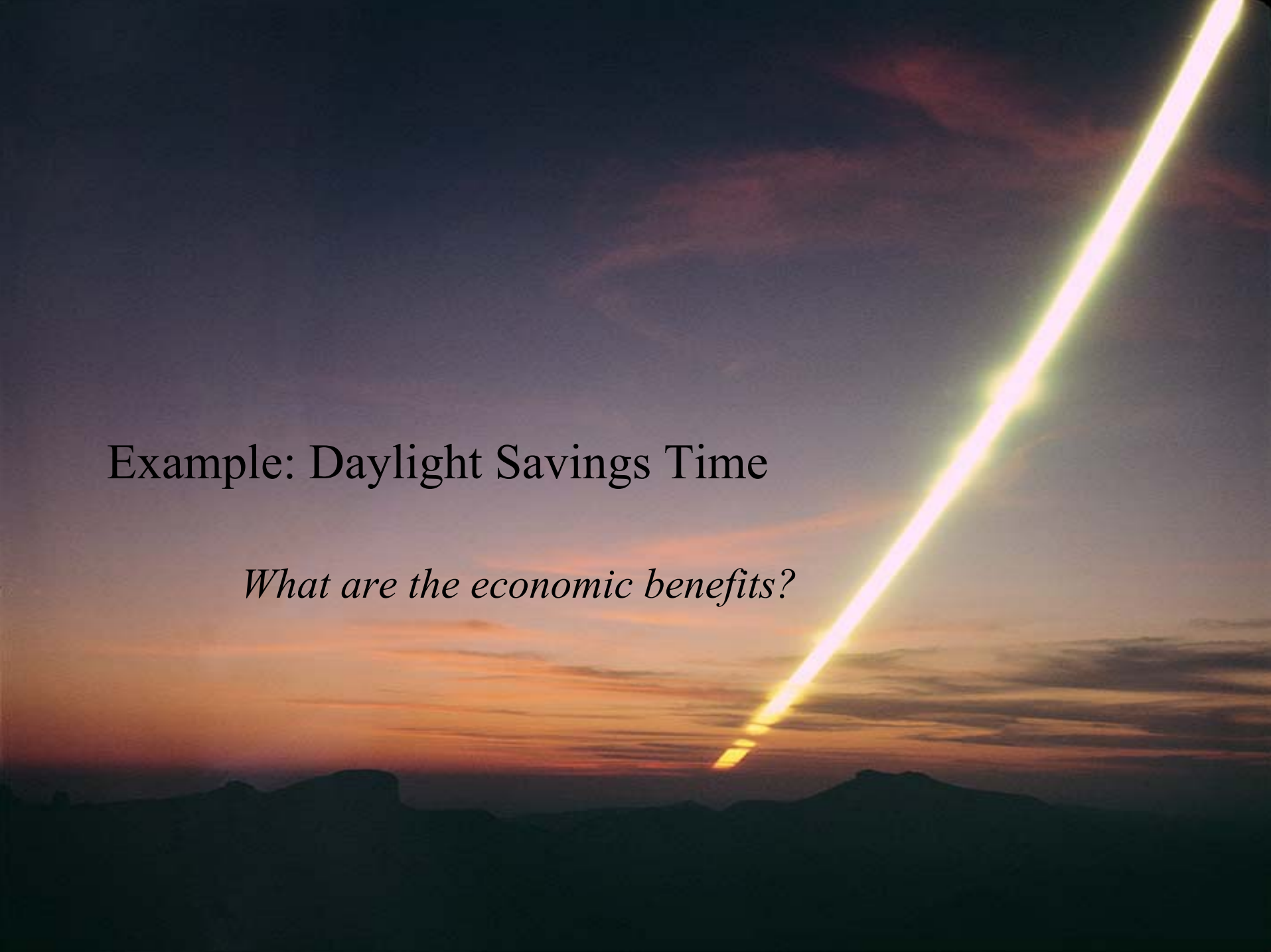

Example: Daylight Savings Time

What are the economic benefits?

Outline

I. Question Formulation
   a. Problem Context
   b. Specific Effect
   c. Future Relevancy

II. Model Formulation
   a. What's the "experiment"?
   b. "Treatment" and "controls"
   c. Thinking through the Mechanics/Econometrics

III. Data Gathering/Analysis
   a. What do you need?
   b. What if you're 'boned'?

IV. Touting your results

Questions:

What do you want to say?

Why does anyone care?

What has already been said on the matter?

What are the involved stakeholders?

Context

The Beginnings:

-Enacted in 1918 and 1942 to aid in war efforts(??)

Standardization

-Uniform Time Act of 1967: 6-month summer DST, nationwide

-Amended in 1987: 7-month summer DST

Policy Shock

-Emergency DST (1974-75): winter DST (January – April)

Failed Legislation

-Attempted Bills in 1976,1981,1983 to extend DST

“War Time”[1]: 1942

Applied national daylight saving through out the entire year…

-“as a defense measure”

-“to assist in dissipating evening peaks in the nation’s electrical power consumption, which were threatening to exceed the capacity available for non-defense purposes”

-“…and which were even greater in winter that in summer months”

Issue: Energy Conservation (particularly that of winter)

1: Excerpts from "Standard Time in the United Sates: A History of Standard and Daylight Savings Time and an Analysis of the Related Laws," US Dept. of Trans., in Committee Print No.12, Committee on Interstate and Foreign Commerce, US House, 93rd Congress

Emergency Daylight Saving Time

Energy Conservation Act of 1973

What did it do?

Expanded Daylight Saving to winter months of

1974: January, February, March, April

1975: March, April

Why?

-Energy conservation measure in response to the Arab oil embargo

-"to try year-round daylight saving time until October 1975 while measuring fuel savings"

-Projected Savings: 1% of fuel used for generation of electricity

Issue: Winter Energy Conservation

Other Legislation

HR 16102, 1976:

-repeal of year-round DST

Issue: Public distaste for it

Safety of children's morning commute to school in dark

HR 1398, 1981:

-would have extended DST two months into winter

House passed, killed in Senate

Issue: Winter Energy Conservation

Congressional Findings[2]:

"Daylight saving time over an expanded period would produce…

-"significant energy savings in electrical power consumption"

-"reduction of crime"

-"improved traffic safety"

-"greater utilization of parks and recreation areas"

-"expanded economic opportunity…to peak shopping hours"

-"greater overlap with the European Economic Community"

2: Act July 8, P.L. 99-359, sect.2(a), 100 Stat.764

Our “Natural” Experiment

Emergency Daylight Savings: The Winter DST Experiment

→ Effect across time

- *Winter 72-73: No DST*
- *Winter 73-74: Jan-Apr DST*
- *Winter 74-75: Mar-Apr DST*

→ Effect across United States (“Cross-sectional Effect”)

- *Alaska, Hawaii exempted: No DST*
- *48 Contiguous U.S.: DST*

What's our "treatment"?

Evening Light, essentially

Objective?

Reducing demand for electricity in powering artificial light

(Save energy fuels)

Basis for measurement?

Residential Electricity Sales by State by Month, in mwh

Controls/ “Right-hand side variables”

What else effects residential electricity consumption?

Essentially, we need to model the demand for electricity:

- -Income measure: GDP (or GSP) per capita?
- -Price: Retail or wholesale?
- -Substitutes: Are there substitutes? How about natural gas?
- -Appliance use: Drives consumption? Efficiency considerations?
- -Weather: Temperature or “heating degree-days”?

Any other exogenous effects that need to be considered?

Might people voluntarily reduce energy consumption, thereby masking the desired results without the causality?

Thinking through the Mechanics

(Econometrics in a nutshell)

General Model

Electricity = *f* (income,price_electricity,price_nat.gas,heating deg.days,…)

More Specifically,

Res_elect(state i,month t) = [exponential] *f* (GSP/Pop, P_E, P_G, HDD…)

Isolation of Effect:

Use Difference in Difference to flesh out the relative change

Control Group: Winter of year prior to change

My Model

$$lC_{iyt} = \boldsymbol{\alpha} + \boldsymbol{\beta}_1 Pop_{iyt} + \boldsymbol{\beta}_2 GSP_{iyt} + \boldsymbol{\beta}_3 P\_E_{iyt} + \boldsymbol{\beta}_4 P\_G_{iyt} + \boldsymbol{\beta}_5 HDD_{iyt}$$
$$+ \boldsymbol{\gamma}_1 AL_i + \boldsymbol{\gamma}_2 AR_i + \boldsymbol{\gamma}_3 CA_i + \boldsymbol{\gamma}_4 CO_i + \boldsymbol{\gamma}_5 CT_i + \boldsymbol{\gamma}_6 DE_i + \ldots$$
$$+ \boldsymbol{\delta}_1 D_t + \boldsymbol{\delta}_2 J_t + \boldsymbol{\delta}_3 F_t + \boldsymbol{\delta}_4 M_t + \boldsymbol{\delta}_5 A_t + \boldsymbol{\delta}_6 My_t$$
$$+ \boldsymbol{\theta}_2 DST_{iyt}{*}J_t + \boldsymbol{\theta}_3 DST_{iyt}{*}F_t + \boldsymbol{\theta}_4 DST_{iyt}{*}M_t + \boldsymbol{\theta}_5 DST_{iyt}{*}A_t + \boldsymbol{\varepsilon}_{iyt}$$

$\forall$ i, y, t

$$dlC_{iyt} = (lC_{iyt} - lC_{iyD}) - (lC_{iy\text{-}1t} - lC_{iy\text{-}1D})$$

$\forall$ i, for y=73,74,75, for t=2,3… [D: t=2]

$$dlC_{iyt} = \boldsymbol{\beta}_1 dPop_{iyt} + \boldsymbol{\beta}_3 dP\_E_{iyt} + \boldsymbol{\beta}_5 dHDD_{iyt}$$
$$+ \boldsymbol{\theta}_2 DST_{iyt}{*}J_t + \boldsymbol{\theta}_3 DST_{iyt}{*}F_t + \boldsymbol{\theta}_4 DST_{iyt}{*}M_t + \boldsymbol{\theta}_5 DST_{iyt}{*}A_t + d\boldsymbol{\varepsilon}_{iyt}$$

Data Issues

What if we can't get population, prices or GSP on a monthly basis?

Assume it away!

Well not entirely:

Assume GSP growth follows a linear growth function

-then month-to-month change is constant

-then it disappears with the diff. in diff.

Assume prices are constant

-most states did regulate the electricity market

Assume population grows exponentially

-estimate exponential growth rate annually

-interpolate monthly levels from the annual changes

Run Regression

Pray you don't have lingering endogeneity issues

Interpret results

-what do the coefficients signify?

-do they conform to expectations?

What can you now say?

→ That residential electricity consumption decreased on average by 2-3% for the months of January, February and March!