Central Tendency and Dispersion

POSC 3410 – Quantitative Methods in Political Science

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Goal for Today

Describe variables by reference to central tendency and dispersion.

Defining and Measuring Variables

Last lecture focused on a typology of variables.

1. Nominal
2. Ordinal
3. Interval

Correct classification will condition how we can *describe* variables.

Central Tendency

The most common description of interest is the **central tendency**.

- This is the variables "typical", or "average" value.
- This takes on different forms contingent on variable type.

Think of what follows as a "tool kit" for researchers.

- More precise variables allow for more precise measures.
- Use the right tool for the job, if you will.

Mode

The **mode** is the most basic central tendency statistic.

- It identifies the most frequently occurring value.

Suppose I have a random sample of 50 students and measured party affiliation.

- Democrats: 26; Republicans: 20; Others: 4

What's the modal category?

Mode

If I randomly grabbed a student from that sample and guessed "Democrat", I would be right 26 times of 50 (on average).

- No other guess, on average, would be as good.

This is the only central tendency statistic for nominal variables.

Median

The **median** is the middlemost value.

- It's the most precise statistic for ordinal variables.
- It's a useful robustness check for interval variables too.

Formally, a median m exists when the following equalities are satisfied.

$$P(X \leq m) \geq \frac{1}{2} \text{ and } P(X \geq m) \geq \frac{1}{2} \tag{1}$$

Finding the Median

Order the observations from lowest to highest and find what value lies in the exact middle.

- The median is the point where half the values lie below and half are above.
- We can do this when our variables have some kind of "order".
- Medians of nominal variables are nonsensical.

Mean

The arithmetic **mean** is used only for interval variables.

- This is to what we refer when we say "average".

Formally, i through n:

$$\frac{1}{n}\Sigma x_i \tag{2}$$

We can always describe interval variables with mode and median.

- We cannot do the same for ordinal or nominal with the mean.

Dispersion

We also need to know variables by reference to its **dispersion**.

- i.e. "how average is 'average'?"
- How far do variables deviate from the typical value?
- If they do, measures of central tendency can be misleading.

The interval variable with no dispersion problem is one in which the mode, median, and mean are the same value.

- This will not happen when there is a significant **skew**, or a **bimodal** distribution.

Frequency Distribution

A **frequency distribution** is a summary of a variable's values.

Table 2-2 Region of Residence (tabular)

Region	Frequency	Percentage
Northeast	344	17.0
Midwest	427	21.1
South	737	36.4
West	515	25.5
Total	2,023	100.0

Source: 2008 General Social Survey.

Cumulative Percentage

A **cumulative percentage** is the percentage of cases at or below a given value.

Table 2-3 Attendance at Religious Services (tabular)

Attendance	Frequency	Percentage	Cumulative percentage
Never or less than once a year	579	28.8	28.8
Once a year	272	13.5	42.3
Several times a year	223	11.1	53.4
Once a month	151	7.5	60.9
2–3 times a month	182	9.1	69.9
Nearly every week	93	4.6	74.5
Every week or more	513	25.5	100.0
Total	2,013	100.1[a]	

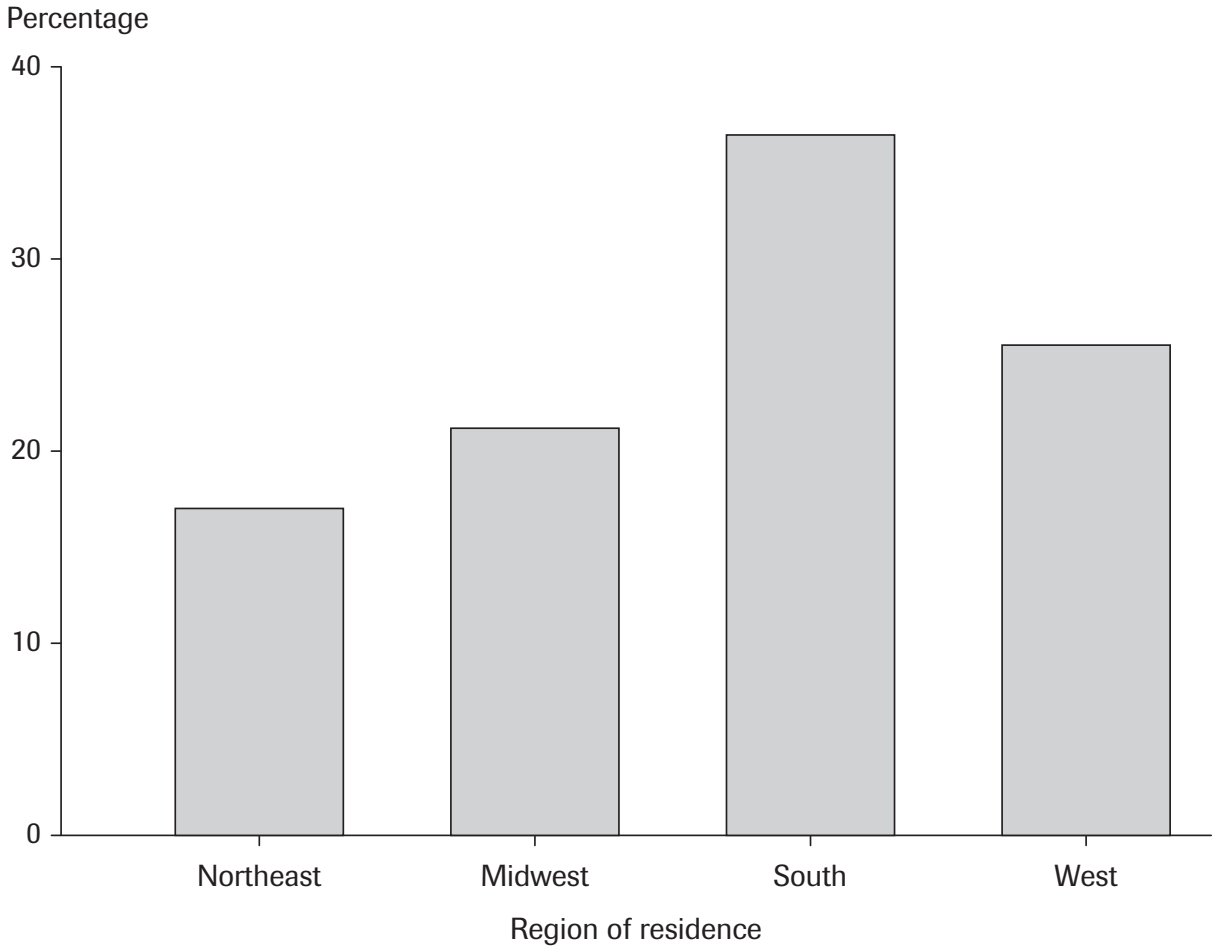
Source: 2008 General Social Survey.

Note: Question: "How often do you attend religious services?" The GSS records nine response categories. Table 2-3 combines "Never" with "Less than once a year" and "Every week" with "Several times a week."

[a]Percentages do not sum to 100.0 percent due to rounding.

Bar Chart

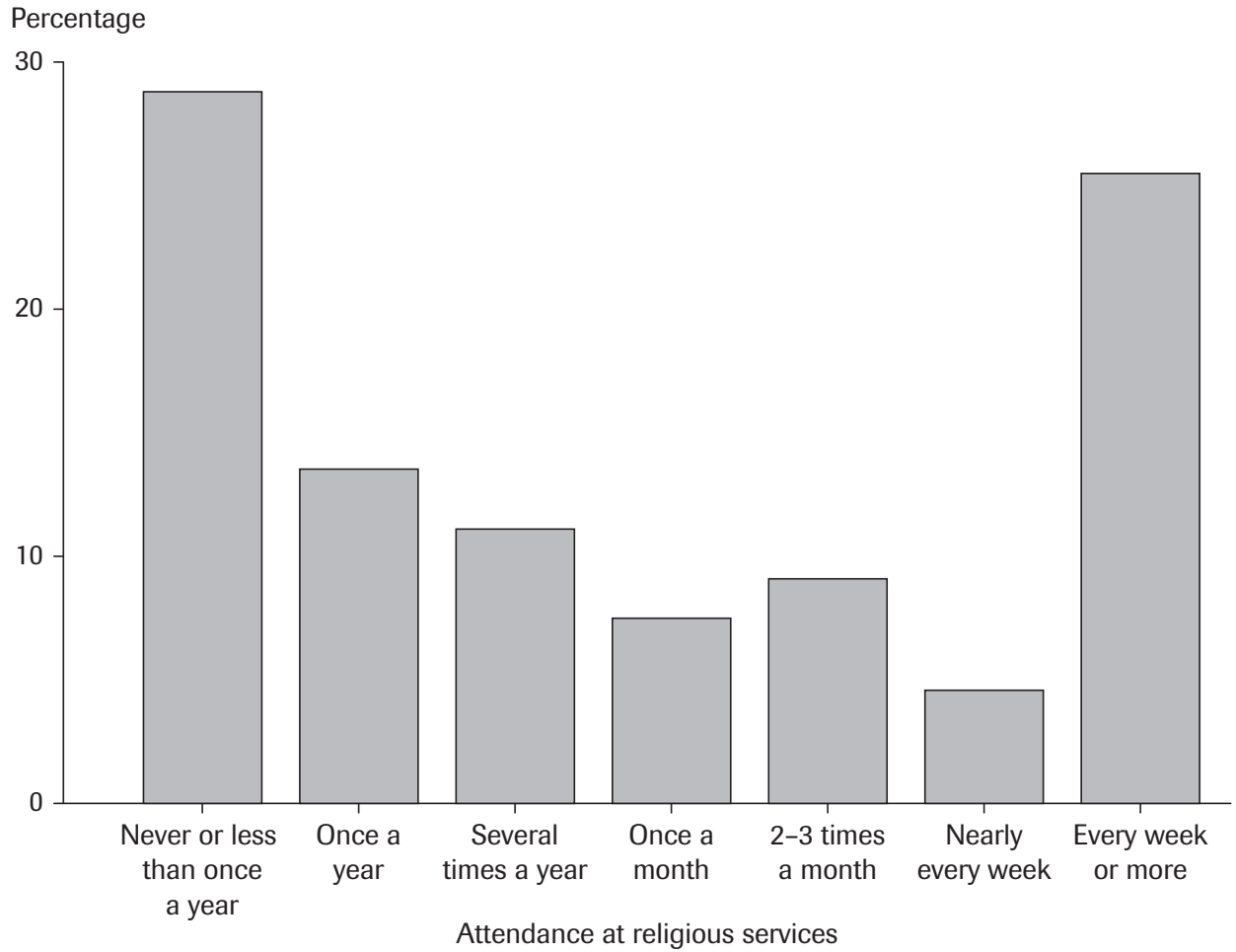
Figure 2-2 Region of Residence (graphic)



Source: 2008 General Social Survey.

Bar Chart

Figure 2-3 Attendance at Religious Services (graphic)

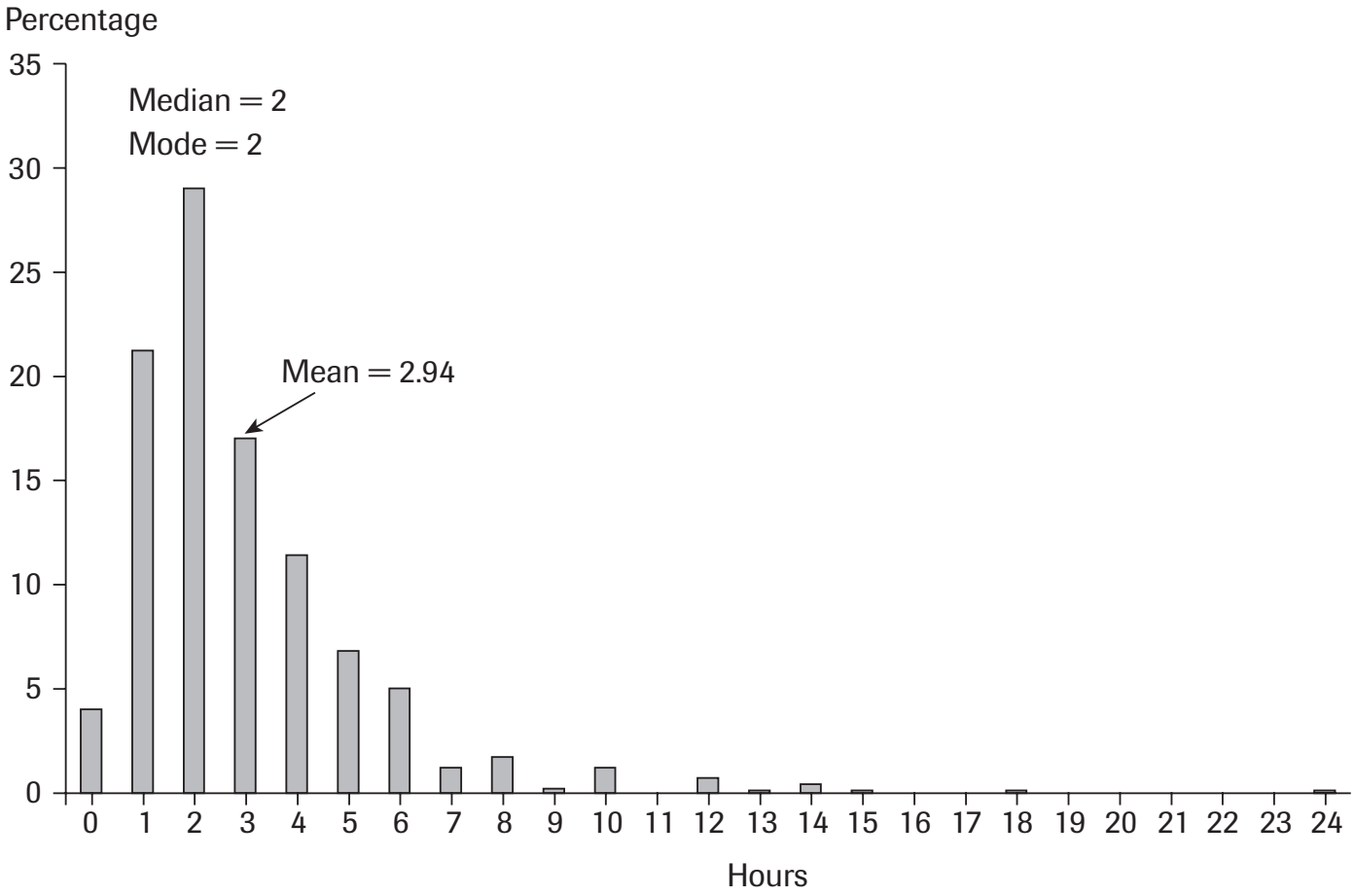


Source: 2008 General Social Survey.

Note: Question: "How often do you attend religious services?"

Issues of Skew

Figure 2–4 Hours Watching TV (graphic)

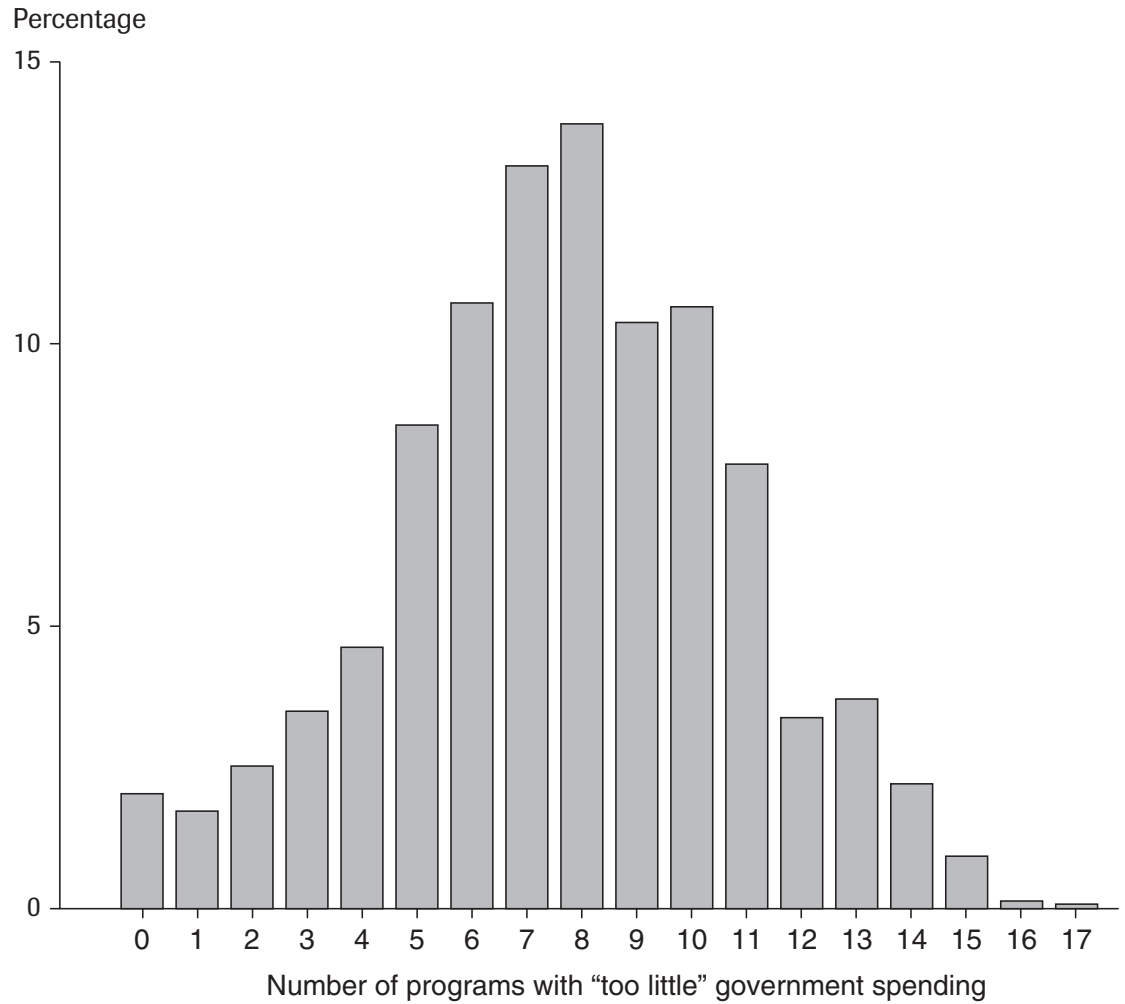


Source: 2006 General Social Survey.

Note: Question: "On the average day, about how many hours do you personally watch television?"

Issues of Skew

Figure 2-5 Number of Programs with "Too Little" Government Spending (graphic)



Source: 2008 General Social Survey.

Conclusion

Here are some final thoughts.

- There is a reason we discuss "median income" and not the "average income".
- The mean of a dummy variable communicates the percentage of 1s, divided by 100.
- Skew is mostly a problem of mean variables, and a problem of degree.

Always look carefully at your data!

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