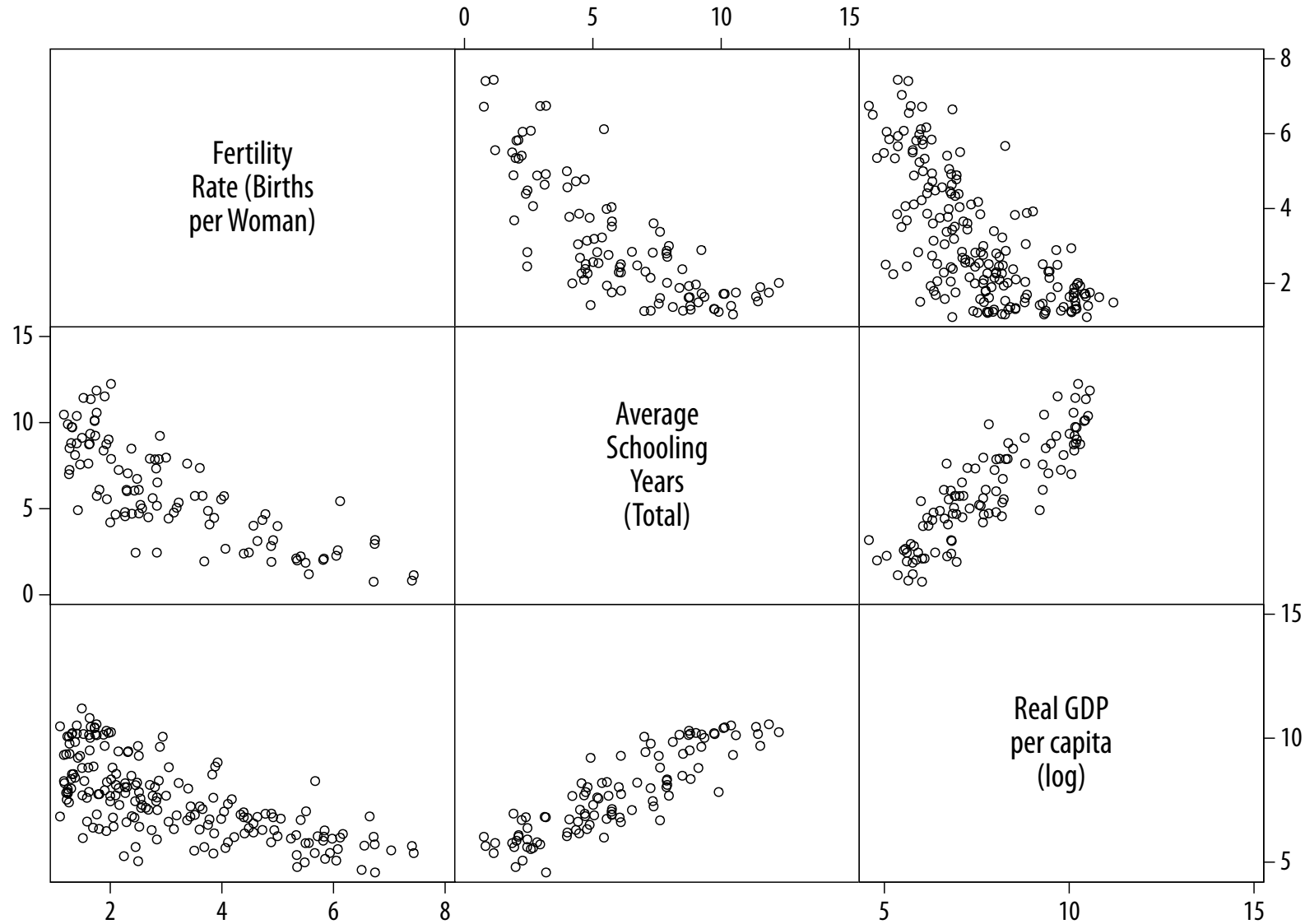
Regression (II)


Fertility Rate (Births per Woman)
Average Schooling Years (Total)
Real GDP per capita (log)
0
5
10
15
2
4
6
8
5
10
15

Multiple linear regression

```
. reg births schooling log_gdpc
```

Source	SS	df	MS
Model	150.301883	2	75.1509417
Residual	70.475313	83	.849100157
Total	220.777196	85	2.59737878

Number of obs	86
F(2, 83)	88.51
Prob > F	0.0000
R-squared	0.6808
Adj R-squared	0.6731
Root MSE	.92147

births	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
schooling	-.1976117	.0724595	-2.73	0.008	-.3417306	-.0534927
log_gdpc	-.4703416	.1324501	-3.55	0.001	-.7337796	-.2069036
_cons	7.950304	.6861182	11.59	0.000	6.585642	9.314965

Multiple linear regression

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 +, \ldots, + \beta_k X_k + \epsilon$$

Partial derivatives

Each coefficient is calculated by holding all others constant.

Least squares

The model is still optimized by minimizing the squared error terms.

Sanity check

The model is still assuming *linear*, *additive* relationships.

`reg births schooling log_gdpc, beta`

Each variable can be normalized to fit $\mathcal{D} \sim \mathcal{N}(0, 1)$, so that their standardized coefficients have comparable standard deviation units:

births	Coef.	Std. Err.	t	P>|t|	Beta
schooling	-.1976117	.0724595	-2.73	0.008	-.3686479
log_gdpc	-.4703416	.1324501	-3.55	0.001	-.4800156
_cons	7.950304	.6861182	11.59	0.000	.

(identical output for overall model fit omitted)

Sanity check

Interpret unstandardized coefficients; use standardization only for model comparisons.

reg births schooling log_gdpc i.region

Categorical variables can be used as dummies, i.e. binary recodes of each category that are tested against a reference category to provide regression coefficients for the net effect of each category:

births	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
schooling	-.0415563	.0639718	-0.65	0.518	-.1688888	.0857763
log_gdpc	-.742187	.1380037	-5.38	0.000	-1.016876	-.4674975
region						
2	-.6523485	.5803126	-1.12	0.264	-1.807432	.5027349
3	.3682404	.254364	1.45	0.152	-.1380585	.8745393
4	1.411177	.2486027	5.68	0.000	.9163457	1.906008
5	1.167491	.337383	3.46	0.001	.4959471	1.839035
_cons	8.315004	.8006456	10.39	0.000	6.721359	9.908649

(identical output for overall model fit omitted)

Thanks for your attention

Project

- Name your paper and do-file like Briatte_Petev_2
- Make sure to print your paper to a slick PDF

Readings

- *Stata Guide*, Sec. 10, 11, 13 and 15

Practice

- Replicate do-file
- Use its structure for Draft No. 2