

Answers and Questions

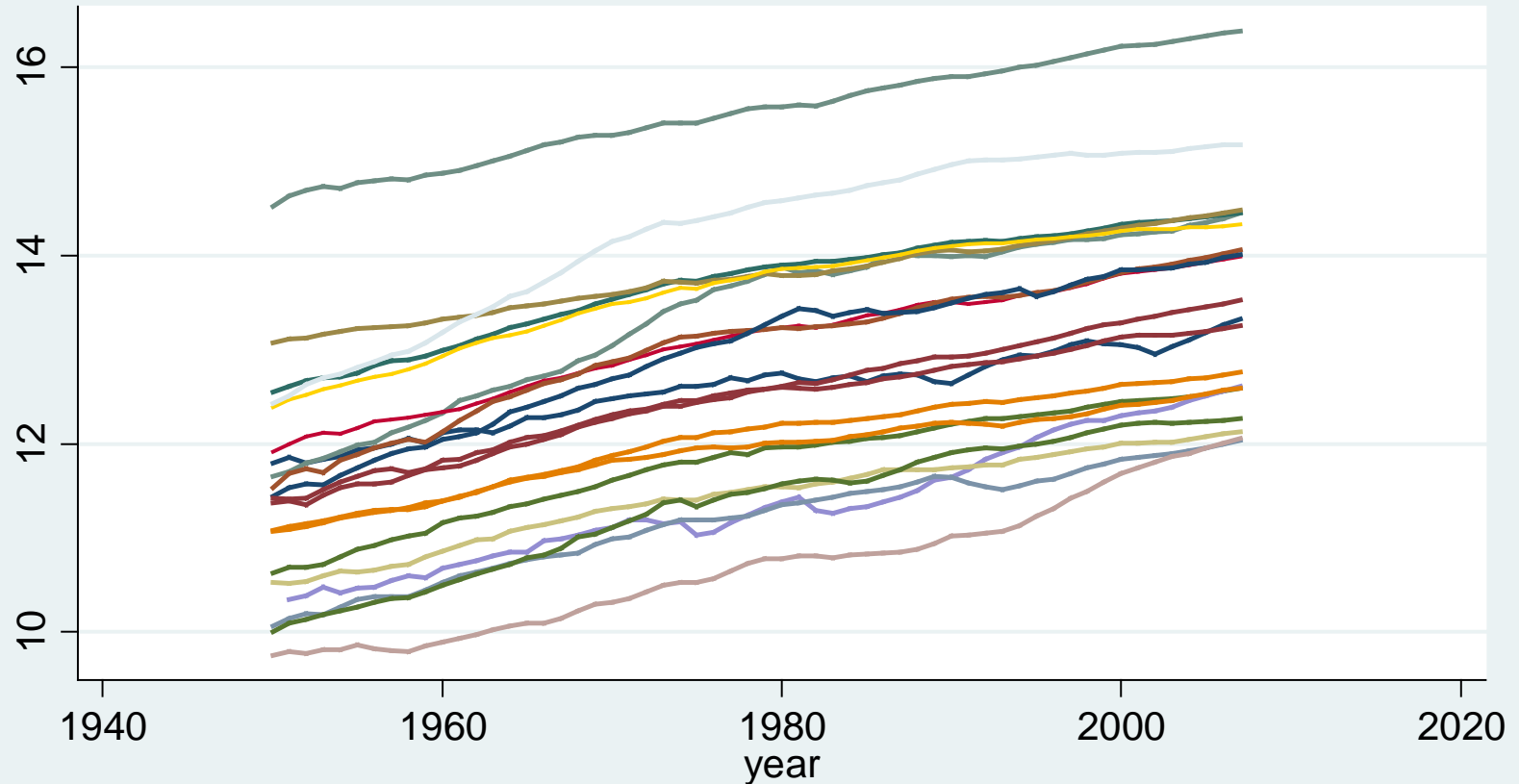
Econ 314: Project 1

Trends, Cycles, and Turning Points

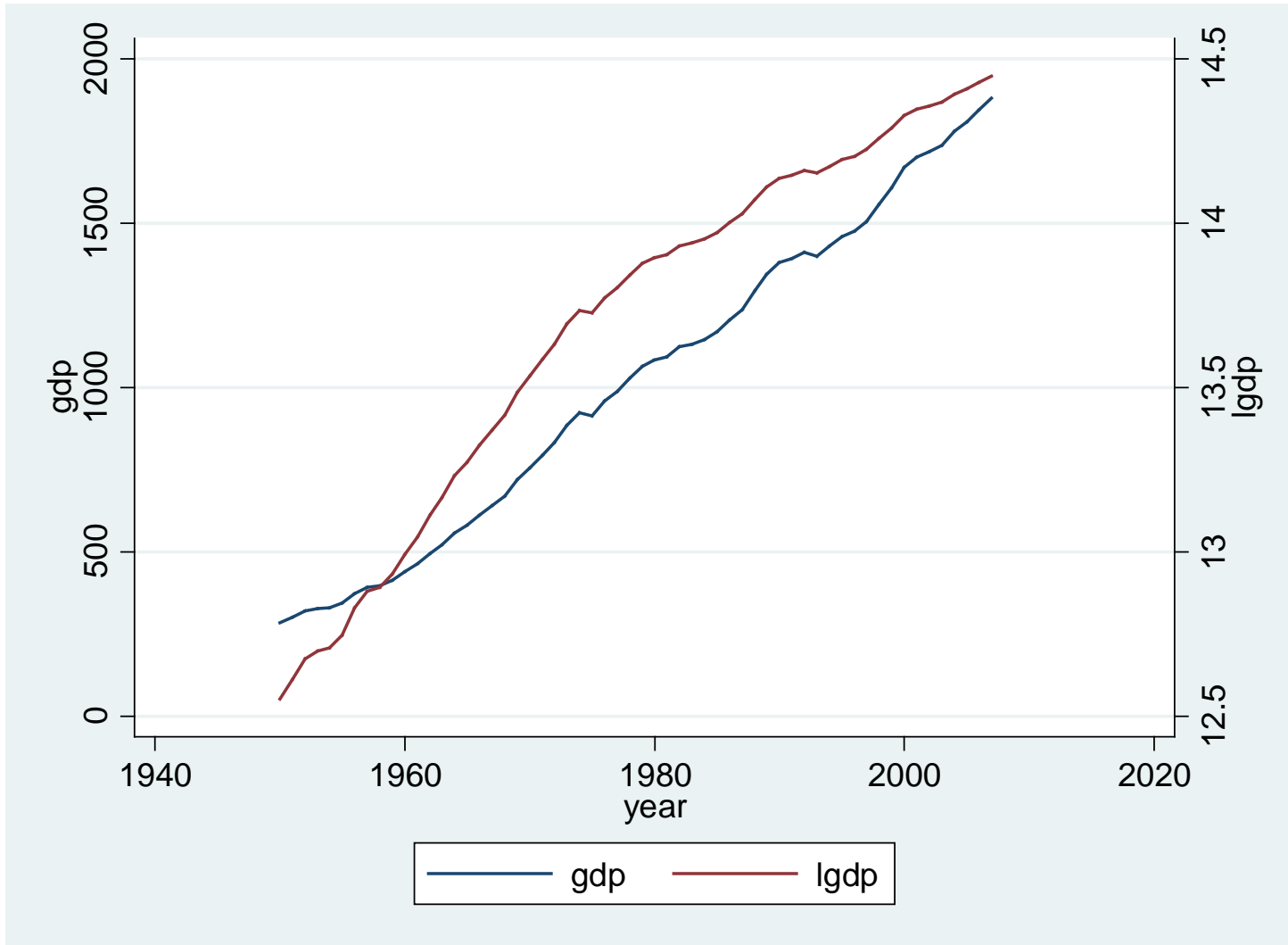
Examining the Growth Data

The Growth Experience

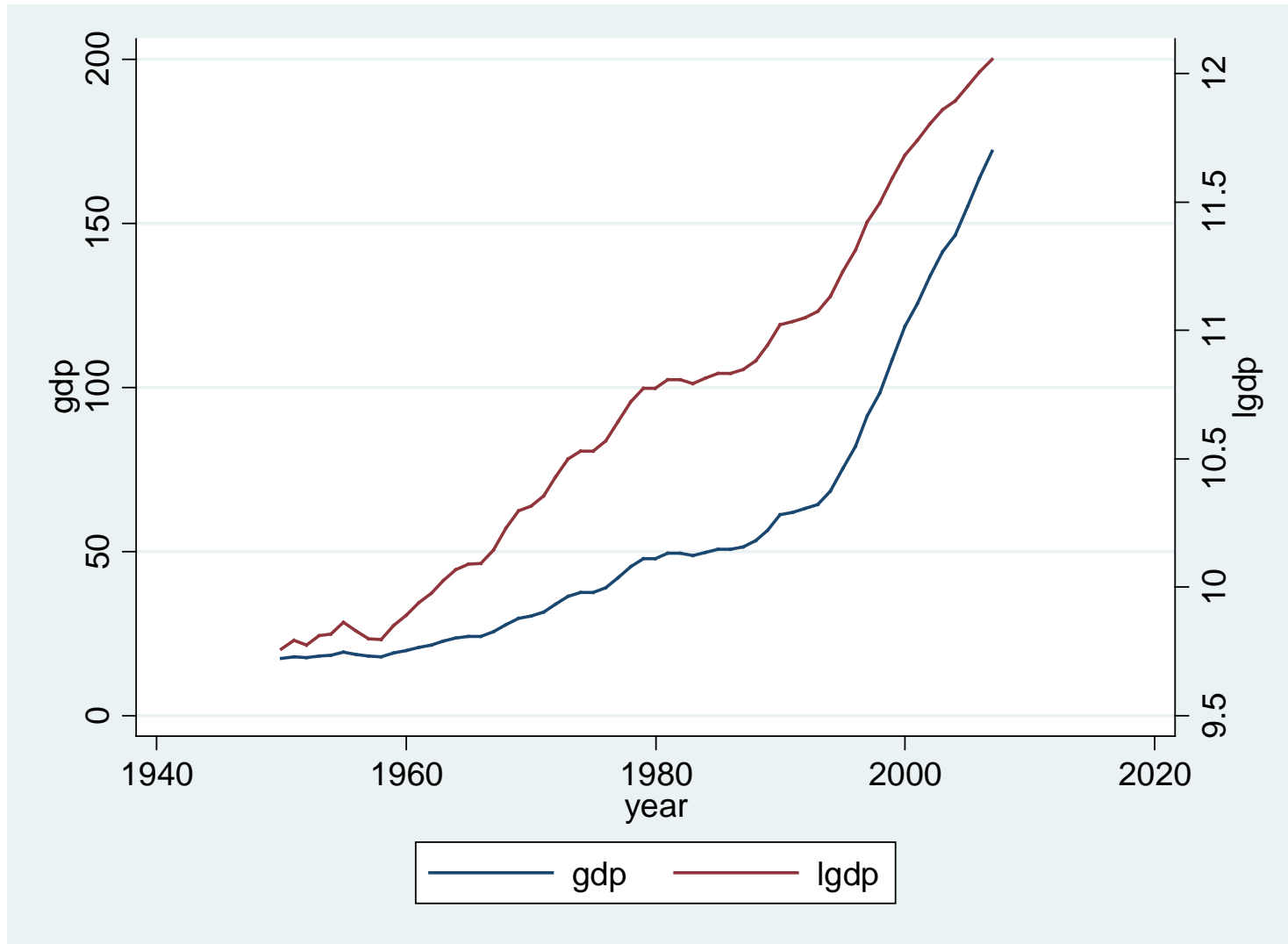
GDP Growth in 20 Countries



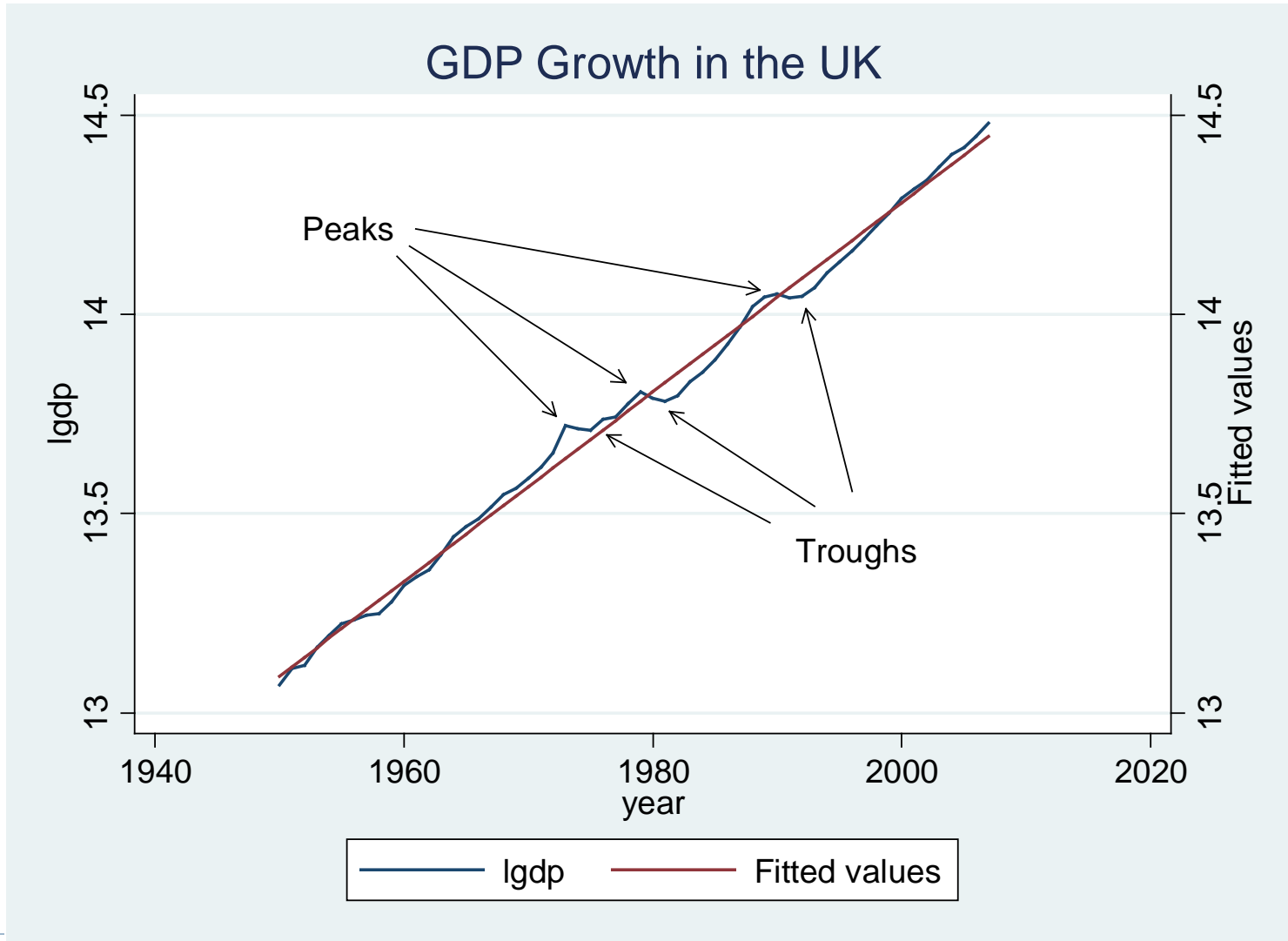
Linearity in levels or logs: France



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

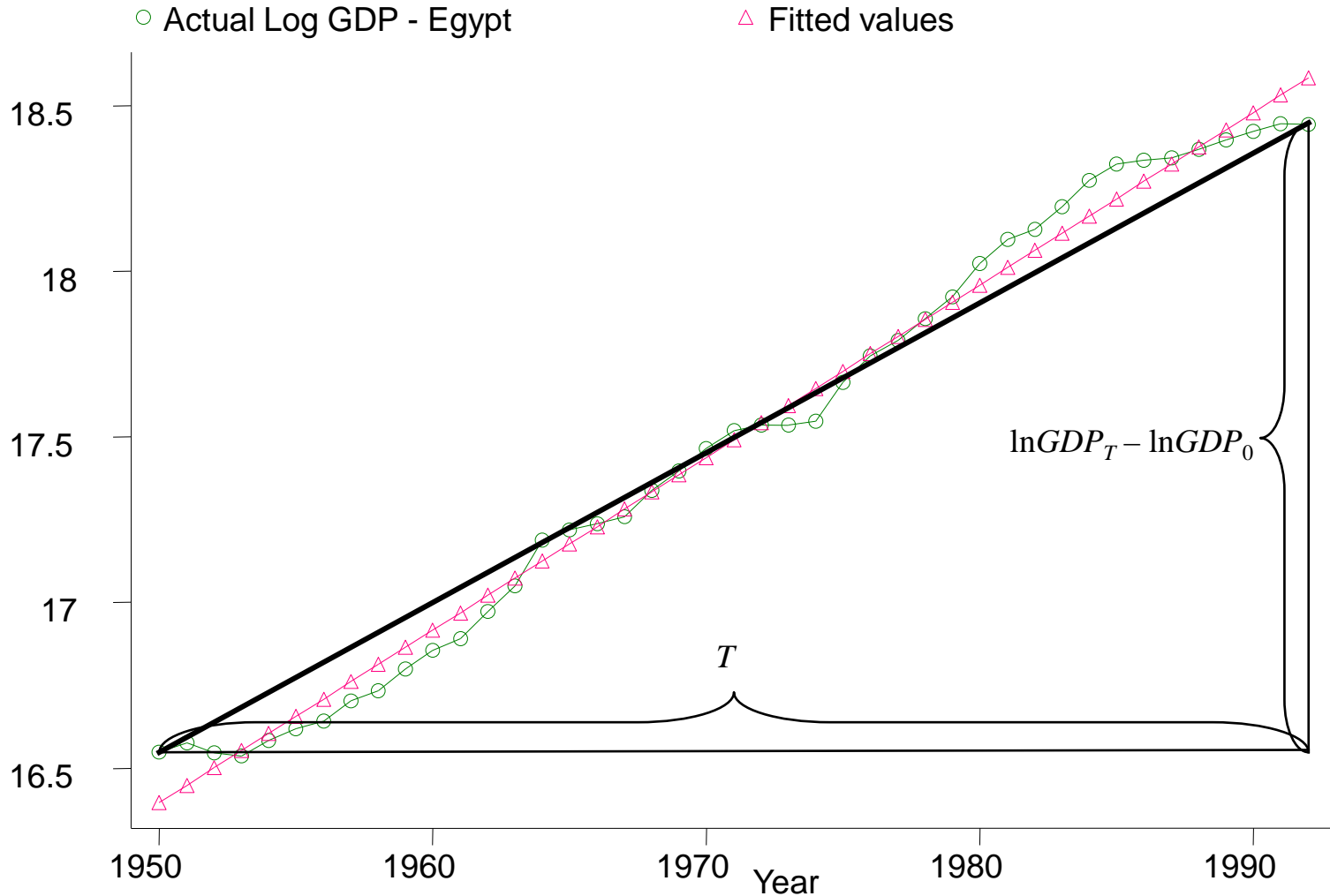
- ▶ Trend rate is slope of best-fit line
- ▶ What is average growth rate?

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 growth vs. average growth



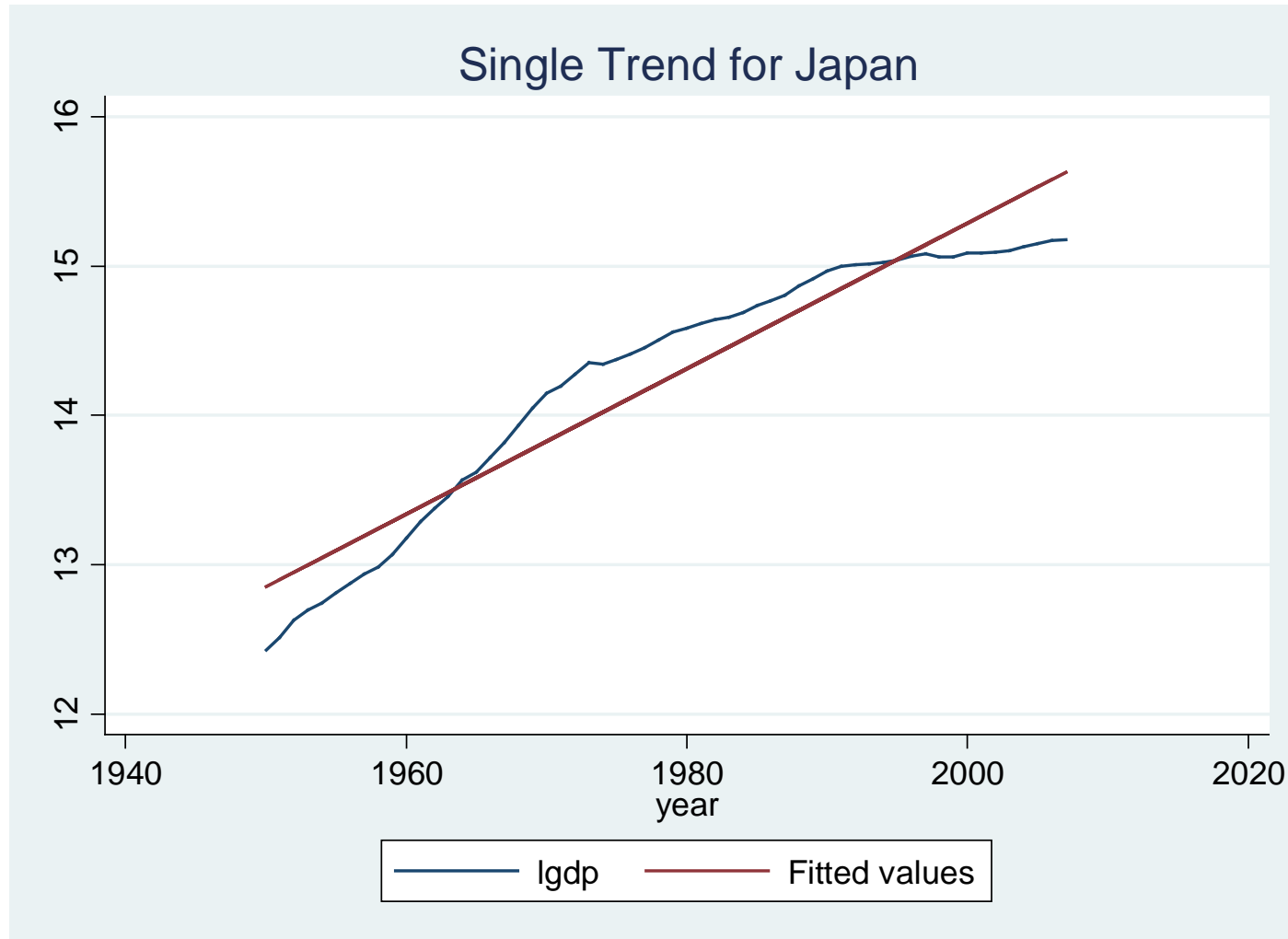
Trend and average growth rates

| Country | Trend growth | Average growth | |
|----------------|--------------|----------------|-------------------|
| | | Annually comp | Continuously comp |
| Argentina | 2.40% | 2.84% | 2.69% |
| Australia | 3.79% | 3.88% | 3.78% |
| Brazil | 4.90% | 5.11% | 4.90% |
| 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% |

Examining the Record

Is Trend Growth Stable?

Is the trend stable?



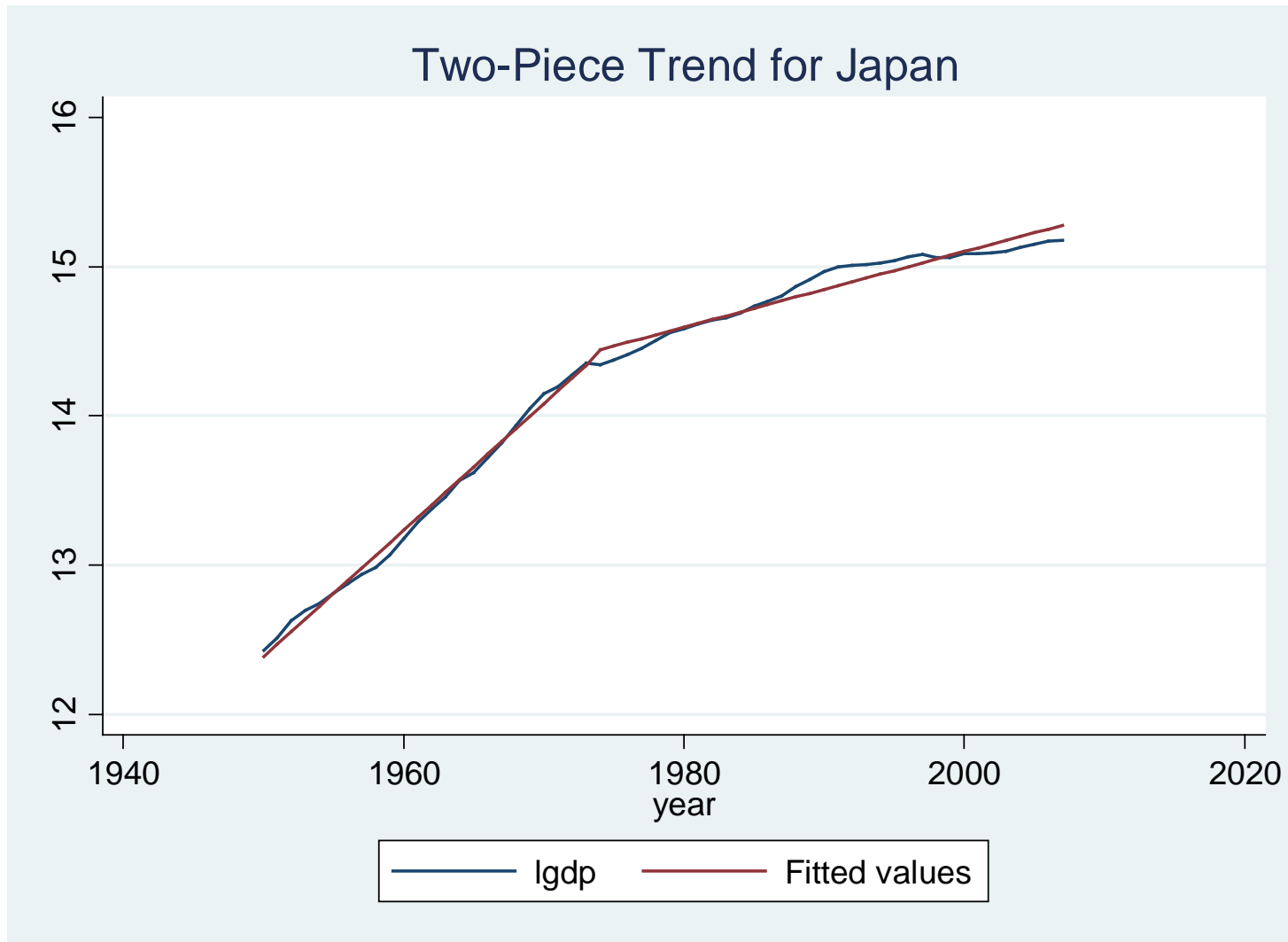
Is the trend stable?

Stability Test for Japan

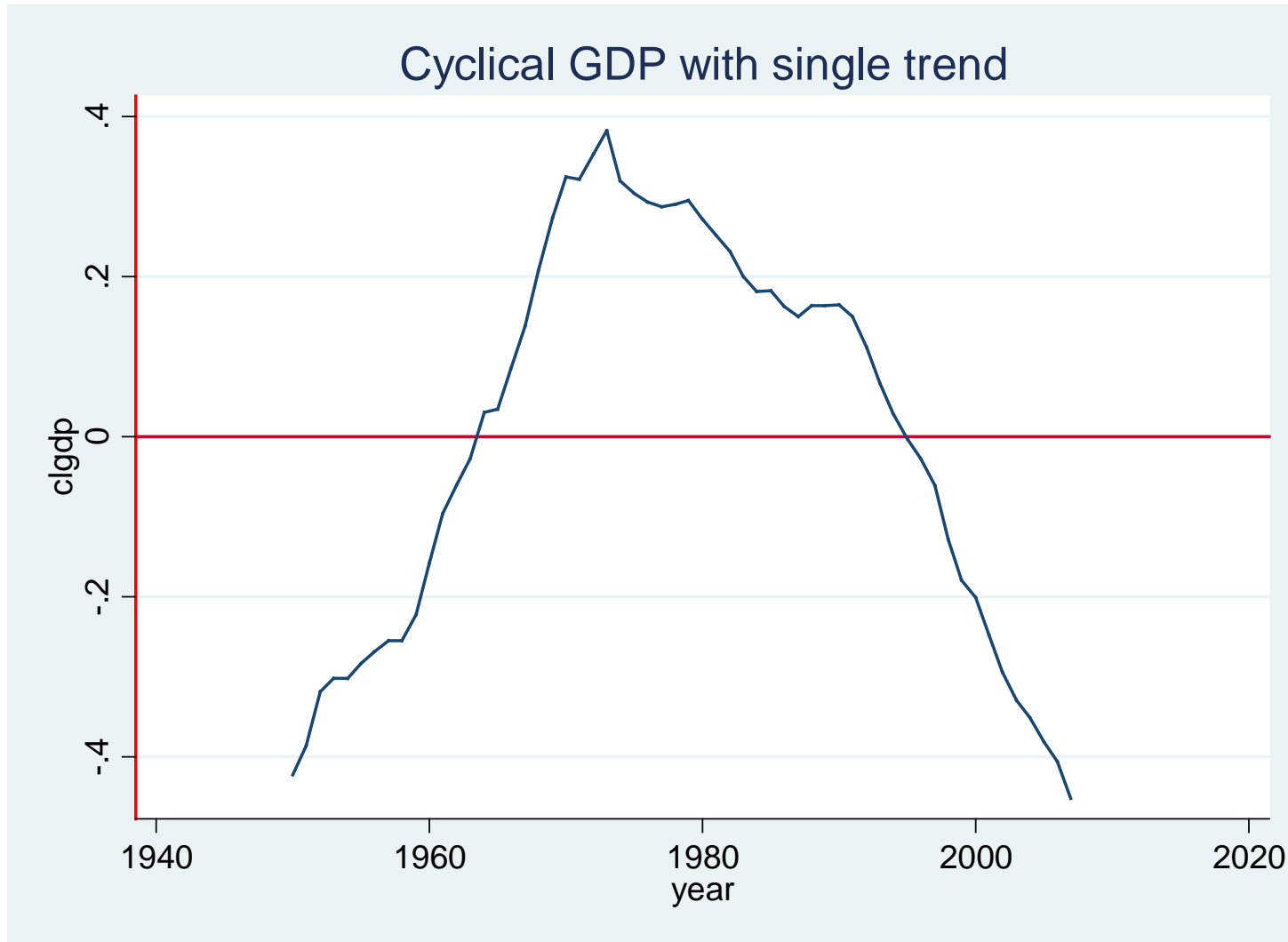
| Source | SS | df | MS | Number of obs = 58 | | |
|----------|-----------------|-----------------|---------------|--------------------|----------------------|------------------|
| Model | 42.0122524 | 3 | 14.0040841 | F(3, 54) = | 3803.57 | |
| Residual | .198818807 | 54 | .00368183 | Prob > F = | 0.0000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



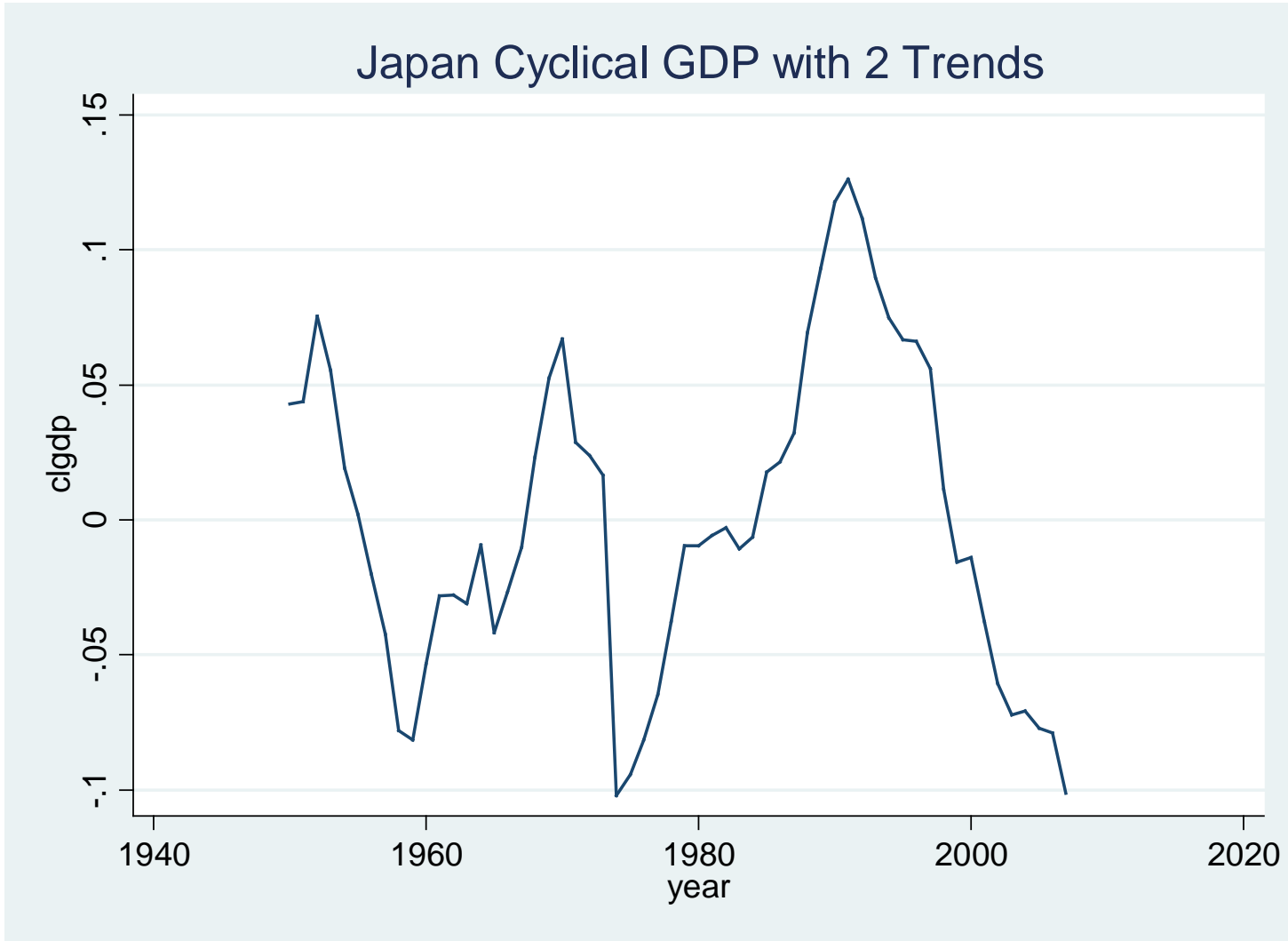
Is the trend stable?



Cyclical series with unstable trend

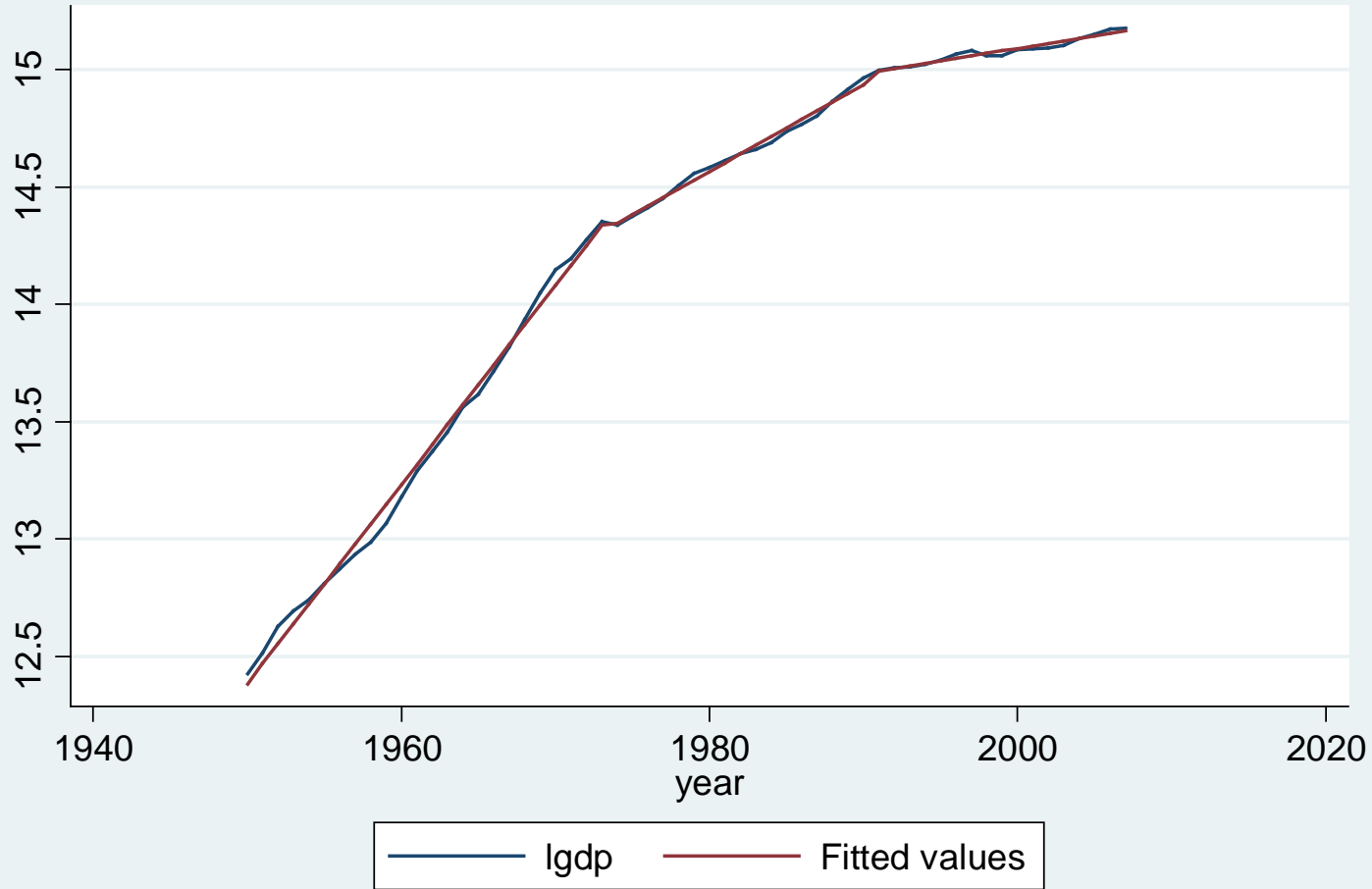


Cyclical GDP: Split trend

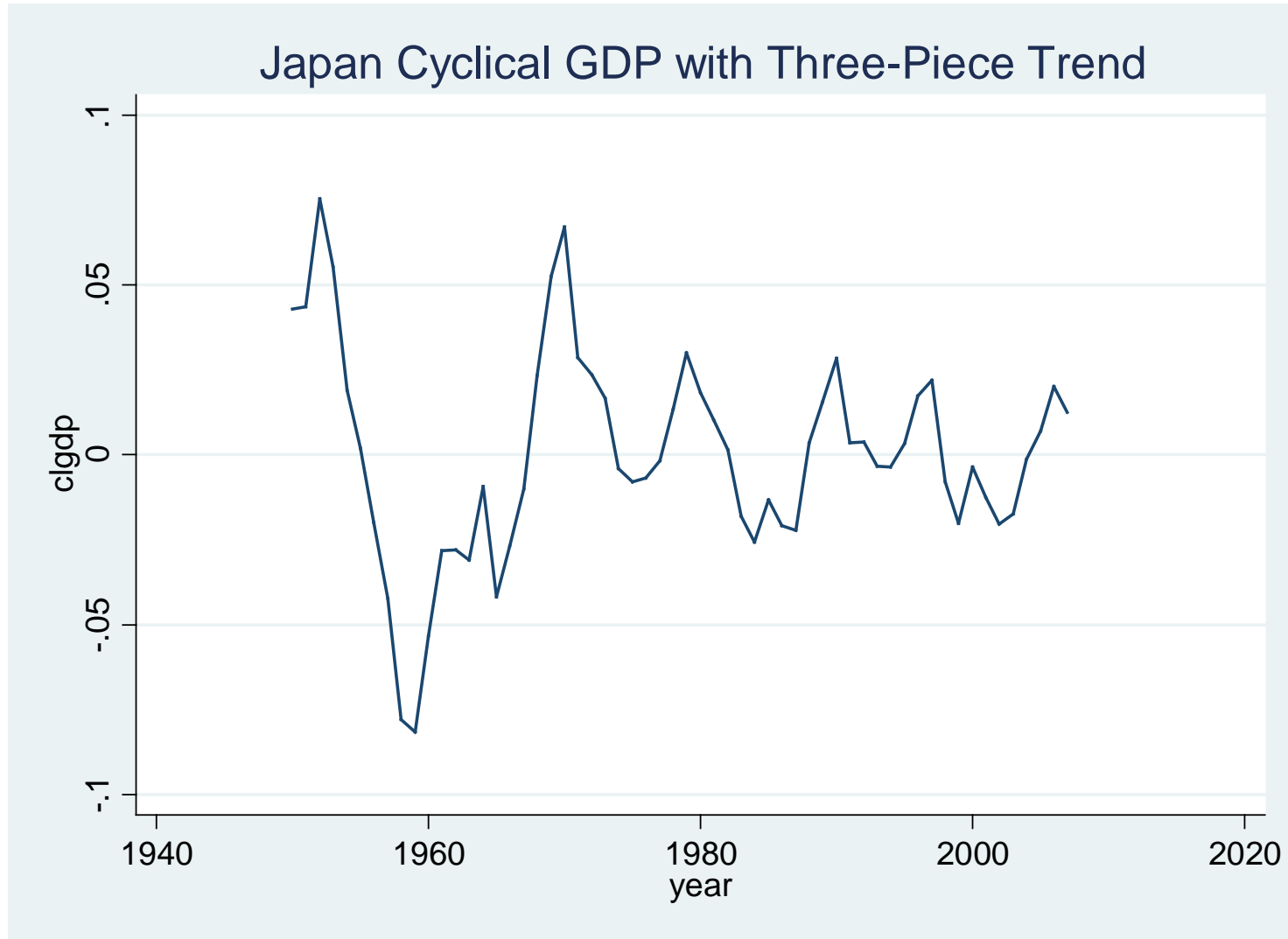


Are there two breaks?

Three-Piece Trend for Japan



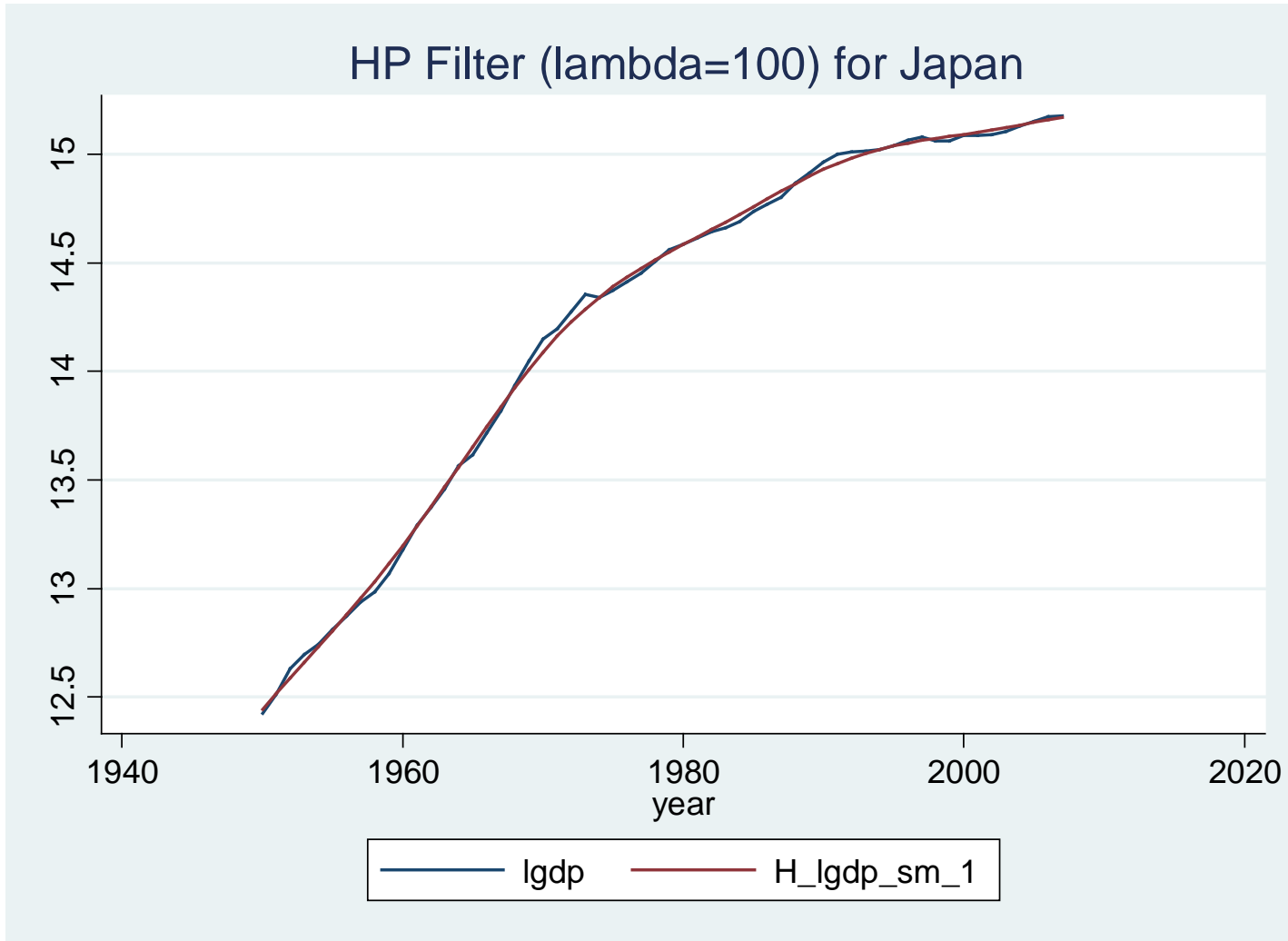
Cyclical series with two breaks



Pre- and post-1973 trend growth rates

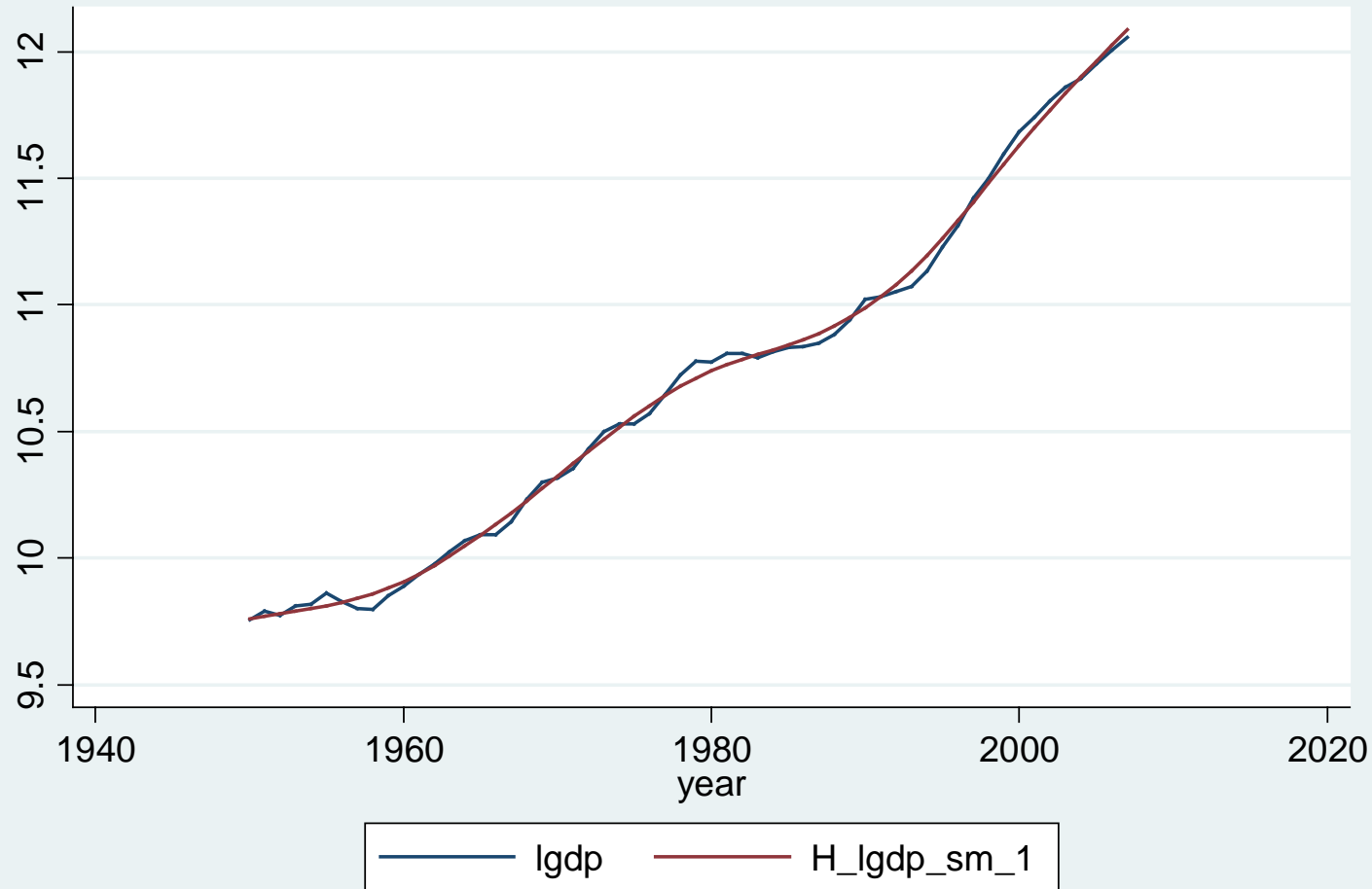
| Country | 1950-1973 trend growth rate | 1973-2000 trend growth rate | Difference |
|----------------|-----------------------------|-----------------------------|------------|
| Argentina | 3.45% | 1.88% | -1.57% |
| Australia | 4.69% | 3.39% | -1.30% |
| Brazil | 7.24% | 2.37% | -4.87% |
| Canada | 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

HP Filter for 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**

