
The economics of higher education
Monday 22nd November
16:00 - 17:15
IFS
UKRI
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Overview

Why do people go to university?

- A model of higher education choice

Why do most governments intervene in the market for higher education?

- What do different governments do?
- What could be their reasons?

What are the financial benefits of higher education?

- How could one find out?
- Some results for England

Why do people go to university?

Why did you go to university?

Why did other people decide not to go to university?

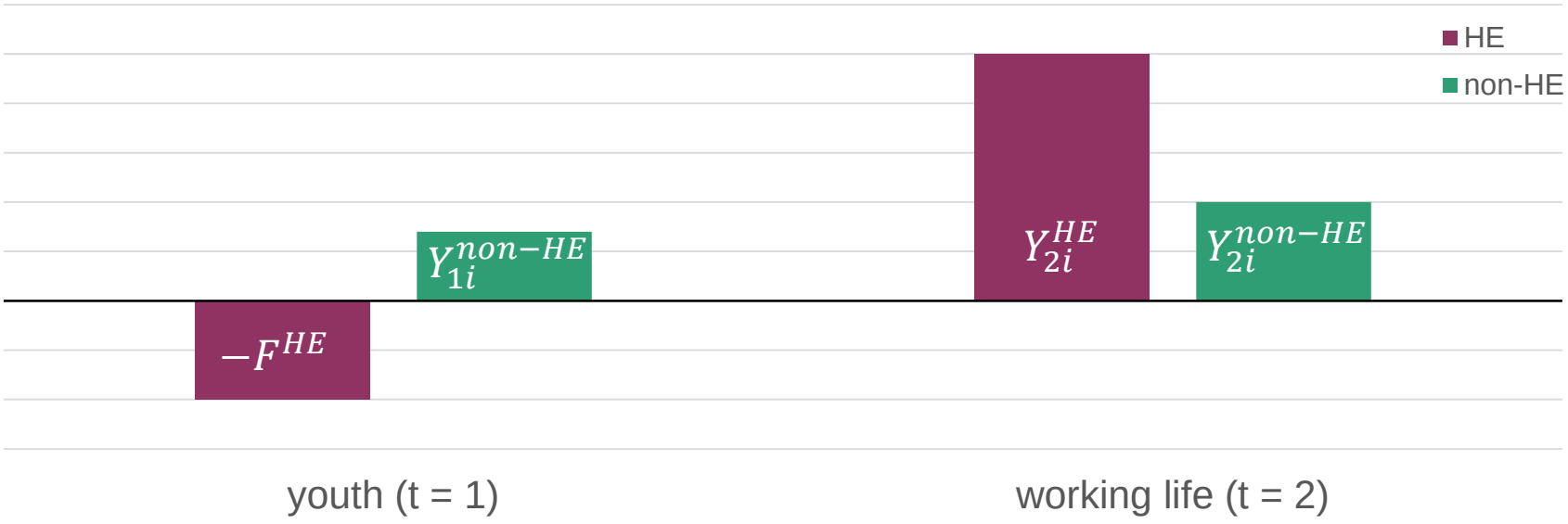
A model of higher education choice

Private market in higher education

- There are two periods $t = 1, 2$
  - In the first period ("youth"), people choose whether to go to university or start work straight away.
  - In the second period ("working life"), everyone goes to work.
- In the **first period**, person i's income is
  - $-F^{HE}$ if they go to university (they have to pay fees)
  - Y_{1i}^{non-HE} if they don't go to university (they earn a wage)
- In the **second period**, person i's income is
  - Y_{2i}^{HE} if they went to university
  - Y_{2i}^{non-HE} if they did not go to university

A model of higher education choice

Private market in higher education



Assume no uncertainty about earnings.

A model of higher education choice

Private market in higher education

- People's **utility function** takes the ("Cobb-Douglas") form:

$$U_i = \phi_i C_{1i}^{1/2} C_{2i}^{1/2}$$

  - C_{1i} and C_{2i} are consumption in periods $t = 1$ and $t = 2$
  - ϕ_i is the non-monetary value of each option

- ϕ_i could contain:
  - **If going to HE**: the value of a more fulfilling job, the joy of knowledge, …
  - **If not going to HE**: the value of never having to take exams again, the value of not having to move away from home, the joy of practical work, …

A model of higher education choice

Private market in higher education

- Assume people can borrow any amount B_i from **financial markets** at the interest rate r
- Then for those who go to university, **budget constraints** are:
  - First period: $C_{1i}^{HE} = B_i^{HE} - F^{HE}$
  - Second period: $C_{2i}^{HE} = Y_{2i}^{HE} - (1+r)B_i^{HE}$
  - **Consolidated:** $(1+r)C_{1i}^{HE} + C_{2i}^{HE} = -(1+r)F^{HE} + Y_{2i}^{HE}$

    Future value of consumption = Future value of income
- For those who don't go to university, the **consolidated budget constraint** is:

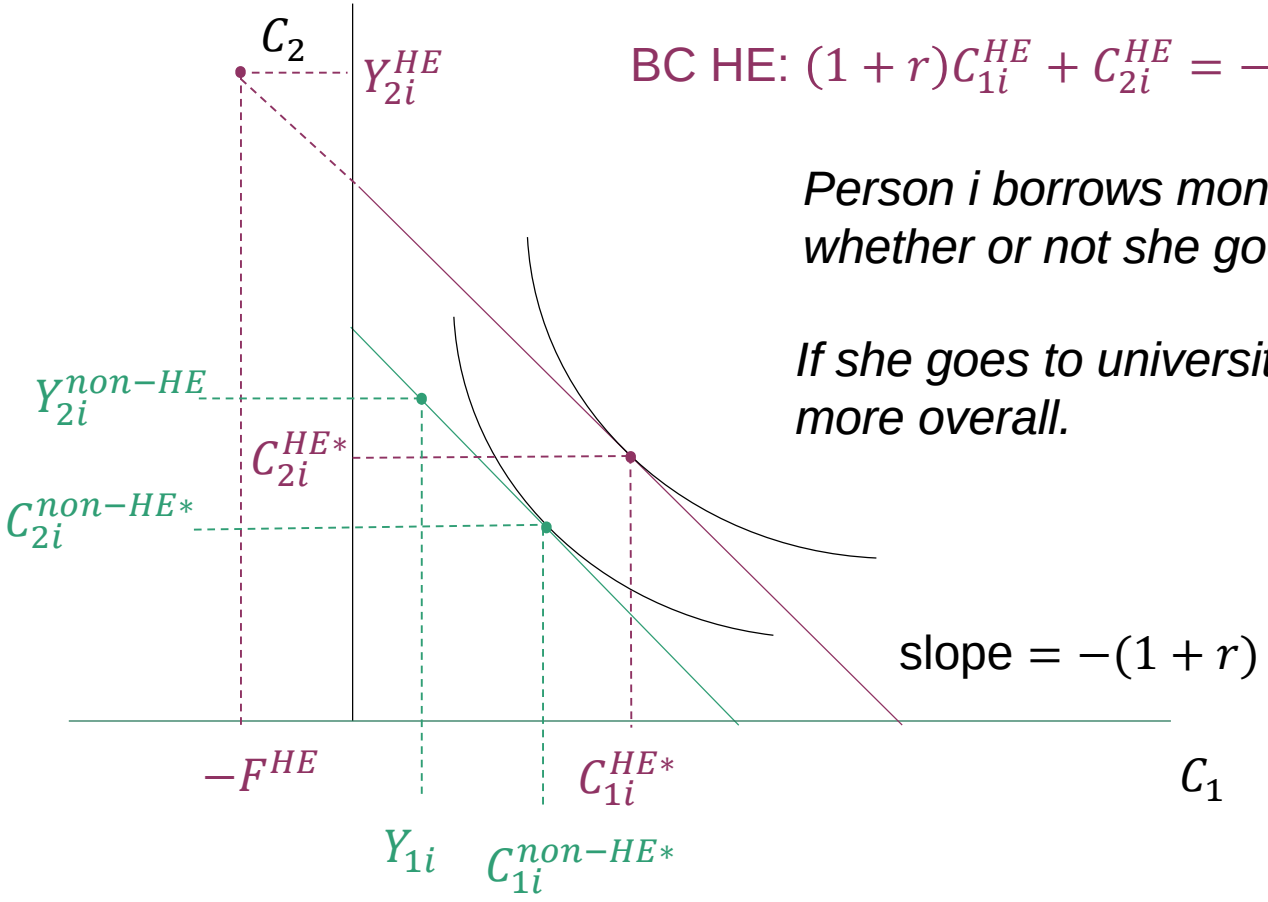
$$(1+r)C_{1i}^{non-HE} + C_{2i}^{non-HE} = (1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}$$

A model of higher education choice

Private market in higher education

BC non-HE: $(1+r)C_{1i}^{non-HE} + C_{2i}^{non-HE} = (1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}$

BC HE: $(1+r)C_{1i}^{HE} + C_{2i}^{HE} = -(1+r)F^{HE} + Y_{2i}^{HE}$



Person i borrows money in the first period whether or not she goes to university.

If she goes to university, she can consume more overall.

A model of higher education choice

Private market in higher education

Now we can work out the utility of each option:

- First solve the constrained optimisation problem to get C_{1i}^* and C_{2i}^* for both the HE and non-HE case
- Then substitute C_1^* and C_2^* back into the utility function to get U_i^{HE} and U_i^{non-HE}.

People will choose university **if and only if** $U_i^{HE} > U_i^{non-HE}$, i.e.

$$\phi_i^{\text{HE}} \overbrace{\left[-(1+r)F^{HE} + Y_{2i}^{HE}\right]}^{\text{future value of earnings (HE)}} > \phi_i^{non-\text{HE}} \overbrace{\left[(1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}\right]}^{\text{future value of earnings (non-HE)}}$$

A model of higher education choice

Private market in higher education

People will choose university if and only if

$$\phi_i^{\text{HE}} \overbrace{\left[-(1+r)F^{HE} + Y_{2i}^{HE}\right]}^{\text{future value of earnings (HE)}} > \phi_i^{non-\text{HE}} \overbrace{\left[(1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}\right]}^{\text{future value of earnings (non-HE)}}$$

Factors pushing people towards higher education are:

- A high non-monetary value of higher education ϕ_i^{HE}
- Low tuition fees F^{HE} or high earnings after university Y_{2i}^{HE}
- A low non-monetary value of not going to university $\phi_i^{non-\text{HE}}$
- Low non-HE earnings Y_{1i}^{non-HE} or Y_{2i}^{non-HE}
- Low interest rates r

A model of higher education choice

Private market in higher education

Assuming that:

1. Students can borrow from financial markets at the **true social cost of funds.**
2. Higher education **only benefits students themselves**.
3. Young people have **perfect foresight and make optimal choices** from their own point of view**.**

Higher education choices in this model will be *efficient.*

Recap

- We now have a ***theory* of higher education choice** when there is a private market in higher education (and a financial market).
- People choose higher education if and only if it is better for *them.*
- Whether it is better for them depends on a number of financial and non-financial factors.
- In particular, people choose higher education in our model if and only if:

$$\phi_i^{\mathrm{HE}}\left[-(1+r)F^{HE} + Y_{2i}^{HE}\right] > \phi_i^{non-\mathrm{HE}}\left[(1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}\right]$$

- Under some assumptions, these choices will be economically *efficient.*

Next section:

- Why might higher education choices *not* be efficient?
- What do governments do about that?

Why do most governments intervene in the market for higher education?

Different ways of funding HE

- We have looked at a model of an entirely private market in higher education
- In fact, most countries do not have an entirely private market
- In the **US**, partly private market but**:**
  - Substantial state sector (subsidised)
  - grant programmes for poorer students
- In **England and Australia**, mostly income-contingent loans:
  - Loans are paid back as a percentage of earnings above a threshold
  - Outstanding balances are written off after some years of repayment (substantial subsidy for most)

Different ways of funding HE

- In **Germany and Scotland:**
  - No tuition fees are charged (including for post-graduates)
  - Subsidised loans are available for living costs
- In **Denmark and Sweden:**
  - No tuition fees are charged (including for post-graduates)
  - Student are entitled to living cost *grants*

What is the point of government loans and subsidies?

If the benefits of HE (non-financial and financial) accrue to students themselves, why does the government need to get involved?

Doesn't the private market attain the efficient outcome?

A model of higher education choice

Private market in higher education

Assuming that:

1. Students can borrow from financial markets at the **true social cost of funds.**
2. Higher education **only benefits students themselves**.
3. Young people have **perfect foresight and make optimal choices** from their own point of view**.**

Higher education choices in this model will be *efficient.*

Three reasons why the outcome of a private market might *not* be efficient

1. Private **financial markets** may not work well in practice, leading to high costs of borrowing.
2. Higher education may have **positive externalities:** it may not only benefits students themselves, but also others.
3. Some students may **choose not to go to university even if that would be optimal** for them.

Consequence: *Market failure*. If the higher education market was completely private, fewer young people would go to university than would be optimal.

By **subsidising higher education**, governments may be looking to raise the higher education participation rate to the optimal level.

1. Financial market imperfections

The interest rate r charged on student loans may be much higher than the true social cost of funds.

One reason: **limited enforceability**

- No collateral for student loans
- People may seek to escape repayment, and the legal process of forcing payment is costly and not always successful

Consequence: $r \uparrow$ so some people are put off going to university by high cost of loans.

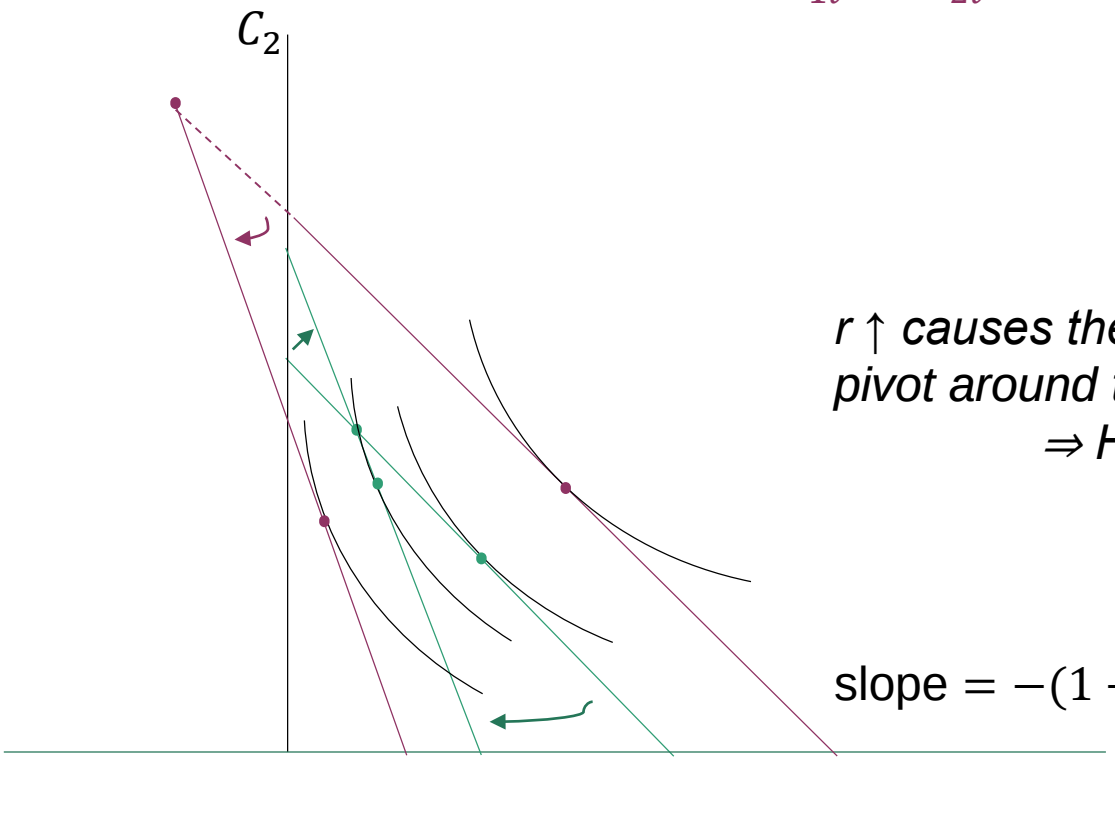
Reminder: People choose university if and only if

$$\phi_i^{\text{HE}} \overbrace{\left[-(1+r)F^{HE} + Y_{2i}^{HE}\right]}^{\text{future value of earnings (HE)}} > \phi_i^{non-\text{HE}} \overbrace{\left[(1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}\right]}^{\text{future value of earnings (non−HE)}}$$

1. Financial market imperfections

BC non-HE: $(1+r)C_{1i}^{non-HE} + C_{2i}^{non-HE} = (1+r)Y_{1i}^{non-HE} + Y_{2i}^{non-HE}$

BC HE: $(1+r)C_{1i}^{HE} + C_{2i}^{HE} = -(1+r)F^{HE} + Y_{2i}^{HE}$



r ↑ causes the budget constraint to pivot around the endowment point.
⇒ HE investment ↓

slope $= -(1+r)$

2. Positive externalities

Higher education may not only benefit students themselves, but also others.

One important channel are **human capital spillovers**: Working or living alongside university-educated people creates learning opportunities for others.

- Moretti (2004): increased share of college graduates in a city raises other workers' productivity.
- Chen et al (2020): sending Chinese university students to live and work in the countryside raised rural education levels.

Another channel are **higher tax revenues** as a result of university graduates' higher earnings.

- Britton et al (2020): nearly half the financial gain for men and around a quarter of the financial gain for women accrues to the taxpayer.

2. Positive externalities

While these are likely the most important effects, there may be others:

- Lower crime, higher civic engagement, spillovers from better health…

This means that it may be socially optimal for more people to go to university than would be privately optimal.

Solution: Pigouvian subsidy to HE to raise HE investment to the socially optimal level.

However: there are also reasons to think that it might be socially optimal for *fewer* people to go to university than would be privately optimal.

- If HE is partly a costly *signal* of productivity to employers, there may be overinvestment in HE in a private market (Spence, 1973)

3. Privately suboptimal decisions

- Prospective students may **underestimate the benefits** of higher education
  - Imperfect information about financial and non-financial benefits
  - Likely to especially affect people from disadvantaged backgrounds.
- I**nternalities**: Students may know that university would be best, but can't bring themselves to apply or actually go.

Policy options:

- provide more information
- **make university more attractive by subsidising it**

Government intervention in the model

Suppose the main problem is that the market for student loans does not work well.

A natural solution: The government borrows on students' behalf

In period 1, the government borrows money from financial markets.

- That money is used to pay for students' fees and living costs.

In period 2, the government taxes graduates to pay off what it borrowed (graduate tax)

This will **not restore the same allocation**, as the government does not know how much each individual would have borrowed.

- But could come relatively close.
- Can subsidise the system to further encourage HE participation

Government intervention in the model

We can capture this policy in the model by making some changes:

- Instead of having to pay fees F^{HE}, students get living cost grants L^{HE} in the first period.
- Students have to pay a graduate tax τ^{HE} of their working-life earnings
- Individuals cannot borrow (or interest rates are prohibitively high)

Then **everyone consumes their endowment**, so:

- For students: $C_1 = L^{HE}$ and $C_2 = (1 - \tau^{HE})\ Y_{2i}^{HE}$
- For non-students: $C_1 = Y_{1i}^{non-HE}$ and $C_2 = Y_{2i}^{non-HE}$

Government intervention in the model

Substituting into the utility function yields:

- For HE: $U_i^{HE} = \phi_i^{\mathrm{HE}}\left[L^{HE}(1-\tau^{HE})\, Y_{2i}^{HE}\right]^{\frac{1}{2}}$
- For non-HE: $U_i^{non-HE} = \phi_i^{non-\mathrm{HE}}\left[Y_{1i}^{non-HE} Y_{2i}^{non-HE}\right]^{\frac{1}{2}}$

People choose HE if and only if $U_i^{HE} > U_i^{non-HE}$, i.e.

$$\phi_i^{\mathrm{HE}}\sqrt{L^{HE}(1-\tau^{HE})\, Y_{2i}^{HE}} > \phi_i^{non-\mathrm{HE}}\sqrt{Y_{1i}^{non-HE} Y_{2i}^{non-HE}}$$

Government can adjust τ^{HE} and L^{HE} to make HE more or less attractive.

Government intervention in the model

Arguably, this model captures the HE funding system in England well:

- (English) students pay no fees upfront and receive money for living costs from the government
- Graduates pay back a percentage (currently 9%) of their later-life earnings above an earnings threshold (currently £27,300).

But doesn't the English system rely on student *loans*?

- True, but the majority of students will never pay off their loans, so for most the system acts like a tax

Recap

- A completely private market in higher education is rare.
  - Most countries subsidise higher education, but systems vary.
- Three justifications for the government to intervene in the market for higher education:
  1. Financial market imperfections
  2. Positive externalities
  3. Privately suboptimal decisions
- If we adapt our model for government funding paid for by a graduate tax, students choose higher education if and only if $U_i^{HE} > U_i^{non-HE}$:

$$\phi_i^{\text{HE}} \overbrace{\sqrt{L^{HE}(1-\tau^{HE})\,Y_{2i}^{HE}}}^{\text{geometric mean of consumption levels (HE)}} > \phi_i^{non-\text{HE}} \overbrace{\sqrt{Y_{1i}^{non-HE}Y_{2i}^{non-HE}}}^{\text{geometric mean of consumption levels (non-HE)}}$$

What are the financial benefits of higher education?

Returns to higher education

We would like to estimate the *financial return* to higher education

- How much higher are an individual i's working-life earnings (in percent) as a result of going to university?
- The comparison is what person i *would have earned* had she not gone to university.

This is important information:

- **For students** thinking about whether or not to attend university
- **For the government** thinking about the design of the higher education funding system

However: financial returns are only one part of the benefit of higher education for individuals (health, happiness, …) and society (externalities!)

Returns to higher education in the model

In terms of our model, we want to estimate the later-life percentage earnings return $\rho_i = \frac{Y_{2i}^{HE} - Y_{2i}^{non-HE}}{Y_{2i}^{non-HE}}$.

Notation: $d_i^{HE} = 1$ if i goes to university, otherwise $d_i^{HE} = 0$.

Suppose we have data on working-life earnings Y_{2i}, d_i^{HE}, and a vector of background characteristics X_i.

Assume that second period earnings for both HE and non-HE are given by the "Mincer-type" earnings equation

$$Y_{2i} = \exp\left(\alpha_0 + \alpha_1 d_i^{HE} + X_i\beta + u_i\right)$$

Vector of observables

Unobservable component

Note I have assumed here that α_1 is fixed across individuals (can relax later).

Substituting into the expression for ρ_i yields: $\rho_i = \rho = \exp(\alpha_1) - 1$.

So estimating the "log point return" α_1 will allow us to get at ρ

OLS estimation

Taking logs of the earnings equation yields:

$$\log Y_{2i} = \alpha_0 + \alpha_1 d_i^{HE} + X_i\beta + u_i$$

u_i is a random error term from the point of view of the econometrician.

Can we estimate α_1 by OLS regression?

Crucial OLS assumption: $E\left(u_i \middle| X_i, d_i^{HE}\right) = 0$ (exogeneity)

This implies: Conditional on the other regressors, each regressor has to be uncorrelated with u_i.

- As we are interested in α_1, the crucial condition for us is $\text{Corr}\left(u_i, d_i^{HE} \middle| X_i\right) = 0$.
- Otherwise: **omitted variable bias/selection bias**

Exogeneity of d_i^{HE}: Intuition

Assumption: $\text{Corr}\left(u_i, d_i^{HE} \middle| X_i\right) = 0$

For instance, u_i may contain some unobserved factors that are valuable in the labour market.

- e.g. charm, self-confidence, strong work ethic, curiosity, …

The assumption says that *conditional on the observables*, these unobserved factors are *uncorrelated* with HE participation.

- Looking at people with the same observable characteristics, people who are charming/self-confident/etc. are no more likely or unlikely to go to university.
- Is this plausible?

If not true, OLS estimate of financial return to HE will be picking up differences in the effect of unobservable factors.

Exogeneity of d_i^{HE}: Theory

One possible guide: **theory from previous sections**.

We showed that in the model with government subsidies funded by a graduate tax we get:

$$d_i^{HE} = \mathrm{I}\left[\phi_i^{\mathrm{HE}} \sqrt{L^{HE}(1-\tau^{HE})\, Y_{2i}^{HE}} > \phi_i^{non-\mathrm{HE}} \sqrt{Y_{1i}^{non-HE} Y_{2i}^{non-HE}}\right]$$

Substituting in the equation for second period earnings gives us:

$$d_i^{HE} = \mathrm{I}\left[\phi_i^{\mathrm{HE}} \sqrt{L^{HE}(1-\tau^{HE}) \exp(\alpha_1) \cancel{\exp(\alpha_0 + X_i\beta + u_i)}} > \phi_i^{non-\mathrm{HE}} \sqrt{Y_{1i}^{non-HE} \cancel{\exp(\alpha_0+X_i\beta+u_i)}}\right]$$

u_i cancels out, because background factors equally affect HE and non-HE utility.

So d_i^{HE} does not directly depend on u_i in that model.

Exogeneity of d_i^{HE}: Caveats

Could still be correlated if ϕ_i^{HE}, $\phi_i^{non-\mathrm{HE}}$ or Y_{1i}^{non-HE} are correlated with u_i even conditional on X_i .

For example:

- **Curiosity** (part of u_i) positively affects earnings and is positively correlated with d_i^{HE} through ϕ_i^{HE}. Then would **overestimate $\boldsymbol{\alpha_1}$**.
- **Strong work ethic** (part of u_i) positively affects earnings and is negatively correlated with d_i^{HE} through Y_{1i}^{non-HE}. Then would **underestimate $\boldsymbol{\alpha_1}$**.

More generally:

- u_i only cancels out from the HE decision rule in this particular model
  - depends on Cobb-Douglas preferences
  - depends on earnings function
- In other models, u_i could affect the HE participation decision d_i^{HE} directly.

Using OLS to estimate returns for English students

Best data: **LEO dataset.**

Contains linked school records, university records, and tax records for **everyone who took GCSEs in England since 2002**. Can look at **annual earnings at age 29.**

With lots of background info, higher education choice may be **as good as random *conditional on these characteristics*** (i.e. we might believe the exogeneity assumption).

Wealth of background information in LEO:

- **prior attainment**: GSCE and A-level choices and results
- **socio-economic background**: Free-school meals, neighbourhood deprivation, independent school
- **demographic characteristics**: ethnicity, region, gender, EAL

Using OLS to estimate returns for English students: Results

	(1)	(2)	(3)	(4)	
Men	0.19***	0.25***	0.22***	0.04***	4%
	(0.00)	(0.00)	(0.00)	(0.01)	
No. of observations	*2,183,120*	*2,183,120*	*2,183,120*	*2,183,120*	
No. of individuals	*629,138*	*629,138*	*629,138*	*629,138*	
Women	0.44***	0.50***	0.46***	0.23***	26%
	(0.00)	(0.00)	(0.00)	(0.00)	
No. of observations	*2,619,982*	*2,619,982*	*2,619,982*	*2,619,982*	
No. of individuals	*731,200*	*731,200*	*731,200*	*731,200*	
Cohort/Age start controls	No	Yes	Yes	Yes	
Background charcteristics	No	No	Yes	Yes	
Prior attainment	No	No	No	Yes	

Source: Belfield et al. (2018)

Heterogeneity in financial returns

So far we have assumed that the return to higher education is the same for everyone.

This is clearly not true between men and women.

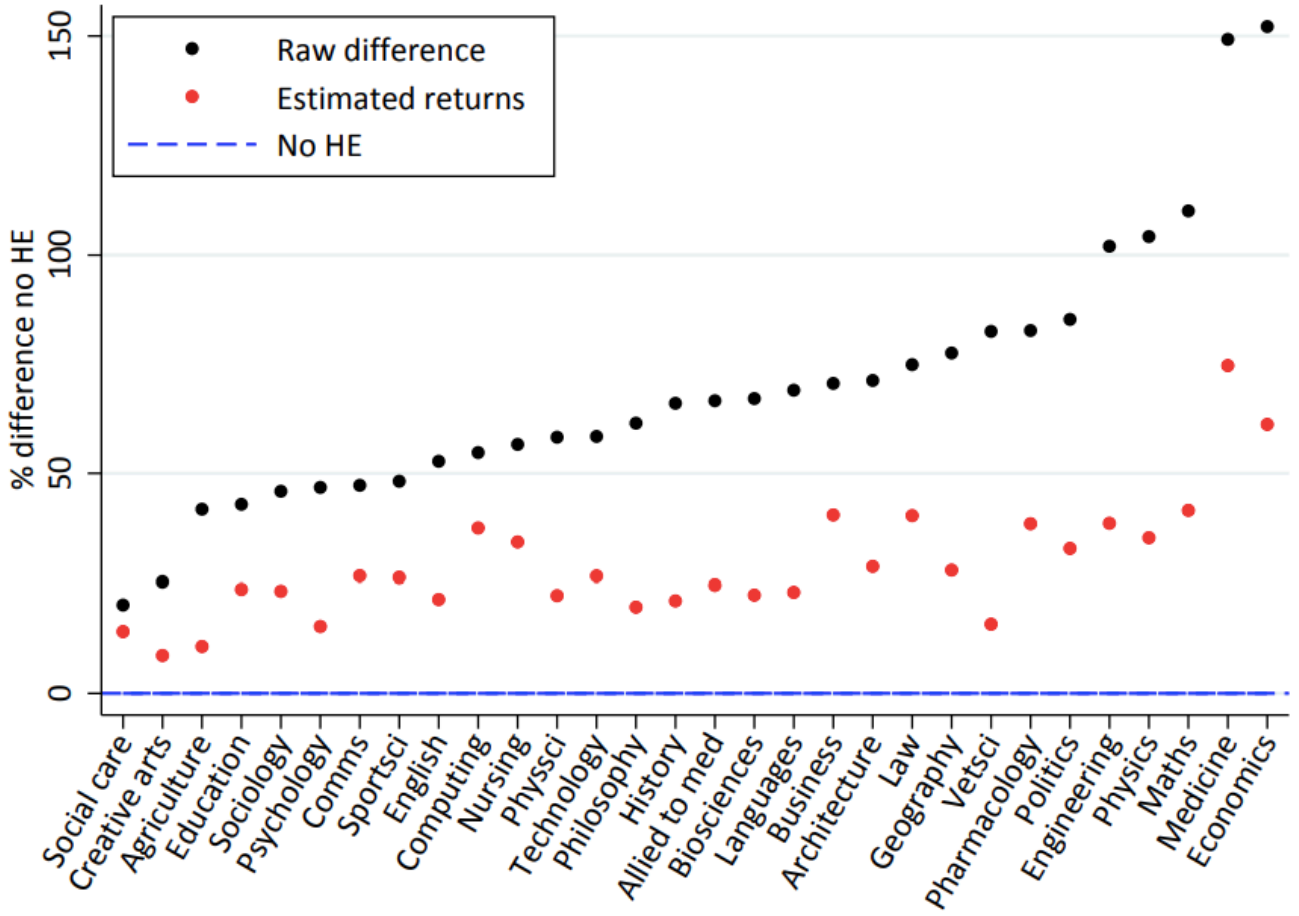
Returns also vary hugely…

- …by **subject** studied
- …by **institution** attended
- …over the **life cycle**

I'll show some evidence of heterogeneity along these dimensions in the next few slides.

Financial returns by subject

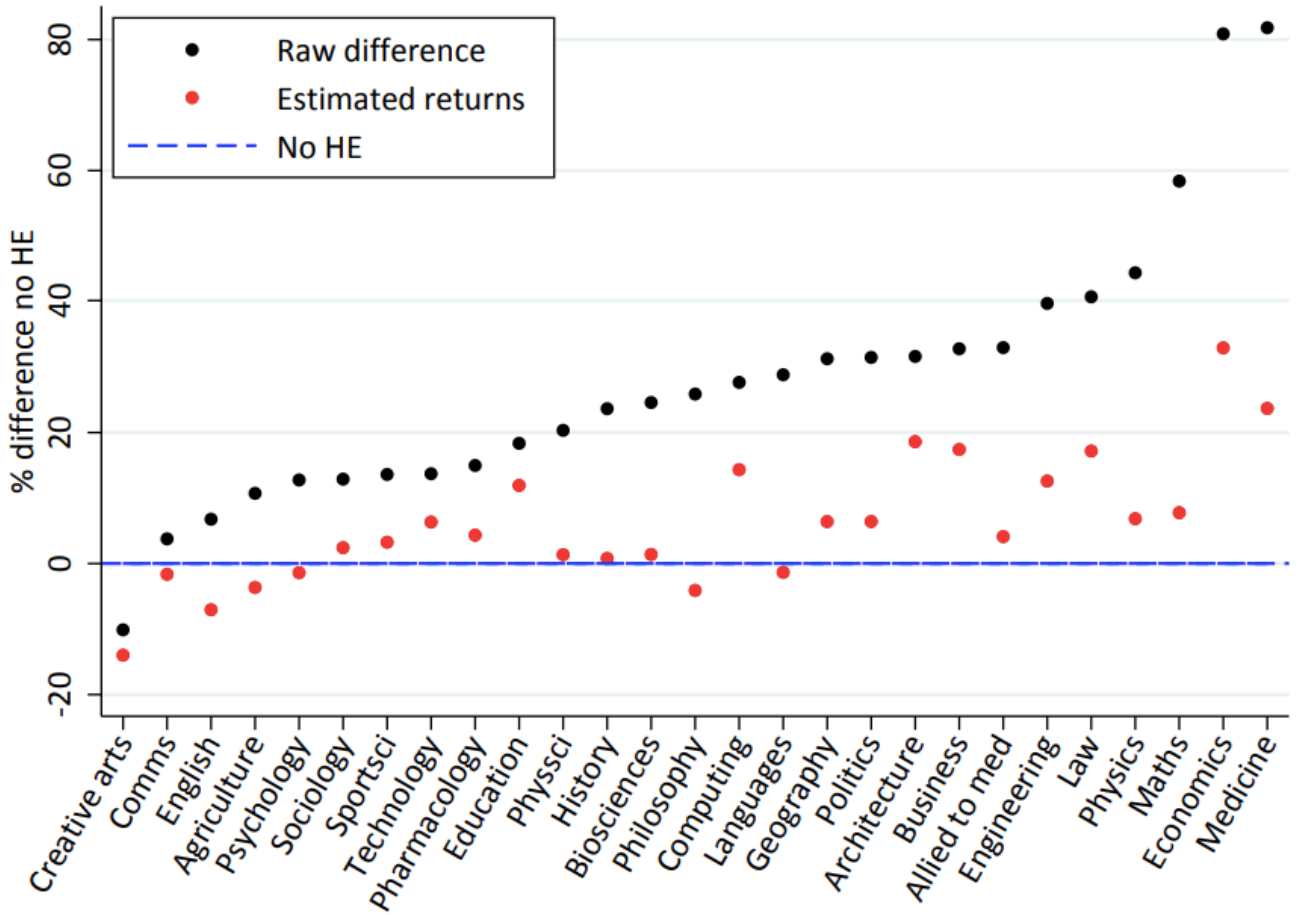
Figure 17: Raw earnings differences and estimated returns at age 29 by subject, women



Source: Belfield et al. (2018)

Financial returns by subject

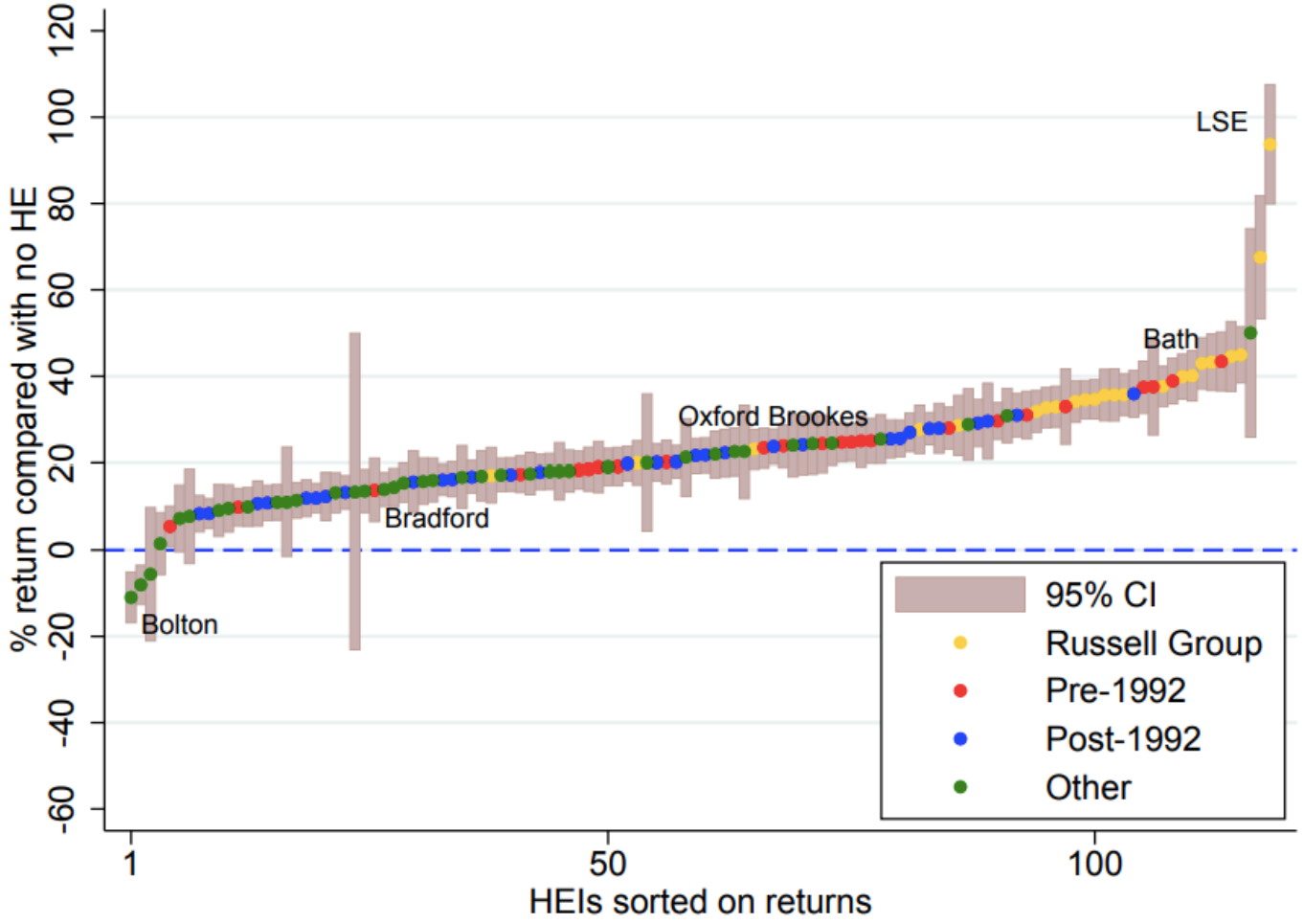
Figure 16: Raw earnings differences and estimated returns at age 29 by subject, men



Source: Belfield et al. (2018)

Financial returns by institution

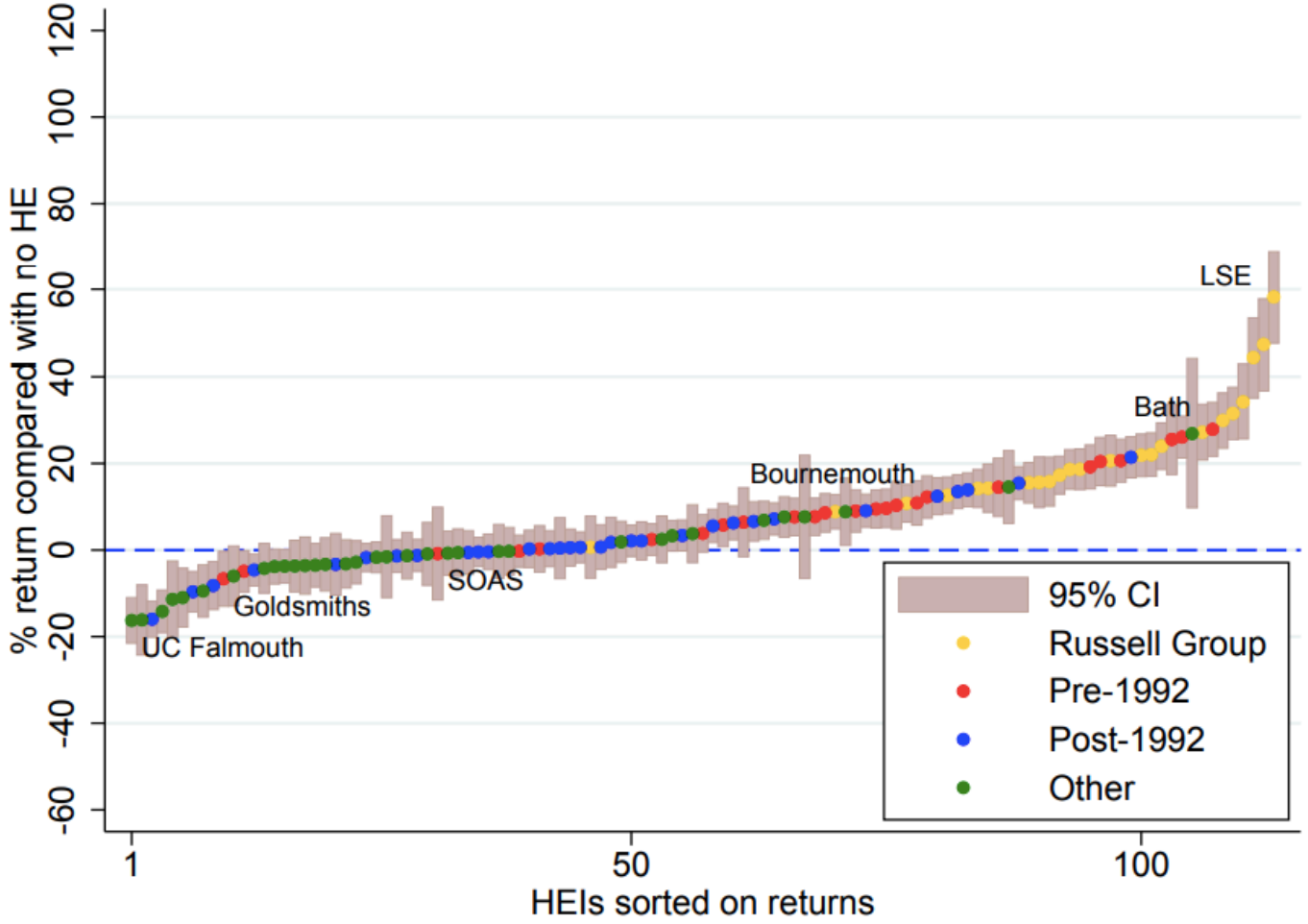
Figure 25: Estimated returns at age 29 by HEI, women



Source: Belfield et al. (2018)

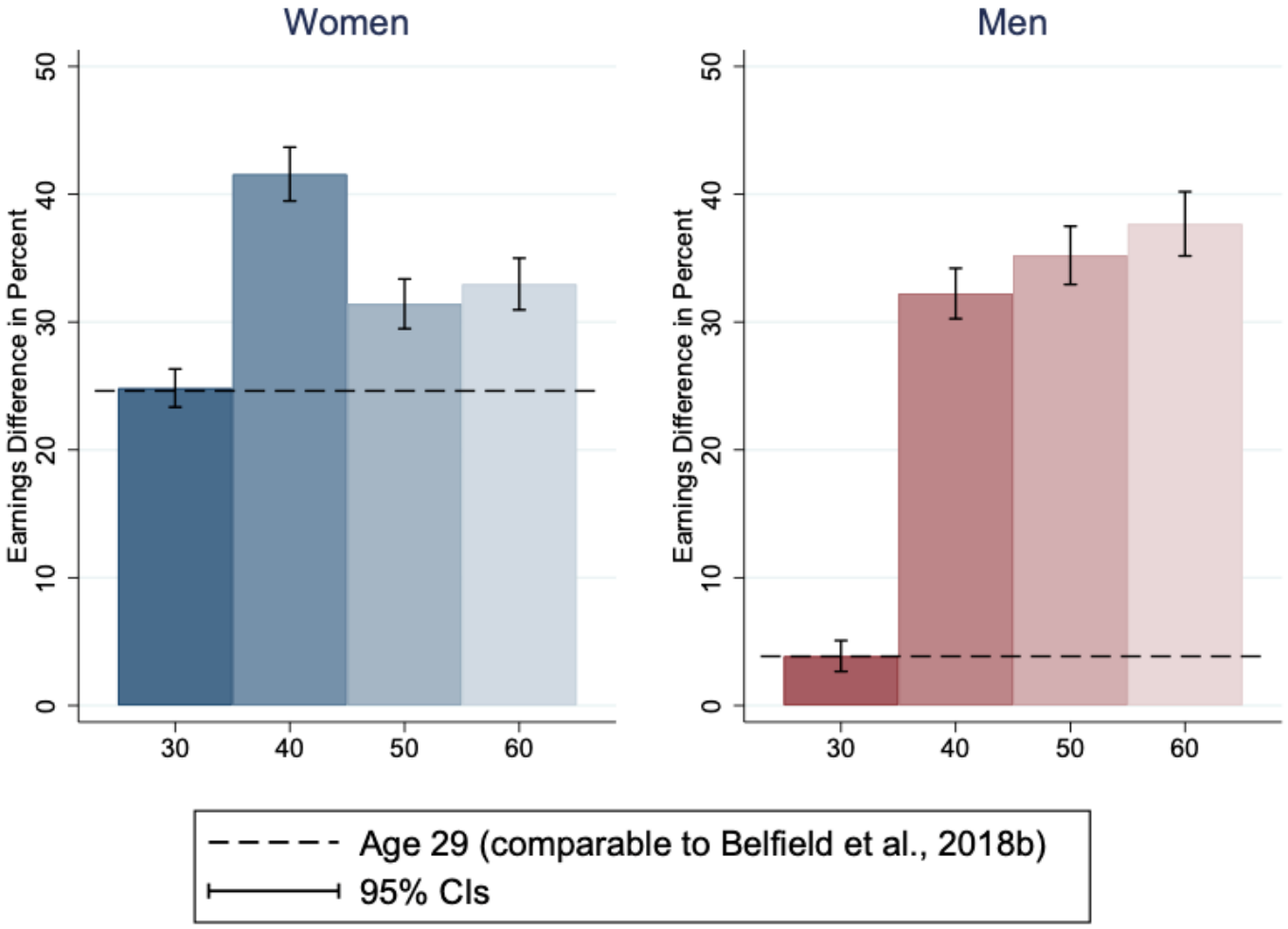
Financial returns by institution

Figure 24: Estimated returns at age 29 by HEI, men



Source: Belfield et al. (2018)

Life cycle financial returns



Source: Britton et al. (2020)

Conclusion

1. There are many reasons why people do or do not go to university (financial and non-financial)

- A model of higher education can help clarify how these factors together influence choices

2. Choices in a completely private higher education market may lead to underinvestment in HE due to:

- financial market imperfections
- externalities
- privately suboptimal decisions

These are reasons for governments to provide loans and subsidise HE, which is what we observe in practice.

Conclusion

3. Financial returns to higher education can be estimated by OLS (provided the exogeneity assumption holds) or other methods.

- OLS results for England: Age 29 financial return is ~25% for women and ~5% for men.
- Large heterogeneity in financial returns:
  - by institution
  - by subject
  - over the life cycle (men catch up).

The Institute for Fiscal Studies
7 Ridgmount Street
London
WC1E 7AE

www.ifs.org.uk