential supply as discussed earlier in Chapter 2. The HP and BP models tend to reflect the "conventional wisdom" of a lengthening cycle over time but one that lies within traditional business cycle territory of between 2 and 10 years. The UC model results are particularly interesting in that they suggest that the duration of cycles are, on average, very much in the range of what modern consensus would deem to be credit cycle territory—a duration of between 8 and 20 years. As we show in Chapter 6 many of the peaks and troughs in the UC model bookend financial crises. On post-WW2 data the annual UC model suggests a long upswing of almost 25 years between 1948 and 1973, once censoring is applied.

We also apply some of the de-trending methods to the quarterly GDP data available from 1920–1938 and from 1955. Charts 5.14, 5.15, 5.16, and 5.17 consider the peaks and troughs for both the interwar and post-WW2 periods and a comparison is made between the HP filter (HP), Band-pass filter (BP(CF)) and an AR(2) cycle from an unobserved components model applied to quarterly data. Once again the BP and HP filters show similar patterns although the BP filter is smoother as it excludes high frequency movements that the HP filter lets through. The UC model exhibits more significant differences particularly in the post-WW2 period. The UC model suggests a more

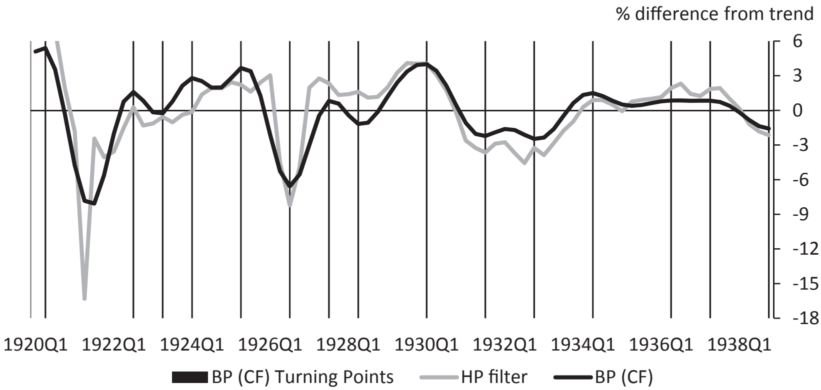

Chart 5.14 Interwar growth cycles using quarterly data—HP and BP models compared

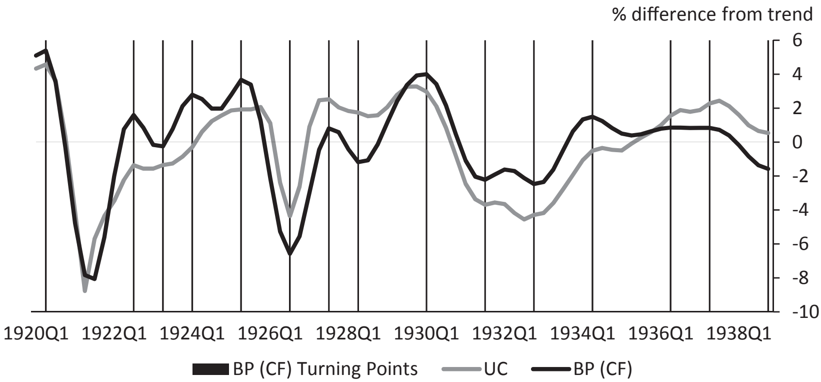

Chart 5.15 Interwar growth cycles using quarterly data—UC and BP models compared

persistent boom in the build-up to the Great Financial Crisis in 2008 and a more persistent contraction relative to trend thereafter. Also note that applied to quarterly data from 1955, the UC model shows more peaks and troughs over the post-WW2 period than the annual UC model (with censoring rules applied). Clearly the development of quarterly GDP data over the 1938–1955 period would be beneficial so a longer quarterly assessment of growth cycles can be made.

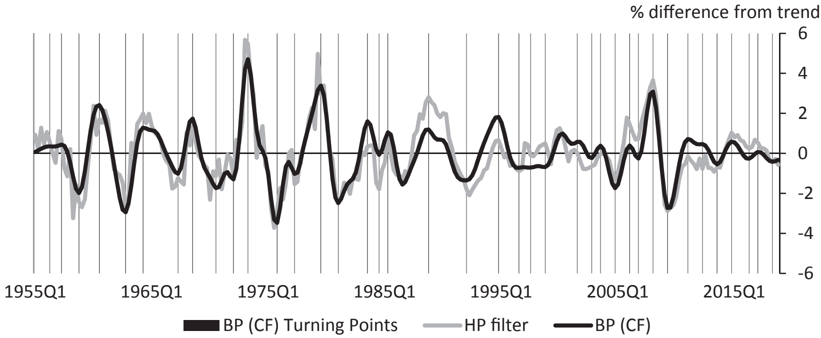

Chart 5.16 Post-war growth cycles using quarterly data—HP and BP models compared

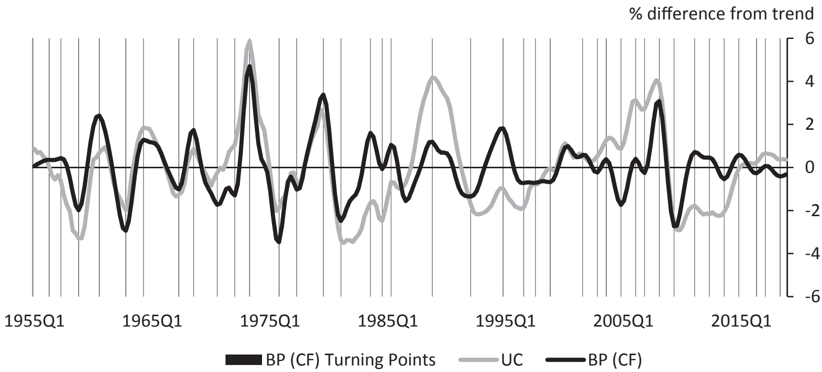

Chart 5.17 Post-war growth cycles using quarterly data—UC and BP models compared

Overall the results reaffirm the conclusion that, although many of the peaks and troughs derived from the various statistical methods show similar patterns, the business cycle metrics can vary quite a lot. None of this is surprising given the discussion of Chapter 3 and it is clear statistical methods alone are not sufficient to uncover the nature of business cycles. A key test is whether these metrics when combined with the historical narrative from contemporary and secondary sources can tell a consistent story over time. This is the focus of Chapter 6.

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