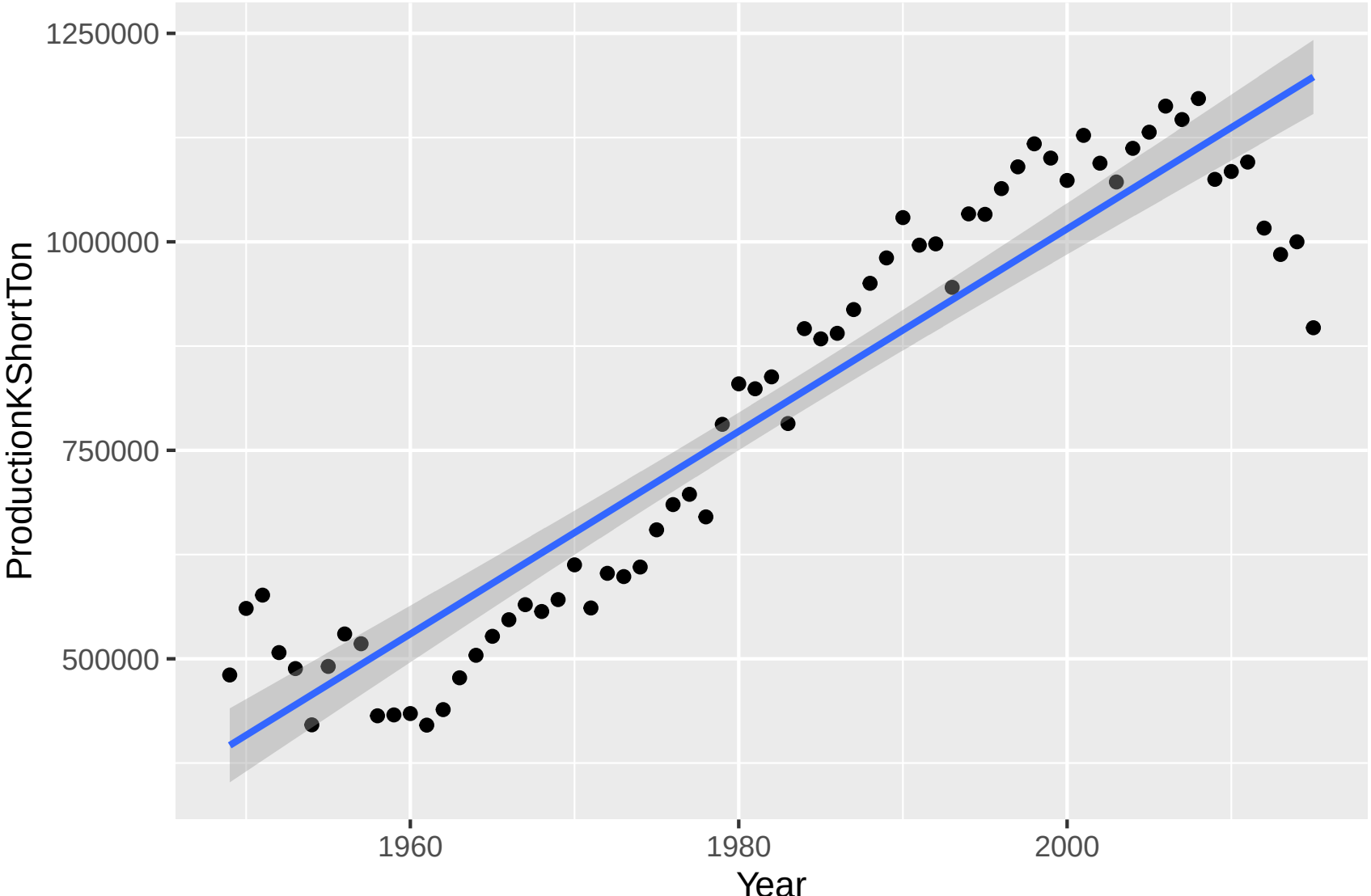
Energy Models

Overview of Energy Models

- Trend
- Time Series
- Guess based on experience
- Survey Based
- Scenario Planning
- I/O Models
- Energy Balance Models
- End Use
- Process Modeling
- Game Theory
- Experimental/Behavioral

Trend

- Uses only patterns of the past to make forecasts about the future.
- Cram a line though the data.



Trend Comments

- Regression with time as RHS variable. $Y = time + \epsilon$
- EC469 shows you how to do this.
- Not everything is a line. You sometimes have to transform the data, logs and such are common.
- Only uses the past.
  - I was 90 lbs at 15, 110 at 17, 130 at 18 and 220 at 26.
  - Today?
- People don't react to prices and there is no change in technology.
- That said, it works for alot of things and work when you have little time.
- Plenty of energy modeling looks like this.
  - If you don't have the time, throw in a trend line.

Time Series

- Similar to trend only
  - May have $Y = ARMA(p, q)$
  - or include a trend $Y = time + ARMA(p, q)$
- EC 472 shows you how to do this.
- Most energy data has a trend to it, which must be included in the model.
- Best thought of as a refinement to the trend regressions with better treatment of residuals.
  - More accurate confidence intervals on existing data.
  - Slightly better with near-term forecasts.
- Same problems as pure regression on trend.
- If you have an extra few minutes, do this.

Guess based on experience

- Don't laugh, this works.
- Old hands make very good guesses based on experience.
- GDP even has components that are based on analysists best judgement.

Survey Based

- Book gives some examples.
- Ask a bunch of experts about their best judgement and summarize
- Often expanded as a Delphi Survey
- For comically bad forecast see “Results of the Delphi IX Survey of Oil Forecasts” California Energy Comission, 1997.

Delphi Surveys

- Ask each person in private for best guess.
- Compile results.
- Ask outliers why they said what they did.
- Give everyone:
  - The distribution of guesses for each parameter
  - The reasons the outliers gave for the answer the gave.
- Ask for another guess.
- Report the new distribution or repeat if desired.

Scenario Planning

I/O Models

- Old school – 1920s Leontief
- Has an equilibrium concept
- Assumes fixed ratios are used in production
  - No reaction to price changes
  - No reaction to input price changes
  - Constant returns to scale.
- Often seen as part of a computable general equilibrium model to shorten run-times. REMI and IMPLAN use it in regional economic models.
- Will not as you to do one unless you want to.
- Book has an overly long explanation.

Walk Through I/O model

$x_1 = \alpha_{1,1}x_1 + \alpha_2 x_{1,2} + d_1$

- x_1 is how much of good one that gets made.
- d_1 is how much final consumers want of good 1.
- $\alpha_{1,1}$ the ammount of good 1 needed to produce good 1.
- $\alpha_{1,2}$ the ammount of good 1 needed to produce good 1.
- Each good has an equation
- α can be zero but there are restrictions on how many and where. The matrix needs to be invertable.

Matrix Form $x = Ax + d$ is solved as $x = (I - A)^{-1}d$

Energy Balance Models

End Use Modeling

Process Modeling

Game Theory

- Not a full all economy model but a tool used to deal with decisons where:
  - There is not a monopoly or monopsony.
  - Not perfect competition.
- Also used for:
  - Dynamic interactions of firms, think how gasoline prices go up fast but down slow.
  - Auction and bidding, technically mechanism design which is game theory backwards, to get people to tell the truth or do the right thing.
  - Basis for a lot of modern "regulation" which focuses on encouraging competition to reach goals.
- Probably did some in 201 or 311.

Experimental/Behavioral

- Admit that people and firms do not act rationally.
- Old school experiments run on people
- Field experiments are common in economics now
  - Esther Duflo recieved the Bates Clark Award 2010
  - Bluffstone in Econ is running two now in Ethiopia and Nepal.
- Typical Issues
  - Internal validity
    - Can you really connect cause to effect?
    - Did you avoid bias and control for everything?
  - External validity
    - Does it work in real life?
    - Does it work on other people?
  - Ecological validity
    - Did the experiment look like the real world?