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Advanced Macroeconomics

[Abstract](#)

Description of business cycles in Cyprus using on time series of main GDP components

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The aim of this work is to describe the behavior of major macroeconomic time series that characterize business cycles in the country Cyprus on the light of the analysis conducted on the Macroeconomics textbook of D. Williamson for the United States of America.

The data is downloaded from the Eurostat database, it contains (the label of each time series on the Excel file is written between parenthesis and contains an indication of the unit of measurement) historical, quarterly, and seasonally and calendar adjusted time series of Gross Domestic Product ("Nominal GDP in Million Euro" & "Real GDP in Million Euro"), consumption ("Approximate total consumption in Million Euro"), investment ("Gross Capital Formation in Million Euro"), government expenditures ("Collective consumption expenditure of general government in Million Euro"), employment ("Total Employment domestic concept in thousands of persons"), and nominal wages ("Nominal wages in Million Euro") as a substitute to real wages that are not available. The data covers the period from the 1<sup>st</sup> quarter of 1995 to the third quarter of 2022, and it is saved on an Excel sheet under the name "DATA". The first four datasets are chain linked volumes (origin at year 2010), whereas nominal wages are nominal values and require further processing to make them real values. The first step to get an estimate of average real wages ("Calculated real wages in Million Euro") is to divide the nominal wages by the number of workers to get an average quarterly nominal wage per worker, and the second step it to divide the last by the implicit GDP deflator ("Calculated implicit GDP price deflator") that is calculated by dividing nominal GDP by real GDP, it is used as an estimate of the price level. Moreover, the sum of real and calendar and seasonally adjusted "Collective consumption expenditure of general government" and "Household and NPISH final consumption expenditure" is used to estimate total consumption. Now that all the time series are in real values, they are transformed using the natural logarithm function ("Natural logarithm of {variable}"), the trend ("HP trend {variable}") is then calculated using the Hodrick-Prescott filter in Excel (lambda equal to 1600 as suggested by Hodrick and Prescott for quarterly data). Finally, the cyclical component (CC {variable}) is calculated through subtracting the trend values from the logarithmic values. For each cyclical component time series, the following is done. The first order autocorrelation coefficient is obtained using the function CORREL applied to the time series and its one period lagged version, the correlation coefficient with the cyclical component of GDP is also obtained using the CORREL function, the time series' standard deviation is computed via the function STDEV.P, and the obtained value is divided by that of the cyclical component of GDP (results are summarized on "Table"). Finally, a graph ("Graph") is created to depict the cyclical components of GDP, consumption, employment, and government expenditure.

The first observation made from the graph is that, oppositely to the USA textbook case, the cyclical component of GDP in Cyprus does not exhibit the signs of a recession during the years 2008 and 2009, in fact during the year 2008 the real GDP is above trend, and the highest negative deviation during both years is reached during the third quarter of 2009 (-1%, not a trough). However, since 2009, business cycles became more severe in Cyprus, and the deviations from trend during the period 2013-2014 show the signs of a recession, this evidence is bolstered by the strong GDP growth starting from the year 2015 as can be seen on the graph. More generally, GDP is persistent (first order autocorrelation coefficient equal to 0.76 as mentioned on the table) similarly to the USA GDP. It is also remarkable on the table that each time series is converging towards procyclicality after 2008 (the correlation coefficient with GDP after 2008 is significantly bigger than before 2008).

Cyclical component time series	1	2	3	4	5	6
RGDP	0.76	1.00	1.00	1.00	0.02	1.00
Consumption	0.39	0.73	0.27	0.83	0.03	1.18
Investment	-0.14	0.41	0.29	0.43	0.22	8.92
Government Expenditure	0.11	0.14	-0.14	0.31	0.07	2.70
Employment	0.93	0.81	0.32	0.86	0.02	0.70
Real wage	0.56	0.39	-0.13	0.50	0.02	0.76

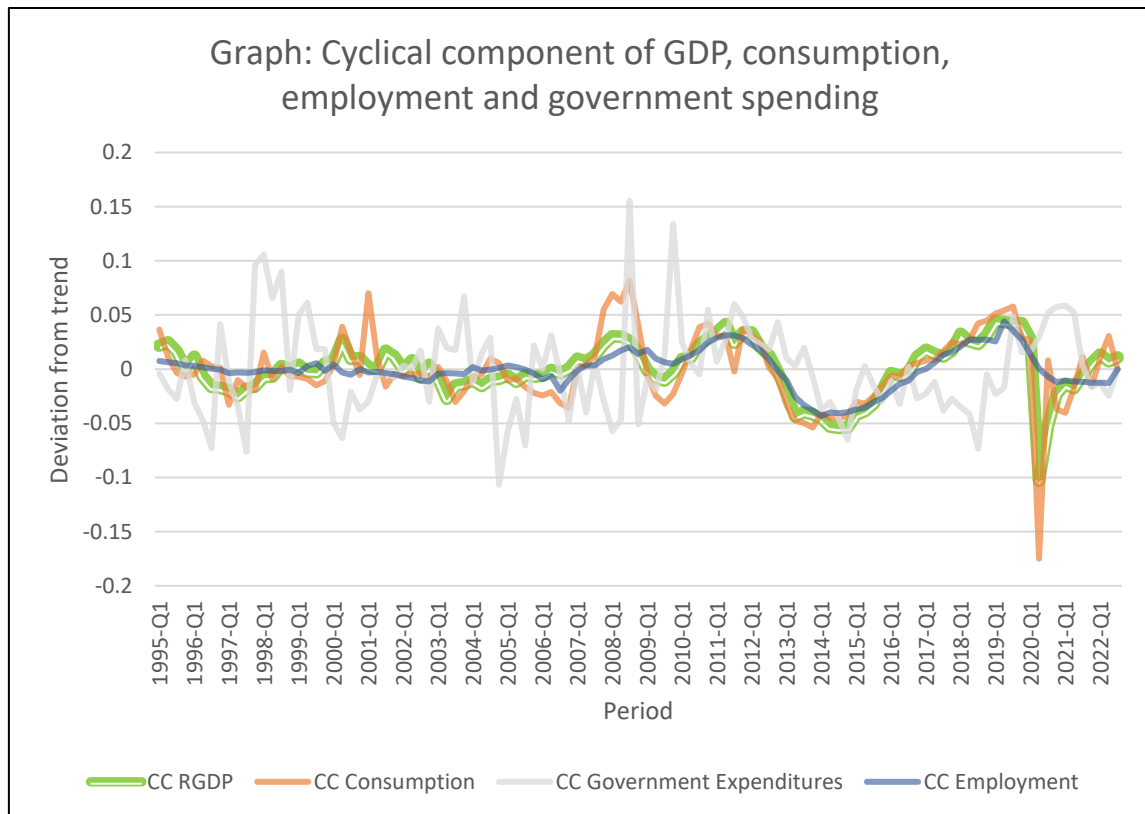
**Table: Business cycle statistics**

#### Legend

- 1: First order autocorrelation coefficient
- 2: Correlation coefficient with the cyclical component of GDP
- 3: Correlation coefficient with the cyclical component of GDP before 2008
- 4: Correlation coefficient with the cyclical component of GDP after 2008
- 5: Standard deviation
- 6: Standard deviation divided by CC GDP's standard deviation

Speaking of GDP components, consumption exhibits procyclicality (the table shows a correlation coefficient equal to 0.73) this can be observed along with decent evidence for coincidence on the graph especially after year 2008. The behavior of the cyclical component of consumption in Cyprus differs from the USA case in that it is more volatile than GDP (the table shows a ratio of standard deviations equal to 1.18), this indicates that consumption smoothing is not as widespread practice in Cyprus as in the USA (the same holds if we consider other consumption aggregates such as the consumption of non-durable goods, the proof is available on the parent table on the Excel file). Investment is the most volatile component of GDP with a standard deviation equal to nearly 9 times the standard deviation of GDP, this is also the case for USA's investment, however, even though investment in Cyprus can be considered procyclical, the amplitude of the correlation is small relatively to the USA case (correlation coefficient equal to 0.41 as mentioned on the table). The cyclical component of government spending is not that correlated with that of GDP (correlation coefficient equal to 0.14), and starting from 2016, the graph shows arising acyclicity between both. This might be a sign of government's efforts to stabilize the economy. Similar to the USA case, employment is procyclical (correlation coefficient equal to 0.81 on the table), it is less volatile than GDP (ratio of standard deviations equal to approximately 0.7), and starting from the year 2008, we can observe on the graph a tendency to coincidence in the absence of any strong sign of lag or lead. According to the ratio of standard deviations, real wages are less volatile than GDP (the table shows a value of 0.76), while in terms of procyclicality, real wages behave similarly to investment.

Besides the predominant similarities between business cycles in Cyprus and in the USA, few differences are highlighted: Recession occurred during 2013-2014 instead of 2008-2009, the evidence in hand hint that consumption smoothing is not adopted, and procyclicality is relatively lower for investment.



References:

Textbook: Williamson, Stephen D. Macroeconomics. 6<sup>th</sup> global edition, Pearson, 2018.

Data source: <https://ec.europa.eu/eurostat/data/database>