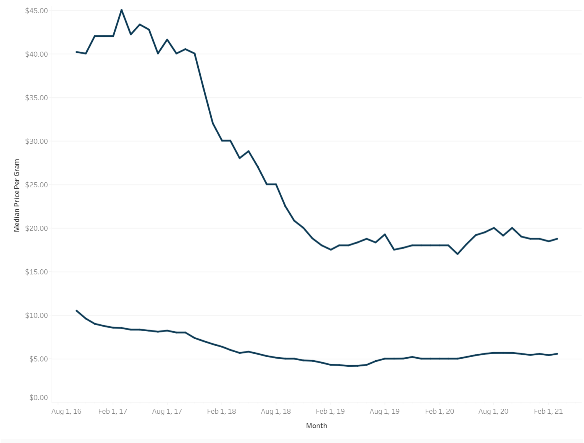
Cannabis Data Science

Meetup

October 27, 2021

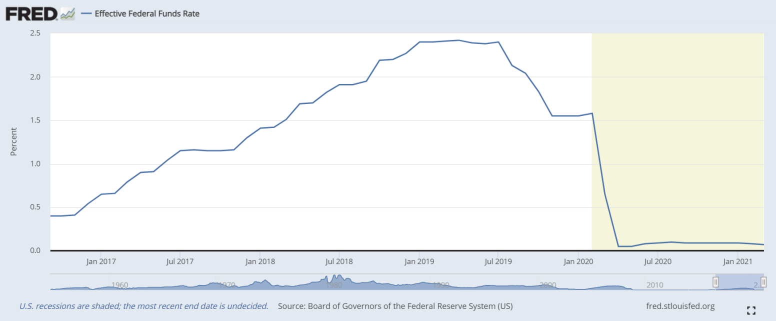
Cannabis Prices in Oregon



Define **inflation** as $\pi_t \equiv \frac{p_t - p_{t-1}}{p_{t-1}}$.

Source: https://data.olcc.state.or.us/t/OLCCPublic/views/MarketDataTableau/Prices

Interest Rates



The central bank sets policy to influence the nominal interest rate, i_t, as a function of the realized output gap, x_t, and the rate of inflation, π_t.

Define the **output gap** as $x_t \equiv \hat{y}_t - y_t$, where $\hat{y}_t$ are prior expectations for output.

VAR Models

Assume the following system of linear equations for output, y, inflation, π, and the interest rate, i.

$$
\begin{aligned}
y_t &= \alpha_y + \cdots + \beta_j y_{t-j} + \cdots + \gamma_j \pi_{t-j} + \cdots + \delta_j i_{t-j} + \mu_t^y \\
\pi_t &= \alpha_\pi + \cdots + \theta_j y_{t-j} + \cdots + \phi_j \pi_{t-j} + \cdots + \lambda_j i_{t-j} + \mu_t^\pi \\
i_t &= \alpha_i + \cdots + \psi_j y_{t-j} + \cdots + \kappa_j \pi_{t-j} + \cdots + \rho_j i_{t-j} + \mu_t^i
\end{aligned}
$$

VAR Models

The advantages to VAR models are that they are;

- Atheoretical
- Flexible,
- Can fit any frequency data

The major pitfall to VAR models is **overfitting** the model with regressors.

VAR Model in Matrix Form

Assume a system of linear equations for output, y, inflation, π, and the interest rate, i,

$$
\begin{aligned}
y_t &= \alpha_y + \cdots + \beta_j y_{t-j} + \cdots + \gamma_j \pi_{t-j} + \cdots + \delta_j i_{t-j} + \mu_t^y \\
\pi_t &= \alpha_\pi + \cdots + \theta_j y_{t-j} + \cdots + \phi_j \pi_{t-j} + \cdots + \lambda_j i_{t-j} + \mu_t^\pi \\
i_t &= \alpha_i + \cdots + \psi_j y_{t-j} + \cdots + \kappa_j \pi_{t-j} + \cdots + \rho_j i_{t-j} + \mu_t^i,
\end{aligned}
$$

that can be written in matrix form as

$$
\begin{pmatrix} y_t \\ \pi_t \\ i_t \end{pmatrix} = \begin{pmatrix} \alpha_y \\ \alpha_\pi \\ \alpha_i \end{pmatrix} + A_1 \begin{pmatrix} y_{t-1} \\ \pi_{t-1} \\ i_{t-1} \end{pmatrix} + \cdots + A_j \begin{pmatrix} y_{t-j} \\ \pi_{t-j} \\ i_{t-j} \end{pmatrix} + \begin{pmatrix} \mu_t^y \\ \mu_t^\pi \\ \mu_t^i \end{pmatrix}.
$$

Forecast Model

Consider the reduced–form model VAR(1) model of output, y, inflation, π, and the interest rate, i,

$$\begin{pmatrix} y_t \\ \pi_t \\ i_t \end{pmatrix} = \vec{\alpha} + A(L) \begin{pmatrix} y_{t-1} \\ \pi_{t-1} \\ i_{t-1} \end{pmatrix} + \vec{\mu}_t.$$

The exogenous shock cannot be explained, $\mathbb{E}_t[\vec{\mu}_{t+1}] = 0$. Then

$$\mathbb{E}_t \begin{pmatrix} y_{t+1} \\ \pi_{t+1} \\ i_{t+1} \end{pmatrix} = \vec{\alpha} + A(L) \begin{pmatrix} y_t \\ \pi_t \\ i_t \end{pmatrix}.$$

The 10 Commandments of Forecasting

1. Know what you are forecasting.
2. Understand the purpose of forecasting.
3. Acknowledge the cost of the forecast error.
4. Rationalize the forecast horizon.
5. Understand the choice of variables.
6. Rationalize the forecasting model used.
7. Know how to present the results.
8. Know how to decipher the forecast results.
9. Use recursive methods.
10. Understand that forecasting models evolve over time.

Alternative Models

If you are interested in aggregate demand and aggregate supply shocks, then you may consider a VAR model with the growth in GDP, $\Delta \log y$, and unemployment, u. You can write the model as

$$\begin{pmatrix} \Delta \log y_t \\ u_t \end{pmatrix} = \vec{\alpha} + B(L) \begin{pmatrix} \Delta \log y_{t-1} \\ u_{t-1} \end{pmatrix} + \vec{\nu}_t,$$

Example: Suppose that you are interested in the growth rate of labor productivity, x_t, and labor hours, n_t. You can write a reduced–form VAR as

$$\begin{pmatrix} \Delta \log x_t \\ \Delta \log n_t \end{pmatrix} = \vec{\alpha} + B(L) \begin{pmatrix} \Delta \log x_{t-1} \\ \Delta \log n_{t-1} \end{pmatrix} + \vec{\mu}_t,$$

Until next time

Make some forecasts and next week we can check our forecasts.