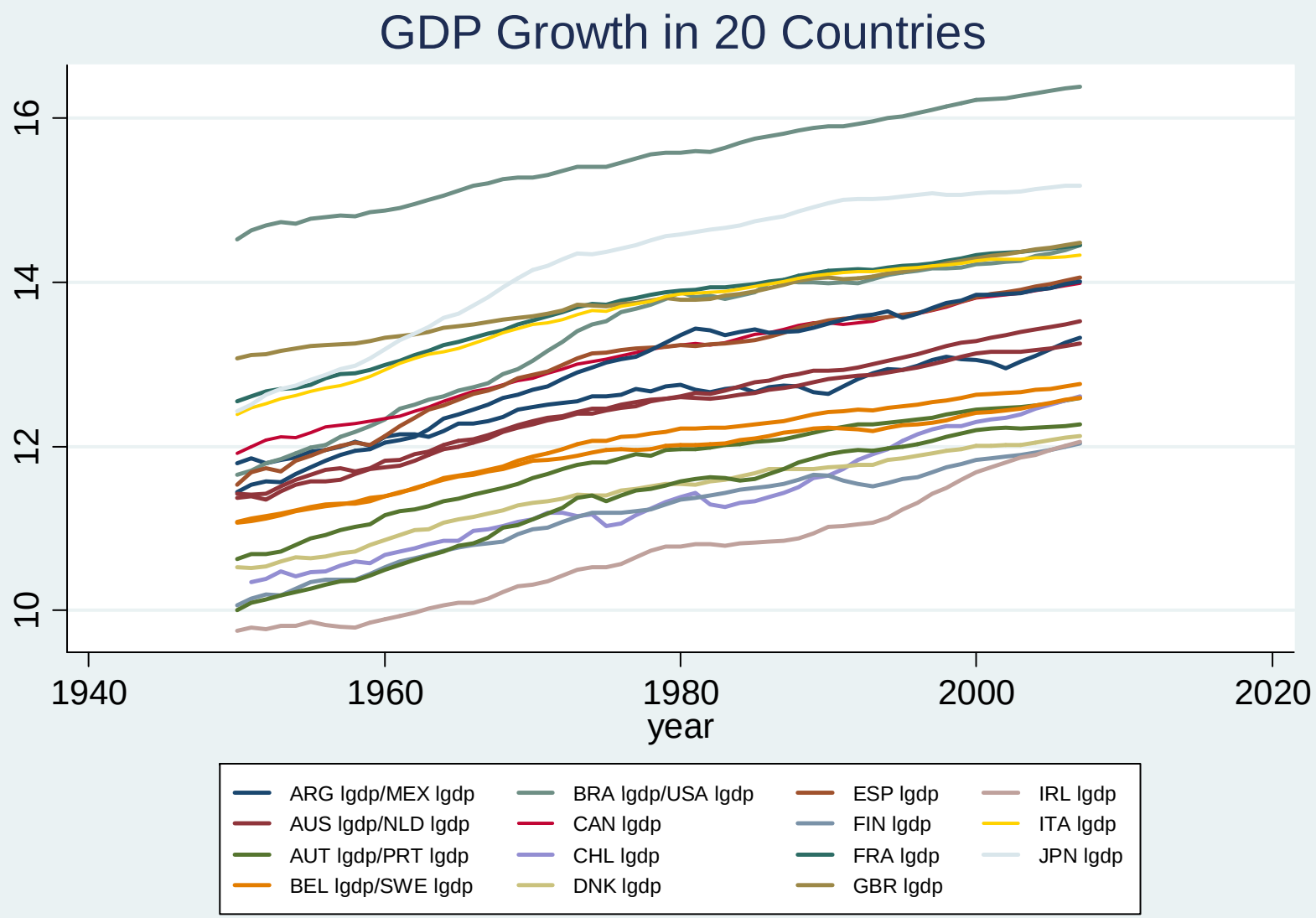
Answers and Questions

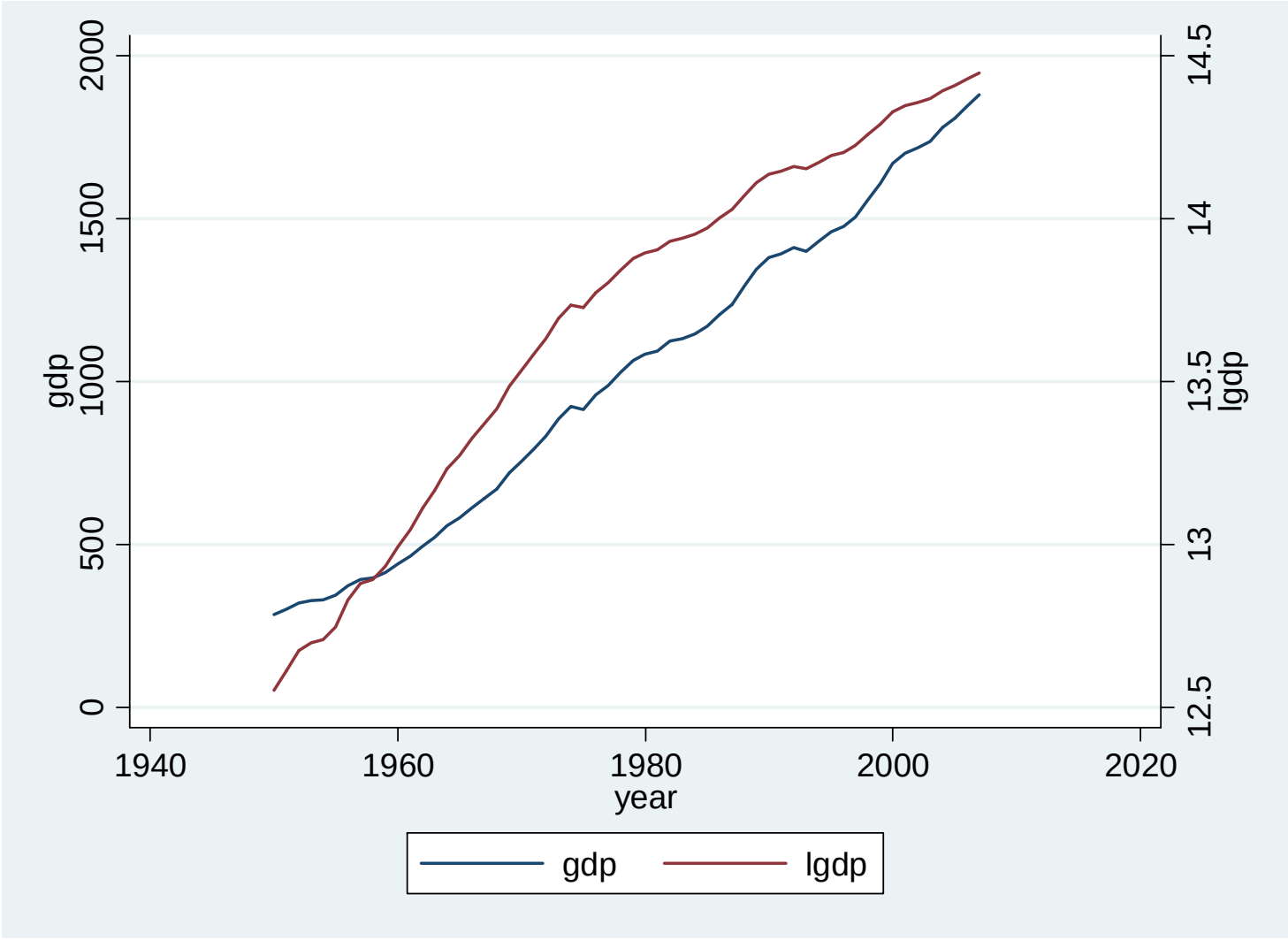
# Econ 314: Project 1

# Examining the Growth Data

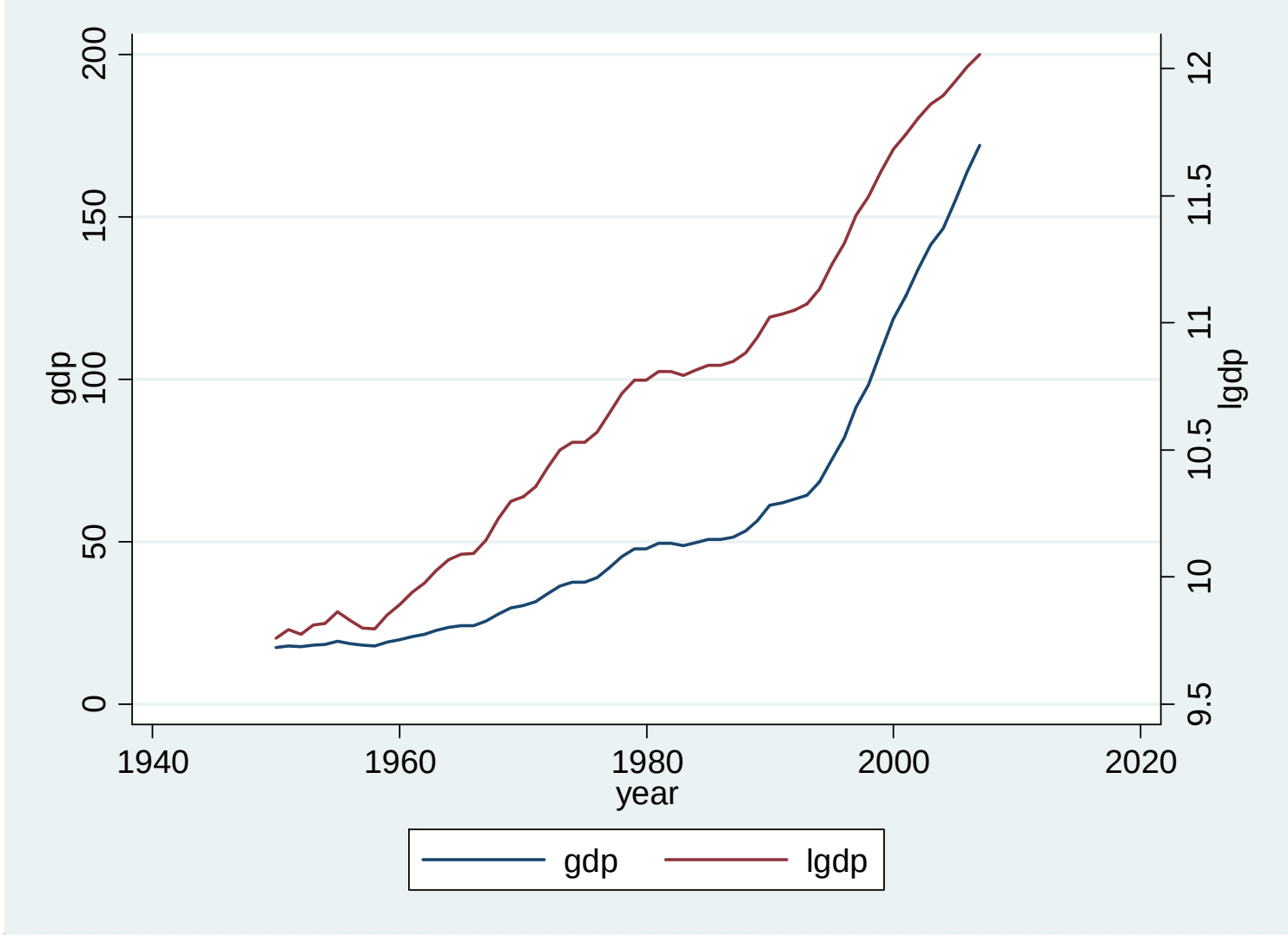
# The Growth Experience



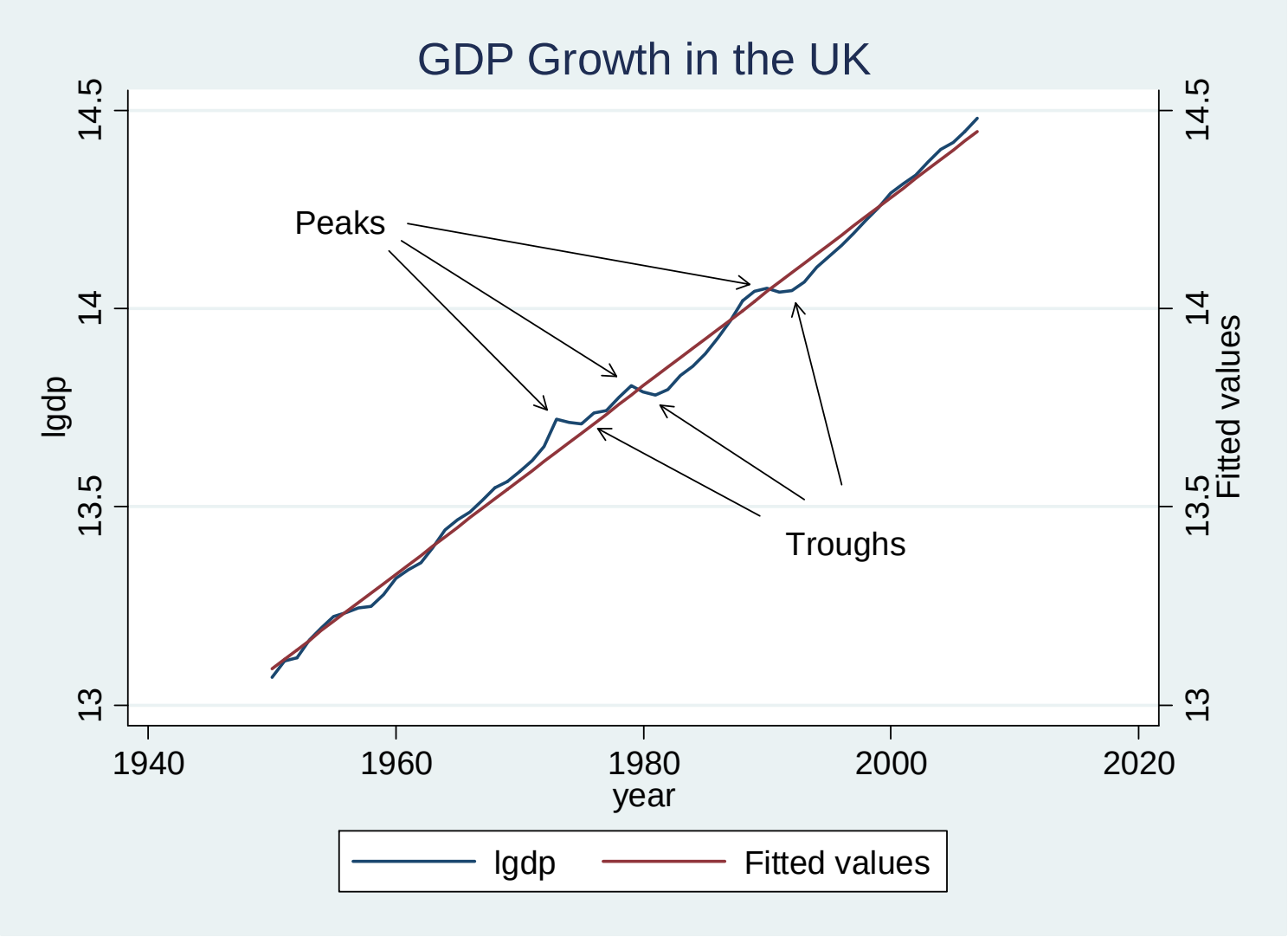
# Linearity in levels or logs: France



# Linearity in levels or logs: Ireland



# Cycle Turning Points



Compounding and Growth Rate Formulas

# Measuring Growth Rates

# Trend growth vs. average growth

- Trend rate is slope of best-fit line
- What is average growth rate?

  From period 0 to 2:

$$\bar{g} = \frac{(\ln GDP_2 - \ln GDP_1) + (\ln GDP_1 - \ln GDP_0)}{2}$$

$$= \frac{\ln GDP_2 - \ln GDP_0}{2}.$$

# Trend growth vs. average growth

- Trend rate is slope of best-fit line
- What is average growth rate?

  From period 0 to T:

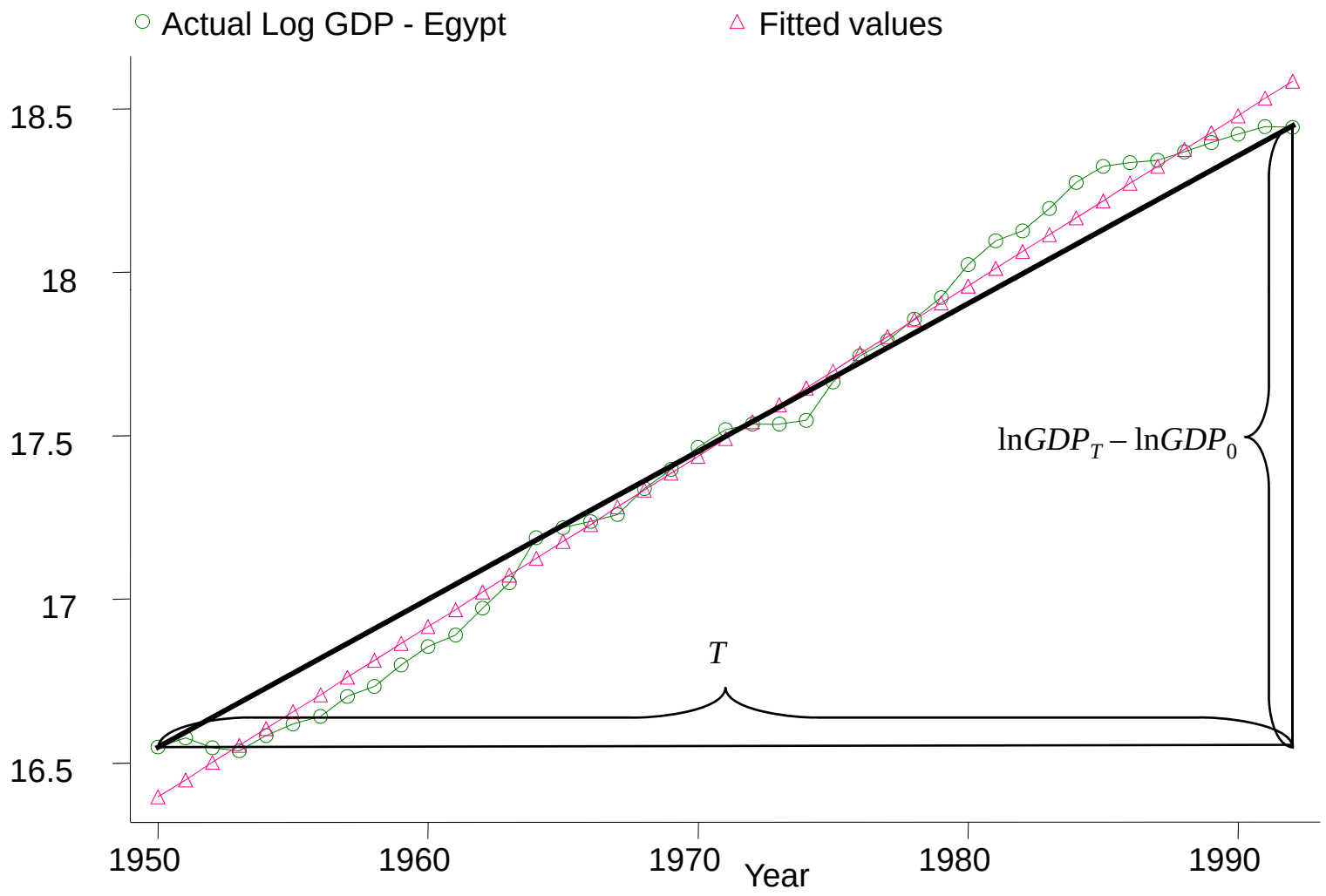
$$\bar{g} = \frac{\left(\ln GDP_T - \ln GDP_{T-1}\right) + \ldots + \left(\ln GDP_1 - \ln GDP_0\right)}{T}$$

$$= \frac{\ln GDP_T - \ln GDP_0}{T}.$$

# Trend and average growth rates

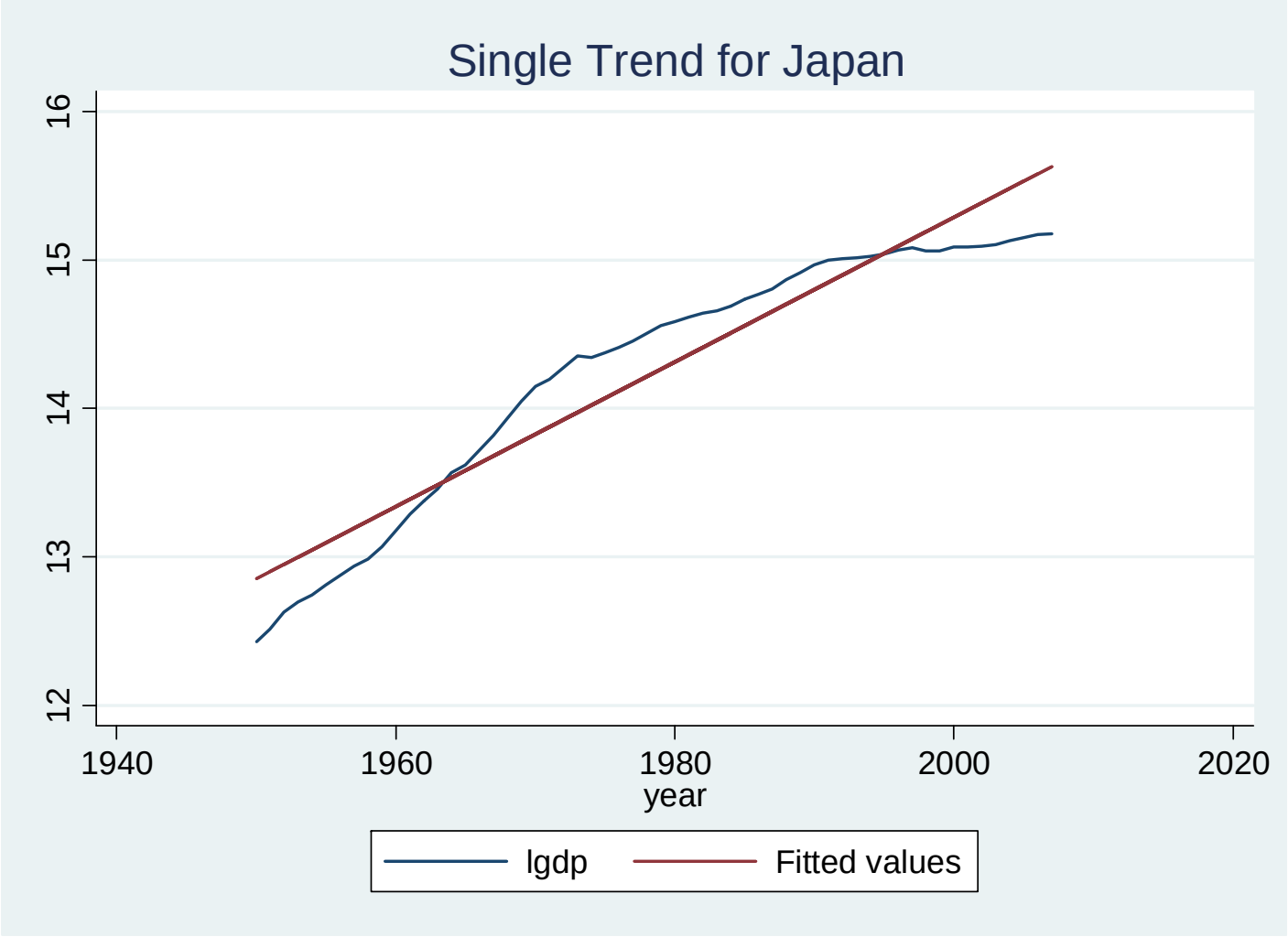
| Country | Trend growth | Average growth | |
|---|---|---|---|
| | | Annually comp | Continuously comp |
| Argentina | 2.40% | 2.84% | 2.69% |
| Australia | 3.79% | 3.88% | 3.78% |
| Canada | 3.53% | 3.72% | 3.63% |
| Chile | 3.87% | 4.26% | 4.05% |
| Finland | 3.28% | 3.57% | 3.47% |
| France | 3.31% | 3.40% | 3.33% |
| Ireland | 4.02% | 4.17% | 4.03% |
| Italy | 3.39% | 3.49% | 3.40% |
| Japan | 4.87% | 5.01% | 4.82% |
| Mexico | 4.47% | 4.69% | 4.51% |
| Spain | 4.10% | 4.60% | 4.43% |
| United Kingdom | 2.38% | 2.52% | 2.47% |
| United States | 3.18% | 3.34% | 3.26% |

# Trend growth vs. average growth



# Is Trend Growth Stable?

# Is the trend stable?



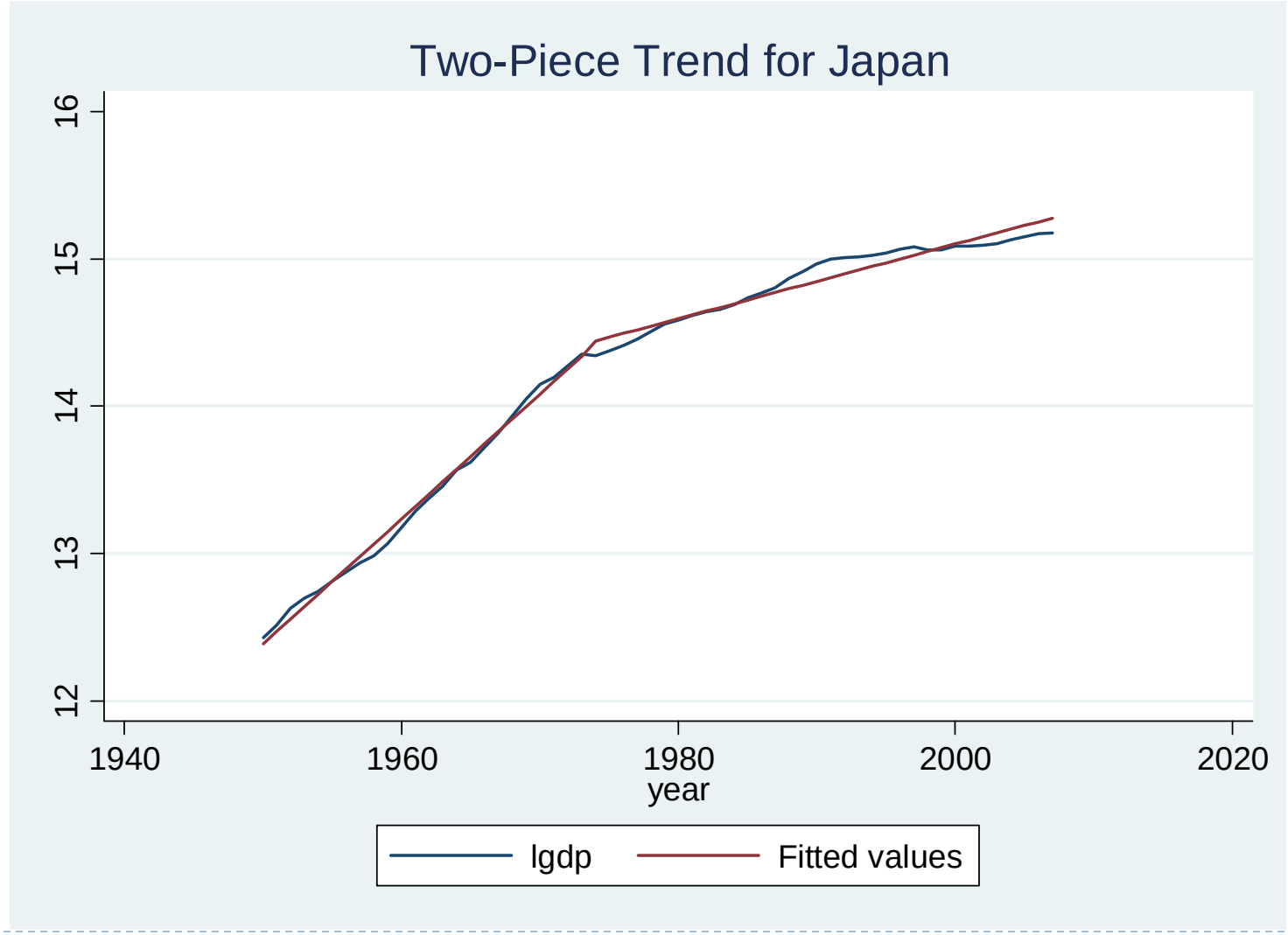
# Is the trend stable?

## Stability Test for Japan

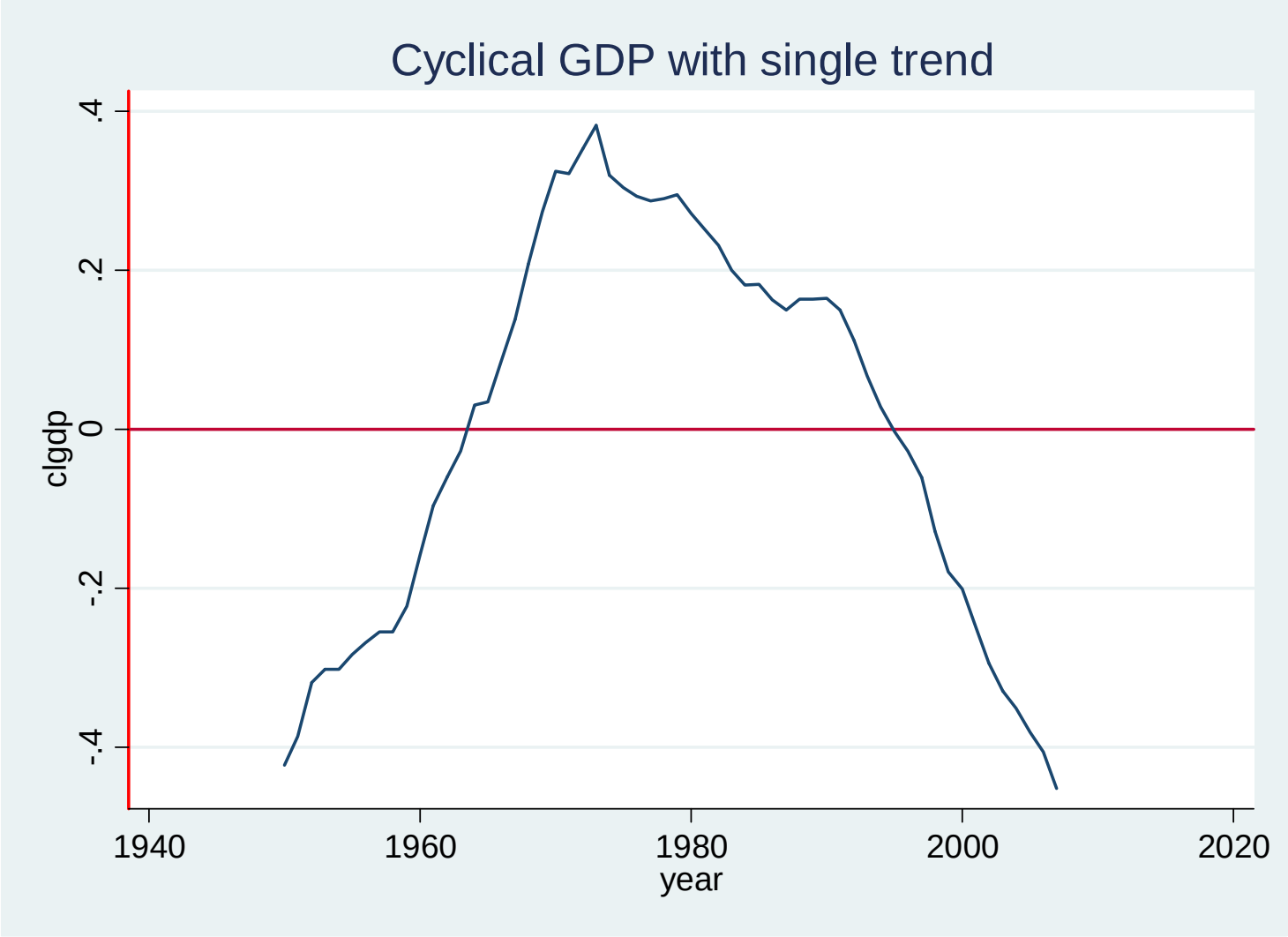
```
 Source |       SS       df       MS              Number of obs =      58
-------------+------------------------------       F(  3,    54) = 3803.57
       Model |  42.0122524     3  14.0040841        Prob > F      =  0.0000
    Residual |  .198818807    54   .00368183        R-squared     =  0.9953
-------------+------------------------------       Adj R-squared =  0.9950
       Total |  42.2110712    57  .740545109        Root MSE      =  .06068

------------------------------------------------------------------------------
        lgdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        year |   .0848916   .0017893    47.44   0.000     .0813043    .0884789
           d |   117.6017   4.095852    28.71   0.000       109.39    125.8133
       dyear |   -.059565   .0020801   -28.64   0.000    -.0637353   -.0553948
       _cons |  -153.1541   3.509732   -43.64   0.000    -160.1907   -146.1175
------------------------------------------------------------------------------
```

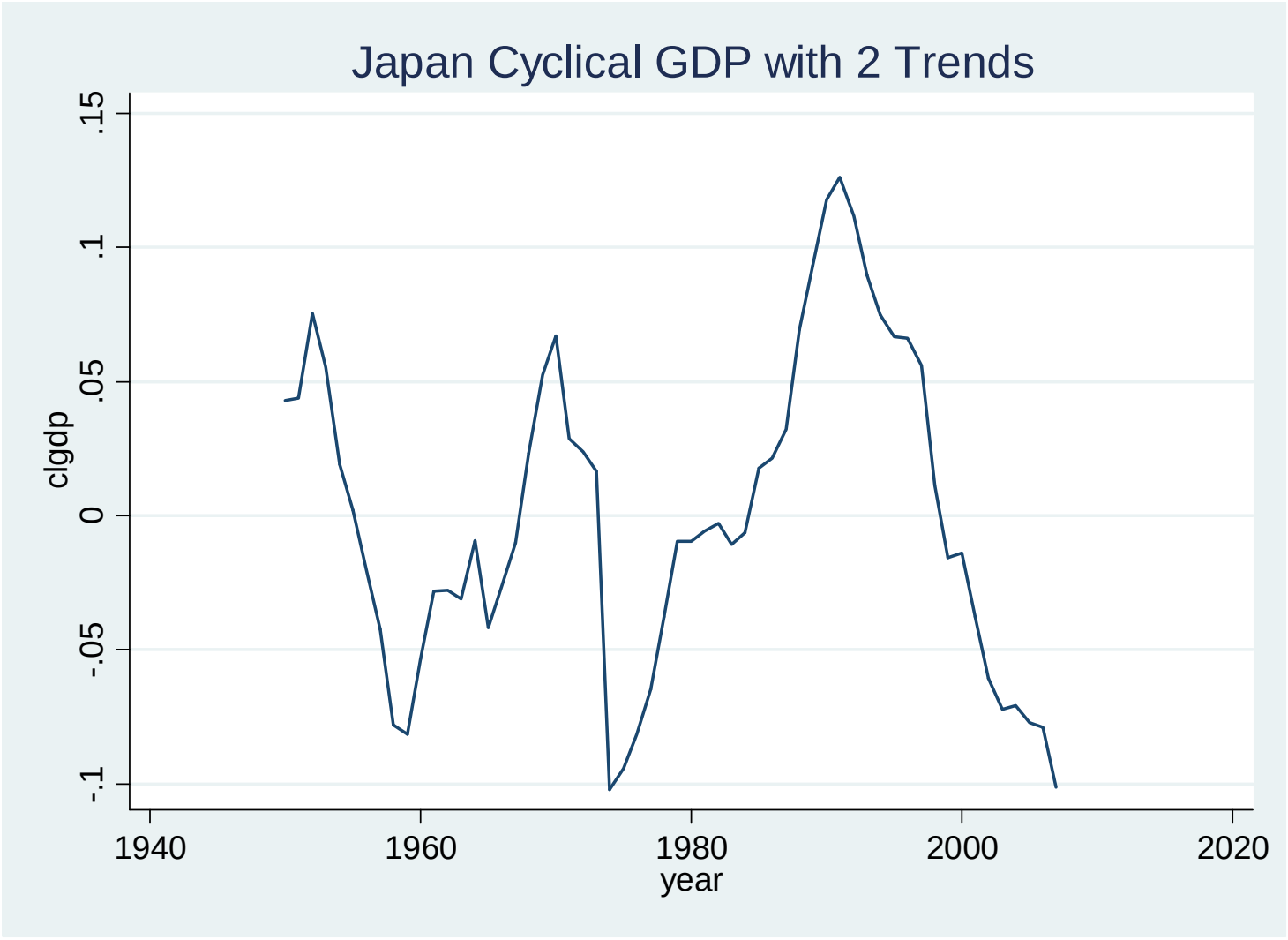
# Is the trend stable?



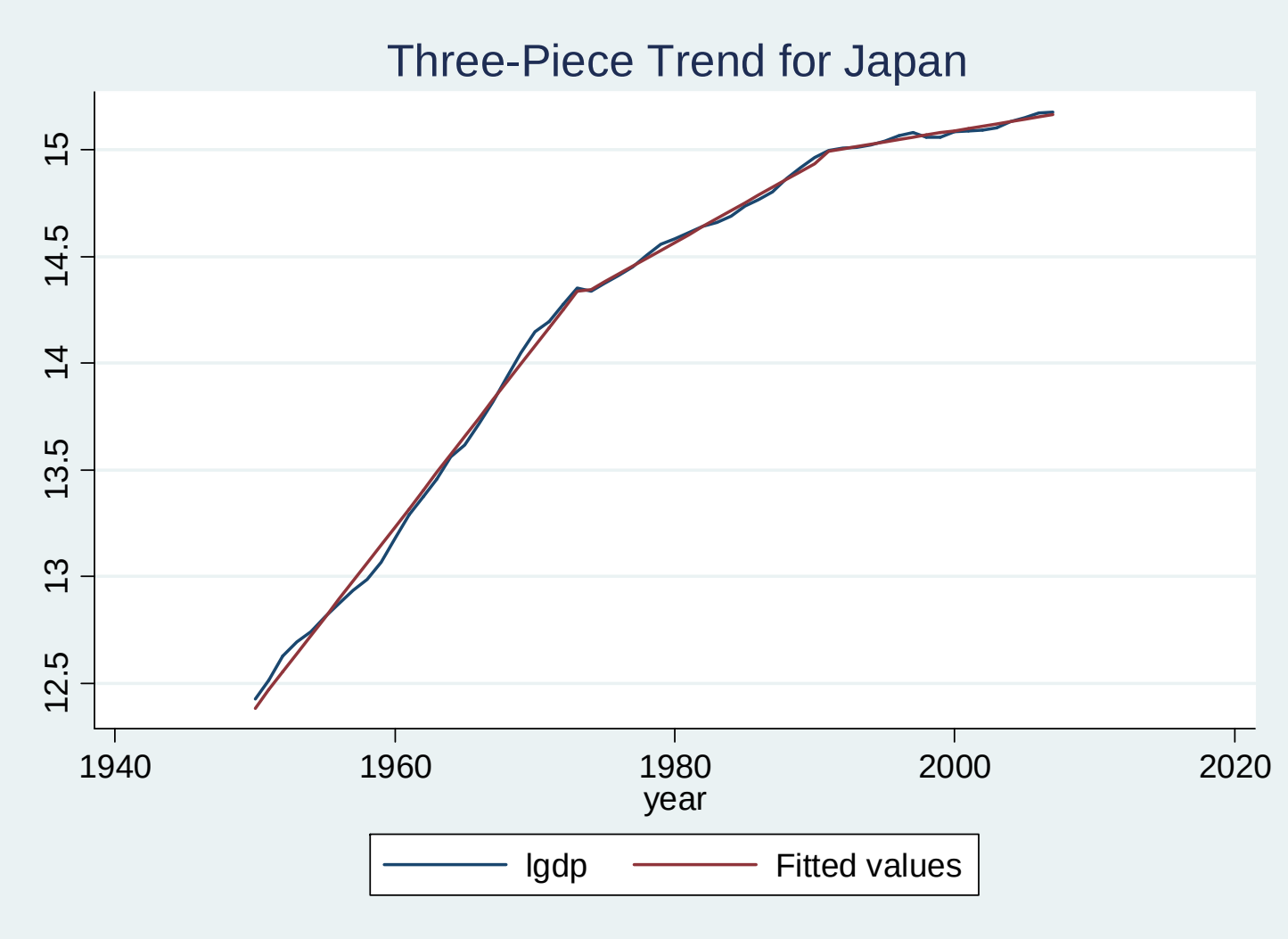
# Cyclical series with unstable trend



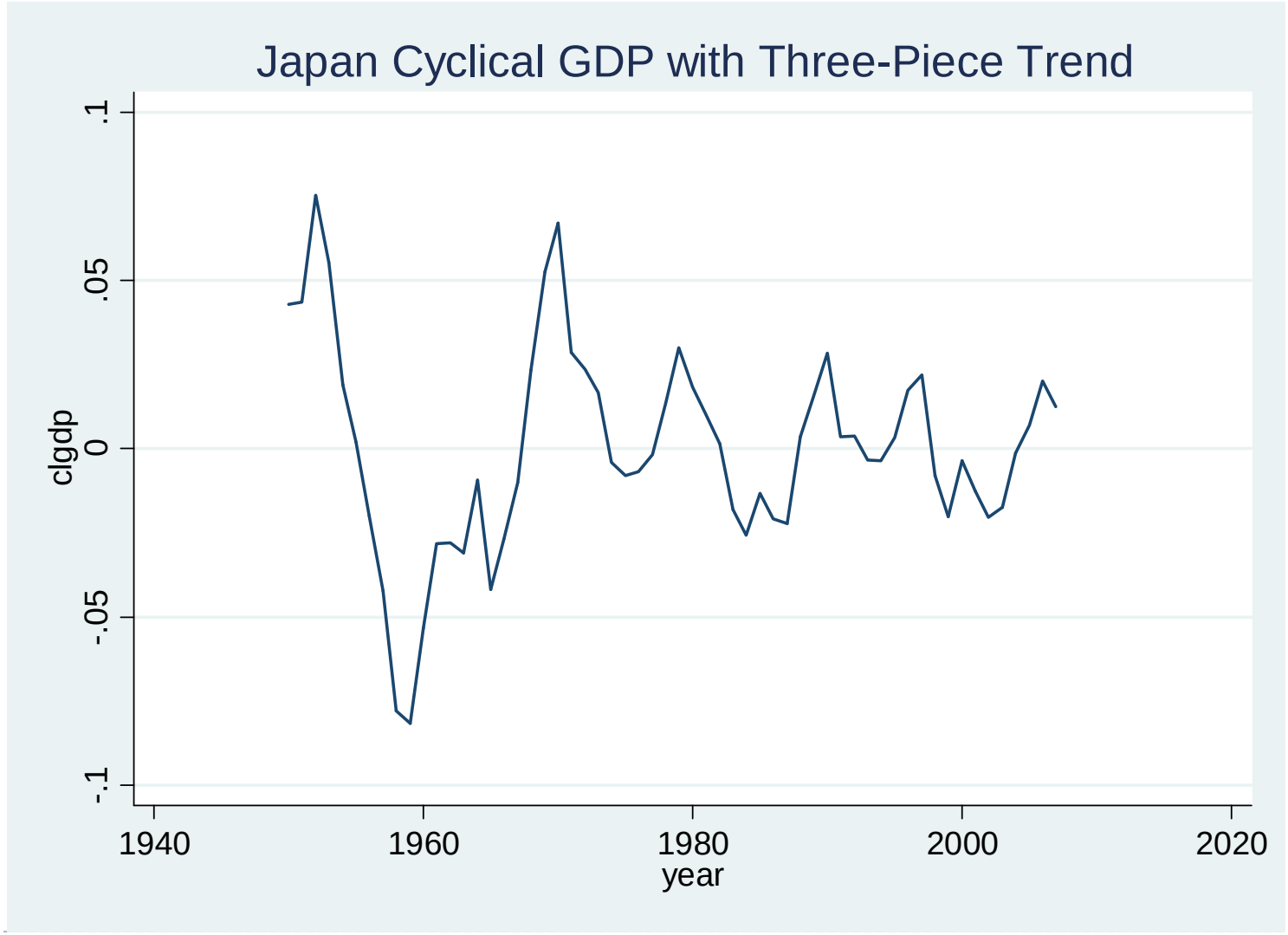
# Cyclical GDP: Split trend



# Are there two breaks?



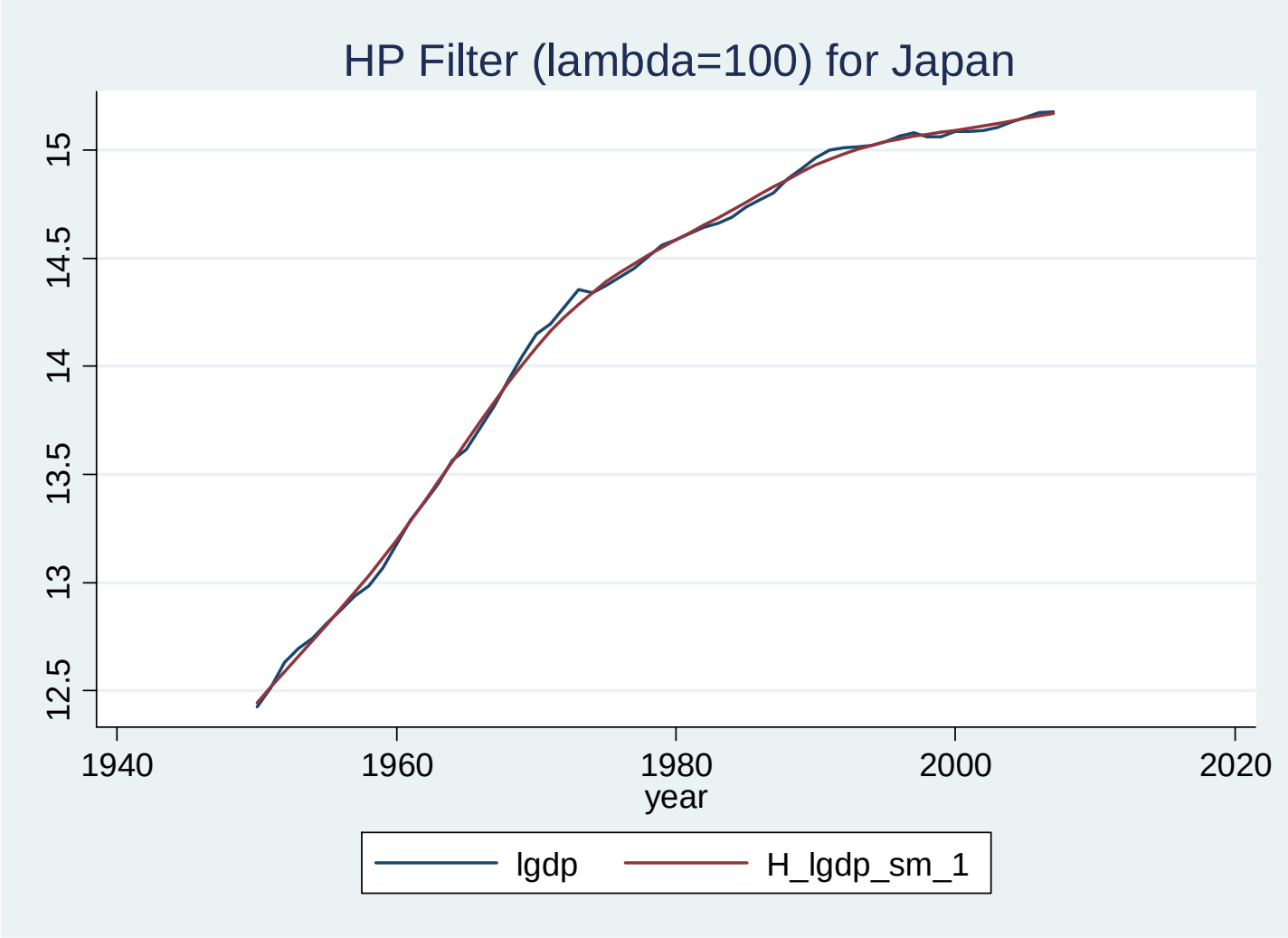
# Cyclical series with two breaks



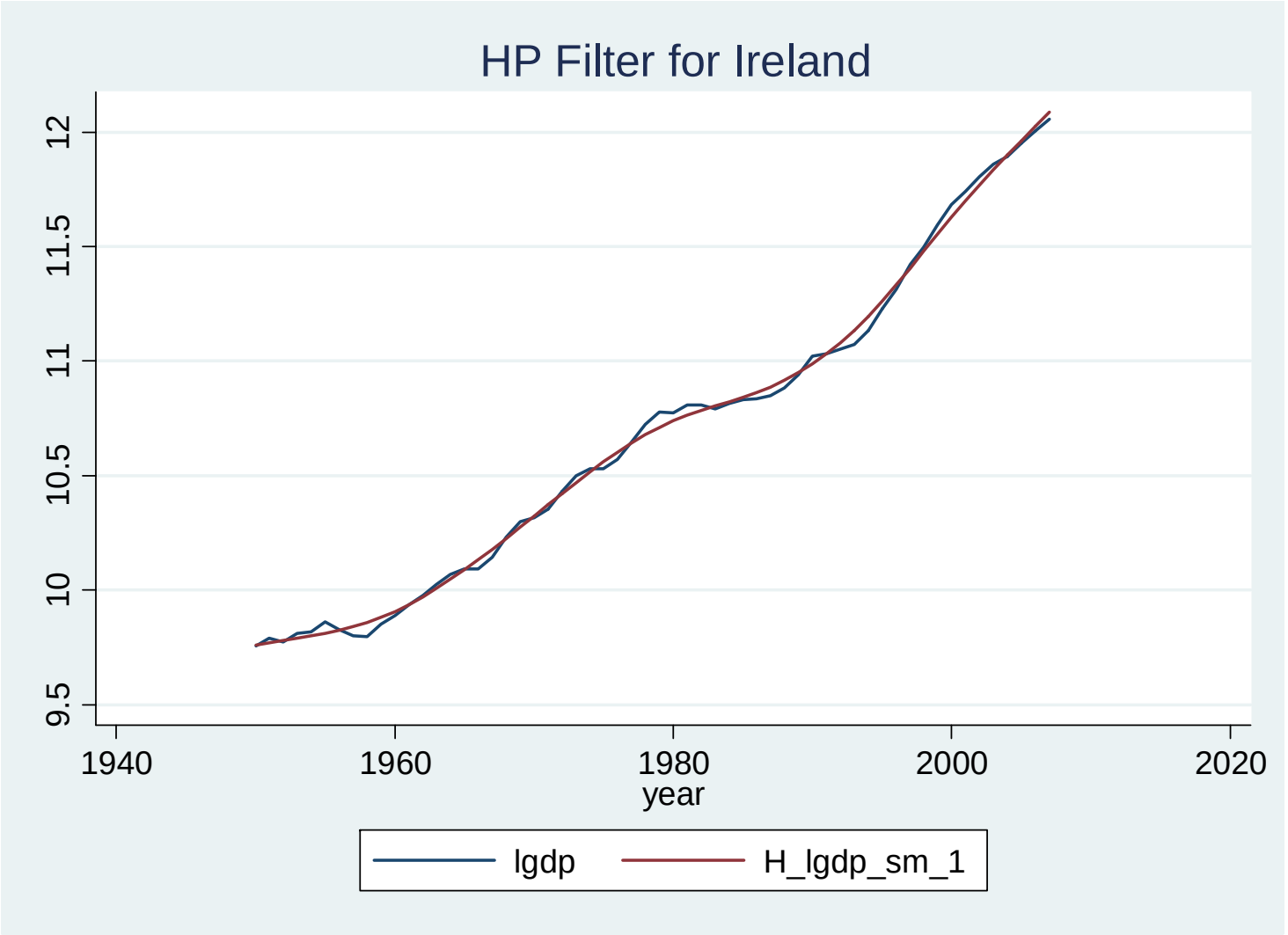
# Pre- and post-1973 trend growth rates

| Country | 1950-1973 trend growth rate | 1973-2000 trend growth rate | Difference |
|---|---|---|---|
| Argentina | 3.45% | 1.88% | -1.57% |
| Australia | 4.69% | 3.39% | -1.30% |
| Canada | 4.49% | 2.82% | -1.67% |
| Chile | 4.09% | 4.96% | +0.87% |
| Finland | 4.49% | 2.43% | -2.06% |
| France | 4.97% | 2.16% | -2.81% |
| Ireland | 3.12% | 4.63% | +1.51% |
| Italy | 5.34% | 2.06% | -3.28% |
| Japan | 8.49% | 2.53% | -5.96% |
| Mexico | 6.32% | 2.80% | -3.52% |
| Spain | 6.63% | 2.87% | -3.77% |
| United Kingdom | 2.64% | 2.41% | -0.23% |
| United States | 3.60% | 3.01% | -0.59% |

# Hodrick-Prescott filter: Japan



# Hodrick-Prescott filter: Ireland



# Separating trend and cyclical components

- No “correct” way to do it
  - Obvious changes in underlying growth rate should be tracked in the trend component
  - Obviously temporary deviations from the trend should be left in the cyclical component
- Piecewise linear trends
  - Assume discrete changes in trend rate
  - Appropriate where discrete event (revolution?) can be assumed to cause change
- HP filter and other, similar methods
  - Trend rate can change continuously
  - HP trend will, to some extent, follow *all* changes in series

# Conclusions

- Most economies grow
  - Growth explains most of the variation in GDP
- Underlying growth rates vary over time
  - Changes in growth rates may result from specific event at specific date
  - Or may be gradual slowdowns or speedups
- GDP fluctuates considerably around its trend
  - Fluctuations are called “cycles” even if they aren’t
  - Traditional “business cycle” has a period of 3-8 years
- We’ll spend the first section of the course understanding trend growth, then the next section looking at fluctuations around the trend