

Education as social infrastructure

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Motivation and Overview

- Starting point is Corrado, Haskel and Jona-Lasinio (2015) SPINTAN framework document
- Sees education services as producing a societal asset that should be included in saving and wealth
- Brief presentation of underlying theoretical model, This paper applies the Jorgenson Fraumeni framework to this model to measure investment in education services
 - Discusses a number of conceptual issues
 - Issues in applying the approach to UK data
 - Some preliminary results

The Jorgenson-Fraumeni framework

Discussion based on Christian (2010)

Calculates the values of human capital stocks based on lifetime incomes by sex (s), age (a) and education level (e).

Let pop = population,

y = current market income

li = lifetime income

δ = the discount rate

g = average income growth

$senr$ = the enrolment rate

sr = the survival rate.

The Jorgenson-Fraumeni framework

In general the lifetime income of those who are not currently in education (assumed aged 35+) is given by:

$$li_{s,a,e,t} = y_{s,a,e,t} + sr_{s,a+1,e,t} \frac{1+g}{1+\delta} li_{s,a+1,e,t} \mid a \geq 35$$

This assumes that the best estimate of a person's income next year is that earned by a similar person this year who is one year older.

The Jorgenson-Fraumeni framework

For persons aged between 5 and 34, lifetime income takes account of if they are enrolled in education or not. For these age groups:

$$li_{s,a,e,t} = y_{s,a,e,t} + sr_{s,a+1,e,t} \frac{1+g}{1+\delta} \left[senr_{s,a,e,t} li_{s,a+1,e+1,t} + (1 - senr_{s,a,e,t}) li_{s,a+1,e,t} \right] | 5 \leq a < 35$$

Their income depends on if they stay in education, in which case they earn li associated with education level $e+1$, or leave school and earn li associated with education level e .

The Jorgenson-Fraumeni framework

Christian (2010) defines net investment in human capital (NIH) as the effect of changes from:

Births

Deaths

Investment from education of persons enrolled in school

Depreciation and aging of persons not enrolled in school.

Investment in Education

The term corresponding to those enrolled in school which we use for nominal investment in education is given by:

$$VES_t = \sum_s \sum_a \sum_e enr_{s,a,e} (li_{s,a+1,e=1,t} - li_{s,a,e,t})$$

Where enr are enrolments. These are multiplied by the amount by which lifetime earnings at that age, sex, and education change with the addition of one extra year of education and the one extra year of age required to achieve that additional education.

Investment in Education

- In order to estimate this equation we need to address a number of issues

The choice of δ (the discount rate) and g (average income growth)

- Attribution of earnings to education
 - Employment probabilities
 - Education progression
 - Foreign students
 - Deflators
- We also want to compare these outcome based estimates with the expenditure on education

Issues in calculating investment in education

δ and g

- The discount rate should be a measure of the social rate of time preference (SRTP as in Corrado and Jaeger, 2015)
- g should not include any elements of capital gains in the national accounting sense
- In the estimates we assume of $g = 0.01$ and $\delta = 0.02$

Issues in calculating investment in education

Attribution

- Some part of lifetime earnings is a return to experience or employer provided training
- To capture the component arising from education we assumed income is constant at the earnings a few years after graduation.
- The assumptions vary by type of education received.
- A more systematic treatment might estimate Mincer wage equations

Issues in calculating investment in education

Employment probabilities

The equations for lifetime income are the potential earnings of those currently in education

However some persons will not be employed throughout their working lives due to unemployment or not in the labour force, e.g. due to maternity leave, illness, retirement etc.

We deal with this by multiplying current income by employment rates, as is standard in human capital stock calculations

Issues in calculating investment in education

Education progression

- The UK data are available by type of qualification rather than years of education, divided into 4 groups
 - GCSE
 - A level
 - Further education (FE)
 - Higher Education (HE)
- We aggregate all students up to age 16 and compare their li with the li of someone aged 17 who has an A-level.
- FE are compared with GCSE for those aged up to 18 and with A levels for older students
- He is compared to A level rather than FE

Issues in calculating investment in education

Foreign students

- Some students receive education and afterwards go back to their home country so arguably should be removed from the estimates
 - Distinguish between EU and non-EU students – only the latter are considered ‘foreign’
- In the UK ‘foreign’ students pay the full cost of their tuition so they are also removed from the public expenditure side



Education services and education costs

What is the relationship between our nominal value of investment and expenditures on education? This could be a measure of effectiveness, i.e.

$$P^{ES} \Delta E = \gamma * EDCosts$$

where γ can be equal to, greater than, or less than one.

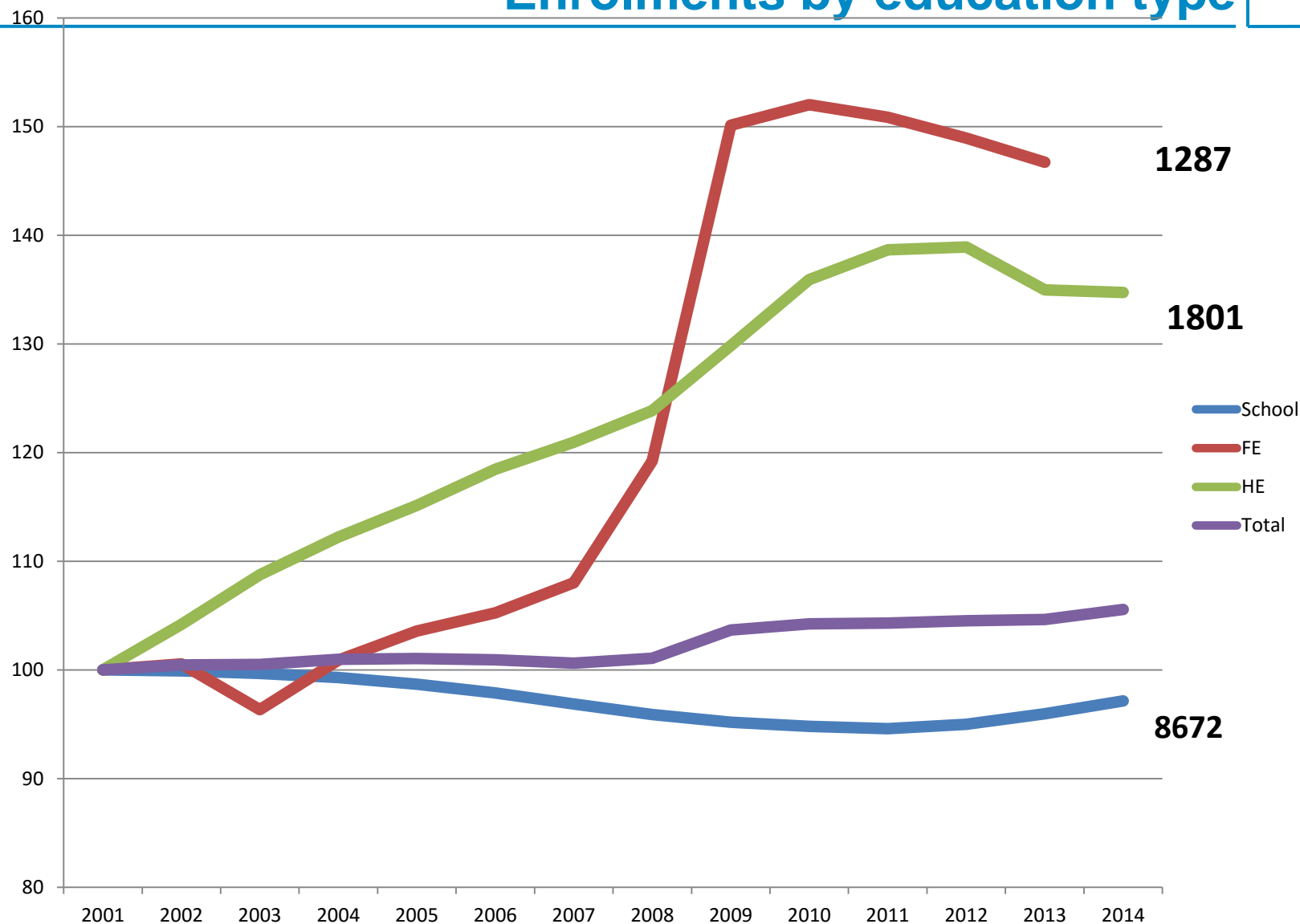
If $\gamma > 1$ then could be a measure of quality.

$\gamma < 1$ could be capturing penalty exacted from society due to resources of the school system not being used effectively.

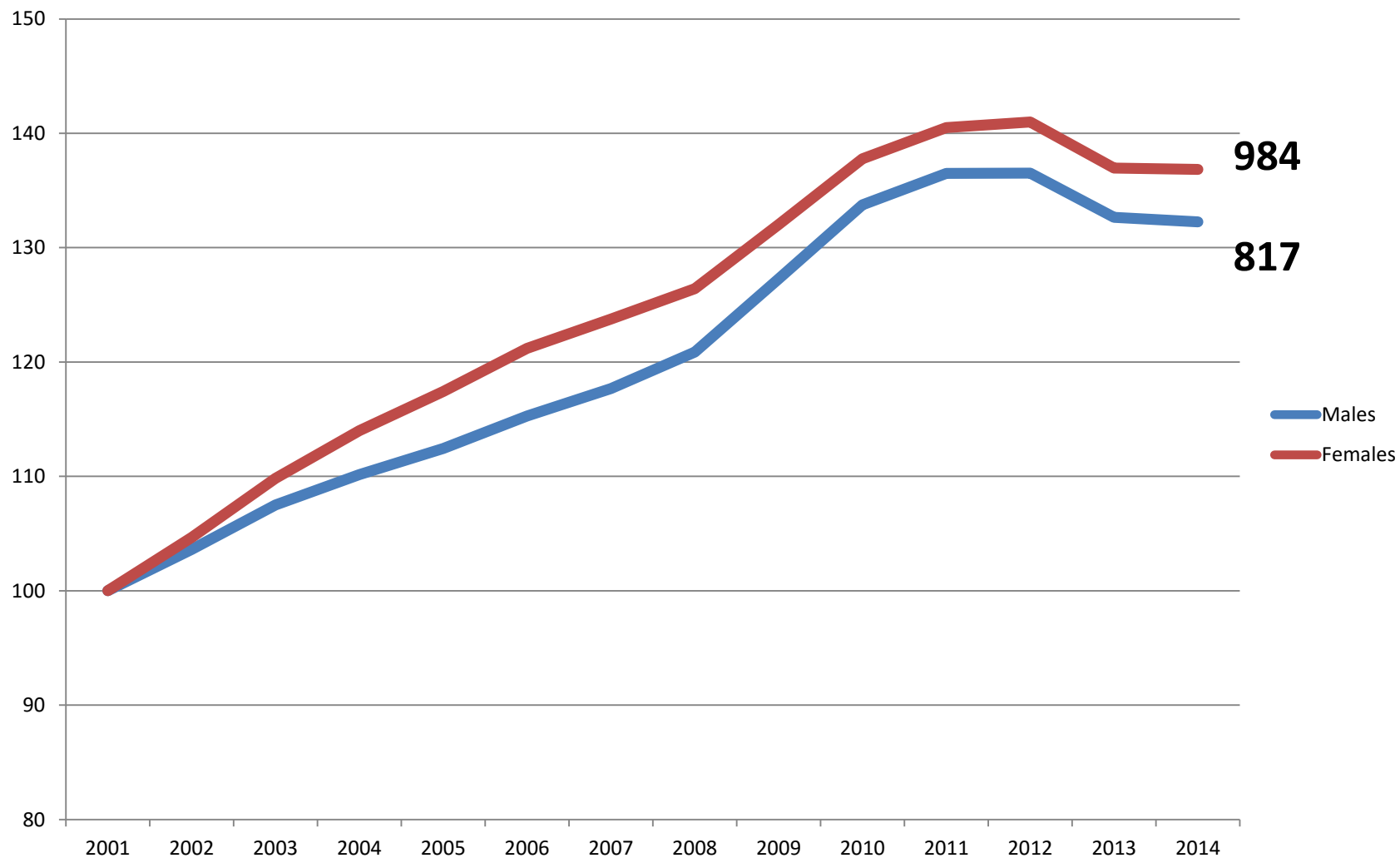
Data Sources: UK estimates

- Enrolment rates from Education statistics
 - Uses unpublished tabulations from HESA for foreign students
- UK Labour Force Survey and Annual Survey of Population were used to estimate earnings by age, gender and qualification level.
- Life Tables for survival probabilities

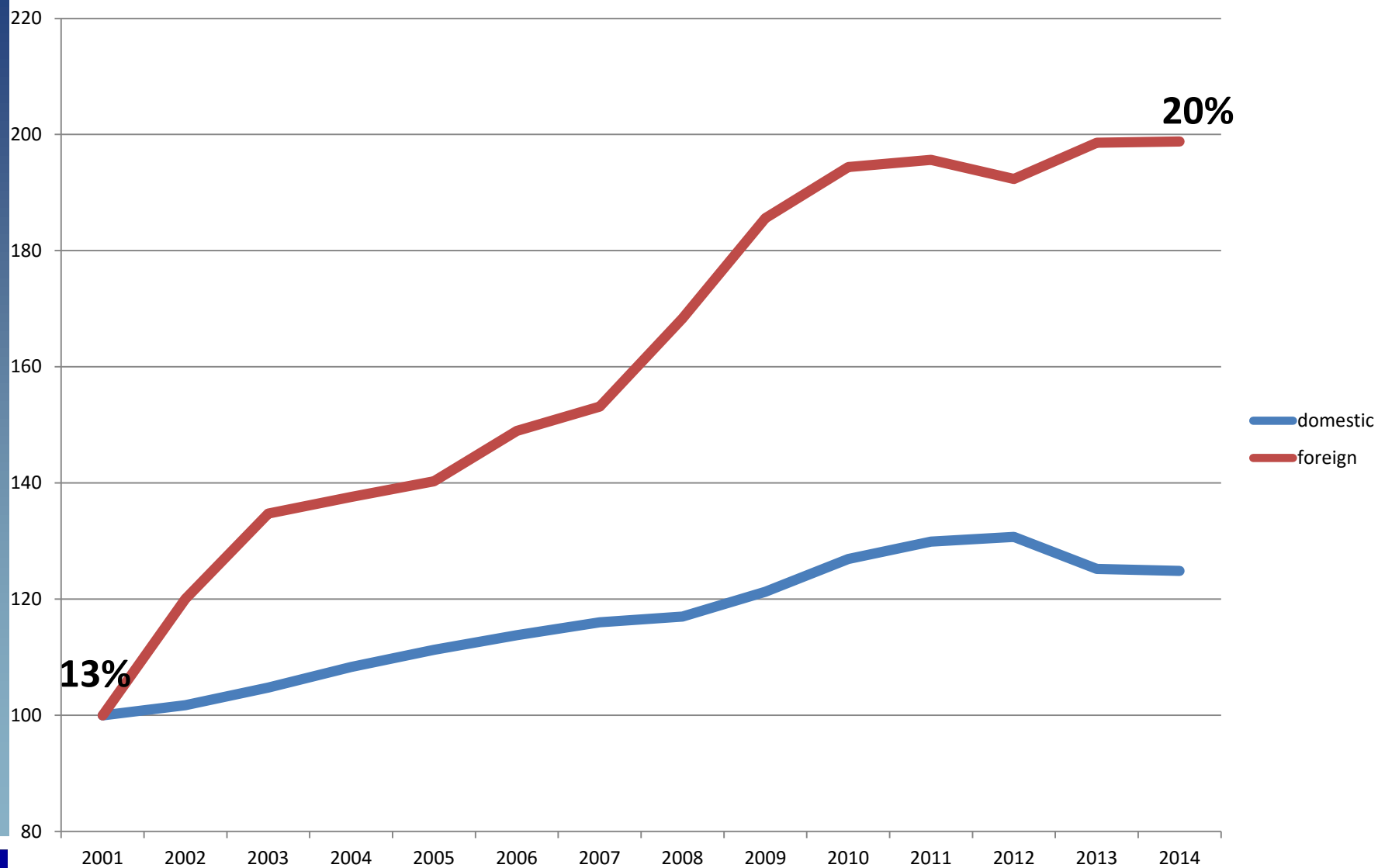
Enrolments by education type



Enrolments by gender: HE



Enrolments in HE



Results (1): comparison of variants

	Education investments			Ratio to B.		
	Males	Females	Total	M	F	T
A. Total population	110,124	104,714	214,838	0.91	1.02	0.96
B. baseline: incl emp propensity	121,401	102,360	223,761	1.00	1.00	1.00
C. B + excl foreign students	96,018	83,902	179,920	0.79	0.82	0.80
D. B +, attribution	97,700	95,048	192,748	0.80	0.93	0.86
E. B +, attribution & excl foreign	73,616	74,459	148,075	0.61	0.73	0.66
F. Baseline: g=0.02, d=0.035	126,783	105,298	232,081	1.04	1.03	1.04

Results (2)

	School	FE	HE
B. baseline: incl emp propensity	54,841	17,384	151,536
C. B excl foreign students	54,841	17,384	107,695
Shares (% of total)			
B. baseline: incl emp propensity	25	8	68
C. B excl foreign students	30	10	60

Education investments per head: Other results

Comparing male and female education investments per head

Ratio M/F: 2002 = 1.3; 2013 = 1.22

Comparing education investments with education spend

2002 = 3.1; 2013 = 2.8

- Estimates are sensitive to the underlying assumptions, in particular the treatment of foreign students and how much of the difference in earnings by qualification group can be attributed to education rather than experience
- These differences are much greater than those arising from assumptions on discount rates and growth in income
- Additional issue: What deflator should be used?