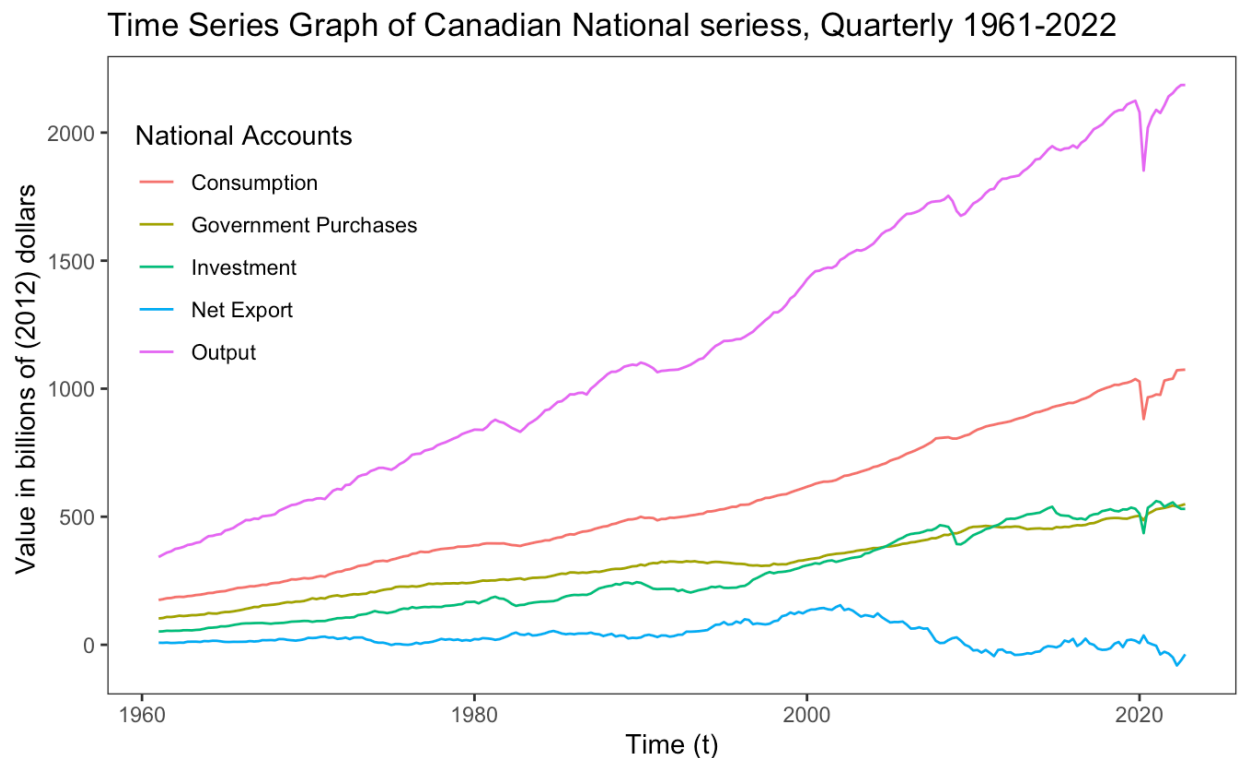# Problemset 5: Business Cycle Analysis

Zamima Islam Sabaa

(a) Time series graph of Output, and all other components including Consumption, Investment, Government Purchases, and Net Exports

Time Series Graph of Canadian National seriess, Quarterly 1961-2022
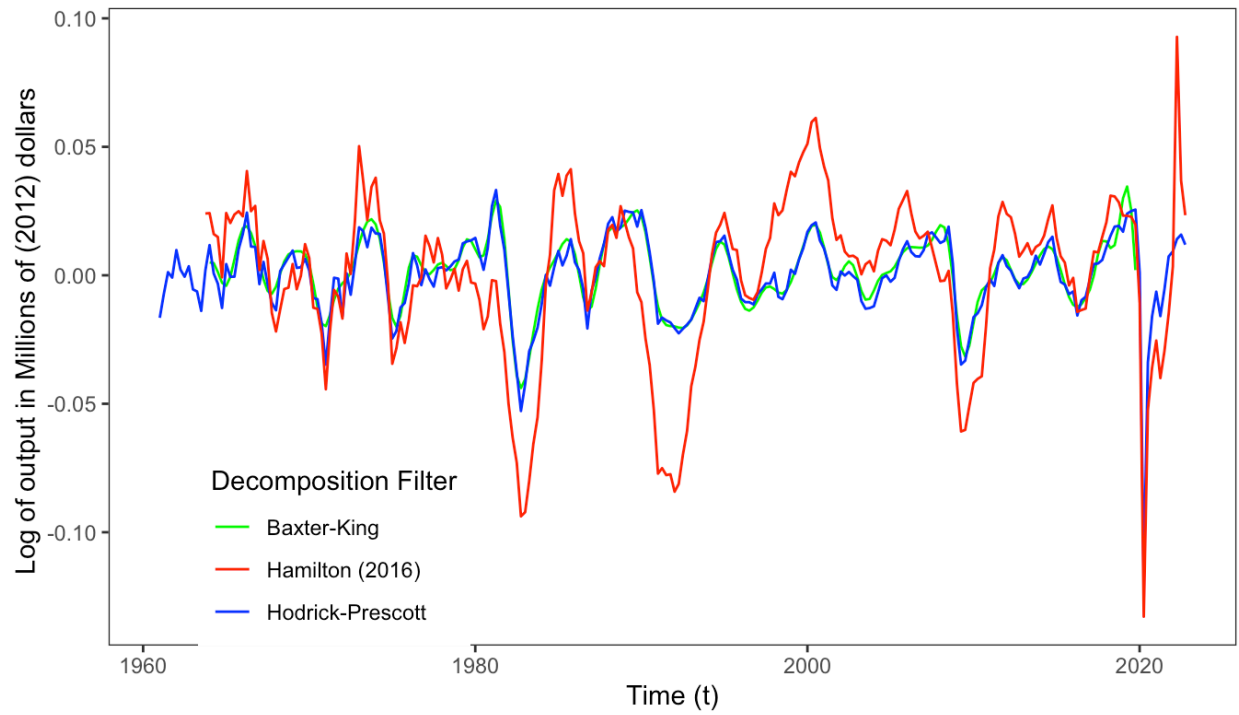
(b) Find the computation of b in the R-file

(c) Graphs; Standard Deviation Table and Correlation with Output Table
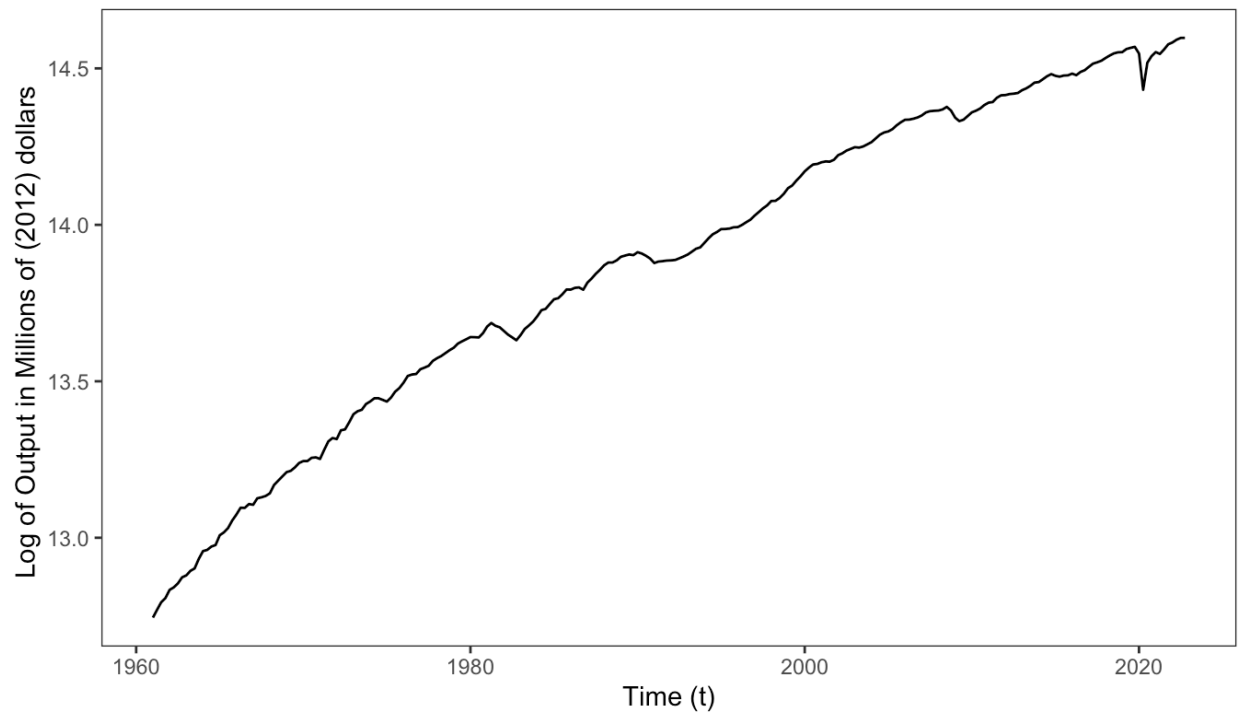
(i)Graphs

Note: I plot the log graphs in another plot because it messes up the axes for the cycles
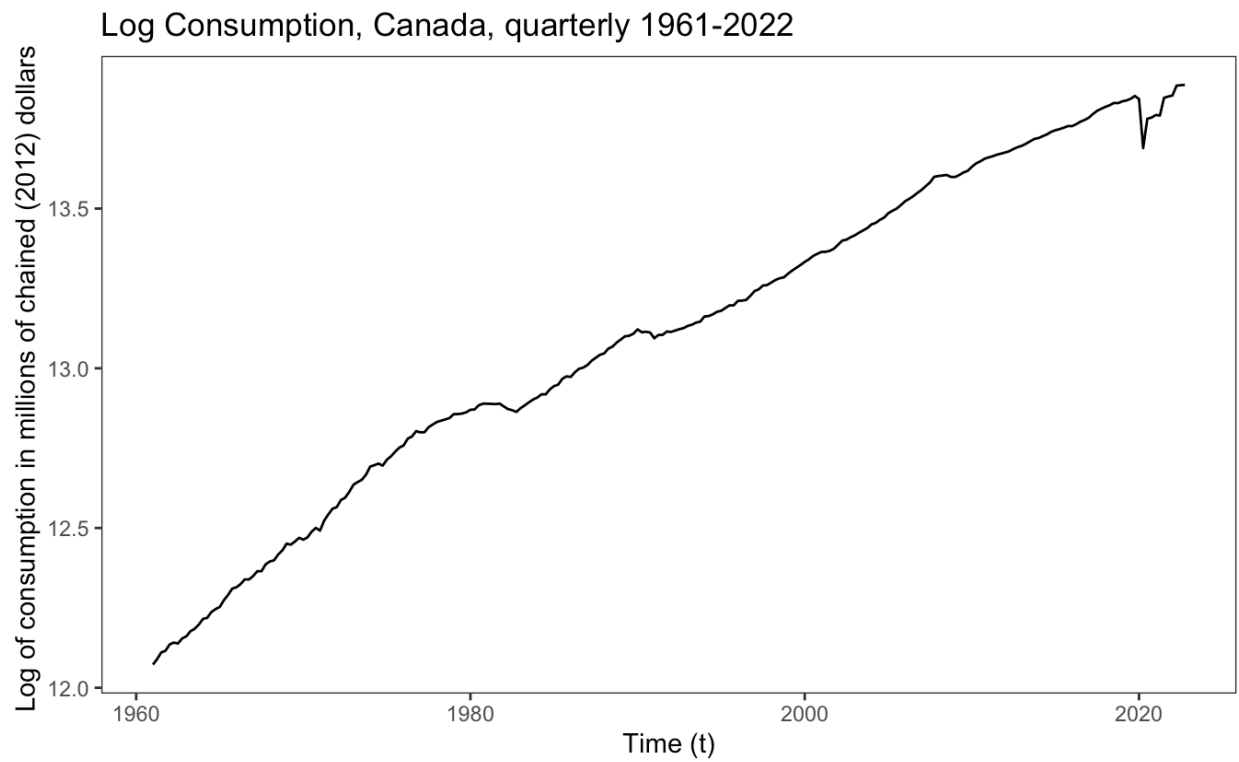
Output Graphs

## Cycles of time series decomposition of output, Canada, quarterly 1961-2022

Log Output,Canada, quarterly 1961-2022

Consumption Graph

Cycles of time series of consumption, Canada, quarterly 1961-2022

Log Consumption, Canada, quarterly 1961-2022

Investment Graph

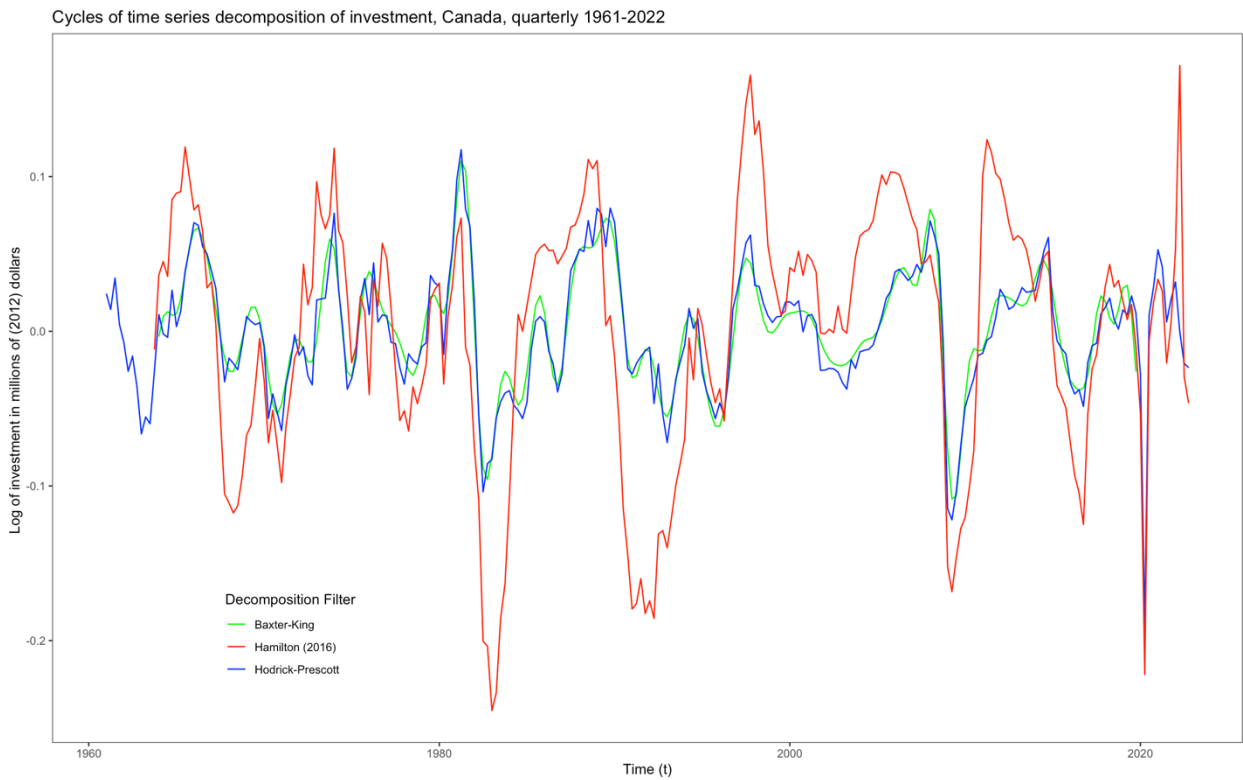Cycles of time series decomposition of investment, Canada, quarterly 1961-2022

Log Investment, Canada quarterly 1961-2022

Government Expenditure Graph

Cycles of time series decomposition of gov. expenditure, Canada, quarterly 1961-2022

Log Gov. Expenditure, Canada, quarterly 1961-2022
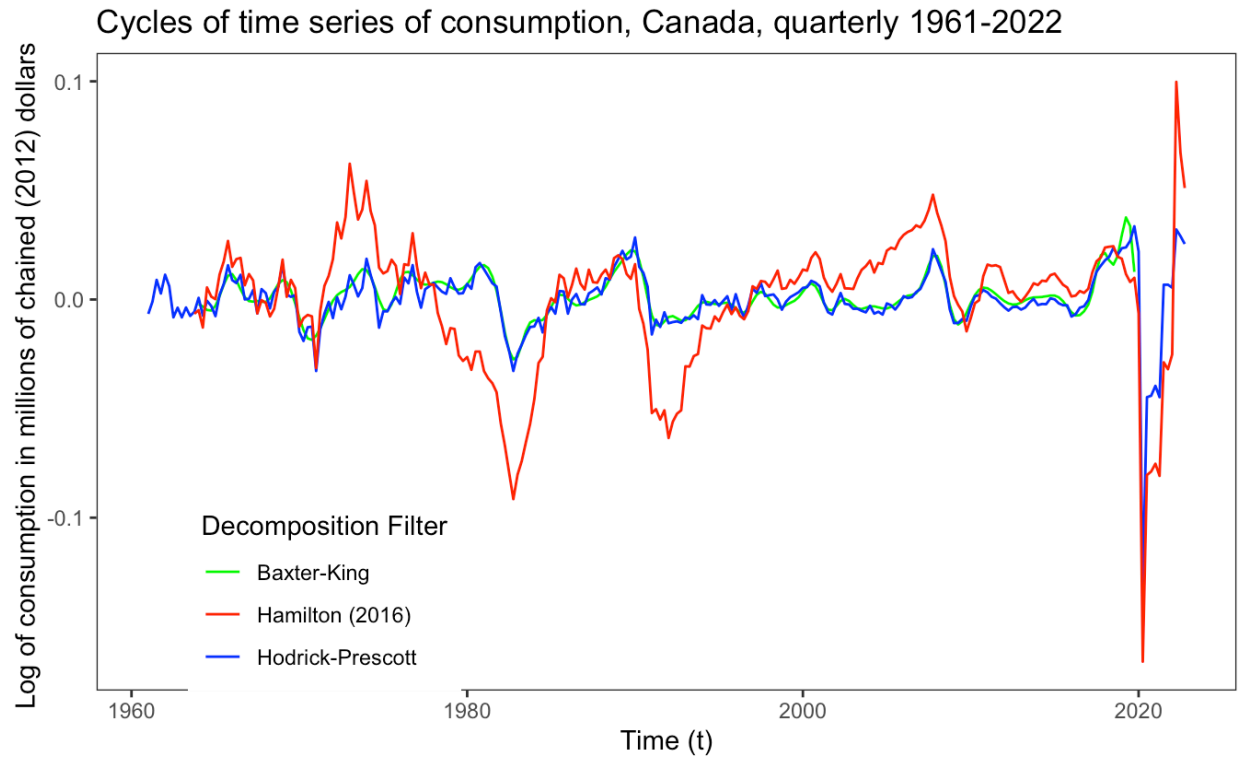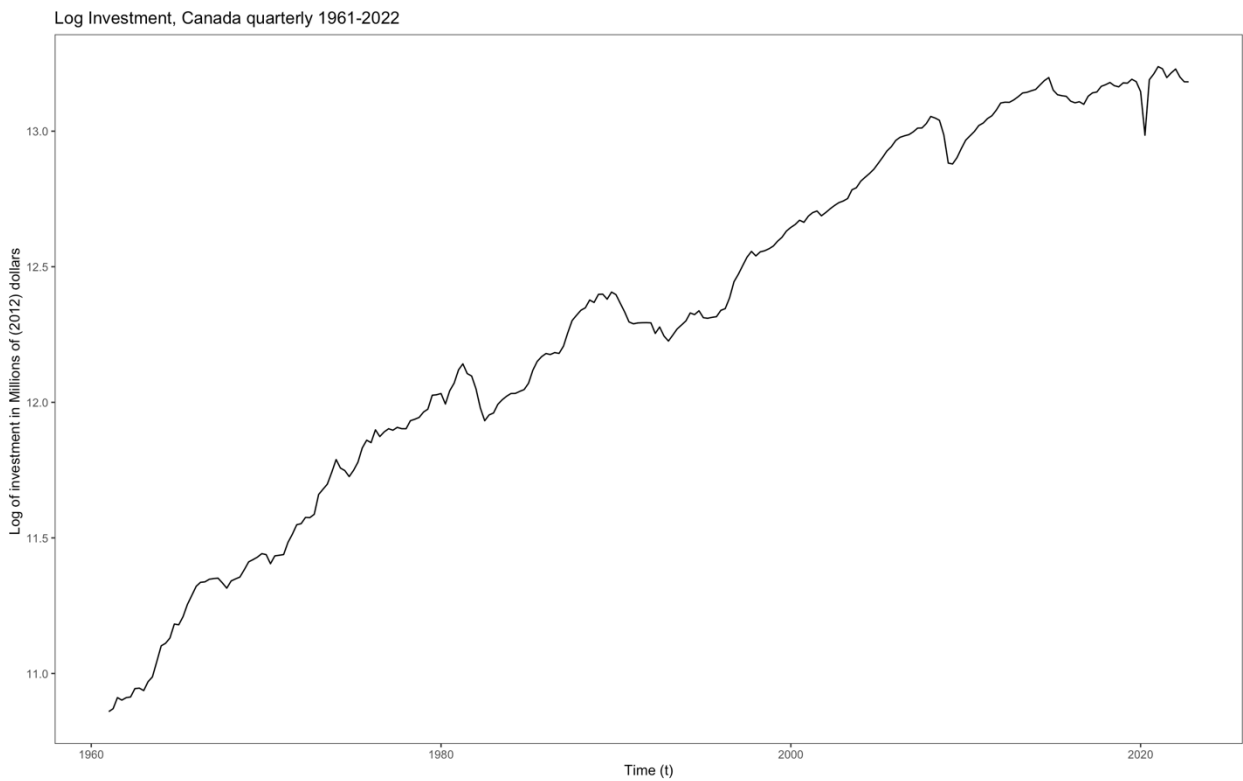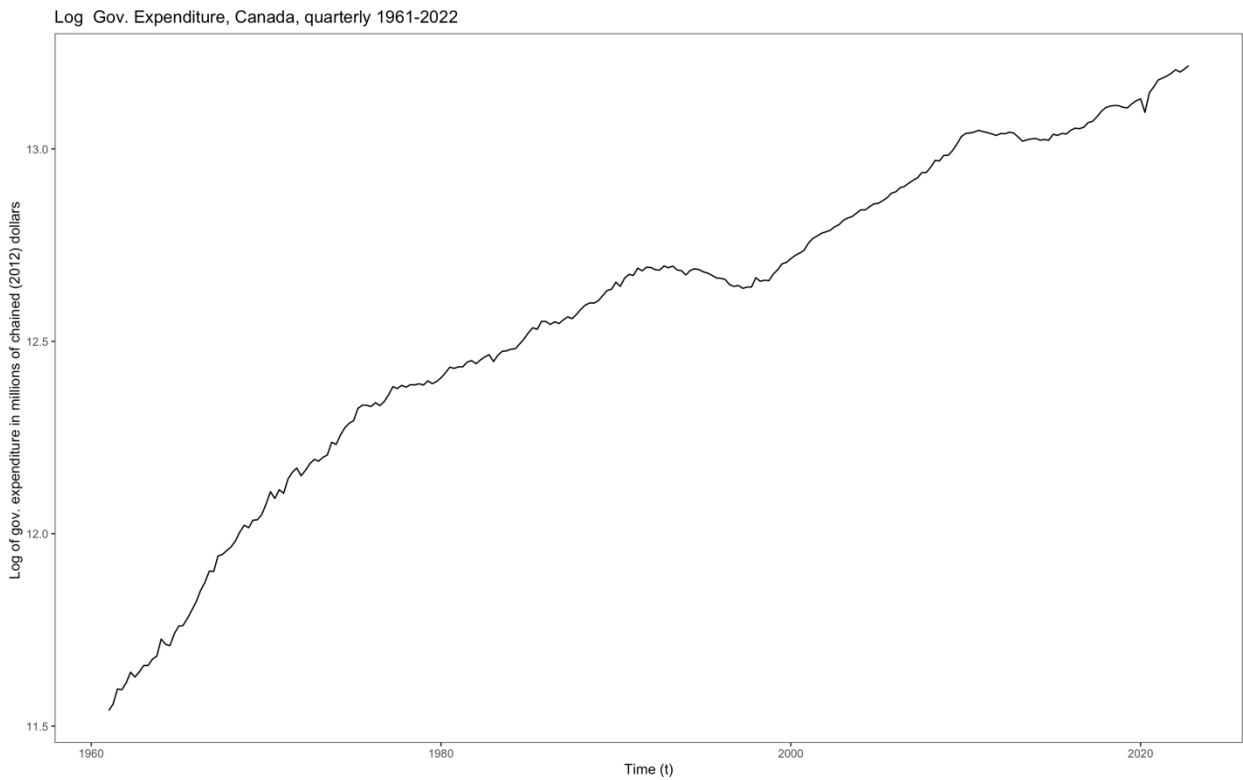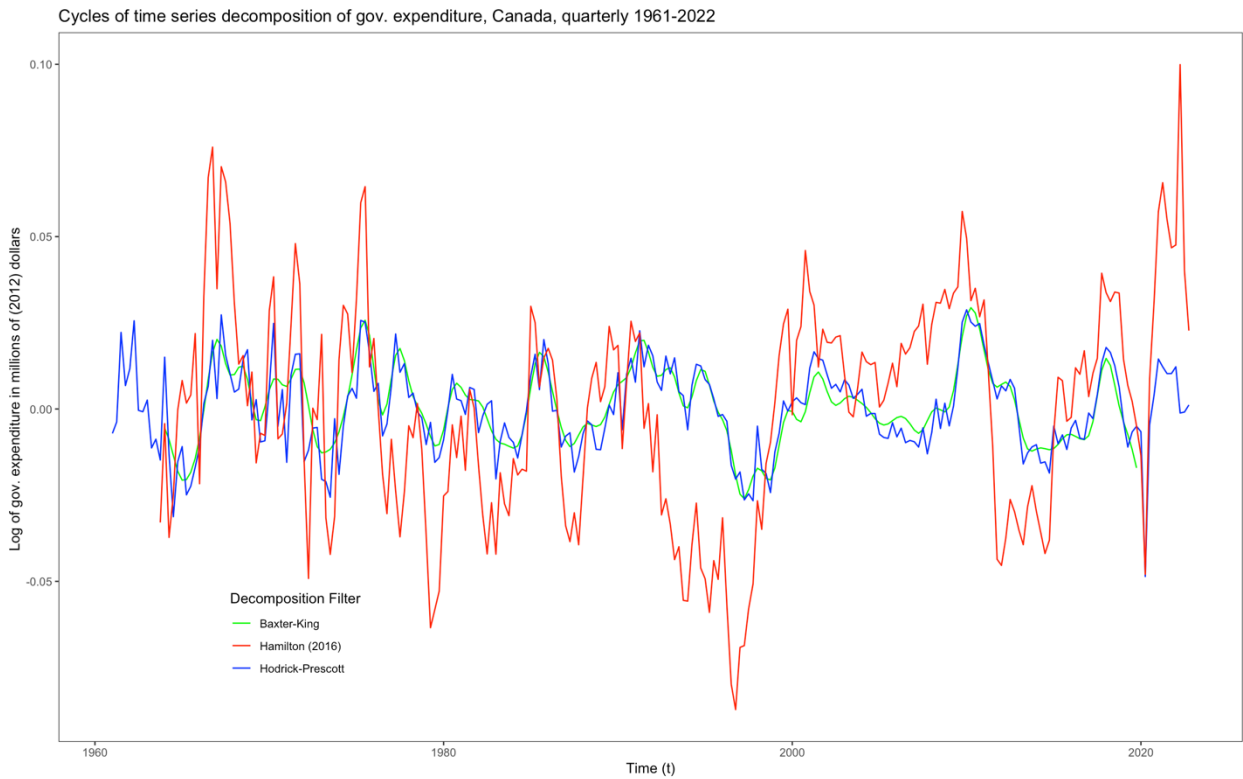
Standard Deviations Table

	Log	BK Filter	HP Filter	Hamilton (2016)
Output	0.50760097	0.01333010	0.01564141	0.03154765
Consumption	0.50399033	0.00947828	0.01449032	0.03000079
Investment	0.67387507	0.03659735	0.04063211	0.08144966
Government Expenditure	0.42550498	0.01079928	0.01243486	0.03197281

Correlations Table

	Log	BK Filter	HP Filter	Hamilton (2016)
Consumption	0.997216	0.823577	0.761311	0.773812
Investment	0.996878	0.791575	0.746716	0.79172
Government Expenditure	0.190171	-0.13455	-0.143955	0.106956

(d) Which filter is the best in capturing the business cycle component of economic fluctuations?

From all the graphs, we can see that the fluctuations reported have the same trend. If we look more closely, it seems the Hodrick-Prescott filter and the Baxter King filter report almost the same volatilities. However, the Hamilton (2016) filter reports volatilities of each component to be almost twice as large as the other two. Except during the Covid-19 pandemic, all the filters report almost the same sharp drop in GDP and its components. I think, the Hamilton (2016) filter does the best job in capturing the business cycle component because it is able to report stronger deviations from the trend.

(e) Which series is the most volatile? The least? Which components of output are procyclical (positively correlated with output fluctuations) or counter-cyclical?

From the detrended graphs it seems that the series that is the most volatile is Investment. The least volatile on the other hand is Consumption which is likely due to consumption smoothing over time.

From the correlations table we can see that almost all the filters report all the components to be procyclical, that is they move in the same way like output. It seems that both consumption and investment are strongly positively correlated with Output, so they are procyclical.

However, the BK filter and the HP filter report government expenditure to be slightly counter-cyclical. And the Log and Hamilton (2016) say they are slightly procyclical. Since the correlation values are extremely small it can be argued that it is acyclical and in case of Canada, which is a developed country, this seems intuitively correct because in times when the economy is in a recession, the government spends more money to stimulate it.

(f) Why are the results different now? What do we learn from them in contrast to b(ii) Baxter King filtering? From an eye-test, do NX appear to be procyclical or countercyclical for Canada?

Cycle Graph of Canadian Output Decomposition, Canadian quarterly 1961-2022
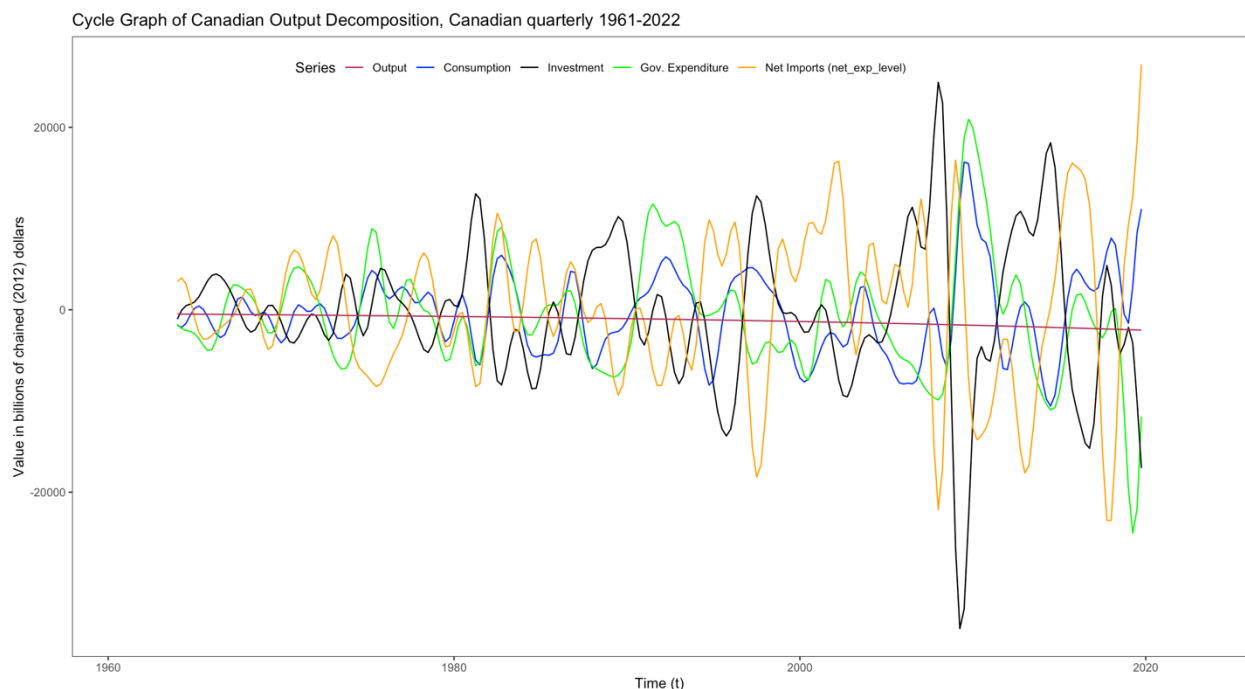
The results are different because we are not using logarithms anymore. In contrast to b(ii), in this graph, the series of Investment is not the most volatile anymore, it is the net exports that is the most volatile, followed my government expenditure. The least volatile is once again consumption, which follows the other filtering method used. What is unique about this graph is that the volatility of every time series seems to be increasing with time.

From the eye-test, it is difficult to say whether Net Exports is procyclical or not because output cycle is plotted to be linear. However, as we know that consumption is procyclical to output (from the correlations table), if we compare the Net exports volatility with consumption, we can conclude that net exports seem to be acyclical: in some instances net exports seems procyclical and counter cyclical in other instances (such as around the 1975s).