Erasmus
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Economics

Is Early Tracking Efficient?
International Short and Long Run (Causal) Evidence

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Motivation: Educational Tracking

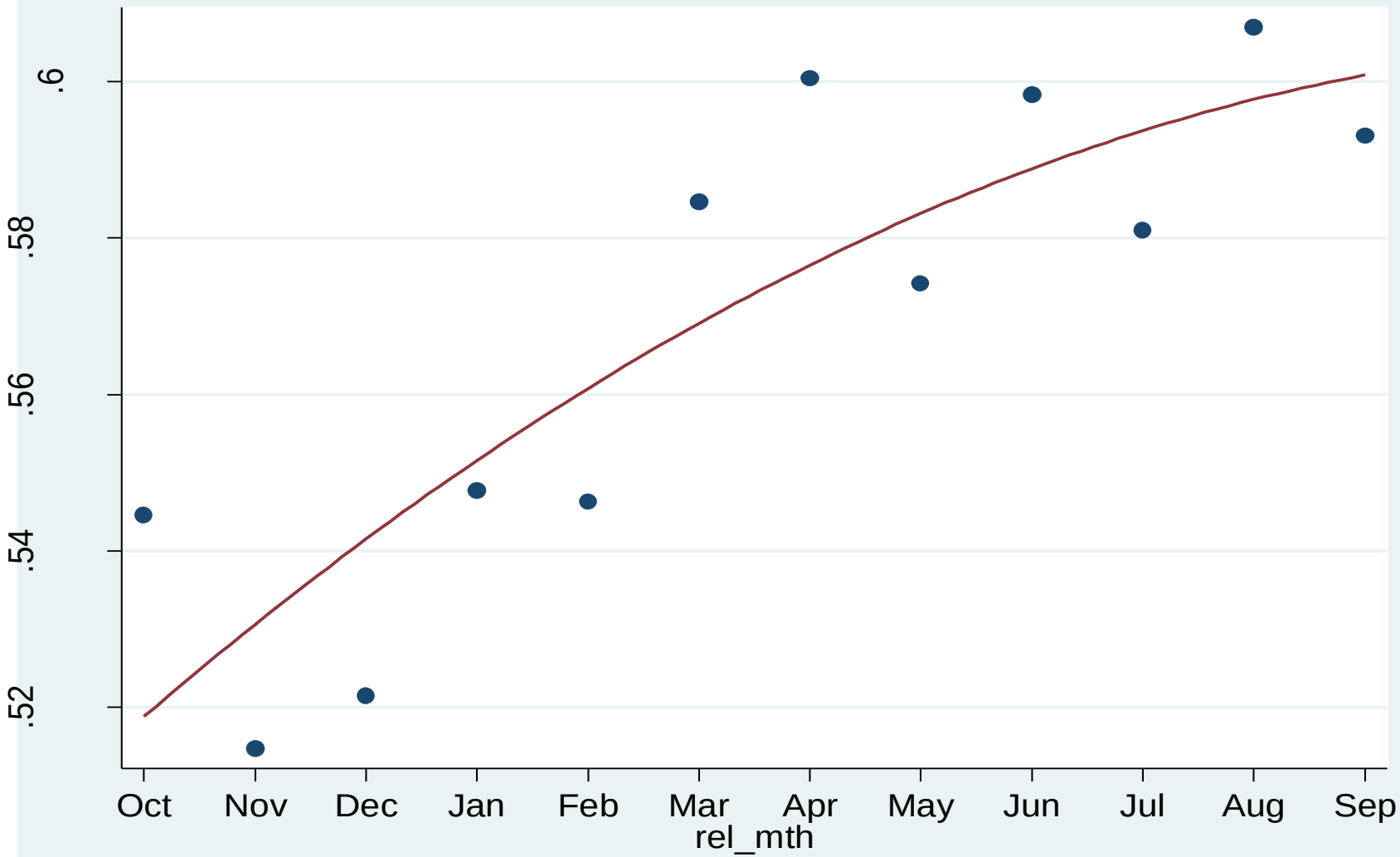
- Tracking of students selected into distinct educational programmes:
  - Proponents → efficiency: ability grouping enables focused curriculum
  - Opponents → inequality: lower ability students are left behind + strong link of selection with socio-eco background

- Looking nationally difficult because of endogenous societal decision:
  - Van Elk et al (2011) –ve; Dustmann et al (2014) ≈; Duflo et al (2011) +ve

- Hannushek and Woesmann (2006) use diff-in-diff in primary Vs secondary test scores and find evidence of inequality if countries track early. Robust…

- Here we explore if *early* or *late* tracking is more efficient in terms of student allocation when considering distortions resulting from ≠ in *timing of birth*

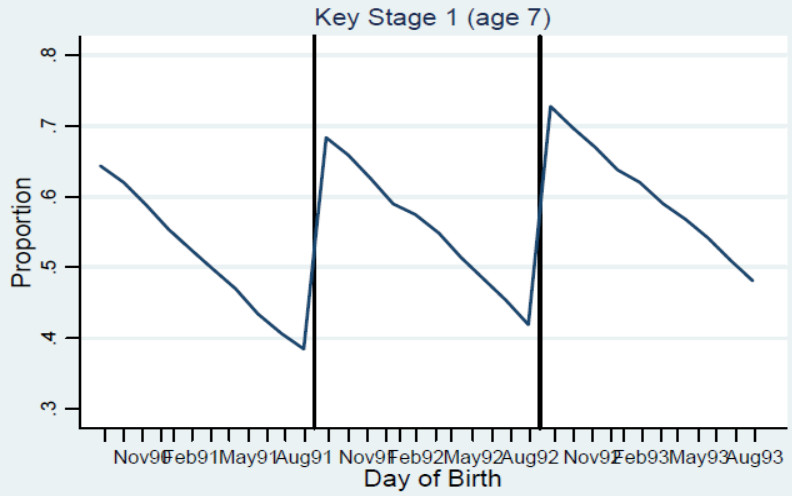
Prob of Enter Low Track in NL by MoB

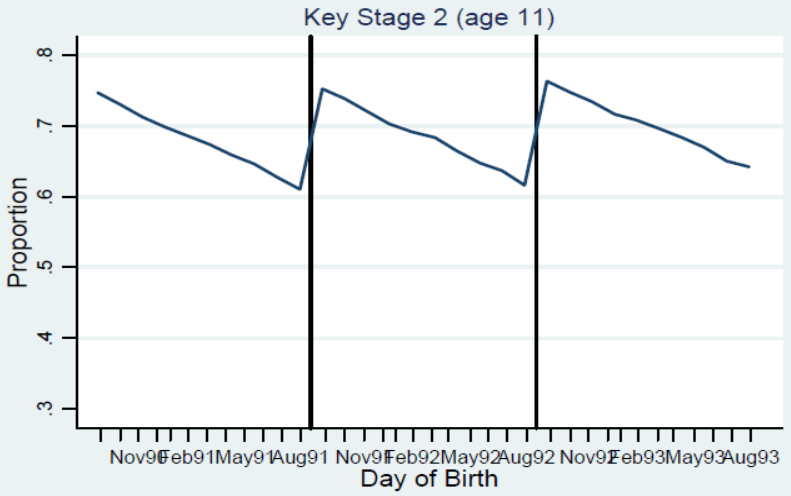


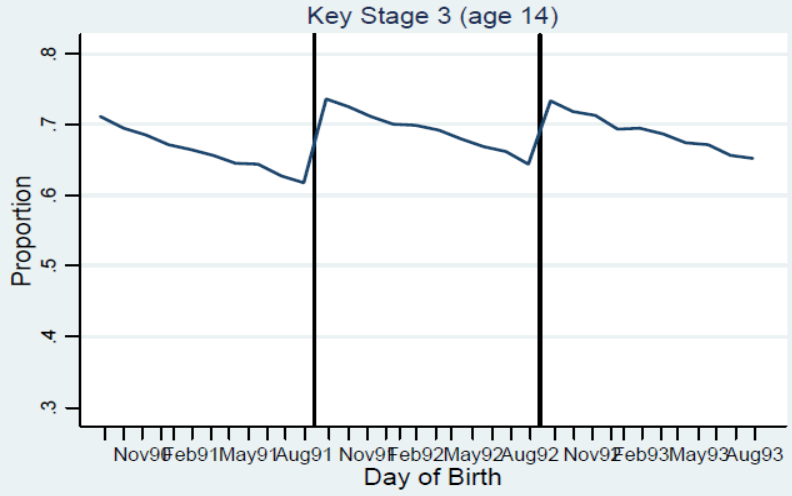
Motivation: Timing of Birth Effects

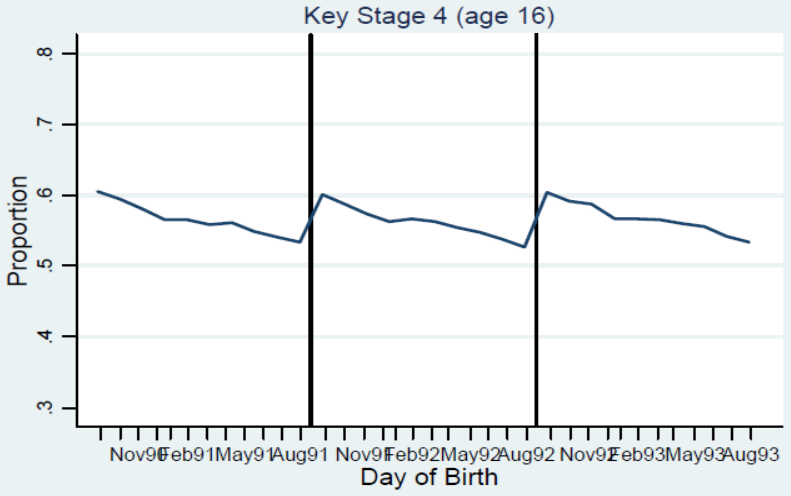
- School entry rules lead to up to 11 months ≠ in age of students from same class and result in ≠ in educational performance/outcome
  - Four potential effects identified: (i) age of school start; (ii) maturity or age at test; (iii) position; (iv) length of schooling
  - Angrist and Krueger (1992) used (iv) and US drop out rules: younger do better
  - International evidence – Bedard and Duhey (2006) - point to older students (i.e. born after entry cut-off) doing better with effect (ii) identified as driver
- This *relative age* effect does not have to be problem in long run
  - Black et al. (2011) do find small negative effect on IQ score at age 18 and tiny negative effect on male earnings until the age of 30
  - Crawford et al. (2013) document how *relage* effect decreases with age…

Relative Age Effect and Student Age









Relative Age and Tracking

- If election into track based on ability at a certain age then 'natural' that relatively young students more often sent to lower track. Some evidence that this is the case
  - Canada: Allen and Barnsley (1993)
  - Germany: Puhani and Weber (2006), Jurges and Schneider (2007), Muehlenweg and Puhani (2010) and Dustmann et al (2014)
  - France: Grenet (2011) call it (v) "educational trajectory effect"

- Large ≠ in age of tracking across countries but surprisingly no international investigation of relative age effect on this…

Selection and the Relative Age Bias?

- Track placement is based on a performance measure at age *t*

$$Performance_t = \beta * Ability + \delta * \underbrace{\frac{Rel.Age}{Age_t}}_{\text{Relative age bias}}$$

- Bias naturally decreases with age improving track placement

$$\lim_{t \to c^*} \frac{Rel.Age}{Age_t} = 0$$

- What to expect in terms of selection into track and their composition in the short & long run in countries which do this early vs late?

Selection Bias and Age of Tracking?

1. Rel. young students (of equal ability) are more likely to go to the lower academic track the earlier the selection decision is made

2. Rel. young students will be on average better students in the class/track in countries that select early in both low and high track

   → As real ability revealed they are on average better than low track peers and only extremely able students made it to high track because of bias

3. Rel. young students more often in low track in early tracking country but best students because of mis-allocation: long run effect?

Model to Test Short Term Outcomes

1. Exploit ≠ in the probability of being tracked resulting from individual (exogenous) variation in month of birth around school entry cut-off dates

2. Categorize countries into two groups: late and early trackers

Since 1 will vary across 2, we can now estimate RelAge bias by running:

$$Y_{ic} = \beta_1 RelAge_{ic} + \beta_2 RelAge_{ic} * EarlyTracking_c + \mu_c + \epsilon_{ic}$$

Where main outcomes, Y_{ic}, are 'track level' and 'test score' and early/late grouping allows for inclusion of country fixed effects μ_c

Data for Short Run Analysis

- Programme for International Student Assessment (PISA) 2009
  - International survey of pupils aged 16 with comparable ability tests in math, reading, and science
  - Month of birth and entry cut-off (!) enable to compute relative for each student in a particualty age ranges from 1 (youngest) to 12 (oldest)
  - Track level of students determined using two different methods:

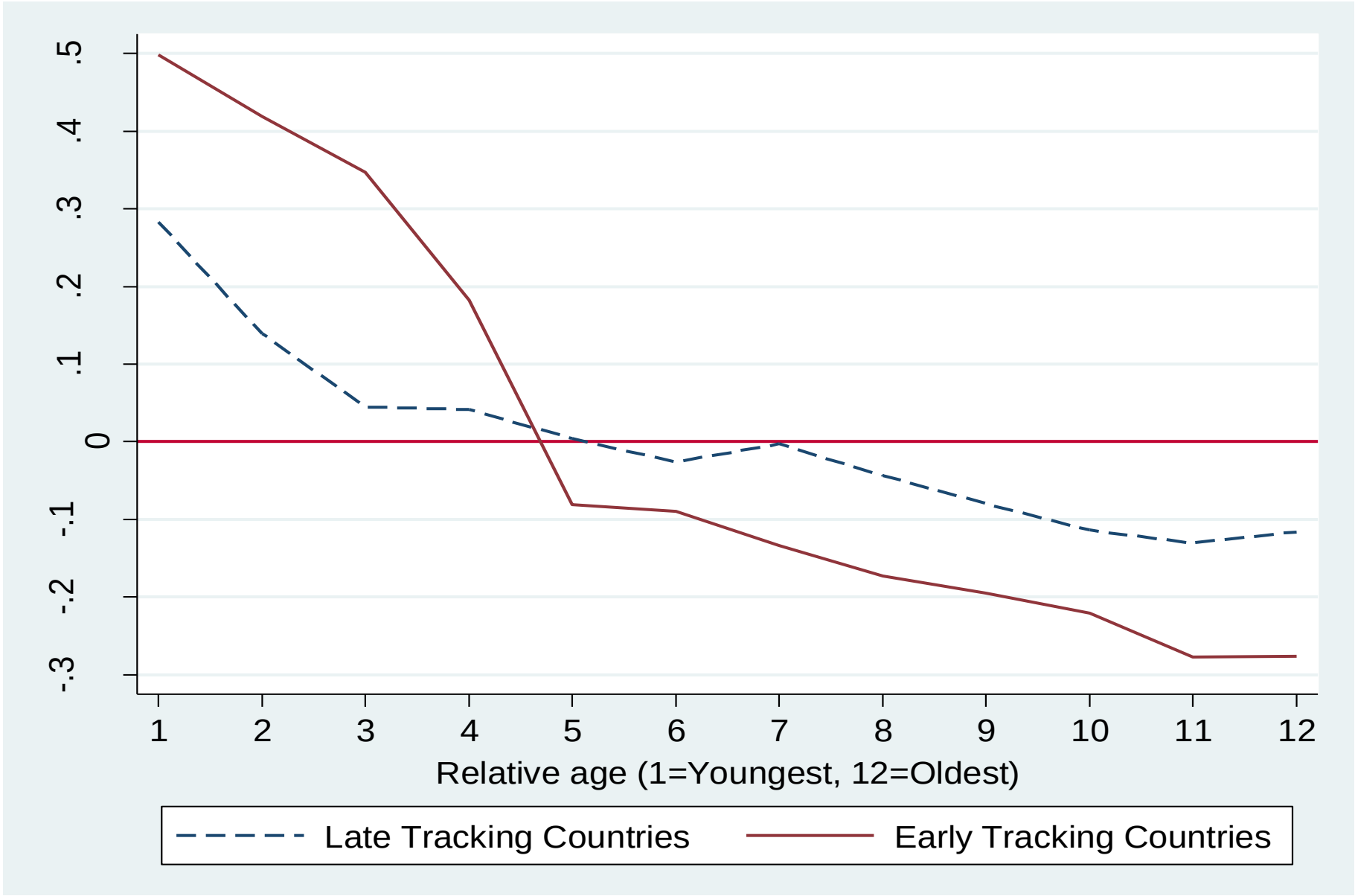
    → Use official description of track + average PISA scores in low or high track
  - Drop if track after PISA & fake trackers: 180,000 students in 23 countries

- Tracking age (OECD and Eurydice) ranges from ages 10 to 15

Tracking in Across PISA Countries

Country	Age of first selection	% in Low Track	Observations
Austria	10	0.48	6,583
Germany	10	0.43	4,979
Czech Republic	11	0.49	6,064
Hungary	11	0.61	4,605
Slovak Republic	11	0.56	4,555
Turkey	11	0.71	4,996
Mexico	12	0.27	38,250
Netherlands	12	0.53	4,759
Switzerland	12	0.92	11,709
Chile	13	0.05	5,543
Luxembourg	13	0.49	4,622
Belgium-Flemish	14	0.26	4,431
Belgium-French	14	0.47	3,620
Italy	14	0.25	30,780
Korea	14	0.29	4,987
Slovenia	14	0.65	6,154
Estonia	15	0,98	4,703
France	15	0.45	4,298
Greece	15	0.17	4,969
Ireland	15	0.64	3,934
Israel	15	0.14	5,761
Japan	15	0.25	6,088

Low Track by RelAge & Late/Early



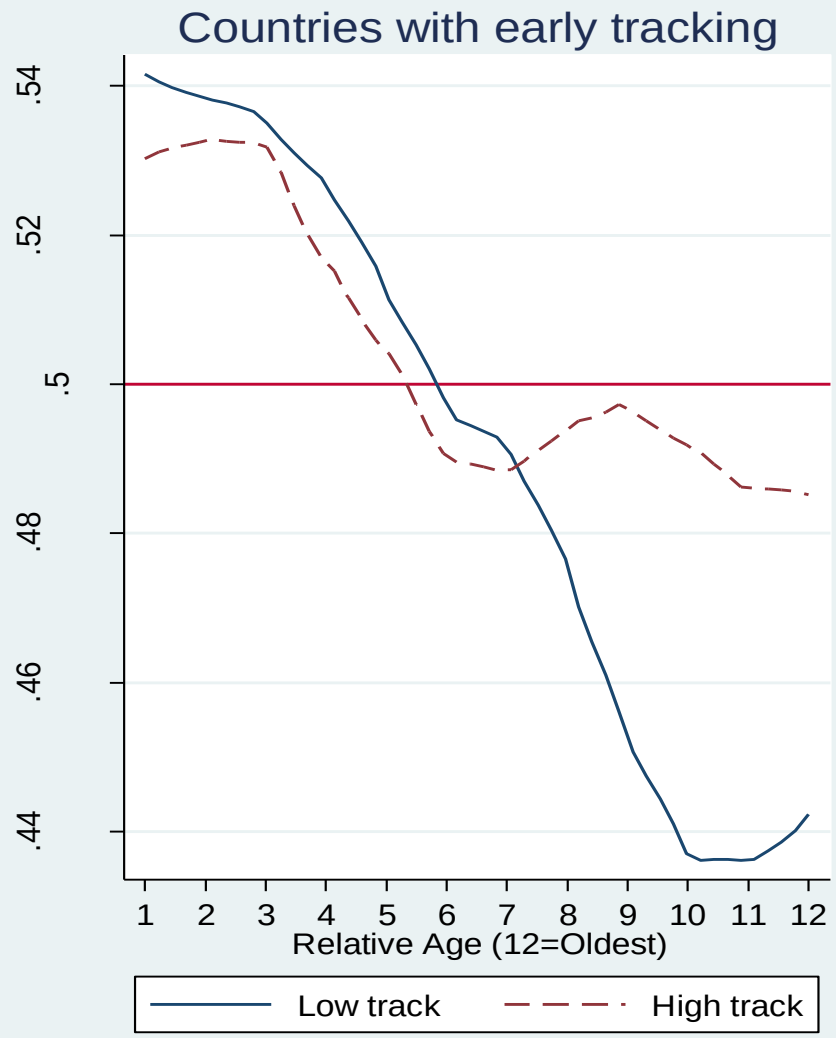
Low Track Probability Results

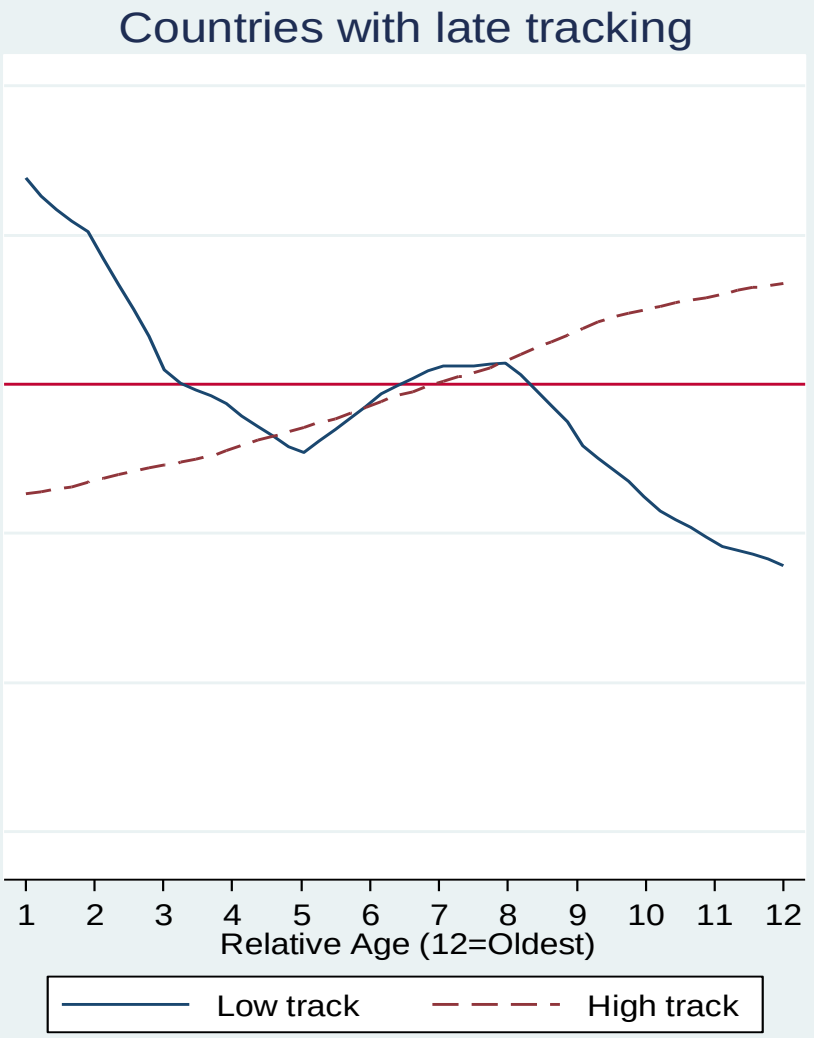
	Probability to be in Low Track (Early Tracking Age < 13)		
RelAge * Early Track Country Dummy	-.0145***	-.0167***	-.0153***
	(.0011)	(.0011)	(.0006)
Relative Age (12=oldest)	-.0088***	-.0086***	-.0086***
	(.0008)	(.0008)	(.0004)
Early Tracking Country Dummy	.3170***	.	.
	(.0085)		
Country Fixed Effects	No	Yes	Yes
Parental Background Controls	No	No	Yes
R^2	.066	.132	.199
# of students	180,967	180,967	180,967
# of countries [# with early tracking]	23 [9]	23 [9]	23[9]

Change in Early Track Group Age?

Age of Selection for Definition of Early Tracking Country	Probability to be in Low Track		
	13	14	15
RelAge * Early Track Country Dummy	-.0153***	-.0123***	-.0072***
	(.0006)	(.0006)	(.0007)
Relative Age (12=oldest)	-.0086***	-.0094***	-.0104***
	(.0004)	(.0004)	(.0006)
Early Tracking Country Dummy	.	.	.
Country Fixed Effects	Yes	Yes	Yes
Parental Background Controls	Yes	Yes	Yes
R^2	.199	.198	.196
# of students	180.967	180.967	180.967
# of countries [# with early tracking]	23[9]	23 [11]	23[16]

Ability Distr. by RelAge & Late/Early?





Test Score Results

Age of Tracking for Early Group of Country	(Early Tracking Age < 13) Math	Reading	Science
RelAge * Early Track Country Dummy	-0.789***	-0.786***	-1.164***
	(0.119)	(0.120)	(0.119)
Relative Age (12=oldest)	1.172***	1.266***	1.463***
	(0.0803)	(0.0809)	(0.0806)
Early Tracking Country Dummy	.	.	.
Country Fixed Effects	Yes	Yes	Yes
Parental Background Controls	Yes	Yes	Yes
R^2	0.312	0.251	0.305
# of students	180,967	180,967	180,967
# of countries [# with early tracking]	23[9]	23[9]	23[9]

From the Short to the Long Run

- We have shown that younger students are at the same time
  - more often ‘misallocated’ to the lower tracks in early tracking countries suggesting that late tracking is more efficient
  - they however perform better at age 15 as ability bias which misallocated them attenuates (especially in low track)

- Total impact on long term outcomes for relatively young therefore ambiguous and we attempt now to evaluate this.

Model for Long Term Outcomes

Same basic concept but now also exploit *changes in tracking age within countries* for identification (i.e. changing composition of the group of early and late tracking countries across cohorts *b*) to estimate:

$$Y_{ibc} = \beta_1 RelAge_{ibc} + \beta_2 RelAge_{ibc} * EarlyTracking_{bc} + \beta_3 EarlyTracking_{bc} + \beta_4 Age_{ibc} + \mu_c + \epsilon_{ibc}$$

Main outcome measures of interestst, Y_{ibc}, are now: educational and labour market situation of affected individuals when adults.

Data for Long Run Analysis

- The Programme for the International Assessment of Adult Competencies (PIAAC): 1st wave 2011/12
  - Survey in 40 countries of adult skills and competencies
  - Focus first on males aged between 25 and 50
  - Educational attainment: obtained tertiary degree
  - Labor market situation: employed, situation income distribution.

- 14 countries changed tracking age between 1936-2012
  - Big thanks to Braga, Checchi and Meschi (2013) for sharing info on this!

Changes in Tracking Age by

Country	Year	Track Age	Change	Track > 13
Belgium FL	1971	15.5	1.5	1
Belgium FL	1985	10	-3.5	0
Czech Republic	1948	15	4	1
Czech Republic	1990	11	-4	0
Denmark	1975	16	2	0
Estonia	1935	14	-2	1
Estonia	1940	15	1	1
Estonia	1960	16	1	1
Spain	1970	14	8	1
Spain	1990	16	2	1
Finland	1971	16	3	1
France	1975	15	4	1
Ireland	2000	15	3	1
Italy	1963	14	3	1
Norway	1969	16	2	1
Poland	1999	16	2	1
Slovak Republic	1944	15	1	1
Slovak Republic	1953	16	-1	1
Slovak Republic	1990	10	-4	0
Sweden	1962	16	4	1
Great Britain	1944	11	-3	0

Results Long Term Outcomes

	Tertiary degree	Employed	Earning above av.	Earning above av. by age group	10% lowest earning by age group
Relage * Early tracking	0.001	0.000	-0.002**	-0.002**	0.003*
	(0.003)	(0.002)	(0.001)	(0.001)	(0.002)
Relative age (12=oldest)	0.001	-0.001	0.001**	0.001**	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
Early tracking	0.008	-0.058***	0.004	0.009	0.004
	(0.026)	(0.021)	(0.008)	(0.0086)	(0.014)
Age	-0.006***	0.004***	0.001***	0.000**	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	22,839	22,774	15,395	15,395	15,395
R-squared	0.05	0.04	0.89	0.90	0.18
Countries	14	14	14	14	14
Country *cohort	377	377	371	371	371

Interpretation of Results

- Relatively older students have a small earnings advantage compared to the relatively young
  - The oldest are 1% more likely to have earning above the average

- Relatively older students in countries with early tracking are 2% less likely to have earning above the average than relatively older students in late tracking countries

- Relatively older students are more likely to belong to the bottom 10% earners in countries with early tracking

Robustness of Long Term Results?

- Weights to give each country the same weight:
  - Difference in the number of observations: 1,049 (Sweden) to 7,279 (Canada)
- Different age categories: 25 to 45 or 25 to 55 or 25 to 65
- Women: no effects on labour market outcomes, but a negative effect of rel. age and early tracking on the age of leaving education.
- No clusters, or only clusters for 25 equal age groups.

Conclusions… So Far

So, in the end, is early educational tracking efficient?

- In short run clearly does not seem to be:
  - Placement of students in low track more distorted in early tracking countries: bias!
  - Important shifts in ability distribution in both tracks relatively young > older peers
- In the long run things are more ambiguous as:
  - No differences in the obtaining a tertiary degree (strange?) or for employments
  - Small but significant disadvantage in terms of position in income distribution for the rel. older students…