

Better late than never? Wage effects of delayed baccalaureate graduation in the United States

Christopher Erwin, Auckland University of Technology

Melissa Binder, University of New Mexico

Xiaoxue Li, University of New Mexico



Motivation

- Time to degree at the baccalaureate level has been increasing in the U.S. for the past three decades
 - We now examine “150% of normal time” graduation rates
 - Phenomenon is especially pronounced at non-top 50 public universities
 - NLS72 50% graduated within 4 years, 82% within 5 years
 - ELS:2002 34% graduated within 4 years, 69% within 5 years
- When does it make sense to pursue a “nontraditional” path to degree attainment?
- What are the implications of delayed graduation in the labor market? Does time to degree function as a productivity signal?



	time to degree distribution				
	4	5	6	7	mean
full sample:					
NLS72	53.1	81.8	90.6	96.3	4.48
NELS:88	39.4	72.7	88.3	94.7	4.81
ELS:2002	42.3	72.1	85.7	93.5	4.83
non-top 50 public:					
NLS72	49.7	82.3	91.1	96.3	4.49
NELS:88	29.1	68.8	87.8	95.1	4.93
ELS:2002	34.2	68.5	85.0	94.1	4.93
top 50 public:					
NLS72	52.7	81.5	89.2	96.4	4.49
NELS:88	39.7	82.0	93.7	96.6	4.66
ELS:2002	56.7	85.2	95.2	98.1	4.42
less selective private:					
NLS72	66.7	87.3	94.0	98.7	4.28
NELS:88	58.0	84.6	93.4	98.6	4.60
ELS:2002	56.1	83.4	92.5	96.1	4.51
highly selective private:					
NLS72	65.2	88.2	93.8	96.8	4.31
NELS:88	73.1	91.9	98.1	99.8	4.20
ELS:2002	68.6	91.7	96.3	98.2	4.28
community college:					
NLS72	36.5	67.8	83.0	92.6	4.90
NELS:88	15.5	44.2	70.8	83.6	5.58
ELS:2002	16.5	43.9	64.4	81.6	5.69

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Motivation

- Why do we care?
- In 2016, the Obama administration proposed two changes to encourage a 4-year track to degree completion:
 - Providing 700,000 students on track to a 4-year degree an additional \$1,915 in aid
 - An “on-track Pell bonus” to raise the maximum award by \$300 for 2.3M students taking at least 15 credits per semester



Motivation

- Why do we care?
- Other proposals include:
 - Increased penalties for course withdrawal
 - Higher per credit tuition for students taking less than 15 credits per semester
 - Lockstep programs restricting student choice in courses to make it harder to change majors



Literature

- Existing literature does not answer the question of whether lengthened time to degree penalizes workers
 - Groot and Oosterbeek, 1994; Brodaty *et al.*, 2009; Flores-Lagunes and Light, 2010; Aina and Pastore, 2012
- Previous studies find a negative relationship between earnings and time to degree
 - Most interpret the result driven by student ability, but lower student ability over time doesn't seem plausible
 - Brodaty *et al.*, 2009: in France they estimate that a one-year delay in graduation results in an 8% wage penalty

Literature

- Time to degree is endogenous in the wage equation
- Previous studies do not control for one confounding factor or another:
 - None control for institutional characteristics, which likely impact both time to degree and earnings after graduation
 - Only one proxies for student ability (Groot and Oosterbeek, 1994)
- Previous estimates not likely reliable as to how time to degree affects wages shortly after college completion

Approach

- 1st: Develop a simplified model of human capital that demonstrates when it makes sense to pursue a nontraditional path to degree attainment
- 2nd: Replicate results from existing literature which finds significant negative relationship between time to degree and wages
- 3rd: Control for institution quality, proxy for ability, and employ two stage least squares (2SLS), instrumenting the student's own time to degree with the average at their first institution

Theoretical Model

- A simplified model of human capital
- A six-year path with .75 FTE of work is preferred to a four-year path with .25 FTE when:

$$\frac{3}{4} \sum_{t=1}^6 \frac{Y_{HS}}{(1+r)^t} + \sum_{t=7}^T \frac{Y_C}{(1+r)^t} - \sum_{t=1}^6 \frac{F}{(1+r)^t} > \frac{1}{4} \sum_{t=5}^T \frac{Y_C}{(1+r)^t} - \sum_{t=1}^4 \frac{F}{(1+r)^t}$$

- Simplifying the expression shows that this nontraditional path is preferred whenever:

$$\frac{4[Y_C + F]}{Y_{HS}} < \frac{2(1+r)^6 + (1+r)^2 - 3}{r(r+2)}$$

Theoretical Model

- The model predicts that students are more likely to prefer a longer, nontraditional path to degree attainment when:
 - Discount rates are higher (current consumption is valued more)
 - Return to a degree is lower
 - Schooling costs are lower
- Applying actual tuition and earnings data...

Theoretical Model

- College students at the University of Washington (UW) and the University of New Mexico (UNM)...
- Bureau of Labor Statistics: $Y_{HS} = \$34,600$, $Y_C = \$57,800$
- From university catalogues: $F_{UW} = \$10,974$; $F_{UNM} = \$7,146$
 - If $r = .05$, then UW students traditional, UNM students nontraditional
 - If $r = .10$, then UW students nontraditional, UNM students nontraditional

Data

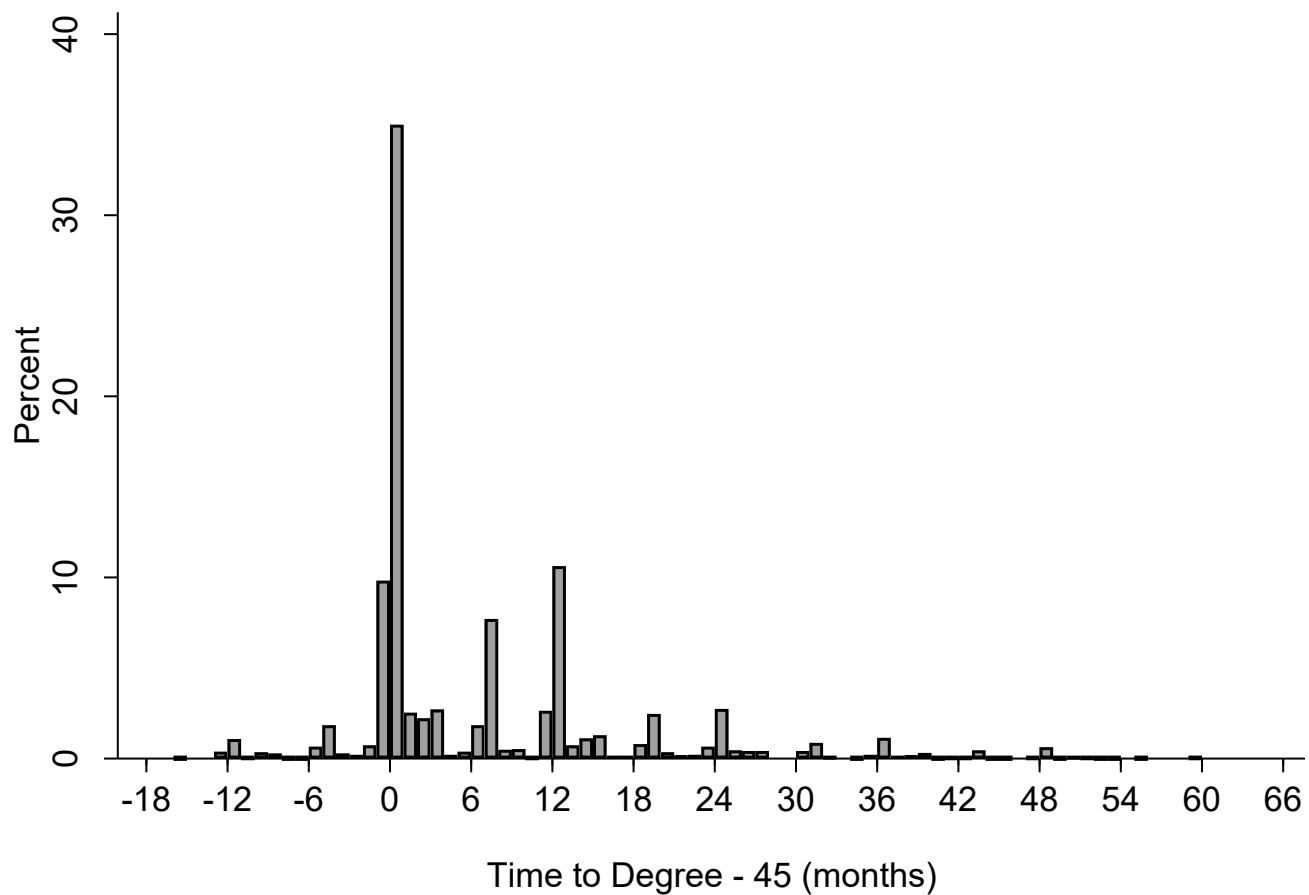
- Education Longitudinal Survey of 2002 (ELS:2002)
 - Nationally representative, restricted data
 - Begins following 10th-graders in 2002
 - Last follow-up is 8 years after expected high school graduation (2012)
- Sample limited to undergraduate degree recipients
- Outcome of interest: log-wages at last follow-up

Data

- Explanatory variable of interest:
 - Graduation delay (in months, centered at 45 months, or “normal time”)
- Instrumental variable: ratio of 6- to 4-year graduation rates at the student’s first institution using the IPEDS (2004 cohort)

$$\overline{Delay} = \frac{6 - yr. grad. rate}{4 - yr. grad. rate}$$

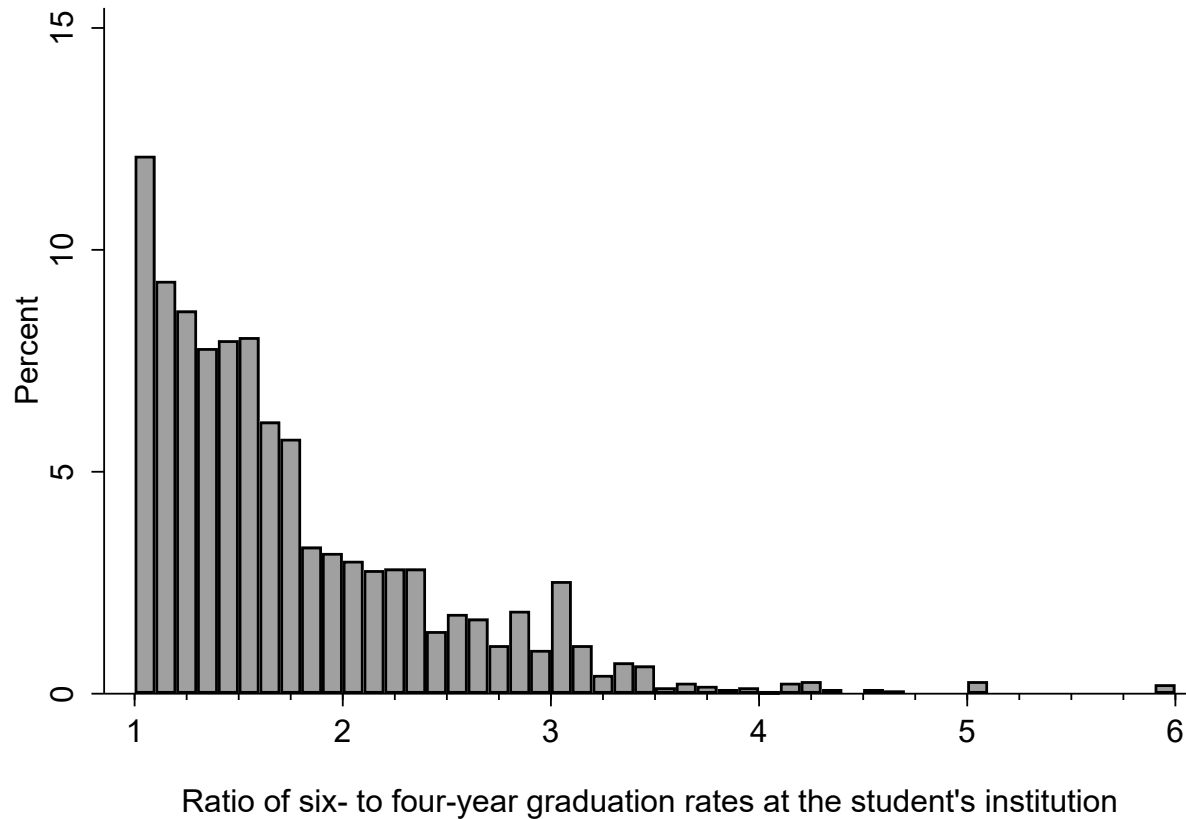
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Source: Education Longitudinal Study of 2002.

Figure 1. Distribution of graduation delay, baccalaureate earners, ELS: 2002.

Data



Source: Authors' calculations, IPEDS 2004, and ELS:2002. Outliers significantly above six, which constitute 0.41 percent of the sample, are not shown.

Figure 2. Distribution of the ratio of six- to four-year graduation rates

Data

- Also consider alternative specifications:
- 2003 and 2005 IPEDS cohorts used to calculate TTD ratio
 - To avoid having study subjects included in the IV themselves
- Using 8- to 4-year time to degree ratio
- Exclusion restriction: graduation delay at the student's institution has no impact on future wages except through the student's own time to degree (after controlling for institutional quality and student ability)

Data

- Bound *et al.* (2012):
 - Time to degree across 1972 and 1992 high school cohorts varies substantially with the student's first institution type
- *U.S. News & World Report* 2005 Rankings:
 - Non-top 50 public colleges
 - Top 50 public colleges
 - Less selective private colleges
 - Highly selective private colleges
 - Community colleges

Data

- We use Barron's 2004 Admissions Competitiveness data as a control for institution quality:
 - Most competitive
 - Highly competitive
 - Very competitive
 - Competitive
 - Less competitive
 - Non-competitive
 - Special designation
- Based on number of applicants, number admitted, high school grades, standardized test scores, etc.



Data

- We also include additional controls for institution quality
 - expenditure per FTE student
 - student-faculty ratios
- We present descriptive statistics by the student's first institution type...

	non-top 50 public	top 50 public	less selective private	highly selective private
hourly wage (2011 USD)	19.06 (9.06)	21.43 (11.31)	20.06 (11.60)	24.49 (14.00)
graduation delay	10.51 (12.28)	4.77 (9.57)	3.39 (9.54)	2.24 (7.54)
time to degree ratio	2.29 (.81)	1.52 (.26)	1.33 (.35)	1.27 (.43)
student-faculty ratio	13.79 (4.35)	9.62 (1.93)	11.48 (8.12)	6.51 (2.66)
expenditure per student (\$1,000s 2004 USD)	15.13 (7.43)	32.63 (12.92)	20.28 (8.50)	70.22 (87.94)
distance college-work (1,000s miles)	.23 (.50)	.32 (.61)	.22 (.45)	.52 (.75)
master's	.15	.17	.18	.16
doctorate	.02	.05	.04	.07
unemployment rate at graduation	7.65 (2.31)	6.85 (2.15)	6.46 (2.13)	6.13 (1.73)
unemployment rate 4 years after enrollment	5.90 (1.19)	6.07 (1.08)	6.00 (1.22)	5.94 (1.09)
experience	3.50 (.93)	3.41 (1.06)	3.35 (3.36)	3.39 (1.15)
ACT composite	22.60 (3.96)	25.92 (3.77)	24.00 (4.15)	28.50 (3.62)
female	.53	.53	.59	.53
white	.75	.75	.80	.77
Hispanic	.07	.06	.09	.08
black	.11	.05	.06	.02
American Indian	.003	.01	.005	.002
Asian	.03	.08	.03	.10
two or More Races	.04	.05	.02	.02
Hawaiian/pacific islander	.002	.001	.00	.00
Barron's – most competitive	.001	.12	.00	.50
Barron's - highly competitive	.03	.30	.10	.27
Barron's - very competitive	.20	.45	.40	.22
Barron's - competitive	.58	.13	.38	.004
Barron's - less competitive	.12	.00	.05	.00
Barron's - non-competitive	.05	.00	.01	.00
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obs.	990	510	550	340

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Empirical Model

- For student i that attended college and works in state s :

$$1^{\text{st}} \text{ Stage: } Delay_{is} = \theta + \mathbf{X}_{is}\boldsymbol{\zeta} + \pi Z_{is} + \mu_{is}$$

$$2^{\text{nd}} \text{ Stage: } \ln(w_{is}) = \alpha + \beta \widehat{Delay}_{is} + \mathbf{X}_{is}\boldsymbol{\gamma} + \mathbf{Y}_{is}\boldsymbol{\delta} + \varphi Z_{is} + \sigma_s + \varepsilon_{is}$$

- \mathbf{X} includes potential experience and its square, ability, gender, race, ethnicity, family characteristics, and institutional characteristics, and college-work distance (in stage two)
- \mathbf{Y} includes determinants of wages that cannot plausibly be included in the student's time to degree equation for timing issues
- \mathbf{Z} is an instrument assumed directly correlated with graduation delay, but not early-career wages, so that $\varphi = 0$ under strict instrument exogeneity

Empirical Model

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- Account for a “plausibly exogenous” instrument by relaxing the exclusion restriction
 - assume $\varphi \neq 0$ following methods in Conley, Hansen, and Rossi (2012)
 - Analytical bounds calculated by making assumptions regarding the support φ
- This allows us to see how much the strict exogeneity assumption is driving results

Results

- Durbin-Wu-Hausman tests indicate that we cannot use OLS
- Instrument relevance assessed by Kleibergen-Paap test statistic
 - Rule of thumb requires at $F\text{-stat} \geq 10$
 - We find strong evidence of instrument relevance (see results)
 - Consider a “peer effect” story
 - If there is a culture of students commonly taking longer than normal time to finish, then the student may also be more comfortable with this strategy
 - One student was quoted in “Crossing the Finish Line” as likening graduating in four years to “leaving the party at 10:30pm” (Chingos *et al.* 2009)

Results

- Instrument exogeneity requires knowledge of the true model error so cannot be directly tested...
- We believe our instrument is exogenous because institutional policies and norms surely affect a student's college trajectory, but should have no bearing on labor market rewards apart from the institution's quality, which we also control for.
- Relaxing exogeneity provides some insight into the importance of this restriction to our findings

Results

- OLS:
 - A one-year delay results in a 5% decrease in early career earnings
- 2SLS
 - No wage penalty associated with delayed graduation

Table 3. Wage models of graduation delay penalty, all institutions

	OLS (1)	OLS (2)	2SLS (3)
<u>variable</u>	<u>Delay</u>	<u>Wages</u>	<u>Wages</u>
graduation delay (months)		-.004*** (.001)	.015 (.010)
time to degree ratio	2.228*** (.263)		
student-faculty ratio	.014 (.035)	-.001 (.002)	-.003 (.003)
expenditures per student	.005 (.005)	.0007** (.0003)	.0007** (.0003)
experience	1.634*** (.590)	.064 (.123)	.012 (.131)
experience ²	.140 (.111)	-.006 (.016)	-.002 (.017)
ACT composite	-.220*** (.048)	.005 (.003)	.009** (.004)
female	-1.417*** (.333)	-.107*** (.022)	-.075*** (.028)
institution selectivity fixed effects	YES	YES	YES
state fixed effects	NO	YES	YES
college-work distance	NO	YES	YES
parents' education	YES	YES	YES
family income	YES	YES	YES
Kleibergen-Paap rk <i>F</i> -statistic			24.08
observations			2,340

Source: ELS:2002, IPEDS, Barron's Admissions Competitiveness Index of 2004. The dependent variable in equation (1) is the total time, measured in months, elapsed between first entering college and earning the first undergraduate degree, centered at 45 months. The dependent variable in equations (2) through (4) is the natural log of hourly wages at the third follow-up. The Kleibergen-Paap rk *F*-statistic tests the null hypothesis of weak instruments. Robust standard errors are reported in parentheses.

Results

- OLS:
 - A one-year delay results in a 5% decrease in early career earnings
- 2SLS
 - No wage penalty associated with delayed graduation

Table 3. Wage models of graduation delay penalty, all institutions

	OLS (1)	OLS (2)	2SLS (3)
<u>variable</u>	<u>Delay</u>	<u>Wages</u>	<u>Wages</u>
graduation delay (months)		-.004*** (.001)	.015 (.010)
time to degree ratio	2.228*** (.263)		
student-faculty ratio	.014 (.035)	-.001 (.002)	-.003 (.003)
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Results

Table 4. Wage models of graduation delay penalty by institution type

	OLS	2SLS	obs.
	(1)	(2)	
<u>institution type</u>			
non-top 50 public	-.003 (.002)	< .001 (.029)	980
top 50 public	-.009** (.004)	.017 (.036)	490
less selective private	-.008** (.003)	.006 (.033)	530
highly selective private	-.007 (.007)	-.014 (.031)	340

Source: ELS:2002, IPEDS, Barron's Admissions Competitiveness Index of 2004. The dependent variable is the natural log of hourly wages at the third follow-up. All models include the same controls as listed in Table 3. Robust standard errors are reported in parentheses.

- OLS penalties driven by less prestigious institutions

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Results

Table 5. Estimates of graduation delay with interaction effects

main/interaction effect	OLS				2SLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
graduation delay	-.003 (.005)	-.004* (.002)	-.005* (.002)	-.003 (.002)	.442** (.224)	-.009 (.025)	.022 (.015)	.023 (.015)
x unemployment rate	< .001 (.001)				-.044* (.023)			
x female		< .001 (.002)				.039 (.042)		
x white			.002 (.003)				-.021 (.029)	
x top 50 public				-.007** (.003)				-.039 (.036)
x less selective private				-.004 (.003)				-.019 (.023)
x highly selective private				.005 (.006)				-.021 (.030)
observations				2,370				2,344

Source: ELS:2002, Barrons Admissions competitiveness Index 2004, and the IPEDS. The dependent variable is the natural log of hourly wages at the third follow-up. Models include both main effects and interaction effects. See Appendix B for definitions of institution type. All models include the same controls as listed in Table 3. Unemployment rate is measured at the month of graduation. Robust standard errors are reported in parentheses.

- Average unemployment rate in 2011 was 8.9%

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Results

Table 7. Analytical bounds relaxing the exclusion restriction following Conley, Hansen, and Rossi (2012)

Model	95% CI of $\hat{\beta}$
OLS	[-.002, -.006]
2SLS	[-.005, .034]
Conley, Hansen, and Rossi (2012)	
$\varphi \in [-.5, .5]$	[-.114, .095]
$\varphi \in [-.4, .4]$	[-.093, .075]
$\varphi \in [-.3, .3]$	[-.073, .054]
$\varphi \in [-.2, .2]$	[-.052, .034]
$\varphi \in [-.1, .1]$	[-.033, .014]
$\varphi \in [0, .5]$	[-.114, -.004]
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Note: φ is the coefficient on the instrumental variable (time to degree ratio) in the second stage (wage equation).

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Conclusions

- Under reasonable assumptions students may rationally prefer to delay college graduation beyond normal time
- Previous OLS estimates of delayed penalty suffer from significant bias
- Instrumenting for TTD and controlling for student ability and institutional characteristics produces no evidence of such penalties

Policy Implications

- Students are not penalized for taking longer than normal time in the labor market, so policies designed to discourage lengthened time to degree must rest on other arguments:
 - e.g., fewer resources for incoming students at universities due to crowding, increased costs for colleges
- Policymakers should be cautious in penalizing students for acting rationally in delaying graduation
 - Policies such as restricting major changes, charging higher per credit costs for part-time students, and increasing withdrawal penalties may potentially decrease students' chances of completing college at all

Next Steps

- Account for those still in graduate school at the final follow-up
 - Early results are counterintuitive- removing those in graduate school from sample yields (+) effect of graduation delay on early career wages
 - Plausible if delay is caused by earning additional human capital (double majors, more credits, study abroad, capstone, etc.)?
 - Plausible if delayers are skillful in avoiding soft labor markets? Perhaps they are more strategic than most and this delay could reflect unobserved ability?
- Thank you for your time!
- Questions?