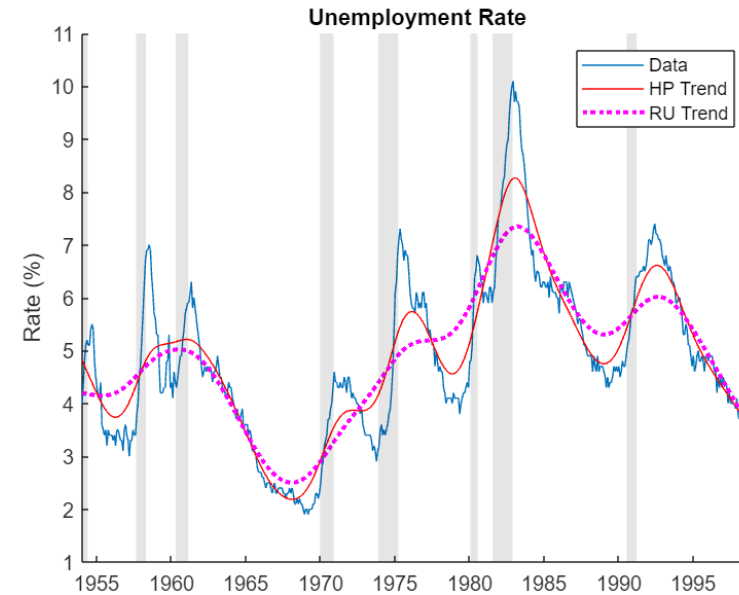


# When to Use the Hodrick-Prescott Filter

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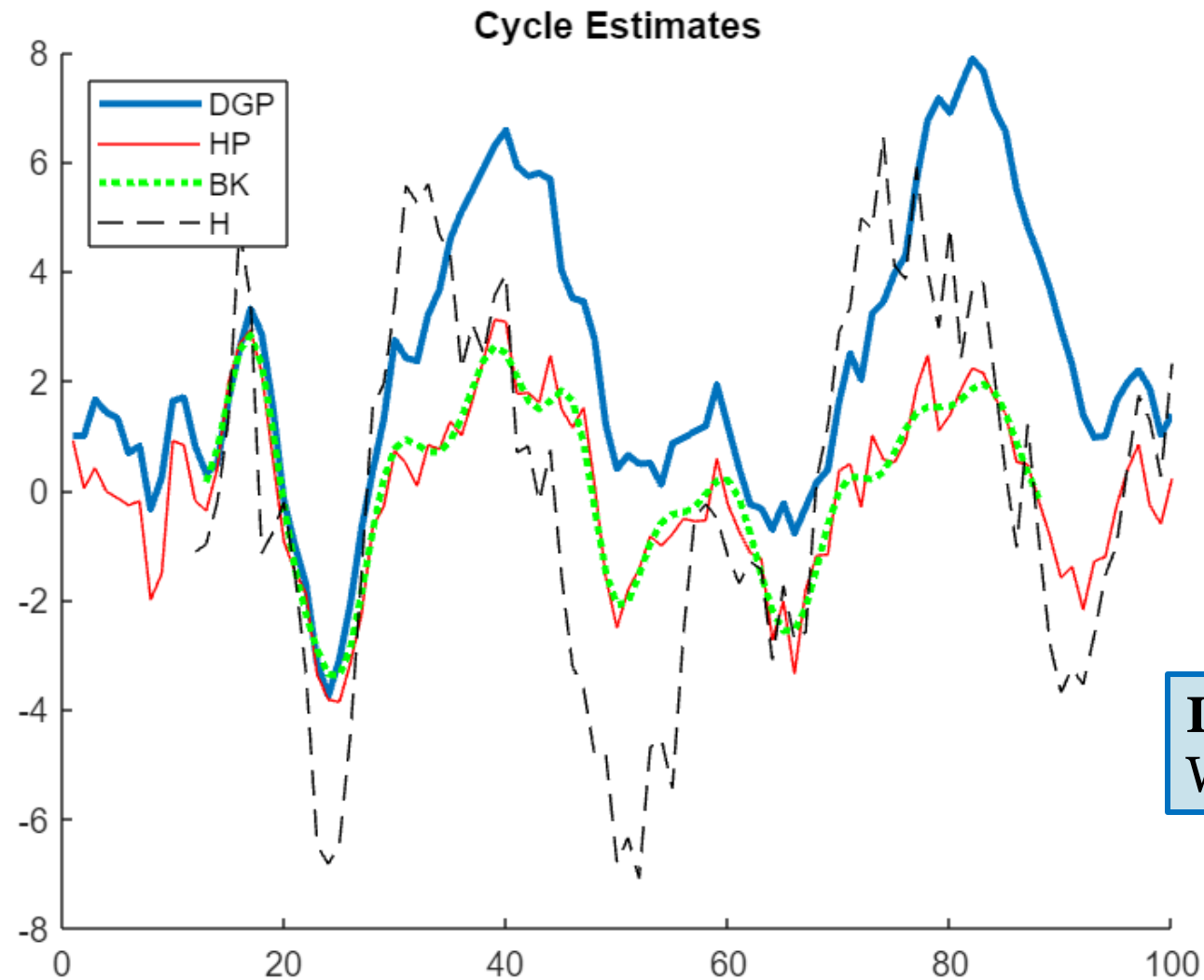


# Business Cycle Filters in Econometrics Toolbox

- **Hodrick-Prescott Filter** `hpfilter`
- **Baxter-King Filter** `bkfilter`
- **Christiano-Fitzgerald Filter** `cffilter`
- **Hamilton Filter** `hfilter`

```
[Trend,Cyclical] = filter(Y)
```

# Featured Example: When to Use the Hodrick-Prescott Filter



**Live Script:**  
[WhenToUseTheHodrickPrescottFilter.mlx](#)

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## Use Hodrick-Prescott Filter to Reproduce Original Result

R2022b

This example shows how to use the Hodrick-Prescott filter to decompose a time series.

The Hodrick-Prescott filter separates a time series into growth and cyclical components with

$$y_t = g_t + c_t$$

where  $y_t$  is a time series,  $g_t$  is the growth component of  $y_t$ , and  $c_t$  is the cyclical component of  $y_t$  for  $t = 1, \dots, T$ .

The objective function for the Hodrick-Prescott filter has the form

$$\sum_{t=1}^T c_t^2 + \lambda \sum_{t=2}^{T-1} ((g_{t+1} - g_t) - (g_t - g_{t-1}))^2$$

with a smoothing parameter  $\lambda$ . The programming problem is to minimize the objective over all  $g_1, \dots, g_T$ .

The conceptual basis for this programming problem is that the first sum minimizes the difference between the data and its growth component (which is the cyclical component) and the second sum minimizes the second-order difference of the growth component, which is analogous to minimization of the second derivative of the growth component.

Note that this filter is equivalent to a cubic spline smoother.

Try This Example