

POLS/CSSS 503:
Advanced Quantitative Political Methodology

POLS 503 Course Goals

Agenda for this week

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How do we interpret our models?

- $\log(\text{income}) = \alpha + \beta_1 \text{age} + \varepsilon$ ■

or

$$\text{wealth} = \alpha + \beta_2 \text{age} + \beta_3 \text{age}^2 + \varepsilon \quad \blacksquare$$

- $\text{deficit} = \alpha + \beta_4 \text{ideology} + \beta_5 \text{power} + \beta_6 (\text{ideology} \times \text{power}) + \varepsilon$ ■

- $\text{budget}_t = \alpha + \beta_7 \text{budget}_{t-1} + \beta_8 \text{partisan}_t + \varepsilon_t$ ■

- $\text{spend} = \alpha + \beta_9 \text{compete} + \varepsilon$ ■

and

$$\text{compete} = \eta + \beta_{10} \text{spend} + \nu \quad \blacksquare$$

- $\Pr(\text{war}) = (1 - \exp(-\alpha - \beta_{11} \text{distance}))^{-1}$

How do we interpret our models?



The *Challenger* launch decision

What factors influenced the decision to launch on 28 January 1986?

What were the arguments for and against launching?

What were the consequences of the launch decision?

What lessons can be learned from the Challenger launch decision?

What role did the media play in the Challenger launch decision?

What role did the military play in the Challenger launch decision?

What role did the NASA management play in the Challenger launch decision?

What role did the Challenger crew play in the launch decision?

What role did the Challenger launch decision play in the history of the space shuttle program?

What role did the Challenger launch decision play in the history of the United States space program?

What role did the Challenger launch decision play in the history of the world space program?

The *Challenger* launch decision

What factors influenced the decision to launch on 28 January 1986?

What were the arguments for and against launching?

What were the consequences of the launch decision?

What lessons can be learned from the *Challenger* launch decision?

How can decision-making processes be improved in the future?

What role should safety and risk assessment play in launch decisions?

How can communication and transparency be enhanced in decision-making?

What impact did the *Challenger* launch decision have on the space industry?

What are the ethical considerations surrounding the *Challenger* launch decision?

How can the *Challenger* launch decision be used as a case study for decision analysis?

What are the key takeaways from the *Challenger* launch decision?

The *Challenger* launch decision

Yes 70

Yes 53

Yes 57

Yes 79

Yes 63

Yes 58

Yes 70



The *Challenger* launch decision

Yes 53
Yes 57
Yes 58
Yes 63

Yes 70

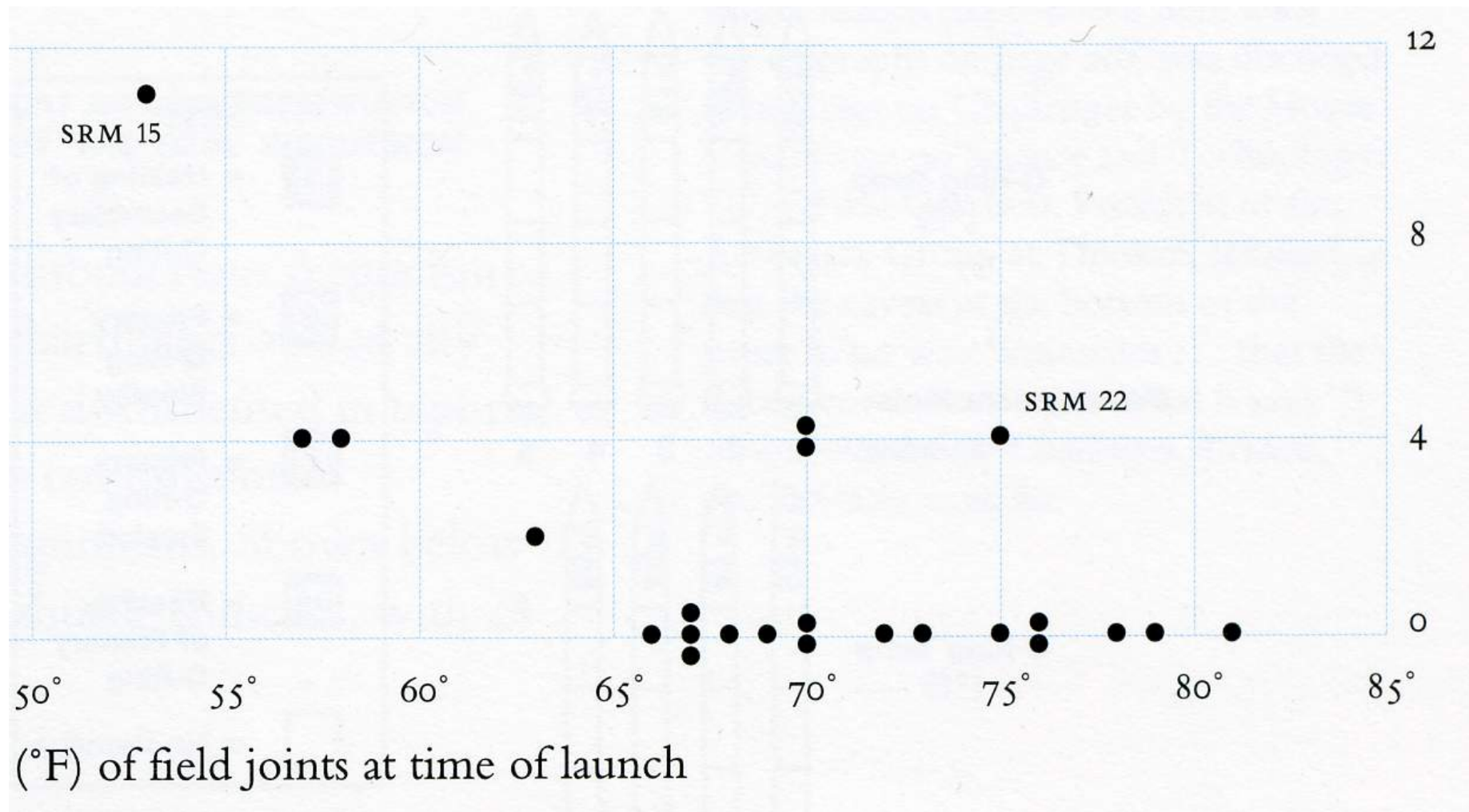
Yes 70

Yes 79

The *Challenger* launch decision



The *Challenger* launch decision



The *Challenger* launch decision

What factors influenced the decision to launch on 28 January 1986?

What were the arguments for and against launching?

What were the consequences of the launch decision?

What lessons can be learned from the *Challenger* launch decision?

What role did the media play in the launch decision?

What role did the military play in the launch decision?

What role did the NASA engineers play in the launch decision?

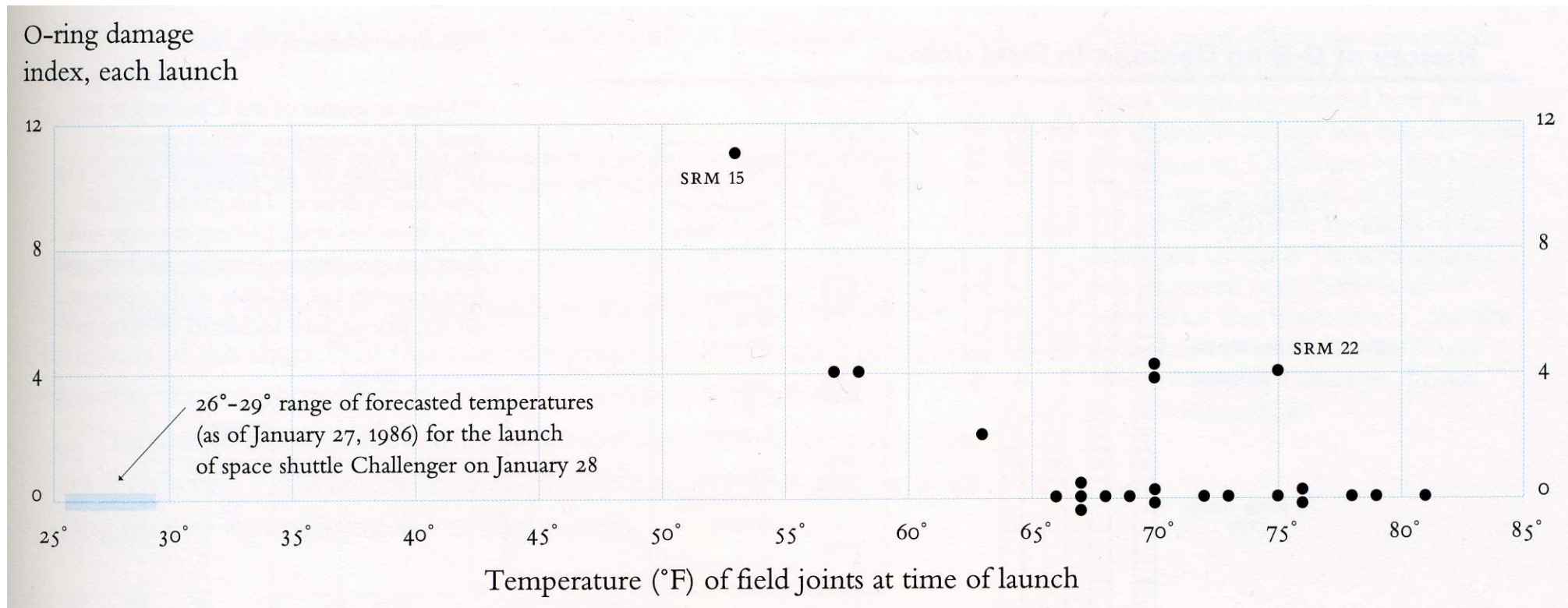
What role did the NASA managers play in the launch decision?

What role did the NASA contractors play in the launch decision?

What role did the NASA customers play in the launch decision?

What role did the NASA public play in the launch decision?

The *Challenger* launch decision

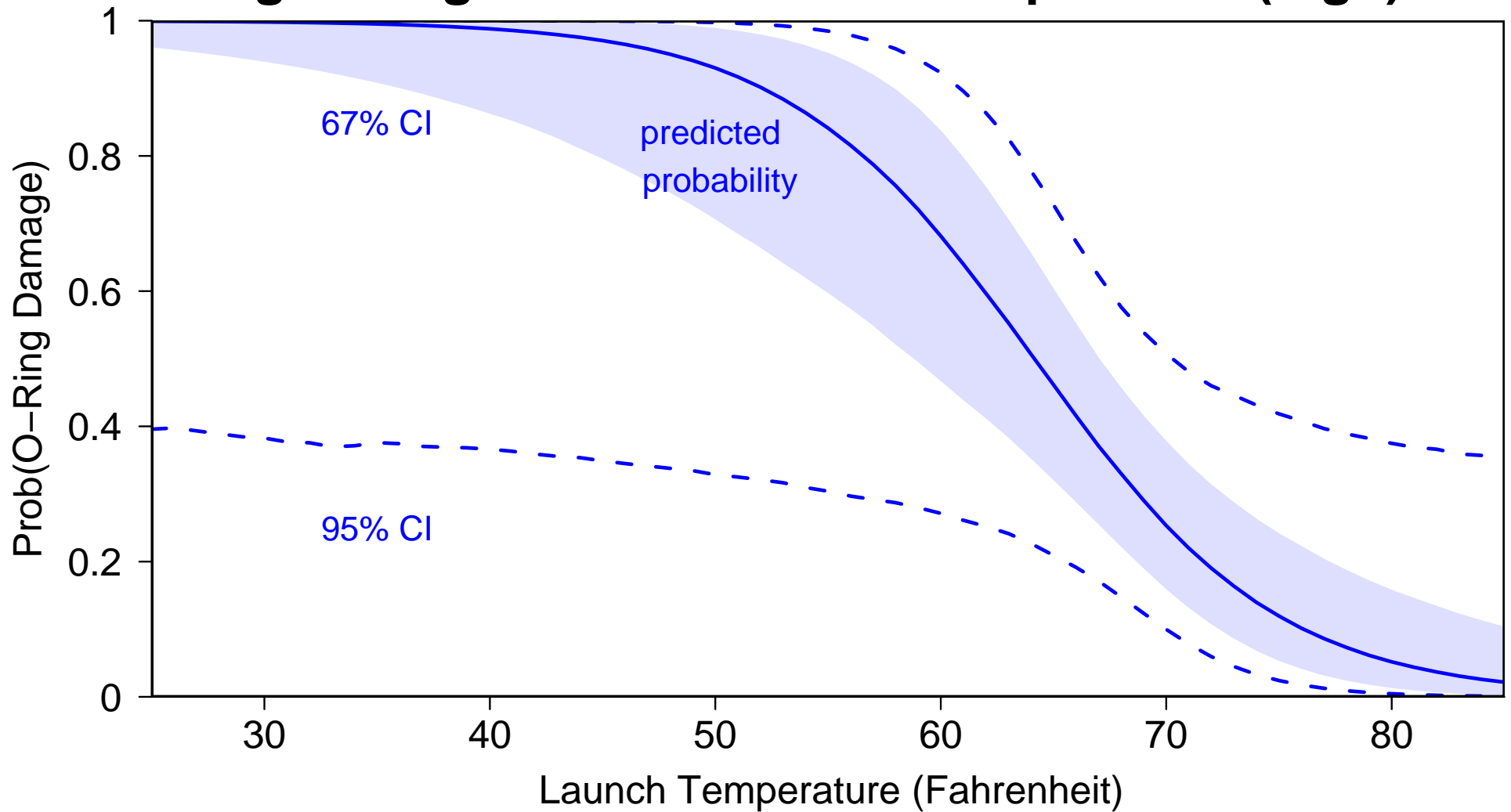


The *Challenger* launch decision

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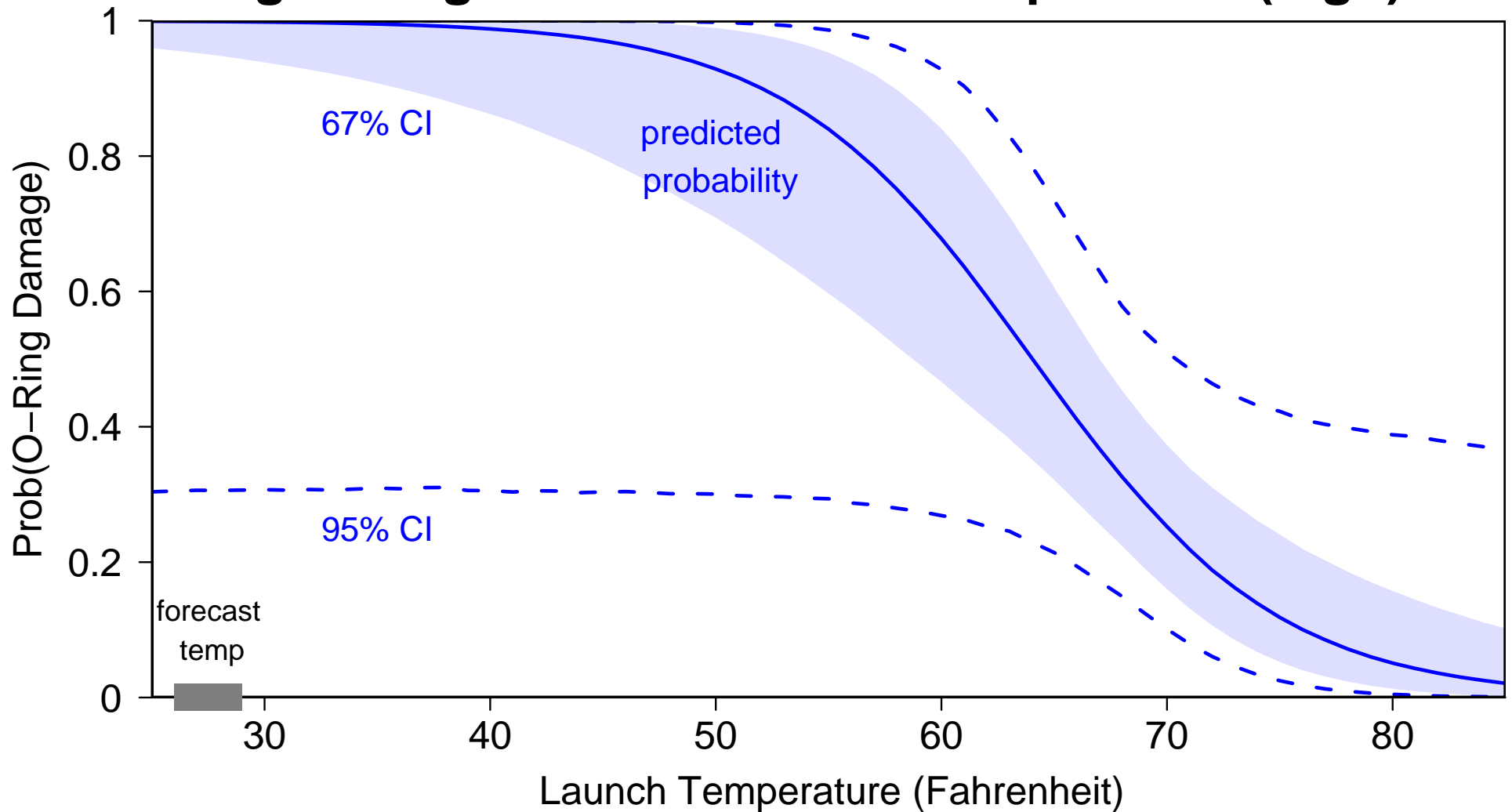
The *Challenger* launch decision

O-Ring damage as a function of temperature (logit)



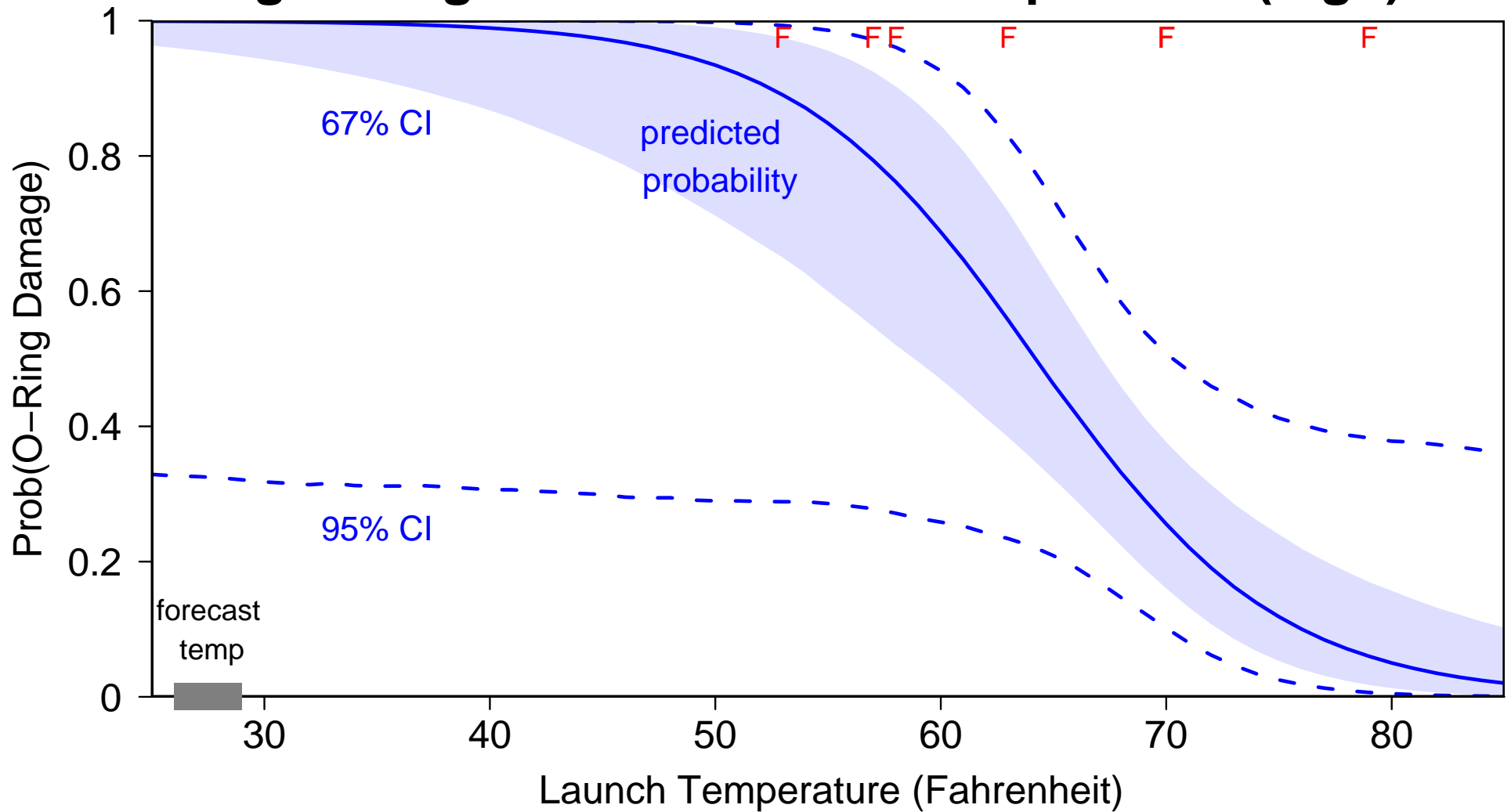
A picture clearly shows non-linear model predictions *and* uncertainty

O-Ring damage as a function of temperature (logit)



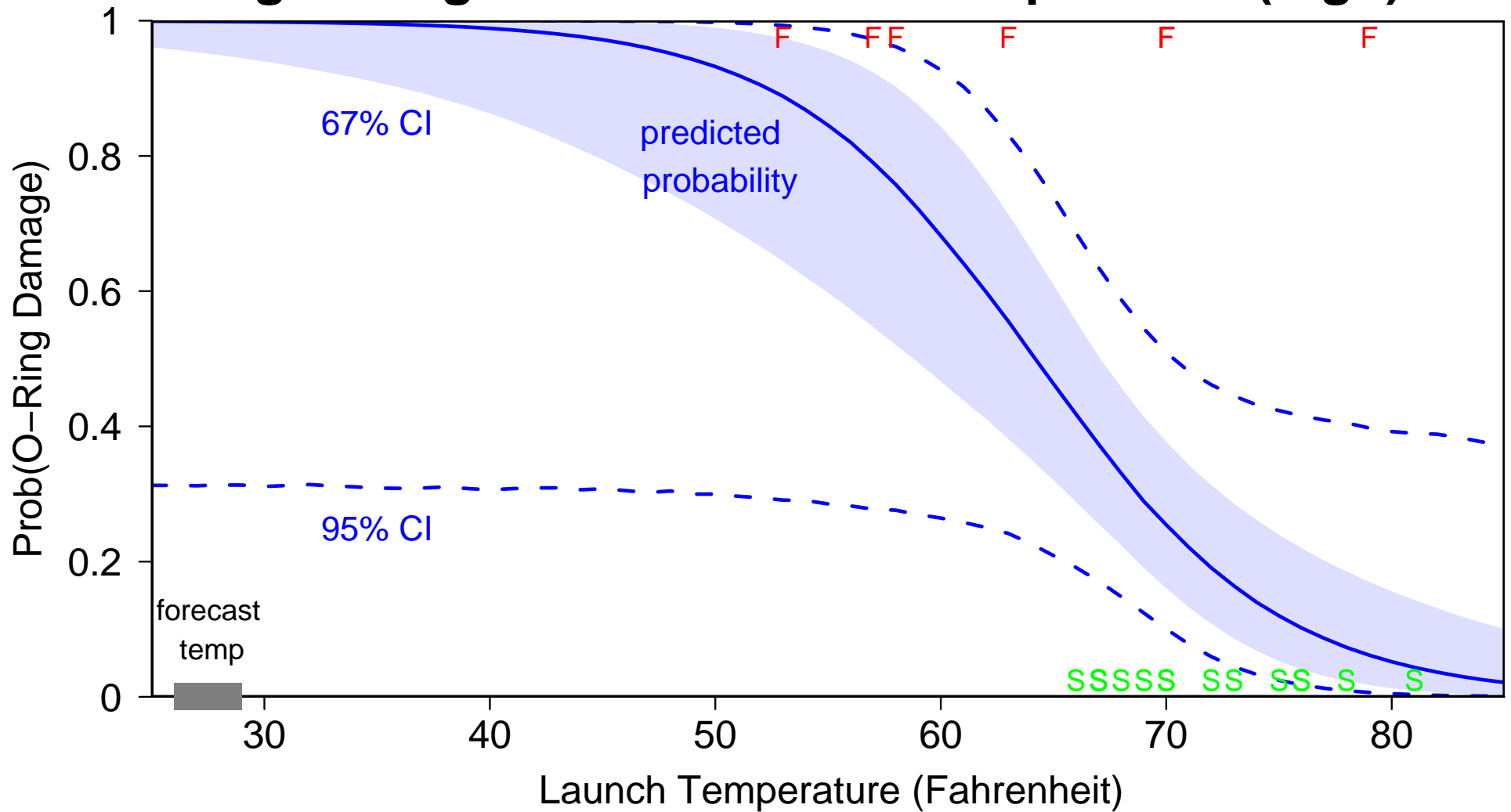
And gives a more precise sense of how foolhardy launching at 29 F is.

O-Ring damage as a function of temperature (logit)



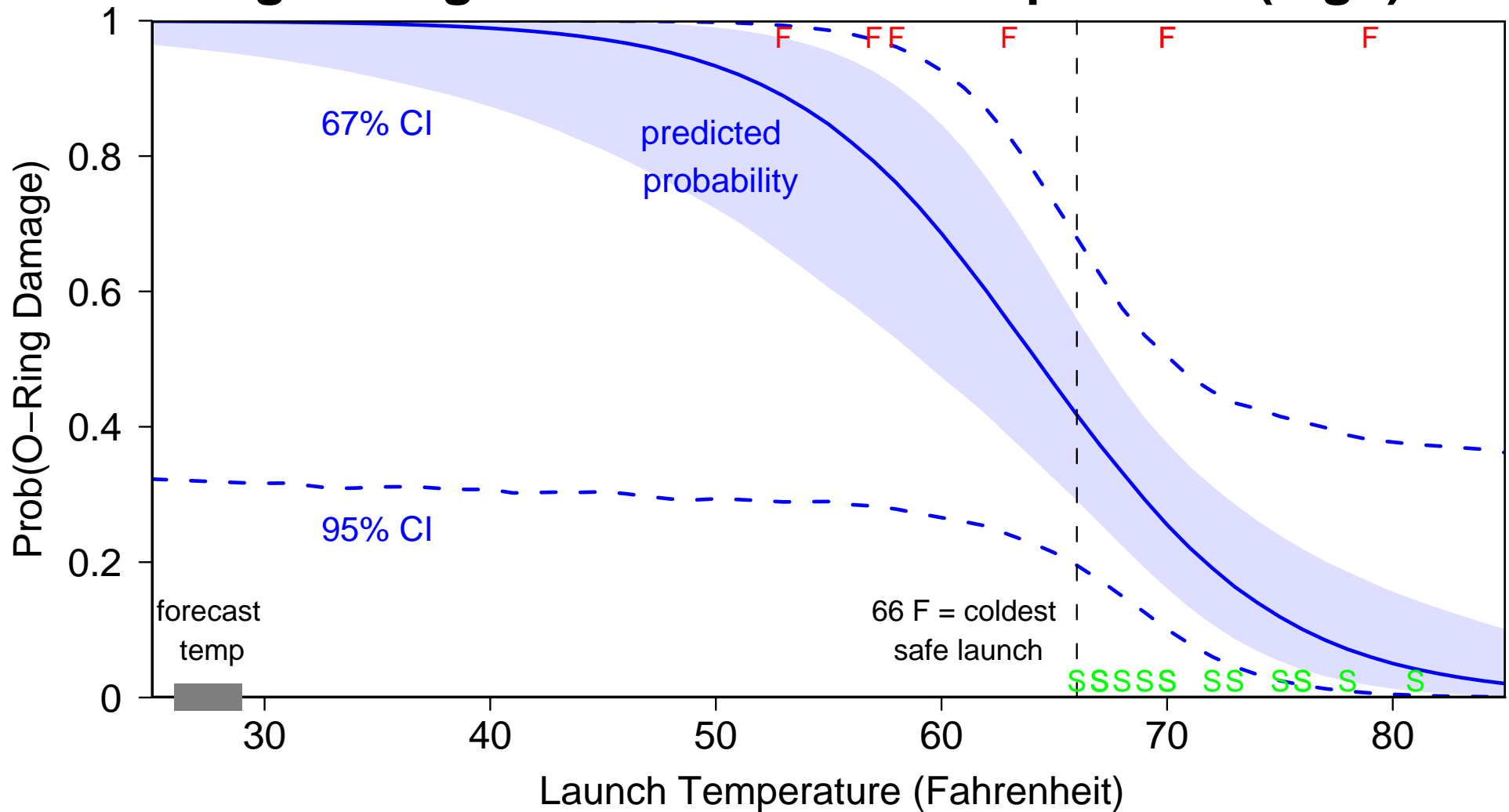
It's also good to show the data giving rise to the model.

O-Ring damage as a function of temperature (logit)



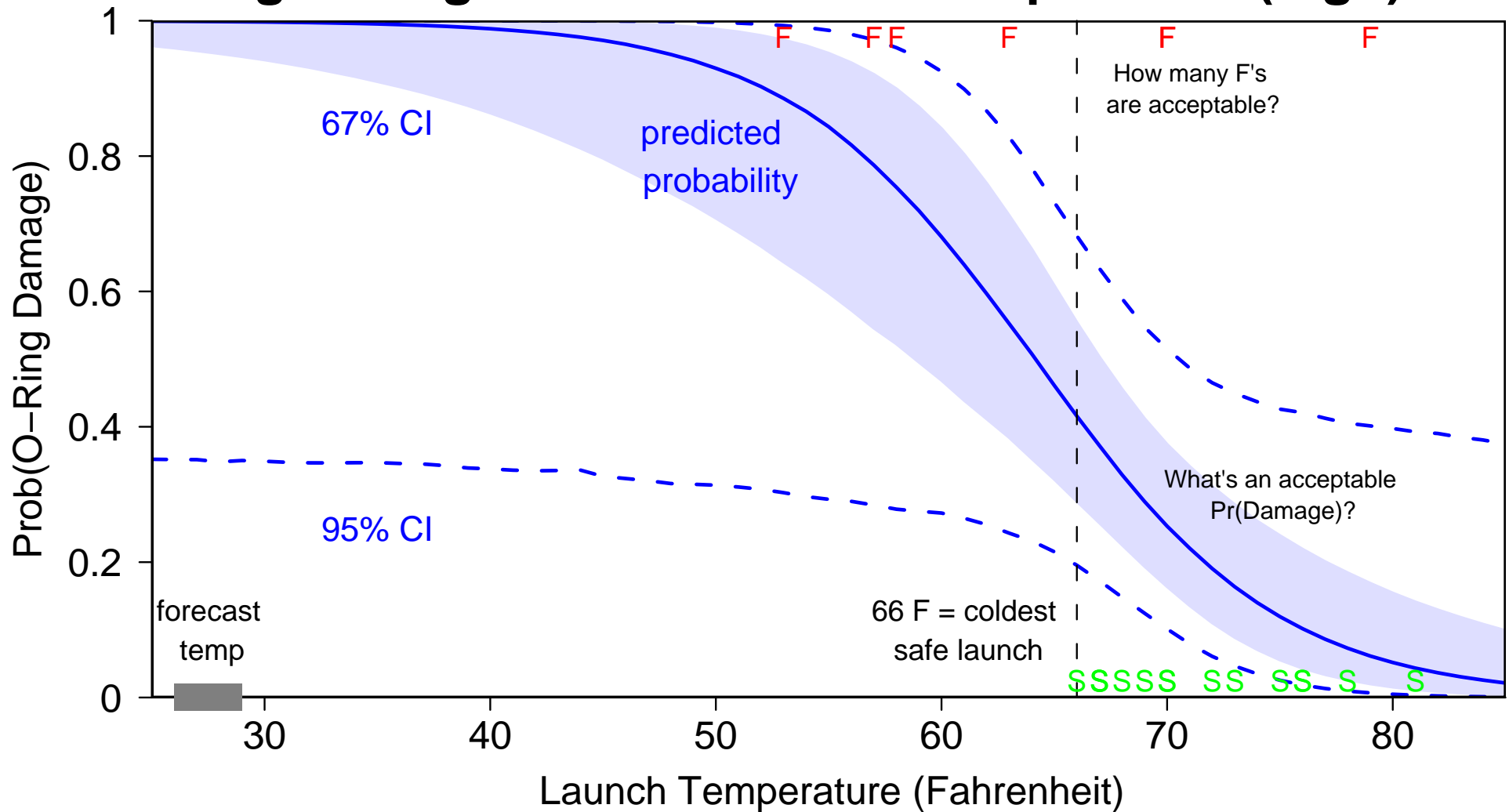
Remembering that the Failures are only meaningful compared to Successes

O-Ring damage as a function of temperature (logit)



Looking just at the data tempts us to say that launches under 66 F are virtually guaranteed O-ring failures. This inference is based on an unstated model.

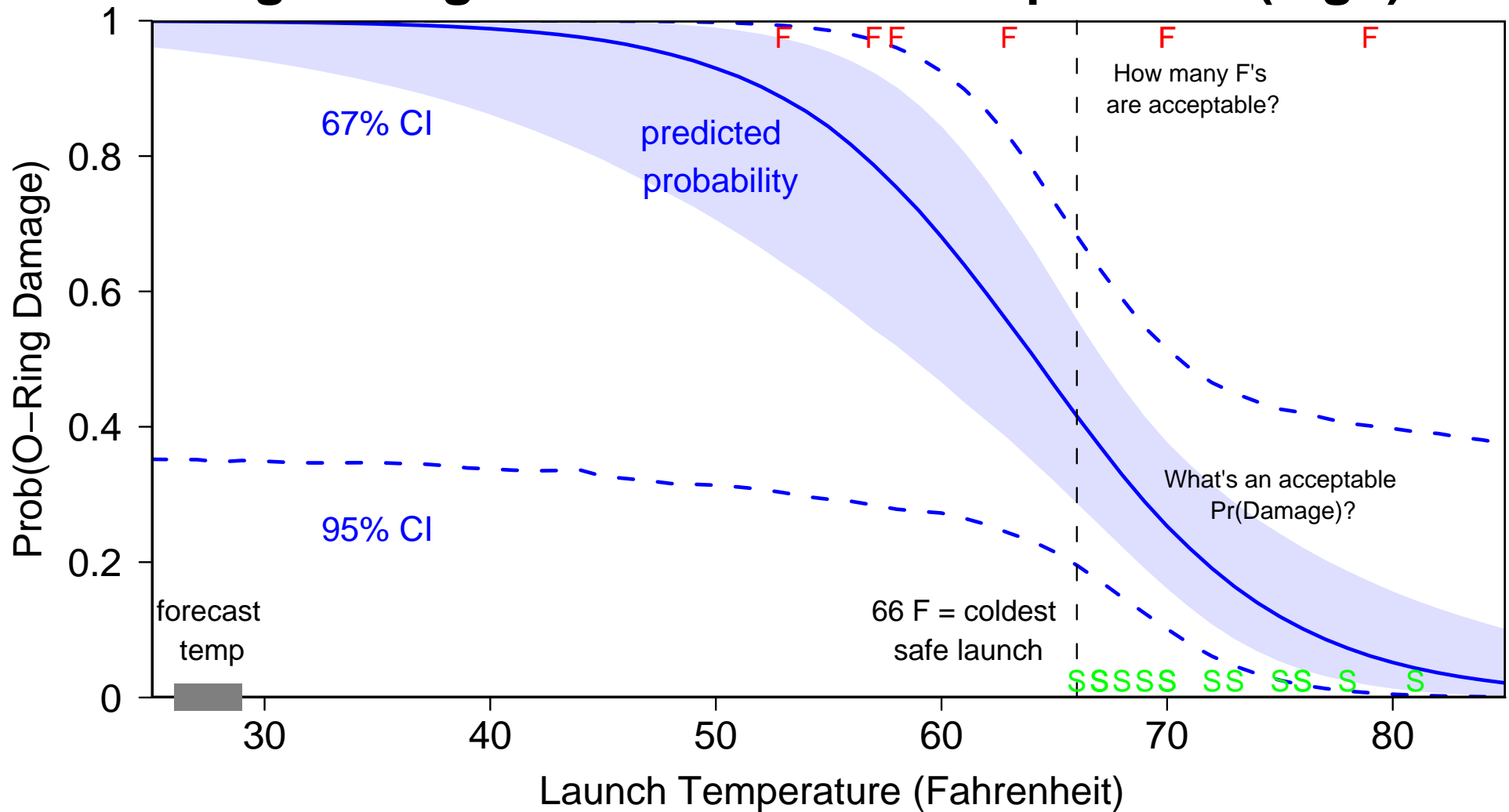
O-Ring damage as a function of temperature (logit)



But the estimated logit model should give us pause.

There is a significant risk of failure across the board.

O-Ring damage as a function of temperature (logit)



What is an acceptable risk of O-ring failure?

Was the shuttle safe at any temperature?



Going further



Going further

Why R?



Why R?

Why R?



Introduction to R

Introduction to R

Introduction to R

Introduction to R

Entering code

Data types

Some special values

Data structures

Vectors in \mathbb{R}^n

Definition 1

Definition 2

Definition 3

Definition 4

Definition 5

Definition 6

Definition 7

Definition 8

Definition 9

Definition 10

Definition 11

Definition 12

Vectors in \mathbb{R}^n

Definition 1

Definition 2

Definition 3

Definition 4

Definition 5

Definition 6

Definition 7

Definition 8

Definition 9

Definition 10

Definition 11

Definition 12

Vectors in \mathbb{R}^n

Definition 1

Definition 2

Definition 3

Definition 4

Definition 5

Definition 6

Definition 7

Definition 8

Definition 9

Definition 10

Definition 11

Definition 12

Matrices in R

Matrices in R

Matrices in R

Matrices in R

Dataframes in R

Dataframes

Loading data

Benefits and dangers of attach()

Benefits of attach():

1. Attach() allows you to attach a new file to an existing process.

2. Attach() allows you to attach a new file to an existing process without having to create a new process.

3. Attach() allows you to attach a new file to an existing process without having to create a new process.

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9. Attach() allows you to attach a new file to an existing process without having to create a new process.

10. Attach() allows you to attach a new file to an existing process without having to create a new process.

Missing data

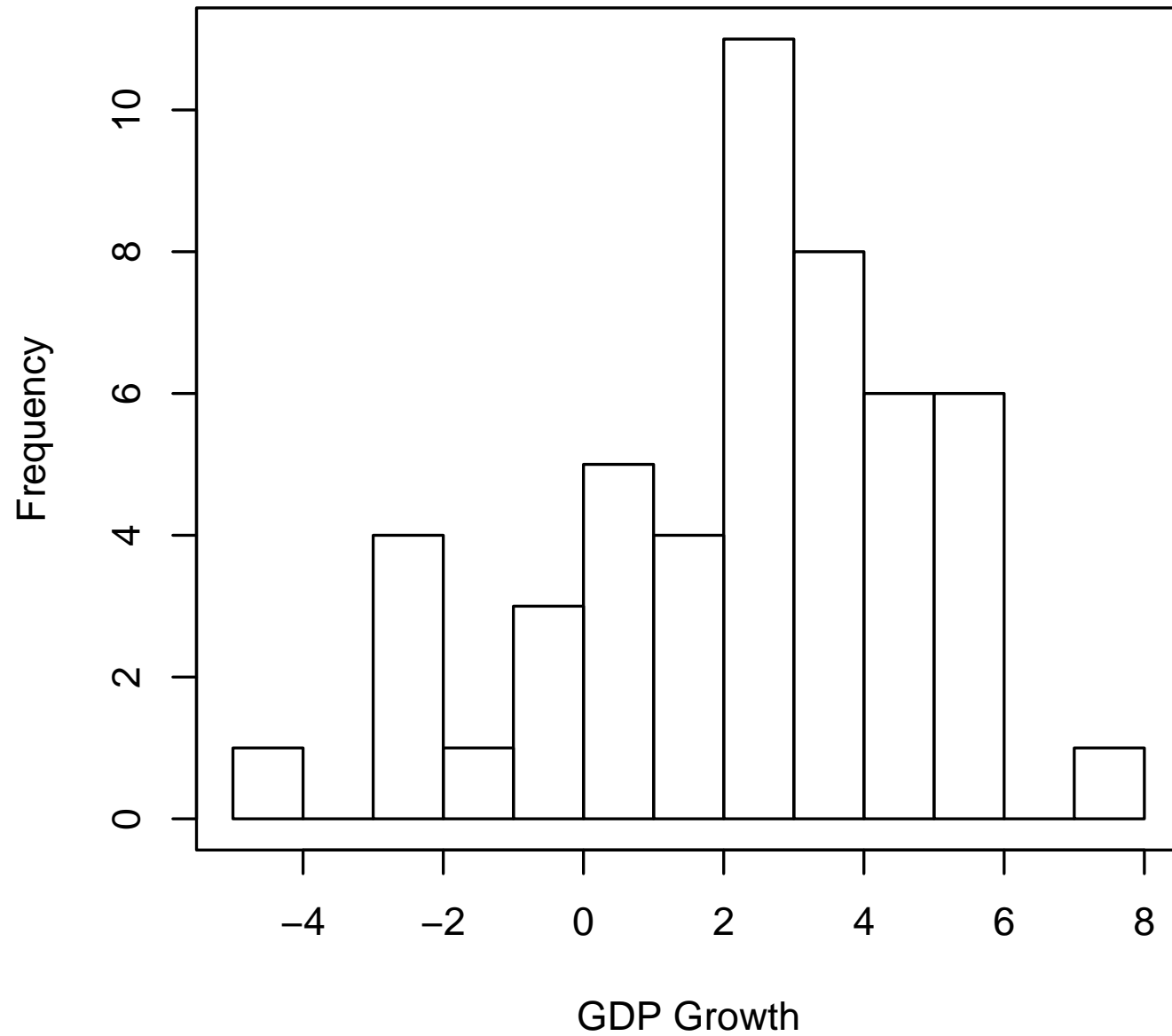
Missing data

Mathematical Operations

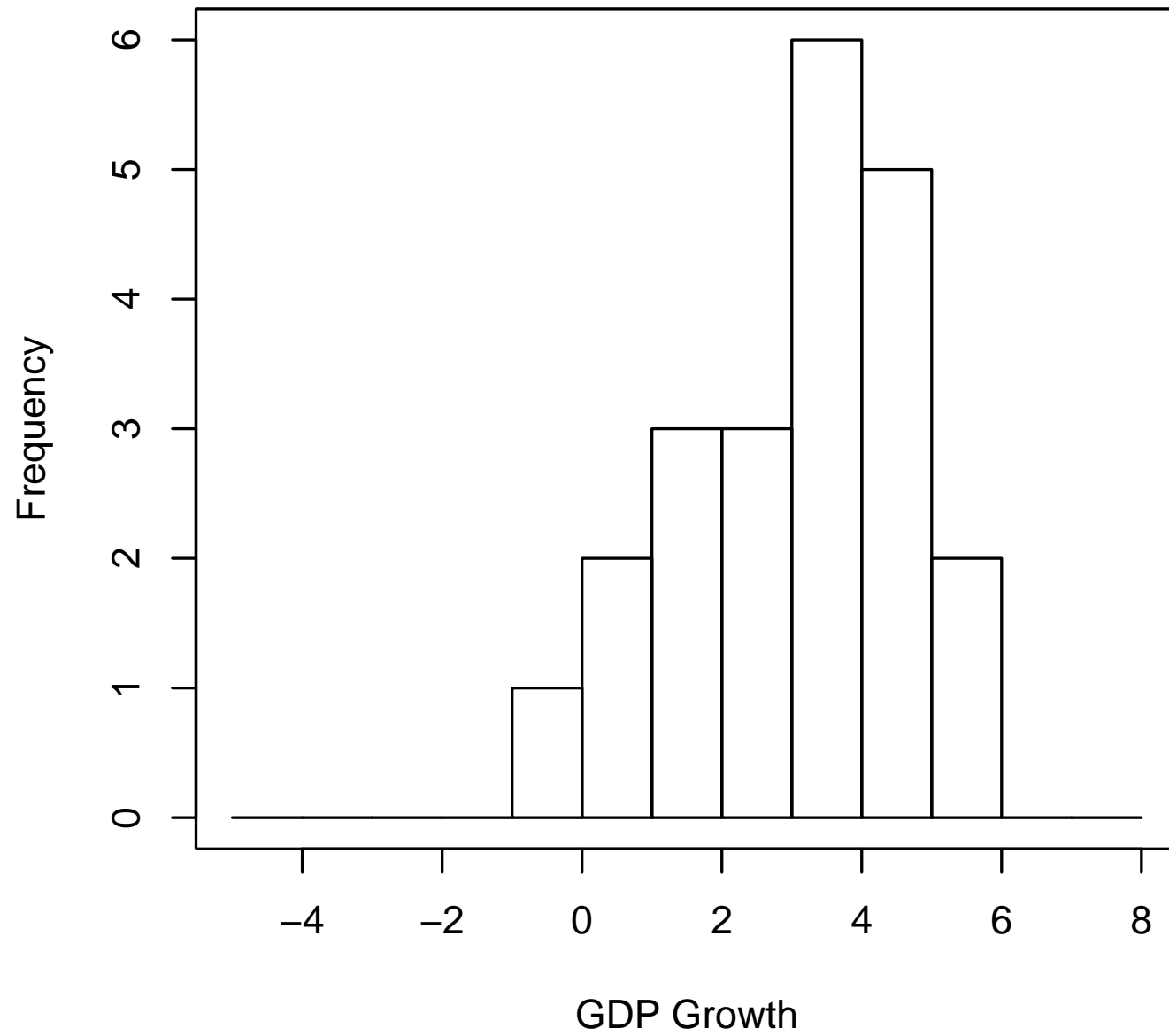
Example 1: US Economic growth

Example 1: US Economic growth

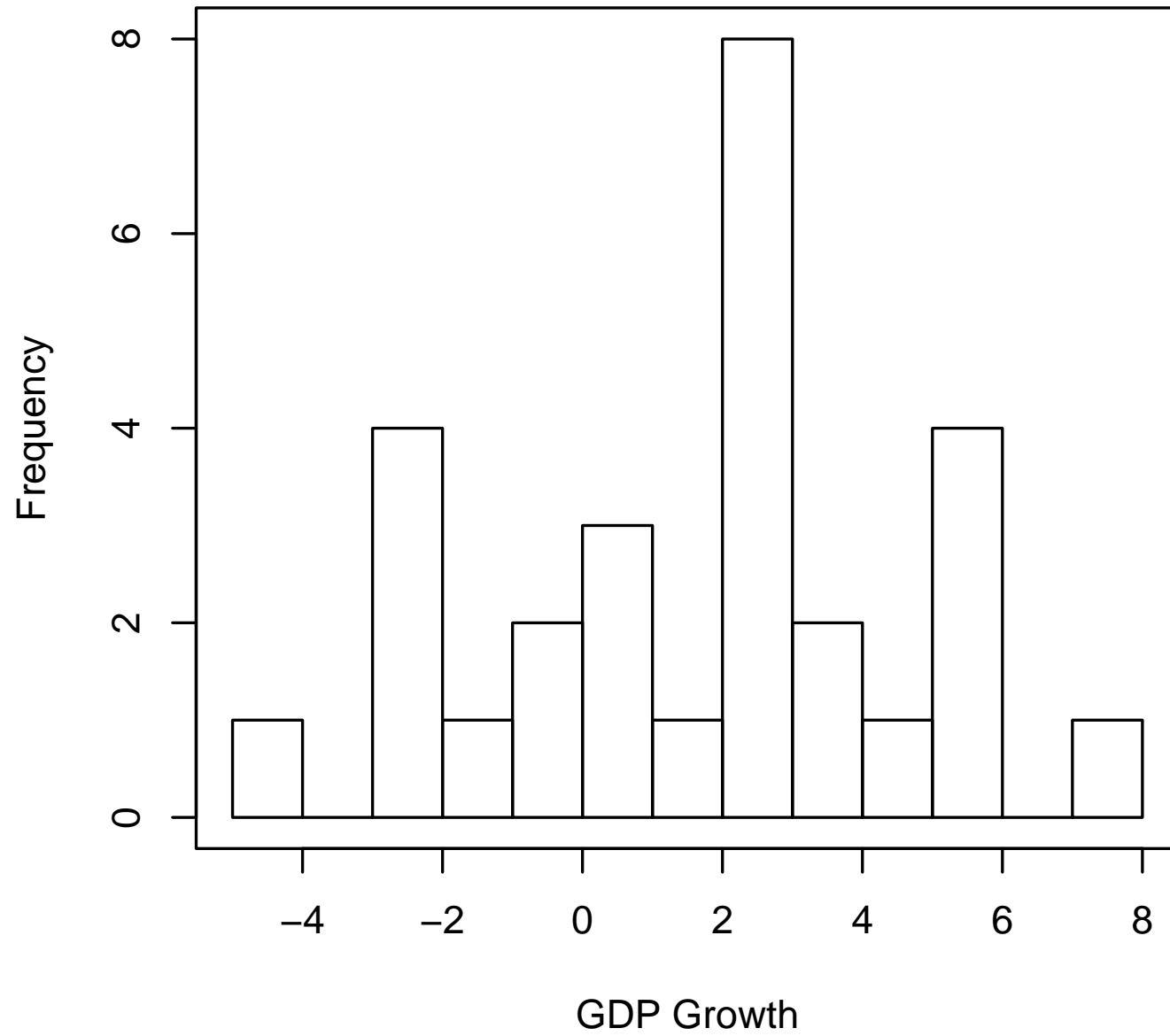
Histogram of US GDP Growth, 1951--2000



GDP Growth under Democratic Presidents

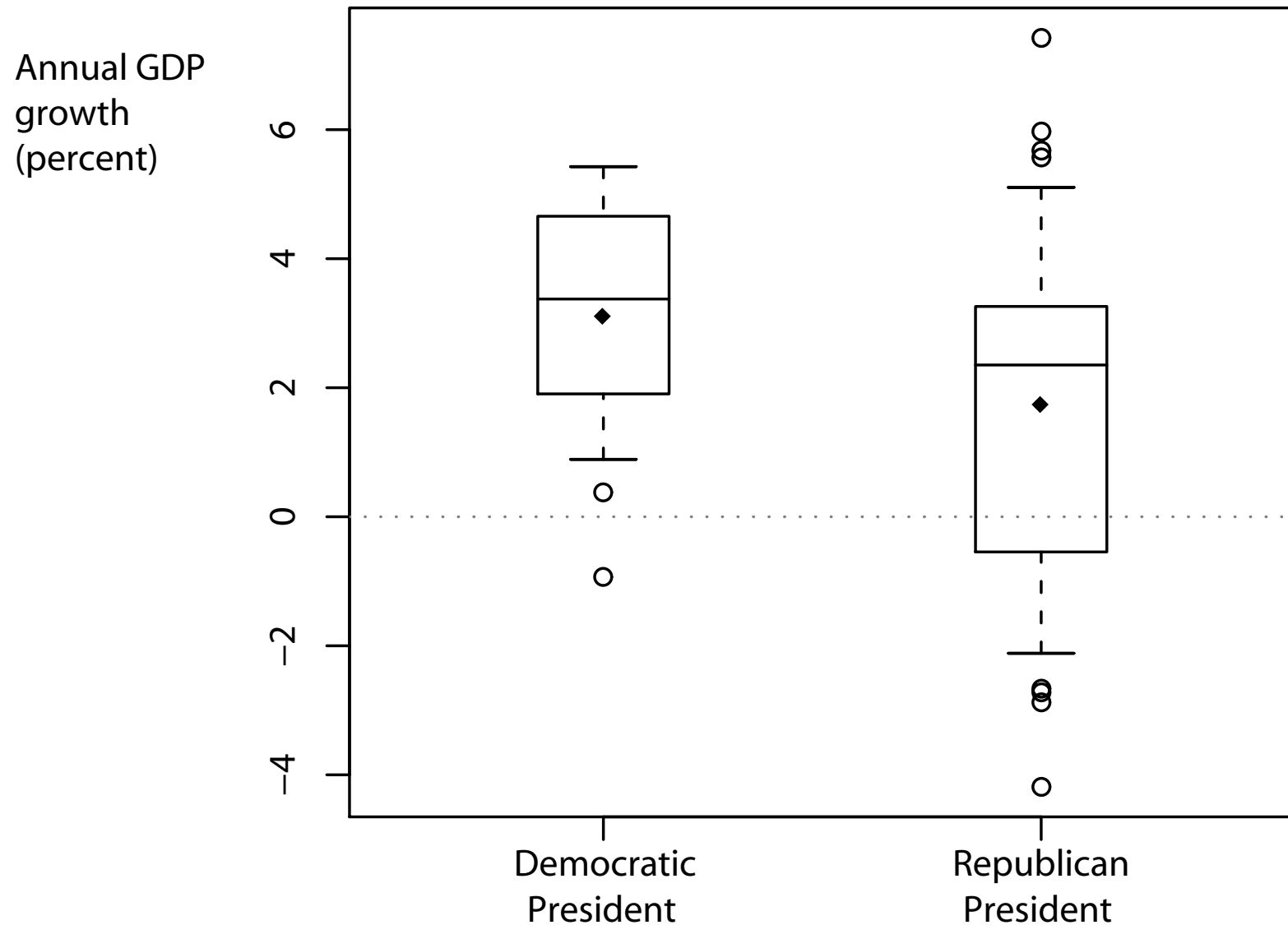


GDP Growth under Republican Presidents



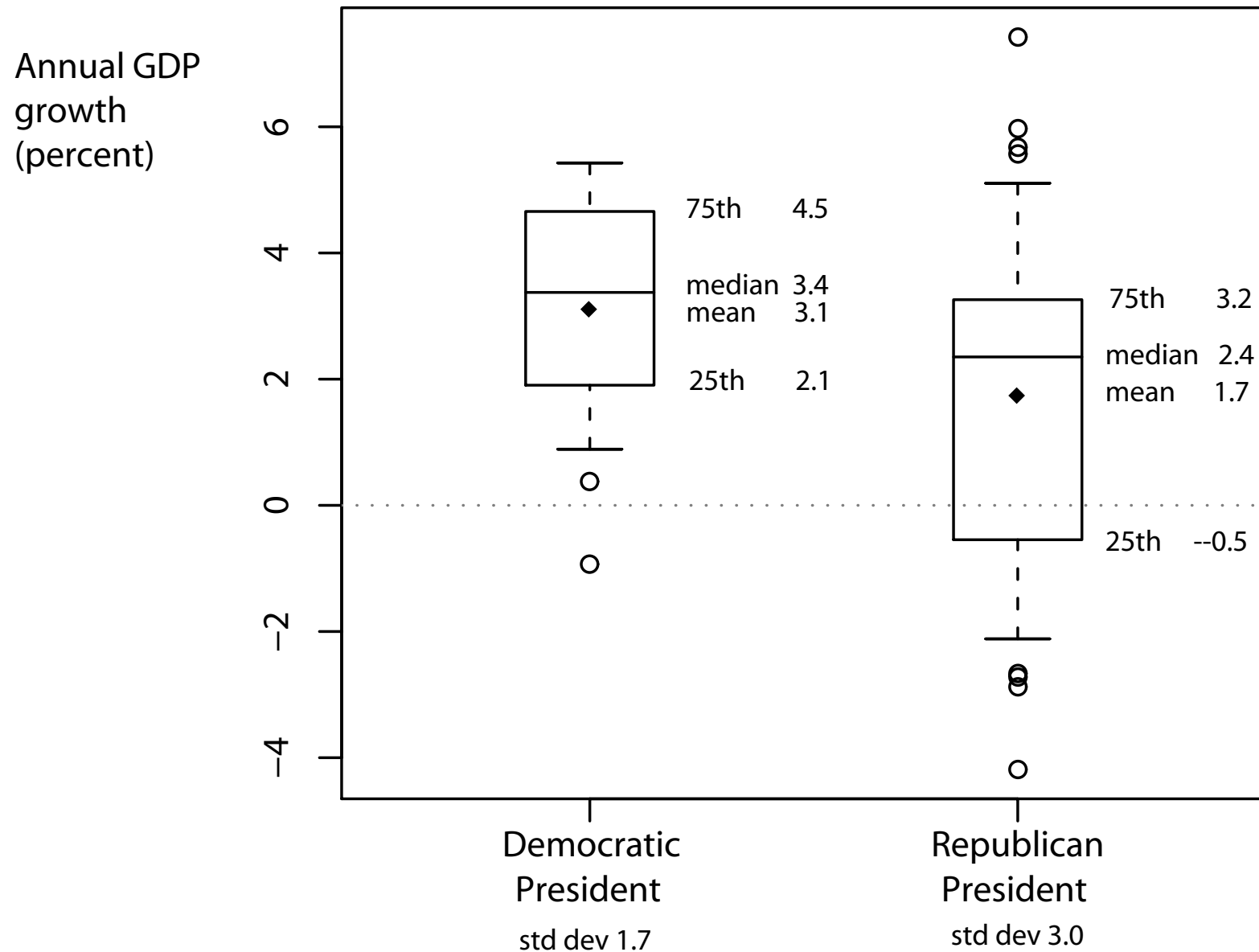
Box plots: Annual US GDP growth, 1951–2000

Economic performance of partisan governments



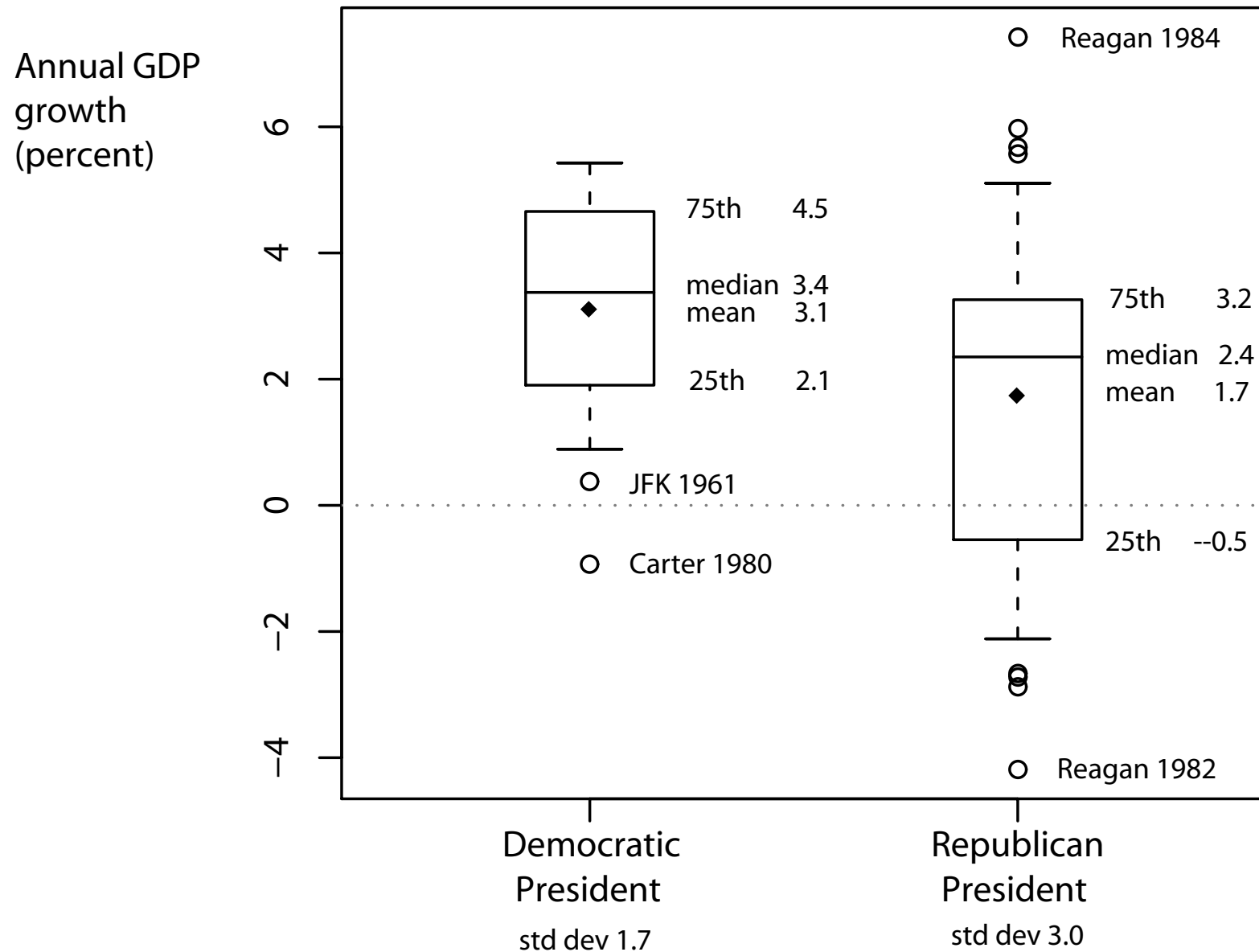
Box plots: Annual US GDP growth, 1951–2000

Economic performance of partisan governments



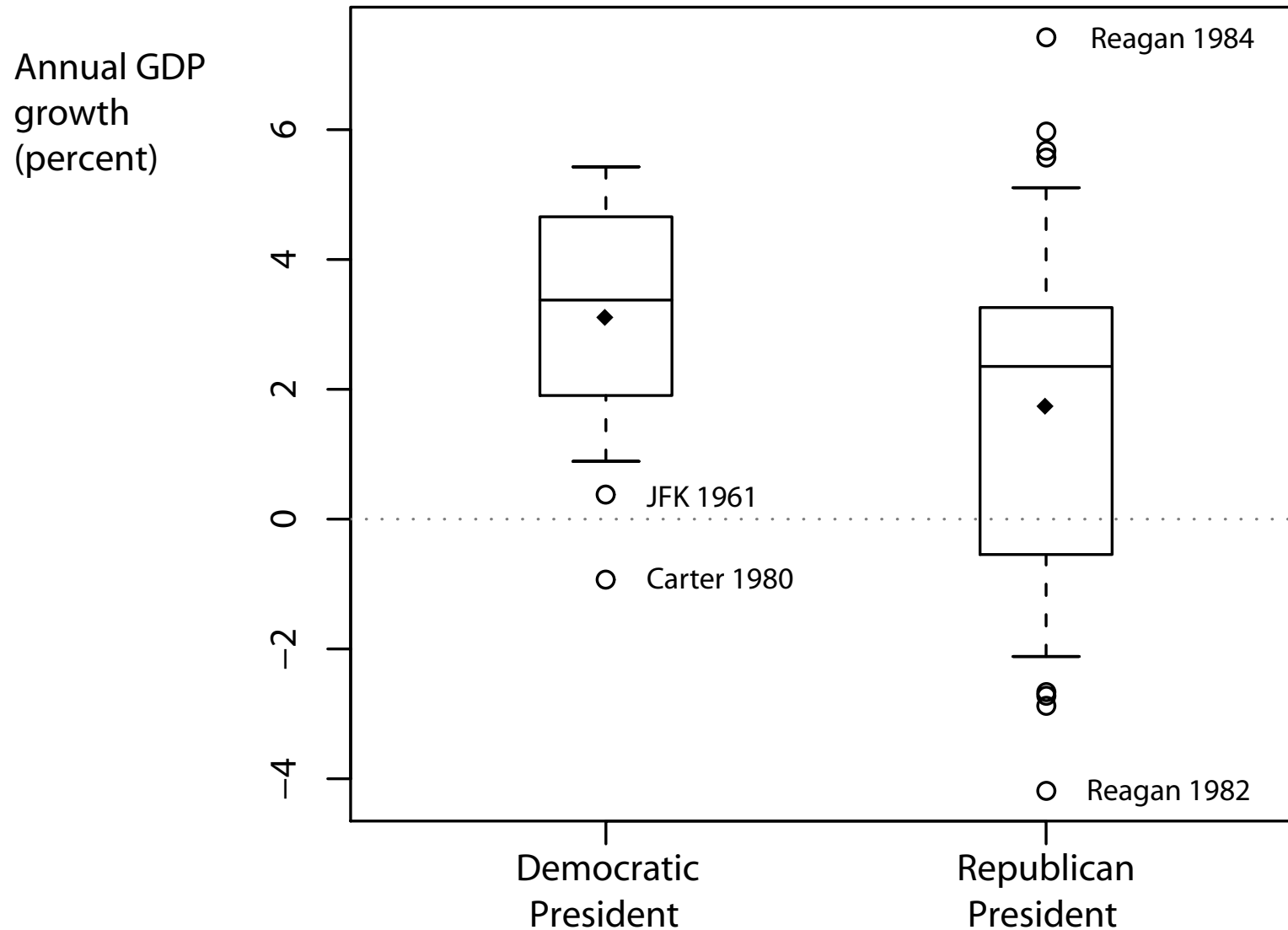
Box plots: Annual US GDP growth, 1951–2000

Economic performance of partisan governments



Box plots: Annual US GDP growth, 1951–2000

Economic performance of partisan governments



Help!

Installing R on a PC



Installing R on a Mac



Editing scripts



Editing data

1. Edit data

2. Edit data

3. Edit data

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10. Edit data

11. Edit data

12. Edit data

13. Edit data

Example 2: A simple linear regression

Example 2: A simple linear regression

Example 2: A simple linear regression

Example 2: A simple linear regression

Data and Prediction

**Average fertility rates & contraception;
50 developing countries**

