1 Trend vs. Cycle

Trend vs. Cycle

- Trend: growth rate
- Cycle: deviations from the trend

The role of λ in HP filter

- λ captures how much one cares about the smoothness of the trend
- $\lambda \to 0$: time-varying trend and there is no cycle
- $\lambda \to \infty$: trend growth is constant

Problems with HP filters

- Instability of the HP trend at the margin.
- HP filter cannot separate demand from supply shocks (i.e., a slowdown in trend growth will be identified during a long-lasting recession).
- What is the right λ for HP filter?

Kalman filter

- The Kalman filter can easily handle missing data
- Future is a special case of missing data

2 Recessions vs. Expansions

Recessions

- Periods with contracting economic activity
- Two consecutive quarters of negative real GDP growth

Forecasting indicator: the yield curve

- Yield curve slope is historically one of the best predictors for upcoming recessions (especially in the US)
- All recessions were preceded by an inverted (negatively sloped) yield curves; yield curve was rarely inverted without a recession following

Forecast vs. Nowcast

- Forecast = is a recession going to start during the next 12 months?
- Nowcast = is an economy in a recession right now?
- Good rule of thumb: a recession has started if 3-month change of the 3-month moving average of seasonally adjusted unemployment rate rises above 0.3 pp

3 Welfare Costs

Lucas calibration

The resulting estimate for costs of economic fluctuations is tiny! Why should anyone care about business cycles?

- observed fluctuations are the ones resulting despite macroeconomic stabilization policies (could have been even larger without stabilization)
- cost of business cycles are not equally distributed over population
- direct costs of unemployment (negative impact on life satisfaction)
- persistent effects of economic fluctuations (recessions lead to a permanent level shift in the trend)

4 Comovement

DFM

- Summarize the data and extract a signal for the current underlying dynamic in an economy
- Essential toolkit for all CBs
- Useful to monitor incoming data
- Good for nowcasts, but not helpful for medium-term forecasts

What is the first principal component doing intuitively?

- The first principal component of a dataset corresponds to f_t, which is an underlying force driving the common variation in the dataset

Why is the DFM useful for monitoring the business cycle?

- can be updated in realtime, allows us to consider all the data simultaneously instead of just focusing on one individual time series

Conclusion

- The business cycle affects many aspects of the economy
- Therefore, it can be seen in many time series (e.g. GDP, unemployment, productivity)
- DFM is very useful if you want to have a more timely and broad-based measure of current dynamics

5 Computing Swiss GDP

- Estimation
  - annual GDP adds up value added according to firm survey
  - is estimated from production side
  - first estimate published 8 months after the end of reference year (i.e. first estimate for 2021 will be published at the end of August 2022)

- Quarterly GDP is an inter- and extra-polation of annual GDP
  - The preliminary estimate does not typically add up to observed annual GDP
  - Chow-Lin approach
- Interpolation vs. Extrapolation
  - The quarterly series is an interpolation for the years for which there is an annual estimate available (e.g. 2020)
  - It is an extrapolation for the latest quarters
- GDP is continuously revised
  - Indicators are revised
  - Annual estimates are revised
  - Benchmark revisions
  - Quarterization revisions: new indicators, new sa methods
  - Changes in estimated Chow-Lin coefficients

6 New Keynesian Model

- NKIS curve

$$c_t \simeq \mathbb{E}_t c_{t+1} - \frac{1}{\sigma}(i_t - \mathbb{E}_t \pi_{t+1} - \rho) + \frac{1-\rho_z}{\sigma} z_t$$

  - IS curve describes current aggregate demand as a function of endogenous variables (future demand, inflation), the interest rate, and an exogenous shock
- Monetary policy rate

$$i_t = MP\left(\underset{+}{\pi_t}\right) + v_t$$

  - Monetary policy reacts to higher inflation by raising the interest rate
- Monopolistic competition
  - Because each firm produces a differentiated good that is not perfectly substitutable, each firm has some monopoly power
- Profit maximizing price under flex prices

$$P_t^*(i) = \frac{\varepsilon}{\varepsilon - 1}\frac{W_t}{A_t}$$

  - Profit-maximizing price is the same for all firms, $P_t^*(i) = P_t^*$
  - Profit-maximizing price does not depend on YP^ε (but total profits do)
  - YP^ε is a measure for how many units a firm can sell for any given price
- Labor market equilibrium under flex price

$$Y_t = A^{\frac{1+\varphi}{\varphi+\sigma}}\left(\frac{\varepsilon-1}{\varepsilon}\right)^{\frac{1}{\varphi+\sigma}}$$

  - Equilibrium production does not depend on prices
- The trilemma of international finance
  - A country cannot simultaneously have an independent monetary policy, a fixed exchange rate, and capital mobility

- Reasoning: arbitrage. If interest rates between two countries differ, but the exchange rate is fixed, capital will flow to the country with higher interest rate

- Profit maximization with sticky prices

$$O_t = \mathbb{E}_t\left[\sum_{j=0}^{\infty} \omega_j P^*_{t+j}\right] \quad \text{where} \quad \omega_j = \frac{\frac{\theta^j}{R_{i+j}} Y_{t+j} P^{\varepsilon}_{t+j}}{\sum_{j=0}^{\infty} \frac{\theta^J j}{R_{i+j}} Y_{t+j} P^{\varepsilon}_{t+j}}$$

  - The optimal price under sticky prices, O_t, is a weighted average of optimal prices under flexibility
  - θ^j: the probability that the price is still in place in $t+j$
  - $\frac{1}{R_{t+j}}$: the present value of the profit that is generated in $t+j$
  - Y_{t+j}: aggregate demand in $t+j$ (i.e. how many units are expected to be sold)
  - $Y_{t+j}P^{\varepsilon}_{t+j}$: it shifts demand for a given price

- Log-linear approximation of the optimal price

$$o_t \simeq \sum_{j=0}^{\infty} \frac{(\beta\theta)^j}{\sum_{k=0}^{\infty}(\beta\theta)^k} \mathbb{E}_t p^*_{t+j}$$

  - We did an approximation around steady state
  - In steady state $Y_{t+j}P^{\varepsilon}_{t+j}$ is constant and therefore cancels out
  - In steady state, $i = -\log\beta = \log\frac{1}{\beta} \simeq \frac{1}{\beta} - 1$, $\pi = 0$

- Optimal price under sticky prices

$$o_t = (1-\beta\theta)p^*_t + \beta\theta\mathbb{E}_t o_{t+1}$$

  - The optimal price today is a weighted average of today's flexible price and tomorrow's optimal price
  - Higher discounting ($\beta \downarrow$) and more often firms adjust ($\theta \downarrow$), the larger weight on today's flexible price

- Aggregate price dynamics

$$\pi_t = (1-\theta)(o_t - p_{t-1})$$

  Intuition: inflation is driven by

  - how much adjusting firms change prices, $o_t - p_{t-1}$
  - how many firms can reset prices, $1-\theta$
  - adjusting firm choose high o_t if
    * they expect high optimal price in the future, $\mathbb{E}_t o_{t+1}$
    * current flex price, p^*, is high

- Inflation

$$\pi_t = \frac{1-\theta}{\theta}(1-\beta\theta)(p^*_t - p_t) + \beta\mathbb{E}_t\pi_{t+1}$$

  Inflation is high whenever

  - expected inflation is high (comes from adjusting firms choosing high o_t because they expect high $\mathbb{E}_t o_{t+1}$)
  - current flex prices are high relative to the price level, $p^*_t - p_t$ (comes from adjusting firms choosing high o_t because p^*_t is high)

- When is $(p^*_t - p_t)$ high?

$$\frac{P^*_t}{P_t} = \frac{\varepsilon}{\varepsilon-1}\frac{1}{A_t}\frac{W_t}{P_t}$$

  - $p^*_t - p_t$ is high, if real wage $\frac{W_t}{P_t}$ is high (reason: high real wage implies high costs for firms)

- Natural level of output

$$\frac{P^*_t}{P_t} = \left(\frac{Y_t}{Y^n_t}\right)^{\varphi+\sigma}$$

  - Whenever the output is above natural level, the optimal flex price is above the price index generating upward pressure on inflation

- NKPK

$$\pi_t = \frac{1-\theta}{\theta}(1-\beta\theta)(\varphi+\sigma)(y_t - y_t^n) + \beta\mathbb{E}_t\pi_{t+1}$$

  - The output gap is proportional to $p_t^* - p_t$
  - $p_t^* - p_t$ is high, whenever
    * production is high, $\frac{P_t^*}{P_t} = \frac{\varepsilon}{\varepsilon-1}A_t^{-\varphi-1}Y_t^{\varphi+\sigma}$
    * the output gap is positive, $\frac{P_t^*}{P_t} = \left(\frac{Y_t}{Y_t^n}\right)^{\varphi+\sigma}$
    * a high production requires a lot of labor, which can only be drawn into the labor market via high real wages
    * high production equals a positive output gap

- The natural real interest rate

$$r_t^n = \rho + \sigma\mathbb{E}_t[\Delta y_{t+1}^n] + (1-\rho_z)z_t$$

  - Real natural interest rate is the interest rate if the output gap is closed and inflation is on target in t
  - The output gap is expected to remain closed in the next period and inflation to remain on target
  - r_t^n increases with growth of natural level of output, also depends on shock z_t

7 Pandenomics

Drawbacks of SIR model

- Behavior does not depend on probability of getting infected (i.e. the number of contacts is given exogenously)
- There exists no interaction with economic decisions

Macro-SIR model

- In Macro-SIR model
  - Stronger recession
  - Less deaths
- Why?
  - Individuals take into account the risk of getting infected at workplace or shops
  - The higher the number of new infections, the larger the risk of getting infected, the more cautious are individuals
- The decentralized equilibrium can be improved when containment measures are introduced
  - In decentralized equilibrium, people only take into account the risk of getting infected but they do not consider their effect on the overall spread of the disease (i.e. negative externality)
- The optimal policy is to immediately introduce severe containment measures
  - Overall utility increases because of fewer deaths
  - Minimizes deaths at the cost of a larger recession in the beginning
- Limitations
  - Policies to mitigate economic hardships are not considered

- Financial markets are not included
- Sticky prices
  * Sticky prices alleviate the impact of a negative supply shift because the pandemic is not only a demand but also a supply shock
- Vaccine assumed to work perfectly
- Age-dependent health risks are not considered