ECON807 PS5: Business cycle properties in Canada

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In this document I walk through my code, equations and results for the ECON807 PS5.

Preliminaries

```
# Load libraries

library(tidyverse)
library(lubridate)
library(mFilter)
library(dynlm)
library(gridExtra)

# Load the data

raw_national_accounts <-
    read.csv('data.csv')
```

Preparing the data

In this part, I prepare the dataset to present a time series of the various national accounts.

```
# Transform to a date

df <-
  raw_national_accounts %>%
  mutate(
```

```r
    date = ymd(paste(REF_DATE, '01')),
    month_year = floor_date(date, 'month')
  ) %>%
  select(-REF_DATE) %>%
  relocate(date, month_year) %>%
  rename(account = 'Estimates',
         value = 'VALUE')

# Create a joint dataframe to plot all of my timeseries. Will be needing to create a lot o

output <-
  df %>%
  filter(account == 'Gross domestic product at market prices') %>%
  select(month_year, account, value) %>%
  mutate(account = 'Output')

consumption <-
  df %>%
  filter(account %in% c('Household final consumption expenditure', 'Durable goods')) %>%
  select(month_year, account, value) %>%
  group_by(month_year) %>%
  summarise(value = value[account == 'Household final consumption expenditure'] -
               value[account == 'Durable goods']) %>%
  mutate(account = 'Consumption')

investment <-
  df %>%
  filter(account %in% c('Gross fixed capital formation',
                        'Durable goods',
                        'General governments gross fixed capital formation')) %>%
  select(month_year, account, value) %>%
  group_by(month_year) %>%
  summarise(value =
               value[account == 'Gross fixed capital formation'] +
               value[account == 'Durable goods'] -
               value[account == 'General governments gross fixed capital formation'] )%>%
  mutate(account = 'Investment')

government <-
  df %>%
  filter(account %in% c ('General governments final consumption expenditure',
```

```
                        'General governments gross fixed capital formation')) %>%
    select(month_year, account, value) %>%
    group_by(month_year) %>%
    summarise(value =
                value[account == 'General governments final consumption expenditure'] +
                value[account == 'General governments gross fixed capital formation'] )%>%
    mutate(account = 'Government Purchases')
```

## (a) Presenting the national account time series

I present graphs with the time series below.

```
output %>%
  bind_rows(consumption) %>%
  bind_rows(investment) %>%
  bind_rows(government) %>%
  ggplot(aes(month_year, value/1000, colour = account)) +
  geom_line(linewidth = 1) +
  theme_bw()+
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        legend.position = c('0.2', '0.8'))+
  labs(x = 'Time (t)',
       y = 'Value in billions of chained (2012) dollars ',
       colour = 'National Account',
       title = 'Time Series Graph of Select Canadian National Accounts',
       subtitle = 'Quarterly 1961-2022')
```

Time Series Graph of Select Canadian National Accounts
Quarterly 1961–2022
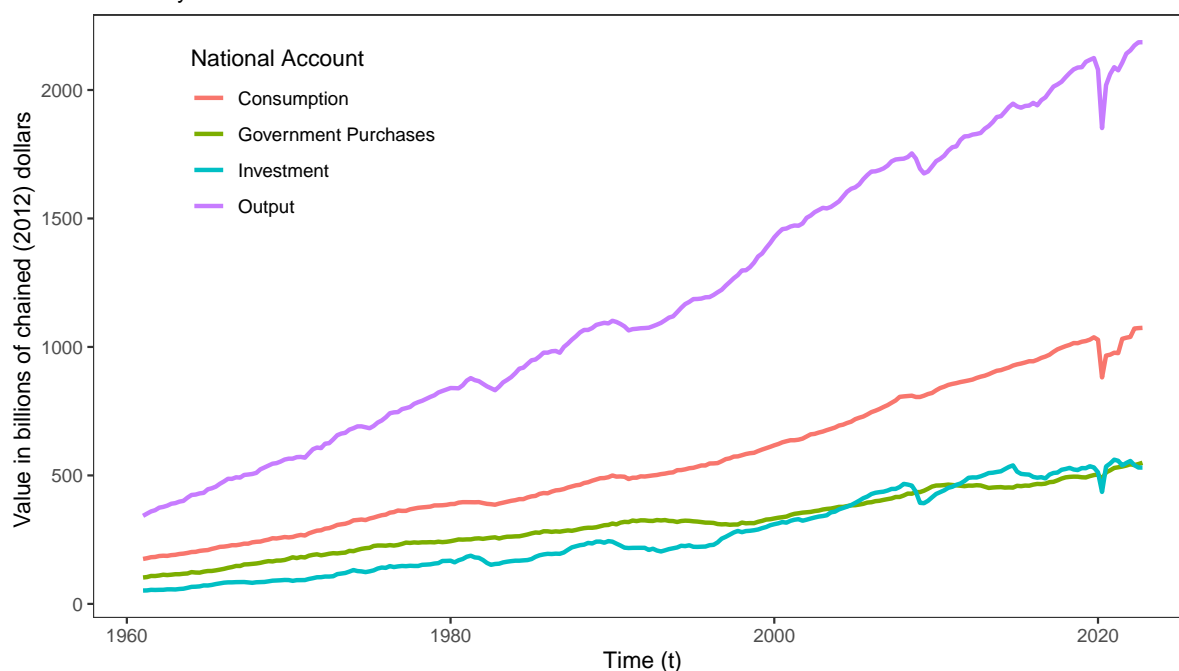
(b) Some transformations

I do the required transformations on the data, but I hide them as they would take too much space. Please see my `.qmd` file (a Quarto source document, which should run in any updated version of R & RStudio). I apply the BK and HP filters, as well as Hamilton's suggested transformation which involves regressing the dependent variables (consumption, investment, government expenditure and output) on their period lags. I use *dplyr*'s function `lag()` for this purpose, and then plot the residuals. All three seem quite similar, and their graphs are shown below.

(c) Presenting graphs

Below, I present four graph panels, with two graphs each. The righmost panel includes the graph of every series decomposed with the BK and HP methods as well as Hamilton's regression approach. The rightmost panel includes the log transformation of the series. I could not include it in the same graph as the magnitued of the decomposed cycles are too small relative to the log, so it is easier to see it in separate graphs.

Output (GDP)

Consumption

Cycles of time series decomposition of consumption
Canada, quarterly 1961–2022

Log Consumption
Canada, quarterly 1961–2022