Why you should study maths (and science and computing) at A-level

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Why choose A-level maths?

Opens lots of job opportunities ...

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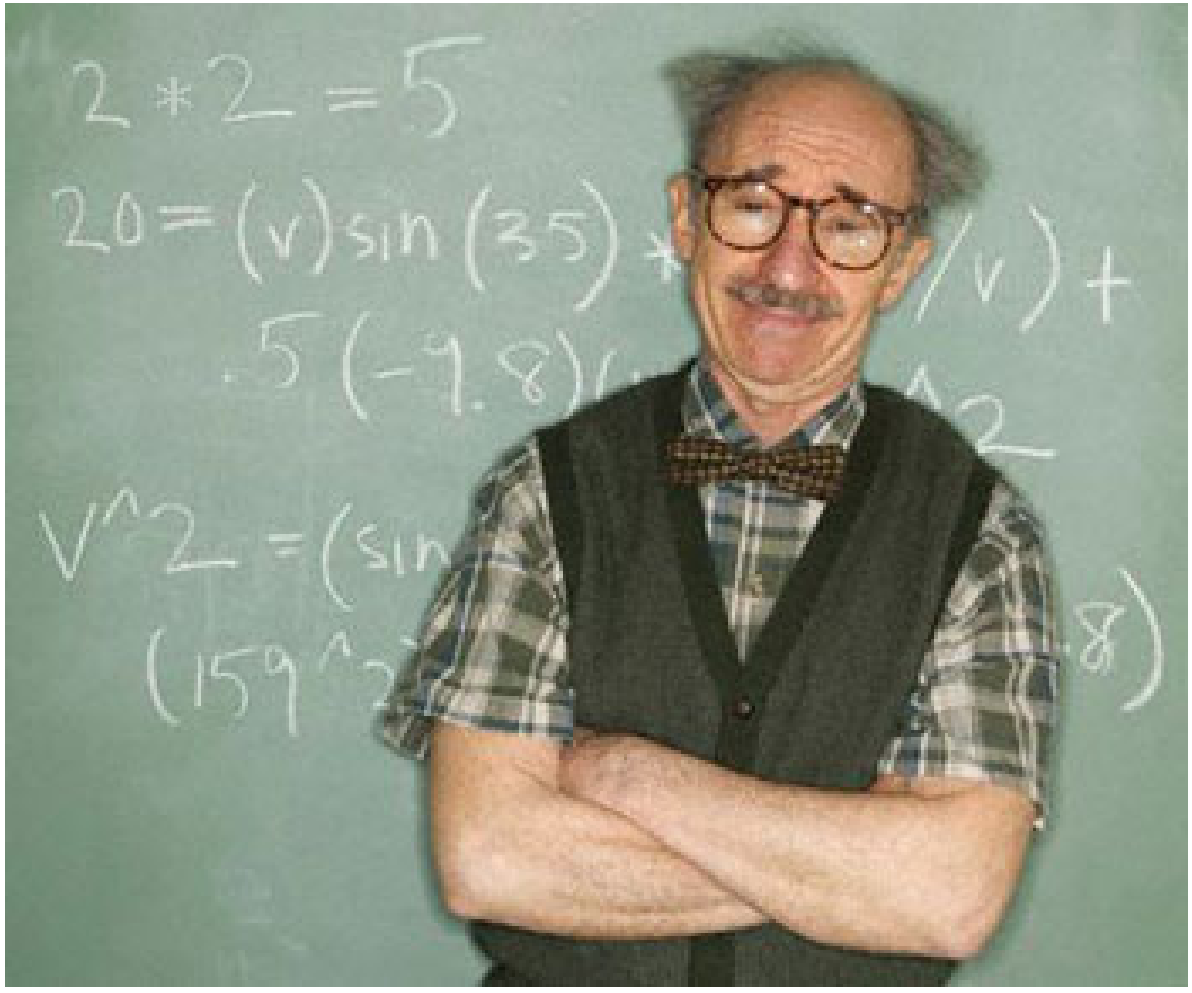

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Why choose A-level maths?

Could do many other jobs ... like working as an economist

What is economics?

- Seeks to explain how individuals, businesses and governments make decisions
  - Why was the Samsung Galaxy S4 launch price £600? Why is it now £400?
  - Why does government try to influence what we eat? What is the most effective way of doing this?
- Uses maths to build theories about how people act
- And statistics to test and quantify these theories

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  - Do people who take STEM A-levels have higher wages on average?
  - What happens when we **control** for other factors?
  - What is the magnitude of the effect?

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  - What happens when we **control** for other factors?
  - What is the magnitude of the effect?
- Can we pin down the **causal** effect?
  - How will your future wages compare with what they would have been if you took one less STEM A-level

What does economic theory say?

- Employers are willing to pay productive workers more
- Taking STEM A-levels may
  - Provide skills that makes someone who studies them more productive
  - And may be a way of signalling to employers that you possess analytical skills that will make you a productive worker
- In either case, we would expect taking STEM A-levels to be associated with higher wages

Testing the theory

- Is there evidence for this?
- And if so, how much more pay is associated with doing one more STEM A-level?
- We want to know:

$$\frac{d \log w}{dSTEM} = \%\text{ increase in wage from doing one more STEM A-level}$$

the **marginal return** to a STEM A-level (MR-STEM)

Estimating MR-STEM

- Use data set on 956 people who studied A-levels
- Has information on:
  - How many STEM and non-STEM A-levels they studied
  - Their weekly earnings at age 30
  - Other characteristics

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Mathematical model:

$$\log w = \alpha + \beta STEM$$

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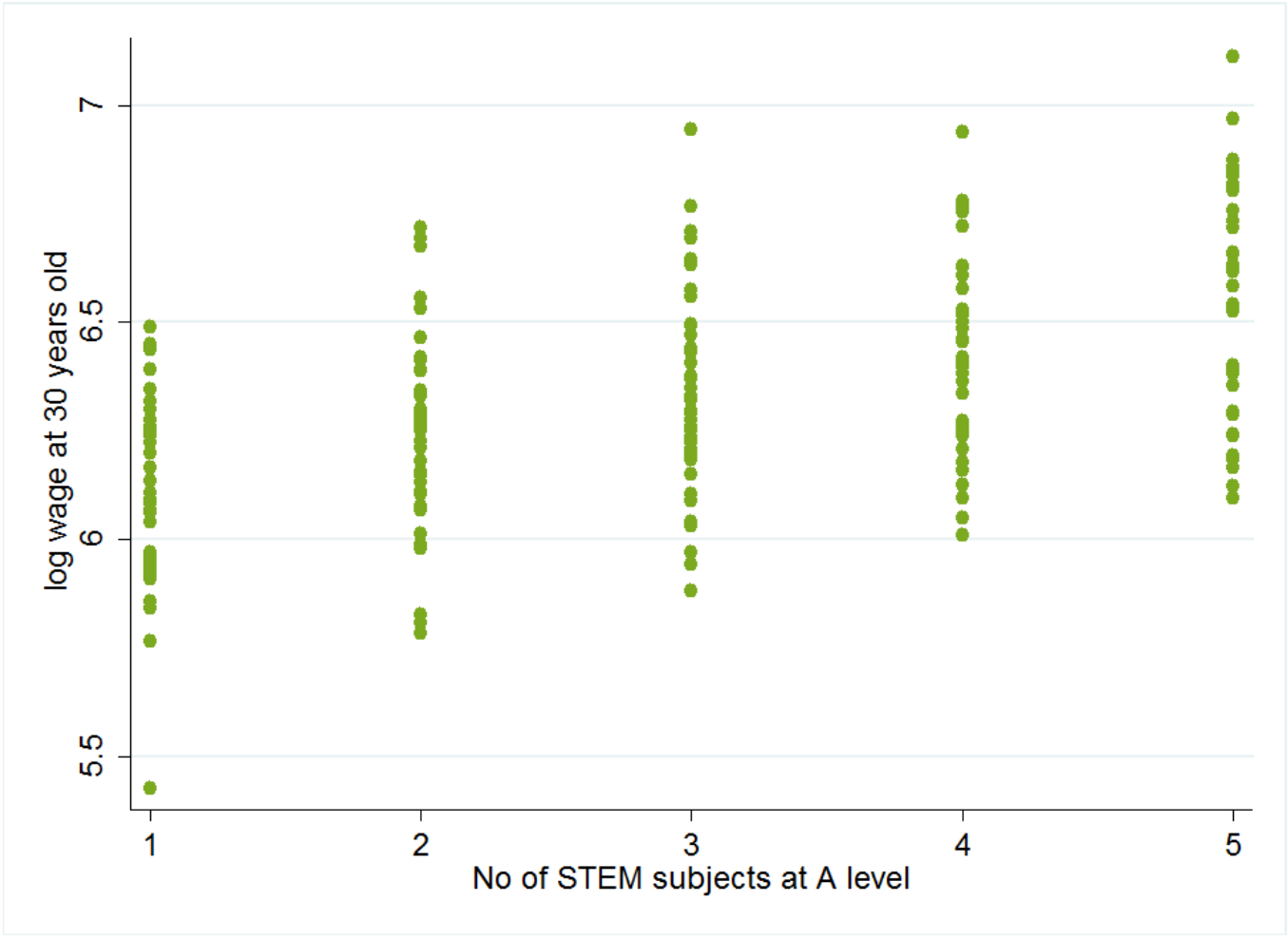
$$\log w = \alpha + \beta STEM + u$$

Aim is to know numerical value of β

Relationship between STEM A-levels and wages



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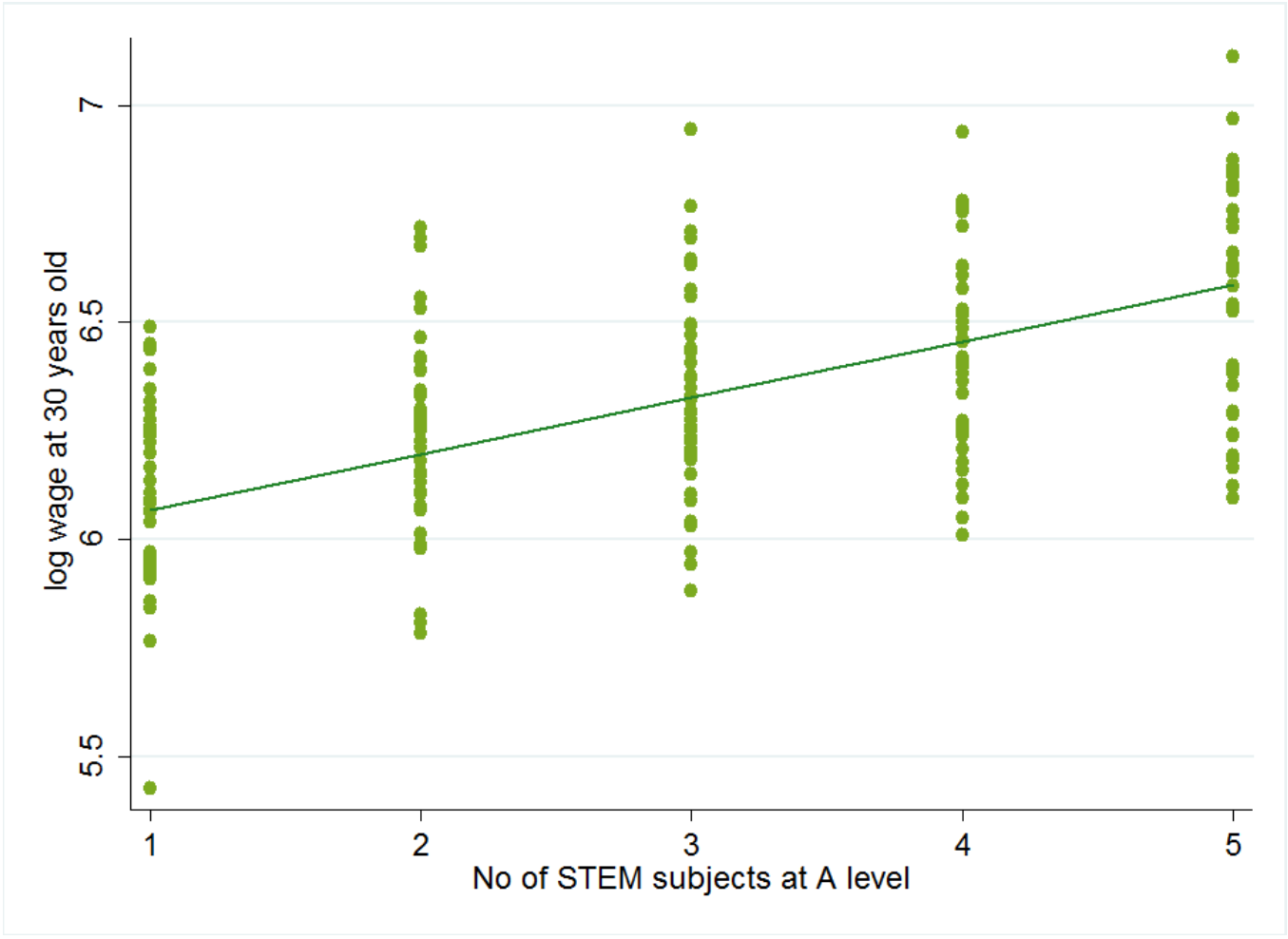

$$\widehat{logw} = 5.94 + 0.13STEM$$

Relationship between STEM A-levels and wages

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- Does this mean for every STEM A-level you do you can expect to earn 13% more at age 30? ...
- No!
- People who take STEM A-levels may have other characteristics that lead them to earn more
- For instance they may also tend to take more non-STEM A-levels

Correlation vs. causation

- Most statistical analysis done by economists tries to separate out causality from correlations
- But this is much harder in economics than in the sciences
- Scientists can run controlled experiments in laboratory conditions
- But in economics
  - Experiments are very rare
  - So instead we need to use statistics to control for other factors that may affect the outcome of interest

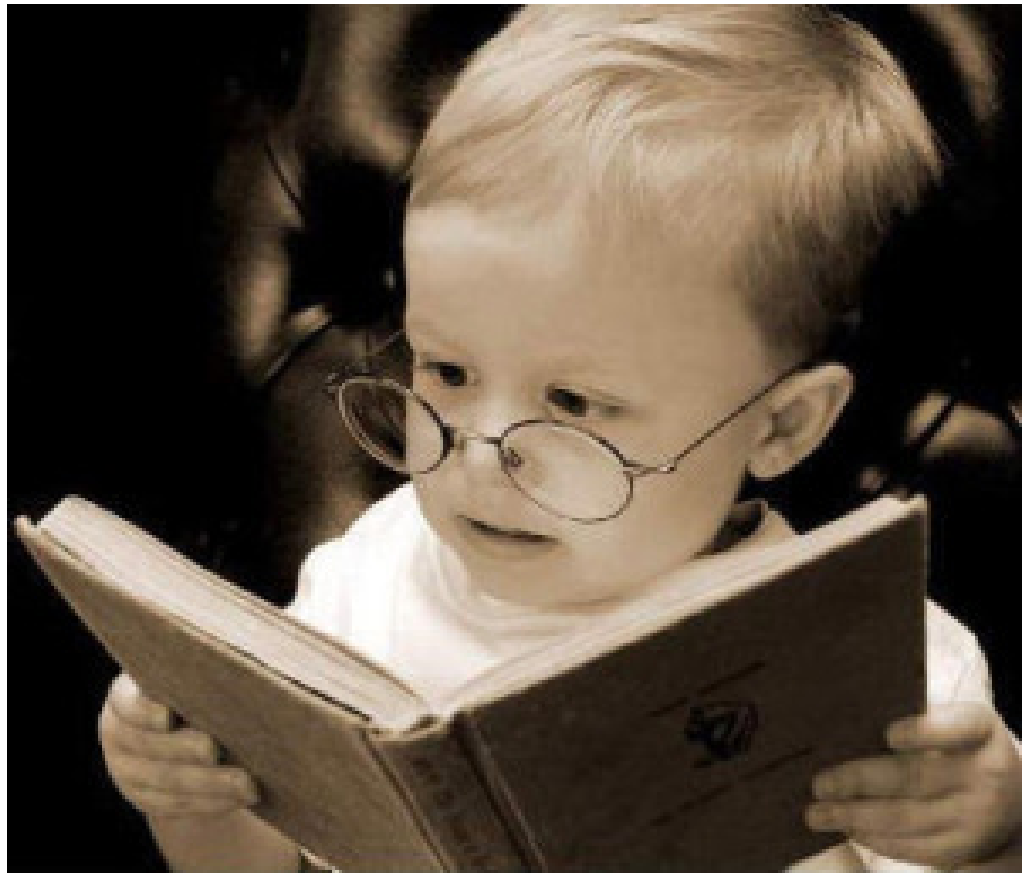
Causal relationship between STEM A-levels and wages

- We need to control for other factors which
  - Affect wages
  - And may differ among people who study different numbers of STEM A-levels
- For instance
  - Number of non-STEM A-levels
  - Whether they obtained a degree
  - Gender, region
  - And ability ...

The ability problem

- Smart people may be more likely to select STEM A-levels
- And they may be more likely to get high paid jobs because they are smart
- So we risk mistaking the causal channel from ability to wages, for the causal channel from taking STEM A-levels to wages
- How can we control for ability ... ?

The ability problem



We can control for people's test scores when they were younger

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$$\log w = \alpha + \beta STEM + \gamma_1 non\_STEM + \gamma_2 degree + \gamma_3 gender + \gamma_4 region + \gamma_5 ability$$

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Now β tells us % increase in wages associated with one more STEM A-level, holding non_STEM - ability constant

The answer

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... but one group did one more STEM A-level ...
... on average their wage at age 30 would be 9% higher

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- Economists will always argue about empirical findings (part of what makes it fun!)
- Here we might ask
  - Is relationship between STEM A-levels and wages really linear?
  - What about the influence of school and/or parents?
- But evidence that studying maths is likely to result in higher earnings is very strong

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- It opens lots of interesting careers paths (without closing any off)
- And it is very likely to lead you to earn more money!