Block 2.2: Dynamic models and probability

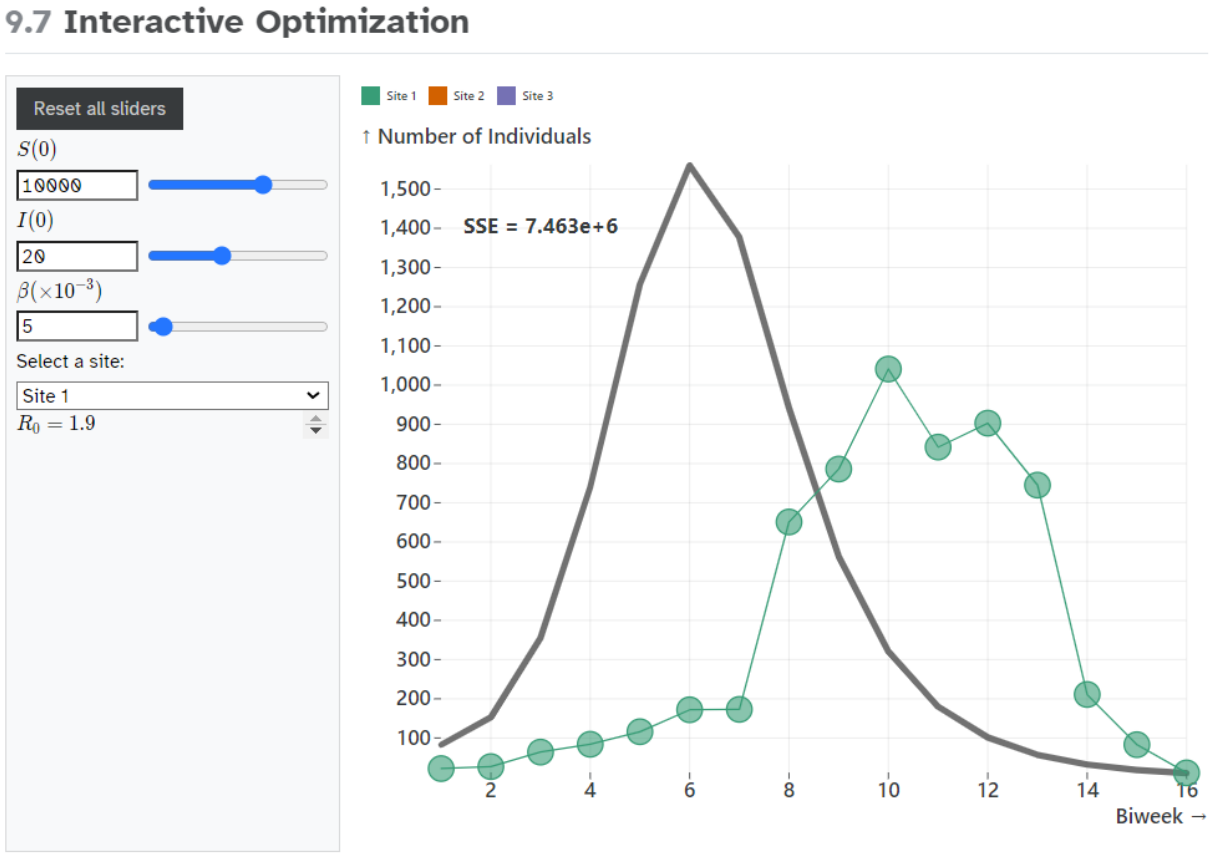
Objectives in this section

- Models can be used to quantitatively interpret data.
- Data can be used to set parameters in models.
- Probability gives us guiding principles for comparing models and data.
- Incorporating sources of uncertainty into models gives them flexibility but it also gives us a lot of new model considerations.

Let’s try it with an SIR model.

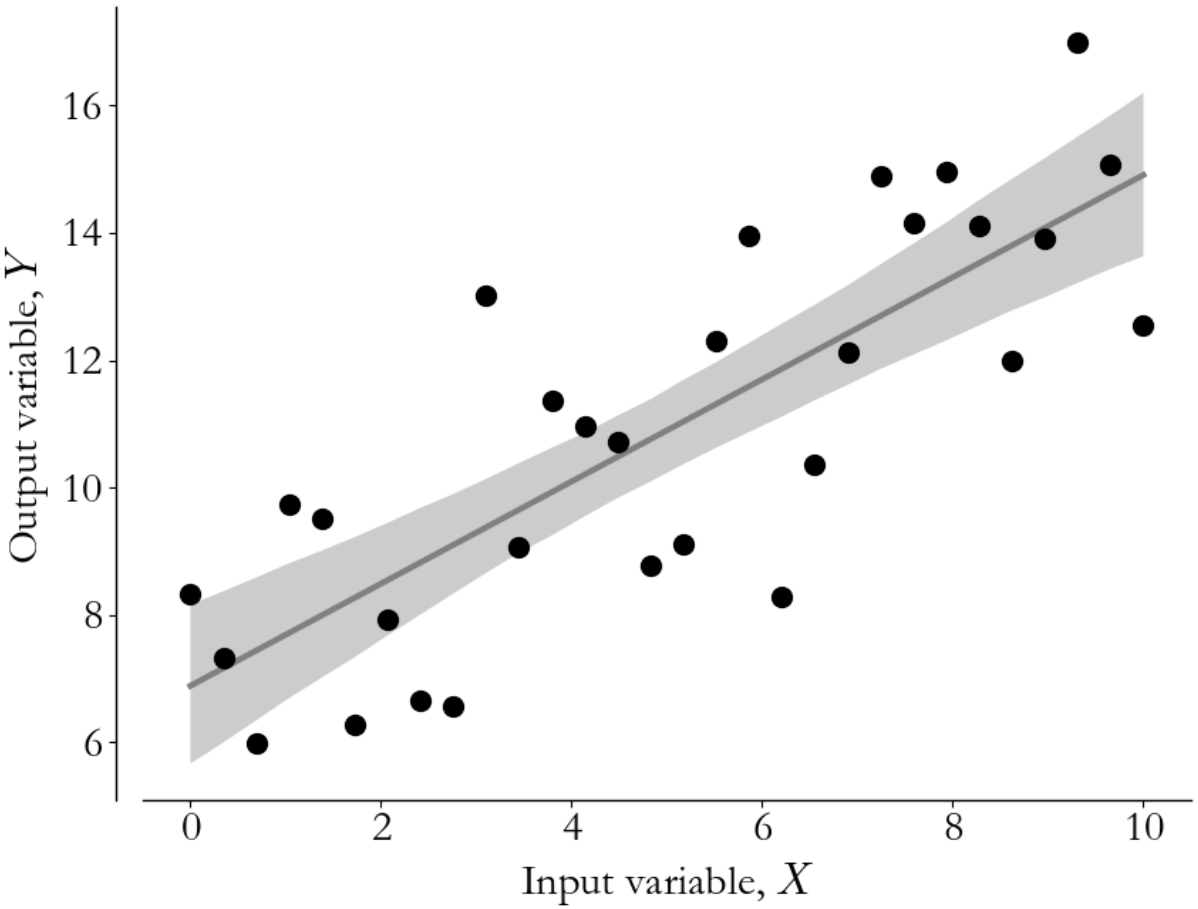
https://sismid2023.callumarnold.com/r-session-03

Start at section 9.5, play at section 9.7

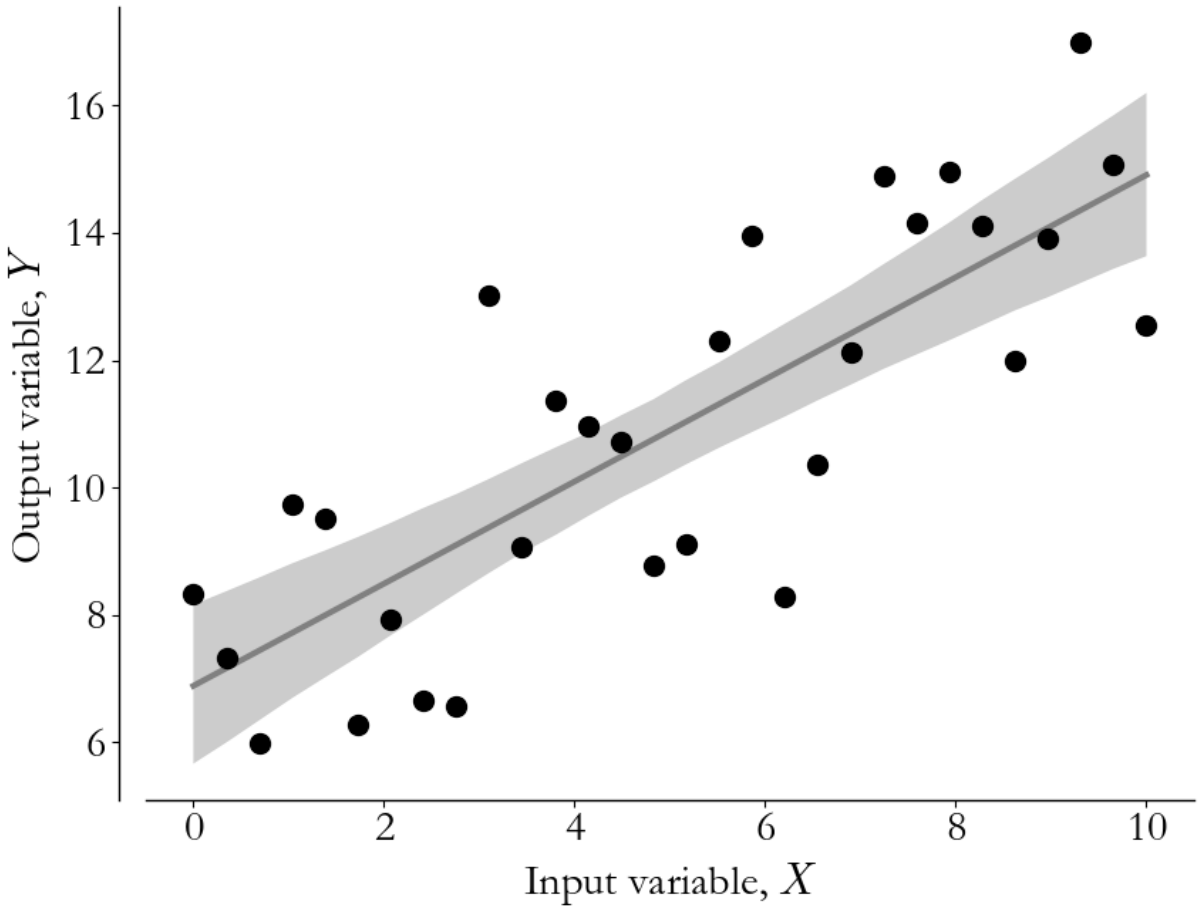


Probability, inference, and linear regression

Let’s write some (pseudo)code



```
# Linear regression pseudo-code
def LinearRegression(X [Nxp],y [Nx1]):

  # Get the problem dimensions
  N,p = dimension(X)

  # Construct the regression operator
  L = inverse(X.T * X)

  # Calculate the MAP estimate
  beta_hat = L * X.T * y

  # Calculate the residuals
  residual = y - X*beta_hat

  # Calculate the covariance matrix
  sigma_sq = sum(residual^2)/(N-1)
  cov = L * sigma_sq

  return beta_hat, cov, residual
```



Let’s revisit the SIR model.

https://sismid2023.callumarnold.com/r-session-03
Start at section 9.8