# 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?



#### 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



# Existing Literature

- Large penalties found (6-8% per year of delay)
  - *However*, 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 early career wages



# Approach

- 1<sup>st</sup>: Develop a simplified model of human capital that demonstrates when it makes sense to pursue a nontraditional path to degree attainment
- 2<sup>nd</sup>: Replicate results from existing literature which finds significant negative relationship between time to degree and wages
- 3<sup>rd</sup>: 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 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:

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

- Discount rates are higher (current consumption is valued more)
- Return to a degree is lower
- Schooling costs are lower



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



- 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)

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



- 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)



- 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



- 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.

- 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
Hispanic black American Indian Asian two or More Races Hawaiian/pacific islander Barron's – most competitive Barron's - highly competitive Barron's - very competitive Barron's - competitive Barron's - less competitive	.07 .11 .003 .03 .04 .002 .001 .03 .20 .58 .12	.06 .05 .01 .08 .05 .001 .12 .30 .45 .13 .00	$ \begin{array}{c} .09\\.06\\.005\\.03\\.02\\.00\\.00\\.10\\.40\\.38\\.05\end{array} $	.08 .02 .002 .10 .02 .00 .50 .27 .22 .004 .00
Barron's - non-competitive Barron's - special designation	.05	.00	.01	.00
obs.	990	510	550	340

	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
Hawaijan/pacific islander	.04	.05	.02	.02
nawanan/pacific Islander	.002	.001	.00	.00
Barron's most competitive	001	12	00	50
Barron's - highly competitive	03	30	10	.50 27
Barron's - very competitive	.05	.30	.40	27
Barron's - competitive	.58	.13	.38	.004
Barron's - less competitive	.12	.00	.05	.00
Barron's - non-competitive	.05	.00	.01	.00
Barron's - special designation	.001	.00	.01	.00
obs.	990	510	550	340

	non-top 50 public	top 50 public	less selective private	highly selective privat
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
Hawaiian/pacific islander	.002	.001	.02	.02
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
Barron's - special designation	.001	.00	.01	.00
obs.	990	510	550	340

	non-top 50 public	non-top 50 public top 50 public		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	
	.07	.06	.09	.08	
American Indian	.11	.03	.00	.02	
Asian	.005	.01	.005	.002	
two or More Races	.05	.00	.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 non competitive	.12	.00	.05	.00	
Barron's - special designation	.001	.00	.01	.00	
obs.	990	510	550	340	

	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 Hispanic black American Indian Asian two or More Races Hawaiian/pacific islander Barron's – most competitive Barron's - highly competitive Barron's - very competitive	.75 .07 .11 .003 .03 .04 .002 .001 .03 .20	.75 .06 .05 .01 .08 .05 .001 .12 .30 .45	.80 .09 .06 .005 .03 .02 .00 .00 .10 .40	.77 .08 .02 .002 .10 .02 .00 .50 .27 .22
Barron's - competitive	.58	.13	.38	.004
Barron's - less competitive	.12	.00	.05	.00
Barron's - special designation	.05	.00	.01	.00
obs.	990	510	550	340

# Empirical Model

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

1<sup>st</sup> Stage:  $Delay_{is} = \theta + X_{is}\zeta + \pi Z_{is} + \mu_{is}$ 2<sup>nd</sup> Stage:  $ln(w_{is}) = \alpha + \beta D \widehat{elay}_{is} + X_{is}\gamma + Y_{is}\delta + \varphi Z_{is} + \sigma_s + \varepsilon_{is}$ 

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



• A one-year

• No wage

delayed

graduation

• OLS:

• 2SLS

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

USUIIS		OLS	OLS	2SLS
		(1)	(2)	(3)
	variable	<u>Delay</u>	<u>Wages</u>	<u>Wages</u>
	graduation delay (months)		004***	.015
$\mathbf{S}$ .			(.001)	(.010)
<b>.</b>	time to degree ratio	2.228***		
A one year		(.263)		
A one-year	student-faculty ratio	.014	001	003
delay results in		(.035)	(.002)	(.003)
	expenditures per student	.005	.0007**	.0007**
a 5% decrease		(.005)	(.0003)	(.0003)
in early career	experience	1.634***	.064	.012
In carry career	. 2	(.590)	(.123)	(.131)
earnings	experience <sup>2</sup>	.140	006	002
8-		(.111)	(.016)	(.017)
	ACT composite	220***	.005	.009**
		(.048)	(.003)	(.004)
IC	female	-1.41//***	107***	07/5***
LS		(.333)	(.022)	(.028)
NT	institution selectivity fixed effects	YES	YES	YES
No wage	state fixed effects	NO	YES	YES
nenalty	college-work distance	NU	YES	YES
penaty	for the income	I ES VEC	YES	YES
associated with	Klaibangan Baan di E statistis	YES	YES	YES 24.08
1 1 1	chearter and the F-statistic			24.08
delayed	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.



• A one-year

earnings

• No wage

penalty

delayed

graduation

delay results in a 5% decrease

in early career

associated with

• OLS:

• 2SLS

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

	OLS	OLS	2SLS
	(1)	(2)	(3)
variable	Delay	Wages	Wages
graduation delay (months)		004***	.015
time to degree ratio	2.228***	(.001)	(.010)
student-faculty ratio	.014	001	003
expenditures per student	(.035) .005	(.002) .0007**	(.003) .0007**
experience	(.005)	(.0003) .064	(.0003) .012
experience <sup>2</sup>	(.590) .140	(.123) 006	(.131) 002
ACT composite	(.111) 220***	(.016) .005	(.017) .009**
female	(.048)	(.003) 107***	(.004) 075***
institution selectivity fixed effects	(.333) YES	(.022) YES	(.028) 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 F-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.



<b>NESUIIS</b>		OLS	OLS	2SLS
		(1)	(2)	(3)
	variable	<u>Delay</u>	Wages	Wages
	graduation delay (months)		004***	.015
			(.001)	(.010)
LS.	time to degree ratio	2.228***		
		(.263)		
• A one-year	student-faculty ratio	.014	001	003
delay results in		(.035)	(.002)	(.003)
	expenditures per student	.005	.0007**	.0007**
a 5% decrease		(.005)	(.0003)	(.0003)
in contra concon	experience	1.634***	.064	.012
in early career		(.590)	(.123)	(.131)
earnings	experience <sup>2</sup>	.140	006	002
carmigs		(.111)	(.016)	(.017)
	ACT composite	220***	.005	.009**
		(.048)	(.003)	(.004)
	female	-1.417***	107***	075***
SLS		(.333)	(.022)	(.028)
	institution selectivity fixed effects	YES	YES	YES
• No wage	state fixed effects	NO	YES	YES
nonoltry	college-work distance	NO	YES	YES
penalty	parents' education	YES	YES	YES
associated with	family income	YES	YES	YES
	Kleibergen-Paap rk F-statistic			24.08
delayed	observations			2,340

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

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.



• 2SLS

Results

• OLS:

# 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



## Conclusions

- Thank you for your time!
- Questions?

