

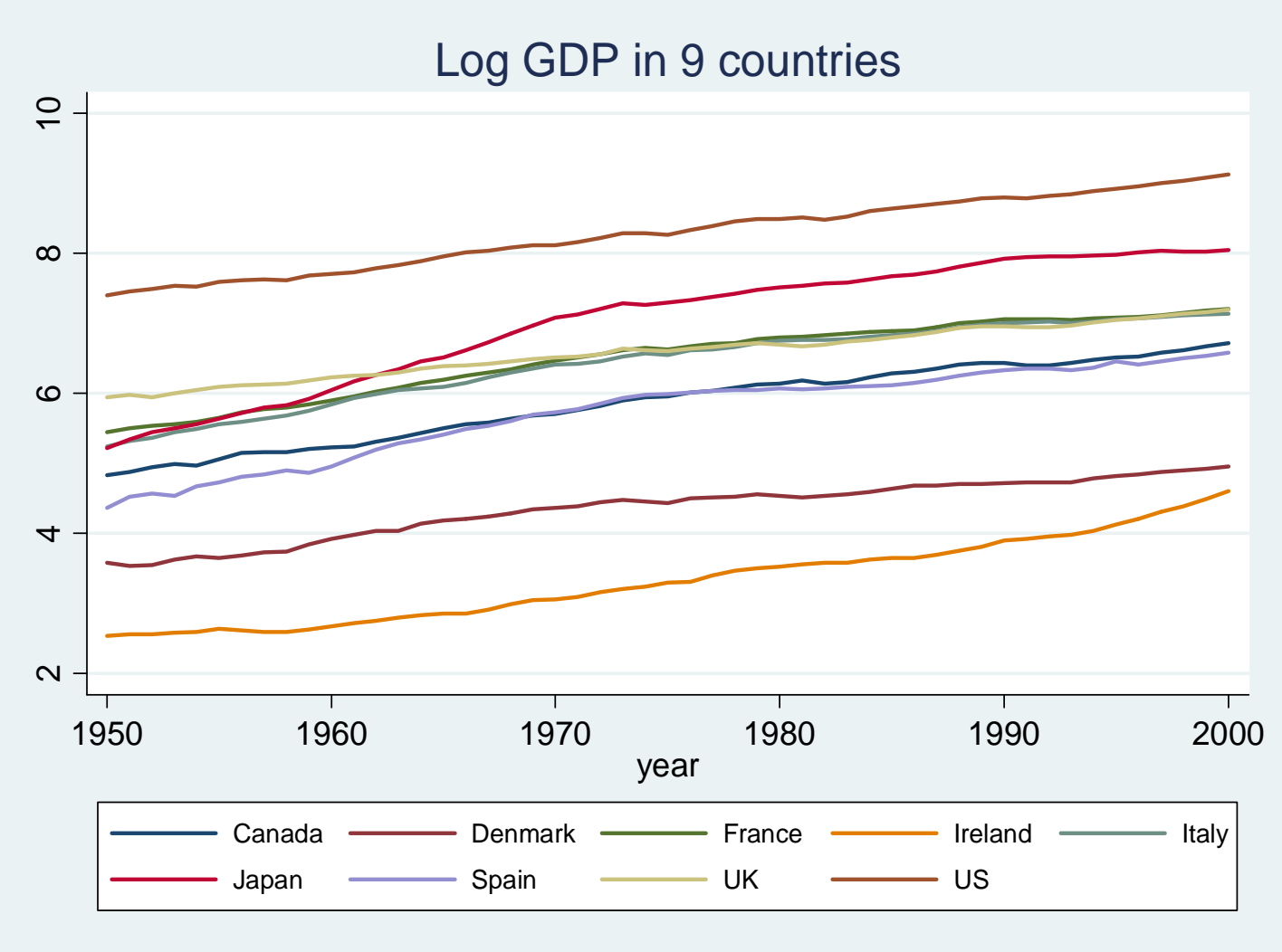
Answers and Questions

Econ 314: Project 1

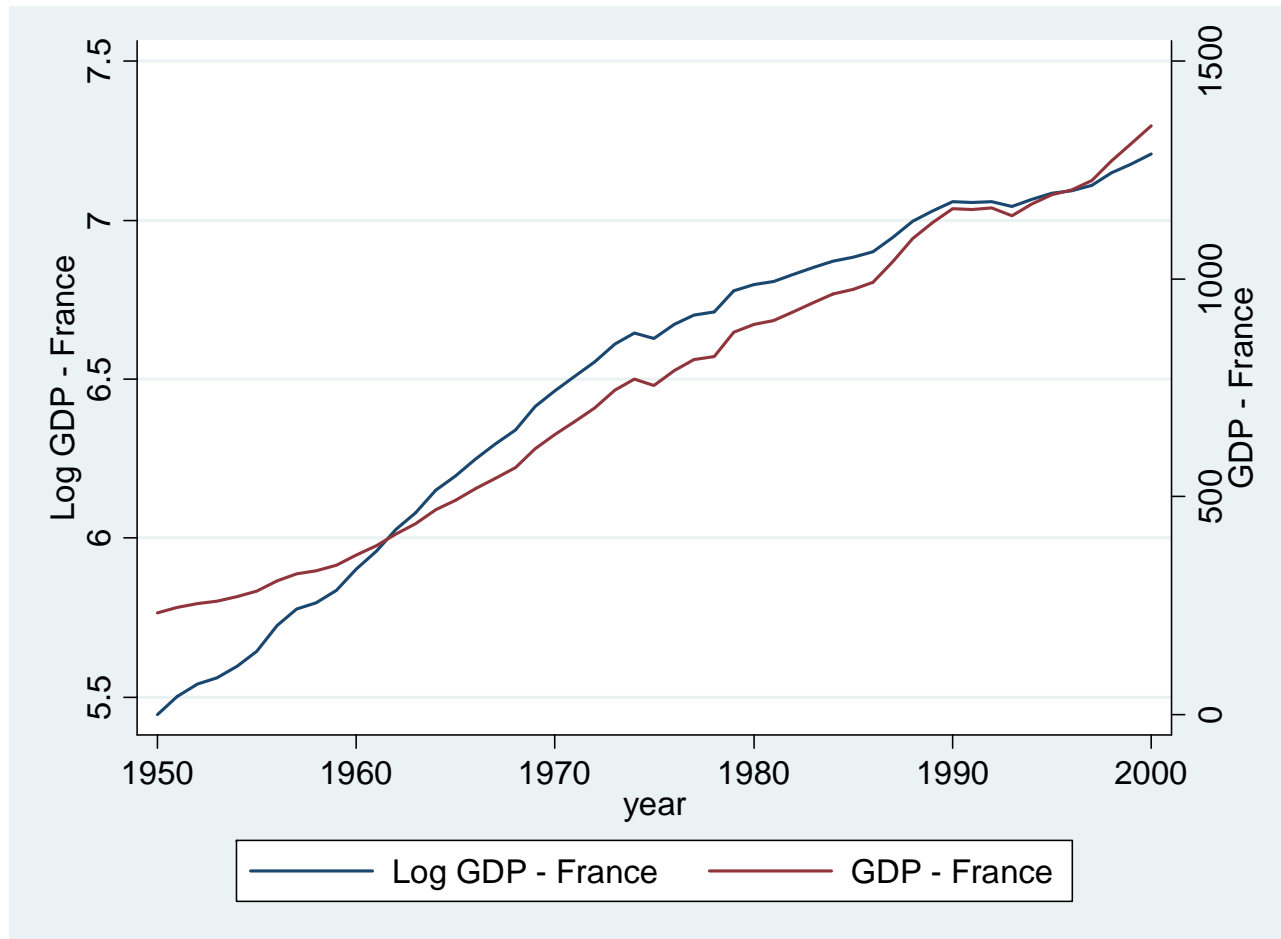
Trends, Cycles, and Turning Points

Examining the Growth Data

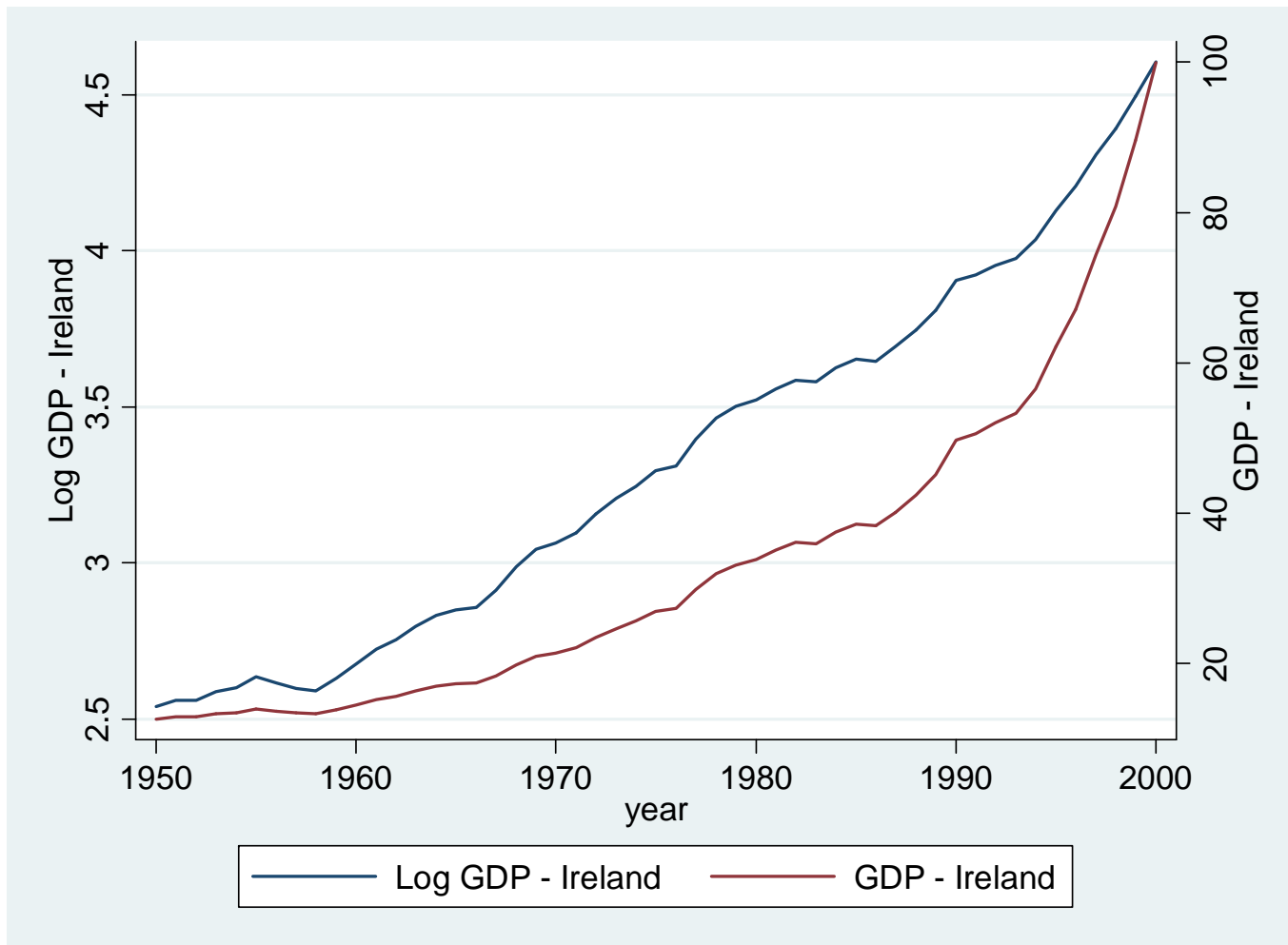
The Growth Experience



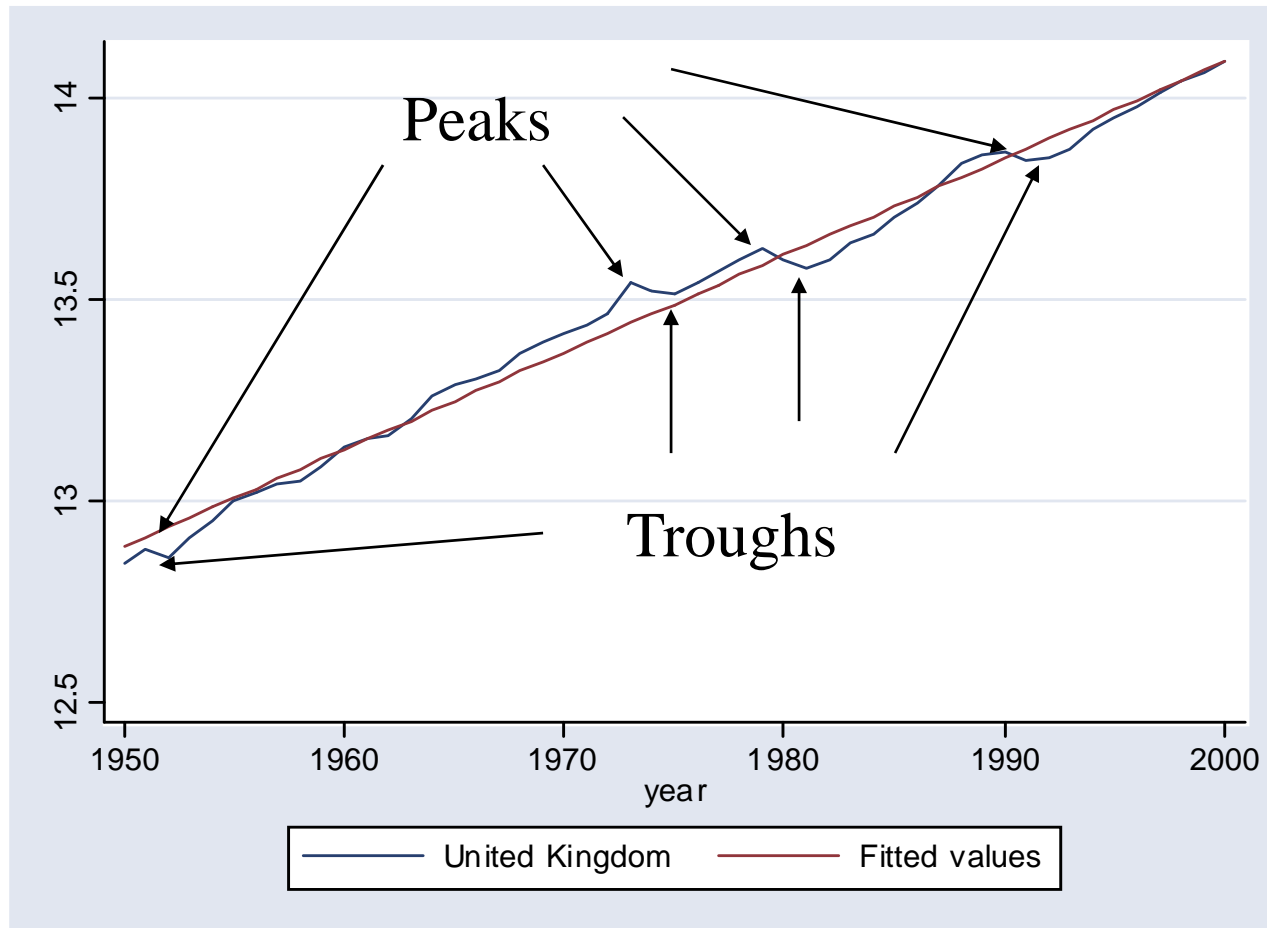
Linearity in levels or logs: France



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:

$$\begin{aligned}\bar{g} &= \frac{(\ln GDP_2 - \ln GDP_1) + (\ln GDP_1 - \ln GDP_0)}{2} \\ &= \frac{\ln GDP_2 - \ln GDP_0}{2}.\end{aligned}$$



Trend growth vs. average growth

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

From period 0 to T:

$$\begin{aligned}\bar{g} &= \frac{(\ln GDP_T - \ln GDP_{T-1}) + \dots + (\ln GDP_1 - \ln GDP_0)}{T} \\ &= \frac{\ln GDP_T - \ln GDP_0}{T}.\end{aligned}$$

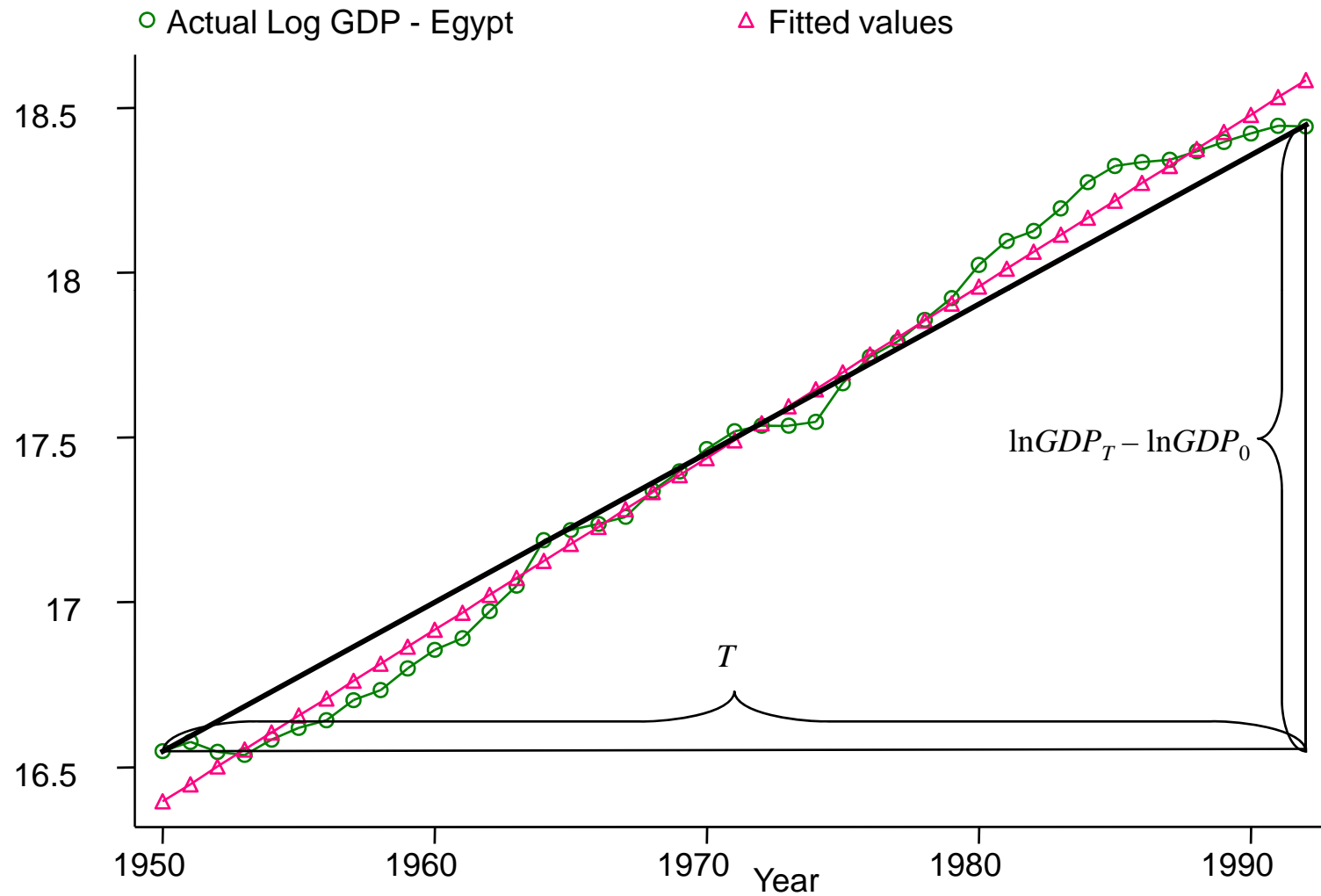


Trend and average growth rates

| Country | Trend growth | Average growth | |
|----------------|--------------|-------------------|---------------|
| | | Continuously comp | Annually comp |
| Canada | 3.75% | 3.78% | 3.89% |
| Denmark | 2.75% | 2.75% | 2.84% |
| France | 3.57% | 3.52% | 3.61% |
| Ireland | 3.95% | 4.13% | 4.27% |
| Italy | 3.75% | 3.79% | 3.90% |
| Japan | 5.80% | 5.66% | 5.90% |
| Spain | 4.20% | 4.42% | 4.61% |
| United Kingdom | 2.42% | 2.50% | 2.56% |
| United States | 3.43% | 3.45% | 3.54% |



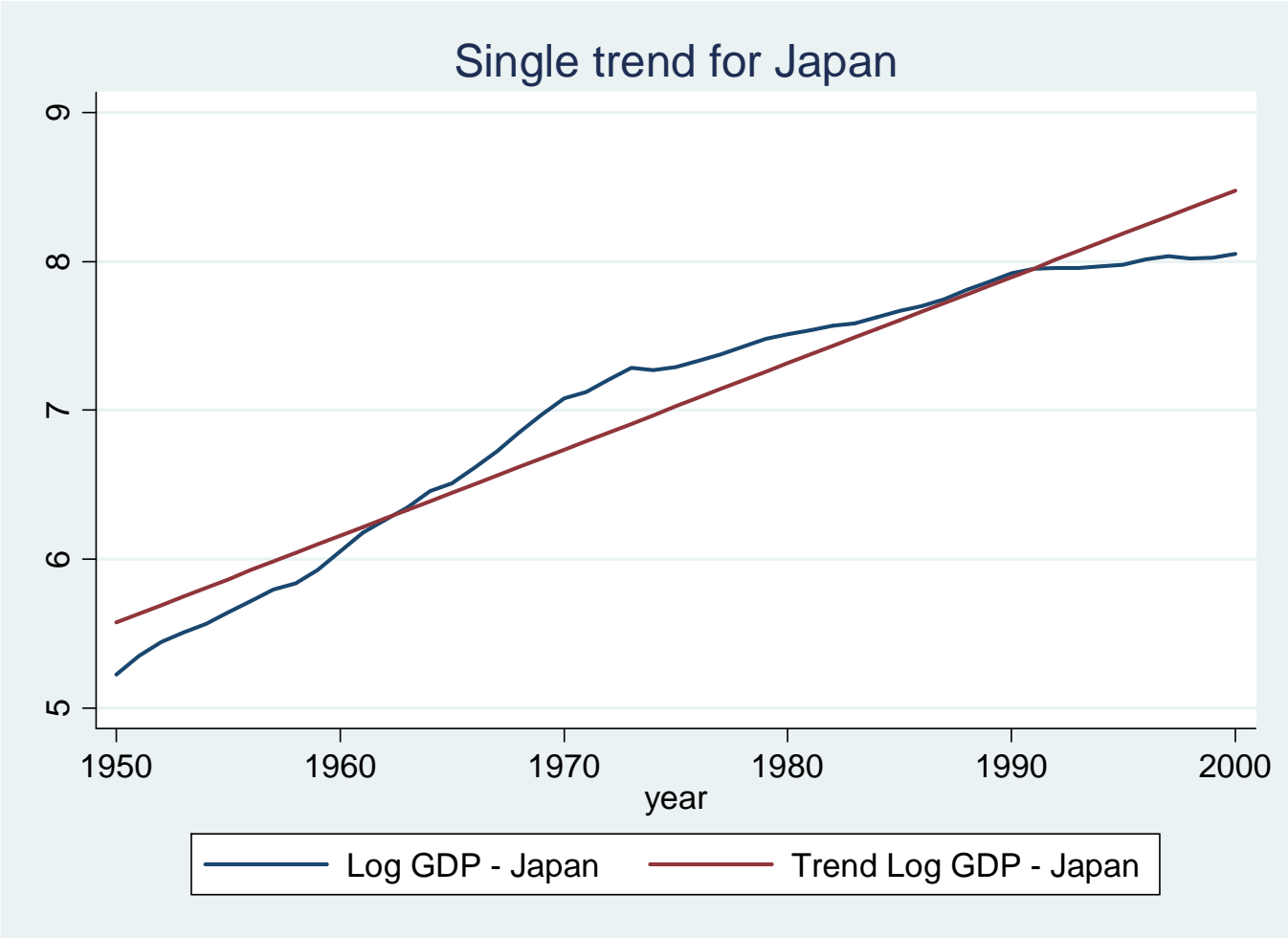
Trend growth vs. average growth



Examining the Record

Is Trend Growth Stable?

Is the trend stable?



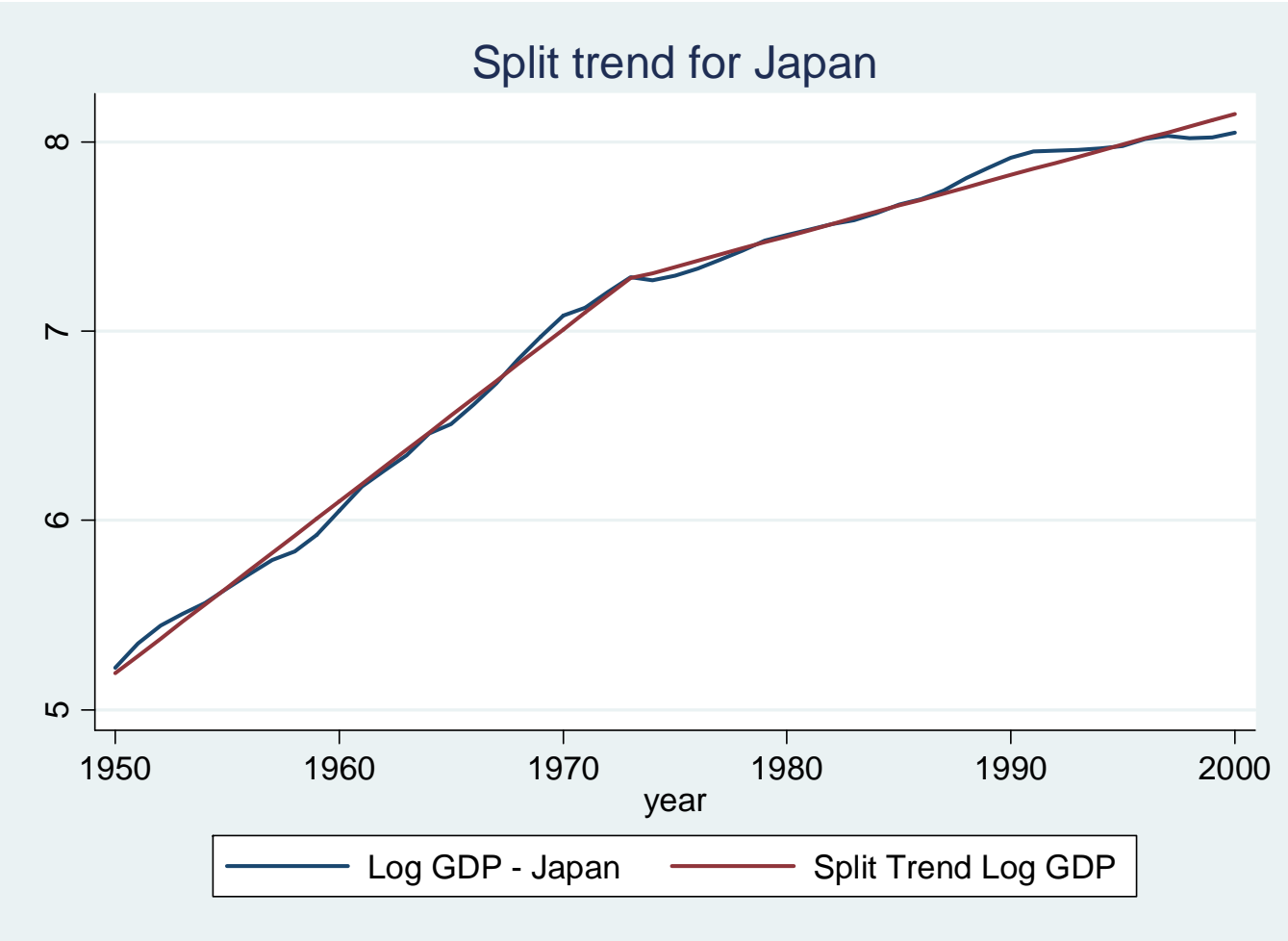
Is the trend stable?

Stability Test for Japan

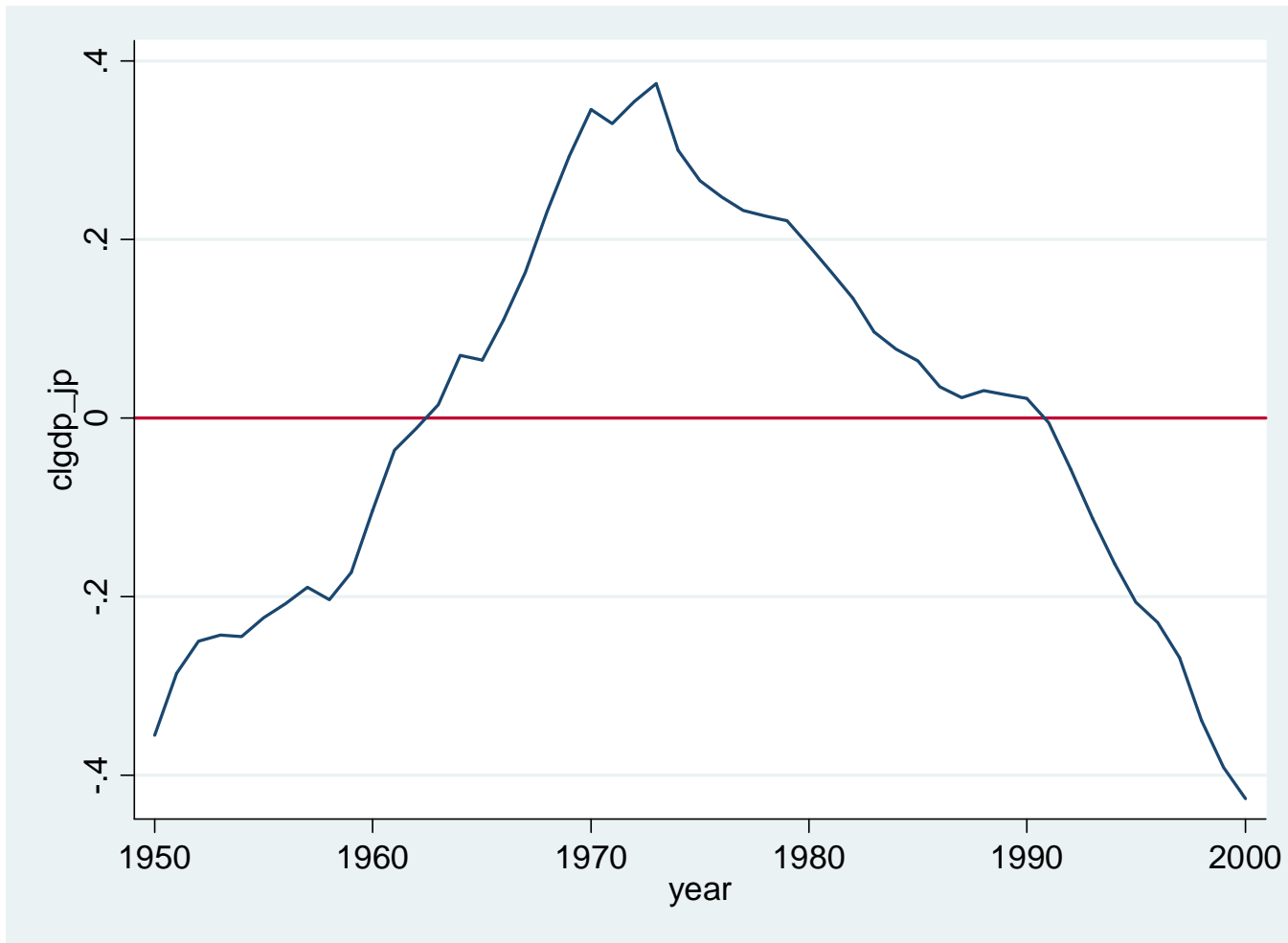
| Source | SS | df | MS | Number of obs = 51 | | |
|----------|------------------|-----------------|---------------|--------------------|----------------------|------------------|
| Model | 39.488173 | 3 | 13.1627243 | F(3, 47) = | 5988.24 | |
| Residual | .103310446 | 47 | .002198095 | Prob > F = | 0.0000 | |
| ----- | | | | R-squared = | 0.9974 | |
| ----- | | | | Adj R-squared = | 0.9972 | |
| Total | 39.5914834 | 50 | .791829668 | Root MSE = | .04688 | |
| ----- | | | | | | |
| lgdp_jpn | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] | |
| year | .0908236 | .0013825 | 65.69 | 0.000 | .0880424 | .0936049 |
| d | 115.4399 | 3.557021 | 32.45 | 0.000 | 108.2841 | 122.5957 |
| dyear | -.0585122 | .0018037 | -32.44 | 0.000 | -.0621408 | -.0548836 |
| _cons | -171.915 | 2.711848 | -63.39 | 0.000 | -177.3706 | -166.4595 |



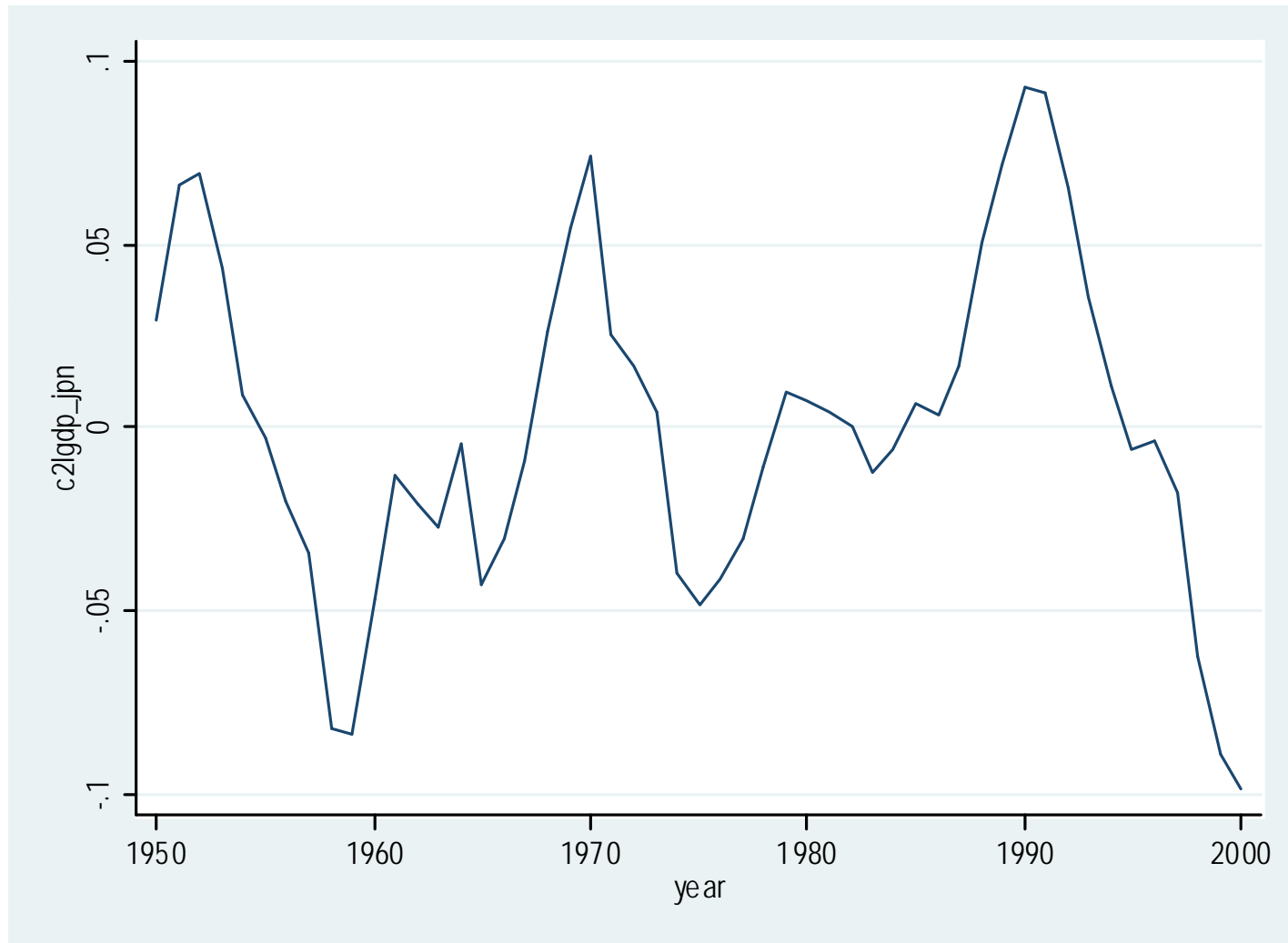
Is the trend stable?



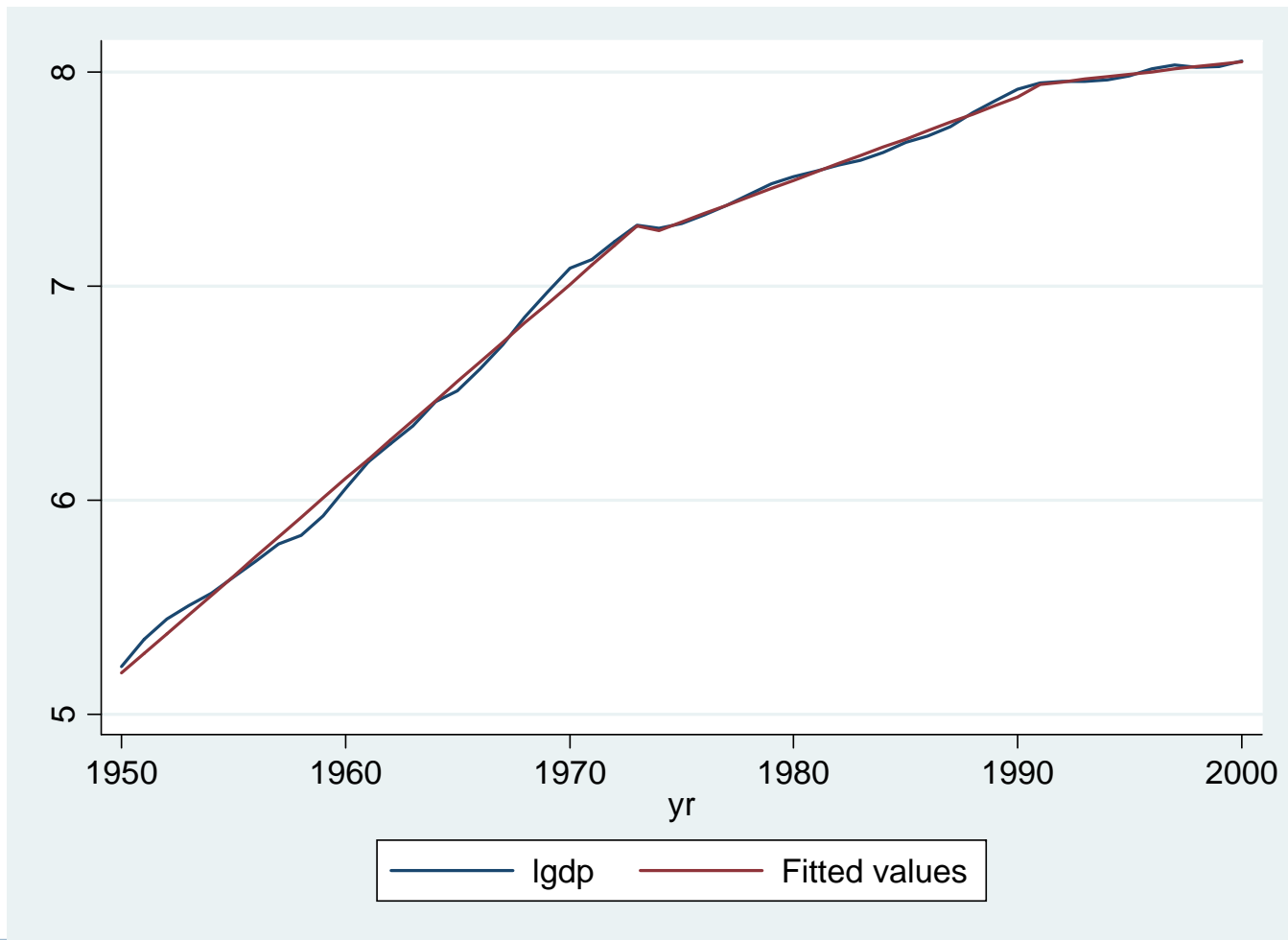
Cyclical series with unstable trend



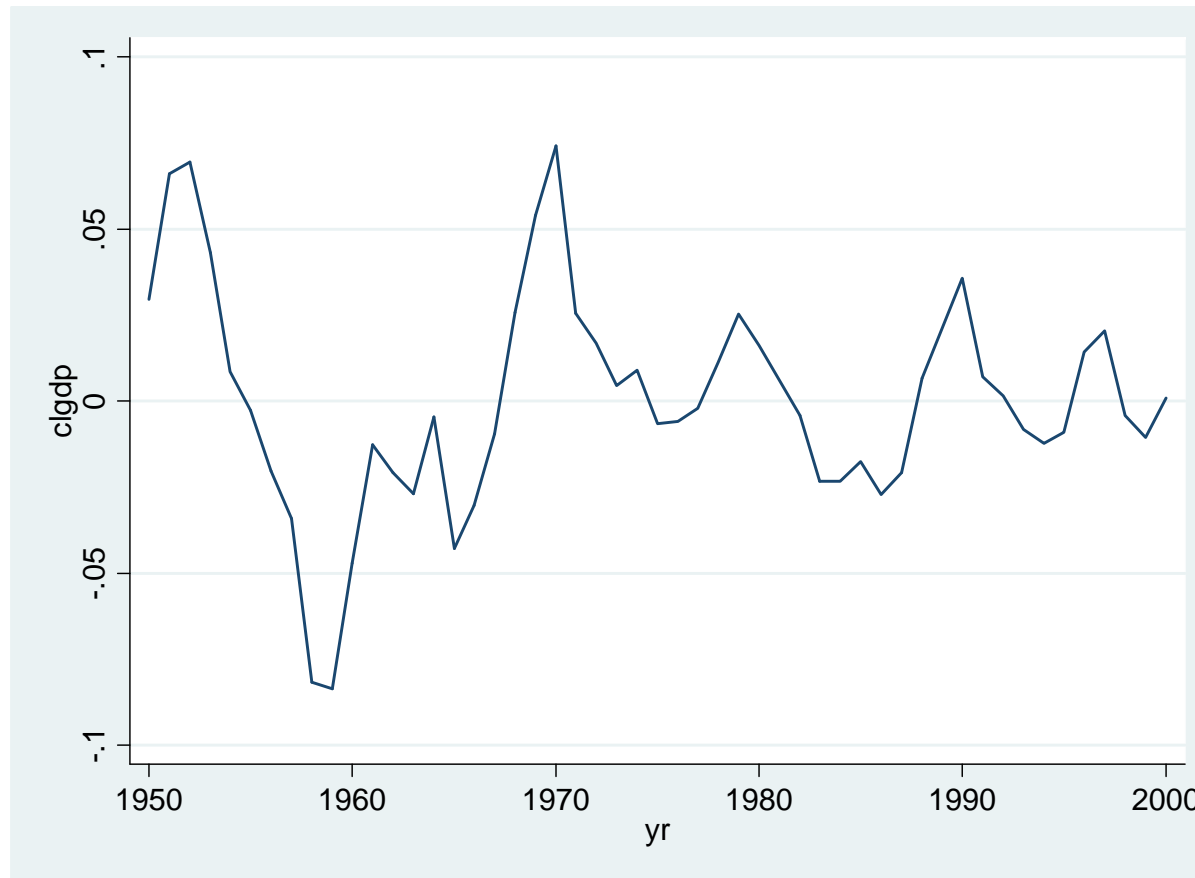
Cyclical GDP: Split trend



Are there two breaks?



Cyclical series with two breaks



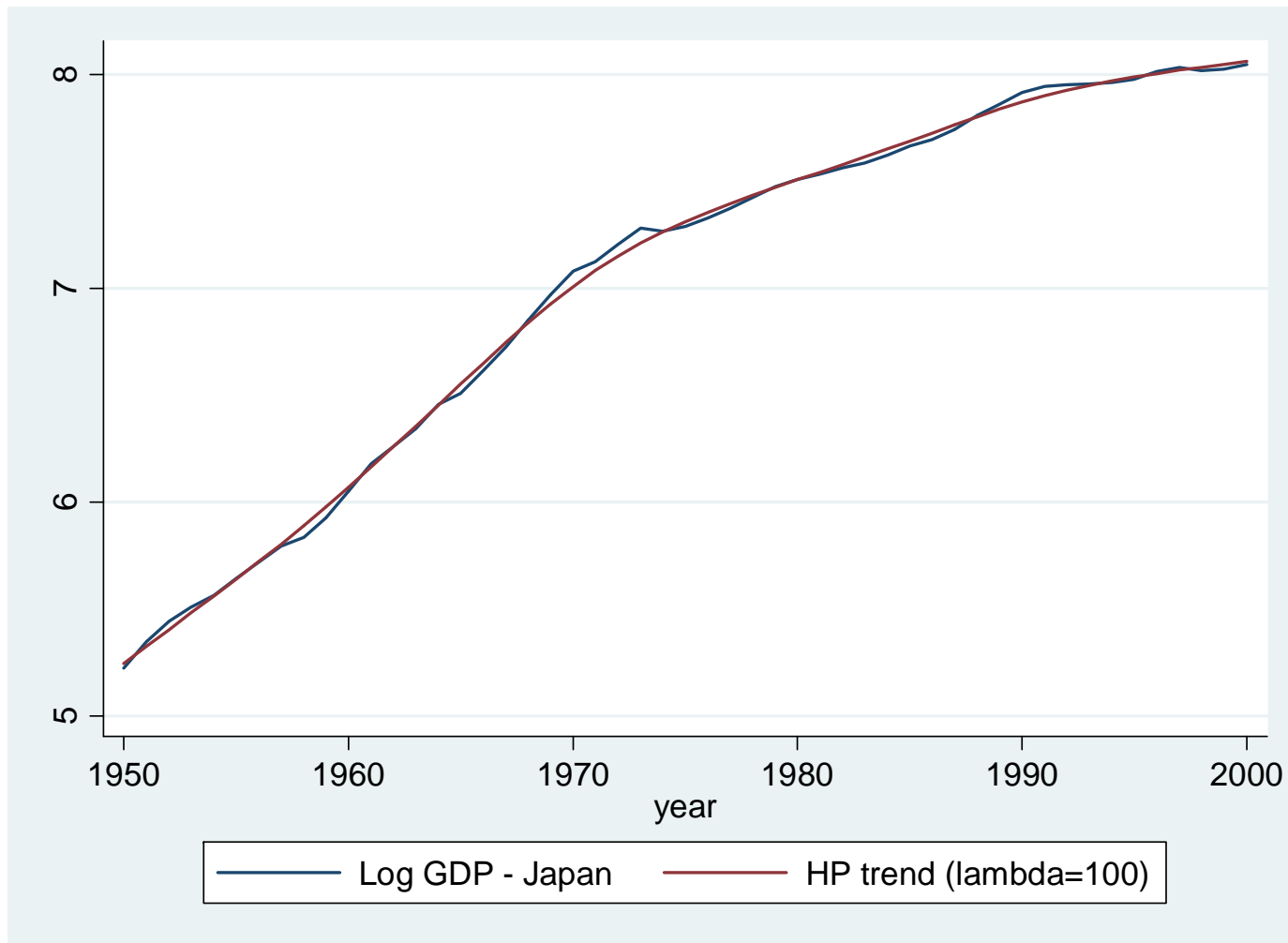
Pre- and post-1973 trend growth rates

| Country | 1950-1973 trend growth rate | 1973-2000 trend growth rate | Difference |
|----------------|-----------------------------|-----------------------------|------------|
| Canada | 4.46% | 2.75% | -1.71% |
| Denmark | 4.44% | 1.87% | -2.57% |
| France | 5.20% | 2.16% | -3.04% |
| Ireland | 2.88% | 4.60% | +1.72% |
| Italy | 5.60% | 2.28% | -3.32% |
| Japan | 9.08% | 3.23% | -5.85% |
| Spain | 6.72% | 2.31% | -4.41% |
| United Kingdom | 2.95% | 2.28% | -0.68% |
| United States | 3.75% | 3.11% | -0.63% |

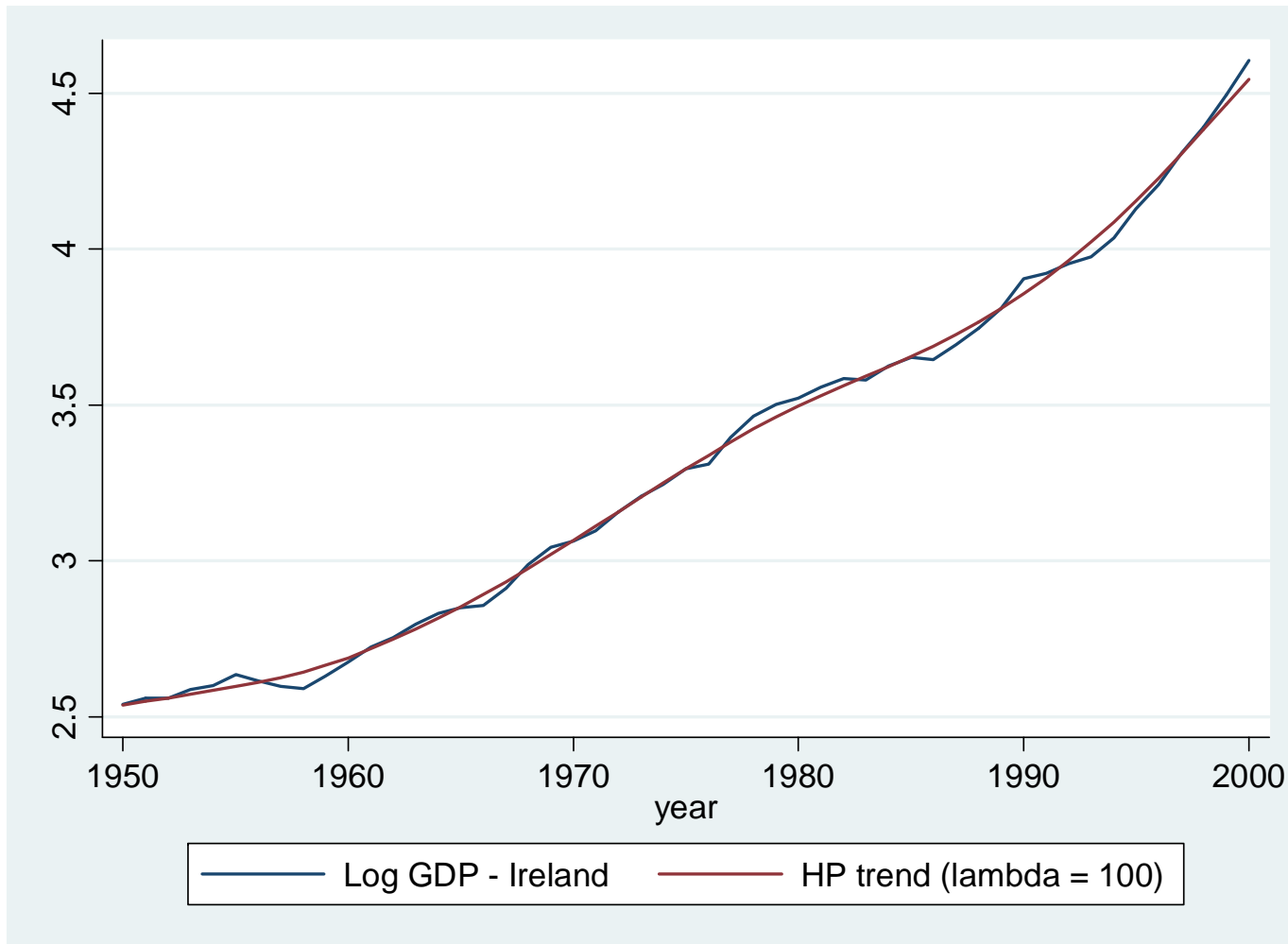
All differences are statistically significant.



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 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**

