Econ 250 VSP
The Wage Premium of Graduate School: Evidence from US Earnings (1997-2020)

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Overview

Research Idea

- It is well-established that those with post-baccalaureate (i.e. graduate) degrees earn more, all else equal.
- We wish to investigate if this premium has stayed the same, increased or decreased in recent years with the proliferation of new graduate programs.
- Much more research work has been done on the premium holding a bachelor's degree.

Previous Work in this area

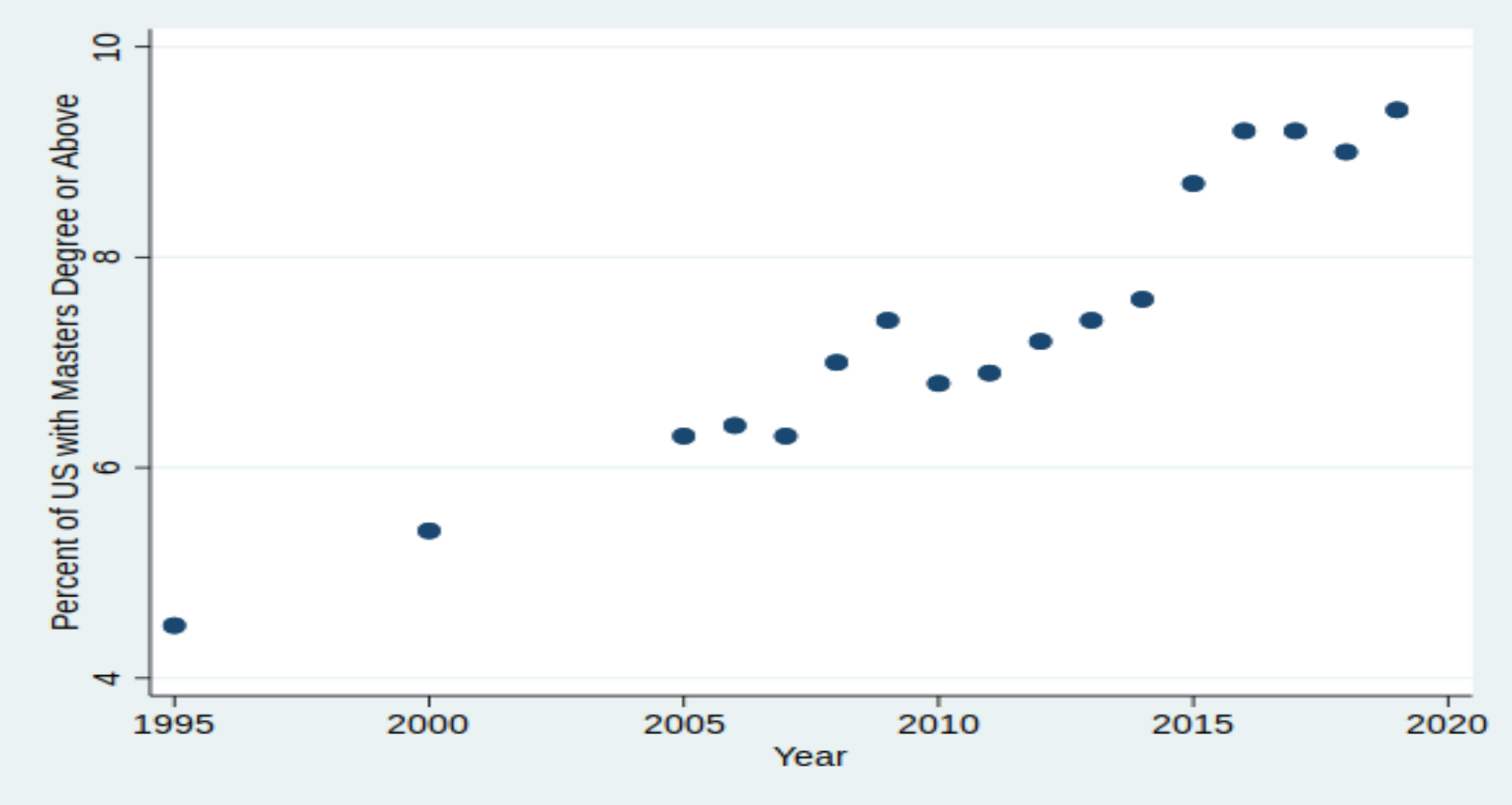
- Link (1975) looked at graduate education on earnings of electrical engineers.

- Previous research on "sheepskin effect" of higher education (Jaeger and Page (1996))

Facts about Education in the United Education

- 12.8 % of the US adult population has a graduate degree. About 33 percent have a bachelor's degree. U.S. Department of Commerce et al. (2019)
- Graduate education in this paper is defined as professional degree (MBA, JD, MD, DDS, PharmD, etc.), terminal Masters (MA), PhD program, MEd etc.
- 61.8 % percent of graduate students are part-time per the 2016 report from The Council of Graduate Schools
- Adults with a graduate degree earn on average $75,945.
- Some public funding opportunities for adults returning to school.
- Graduate degree holders in our sample tended to be older, less likely to be African American or Hispanic, more likely to be Asian and similar percentage Male/Female.

Post-Baccalaureate Attainment since 1995



U.S. Department of Commerce et al. (2019)

Data Sources

- Our dataset is extracted from the Current Population Survey (CPS), which covers microdata from 1962.
- Sample is restricted to individuals in labor force in 1997, 2007, 2017 and 2020.
- Characteristics such as sex and race are controlled in our analysis.

Data Sources

- Education level is divided into bins:
  - High school dropouts
  - High school graduates
  - Some college and Associate's degree
  - College graduates (Bachelor's degree) (Control group)
  - Graduate degree (Master's, Professional school and Doctorate degree)
- Work experience is approximated by:

$$\text{Work experience} = \max\{\text{Age} - 6 - \text{Years of education}, 0\}$$

- Both experience and square of experience are included in our analysis.

Primary model

Our primary model takes the following form:

$$\begin{aligned}\ln(wage_i) = \alpha_0 + x_i\Gamma + \beta_{grad}[\![grad]\!] + \beta_{somecollege}[\![somecollege]\!] \\ + \beta_{highschool}[\![highschool]\!] + \beta_{dropout}[\![dropout]\!] + \varepsilon_i,\end{aligned}$$

where x_i are controls, and $[\![.]\!]$ denotes an Iverson bracket (indicator function).

- Our primary coefficient of interest is β_{grad}.
- Due to endogeneity, we interpret these coefficients to be the best (linear) estimator of how the log wage changes with an individual's graduate education status.

Endogeneity

- Getting graduate education is a self-selected action related with innate ability. Wages, on the other hand, are probably also related with ability as well.
- Hence education level indicators are endogenous.
- Currently no perfect IV for this issue. We instead choose not to interpret the coefficients casually.

Selection Problem

- Graduate degree holders are more likely to be employed. Their wage tend to higher as well.
- Different probability on observability of wages causes selection problem.
- We use Lee bounds and Heckman selection model to resolve this.

OLS Estimates

Table 3: OLS results

	1997	2007	2017	2020
Graduate degree	0.270***	0.298***	0.329***	0.327***
	(0.0161)	(0.0115)	(0.0107)	(0.0116)
Some college or AA degree	-0.381***	-0.399***	-0.456***	-0.405***
	(0.0111)	(0.00841)	(0.00864)	(0.00917)
High school diploma	-0.580***	-0.573***	-0.610***	-0.583***
	(0.0110)	(0.00835)	(0.00883)	(0.00972)
High school dropouts	-1.109***	-1.132***	-1.118***	-1.096***
	(0.0153)	(0.0123)	(0.0147)	(0.0166)

OLS Estimates

- Higher education level is associated with higher wage.
- The effect of graduate education seems pretty stable in the past two decades with a mild increase from 27% to 33%.
- Due to reason addressed before, these estimates are likely to be upward biased.

Lee Bound Estimates

Table 4: Lee Bounds results

	1997	2007	2017	2020
Graduate degree				
Lower bound	0.799***	0.707***	0.708***	0.668***
	(0.0320)	(0.0188)	(0.0154)	(0.0118)
Upper bound	0.958***	0.970***	0.959***	0.913***
	(0.0296)	(0.0190)	(0.0152)	(0.0112)
Observations	66211	103635	90692	76919

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- We use sex and race dummies to tight the bound.
- Education level except for graduate education is NOT controlled. Heterogeneity in the control group leads to coefficients far from OLS estimates.

Lee Bound Estimates with Restricted Sample

Table 5: Lee Bounds results with individuals above college

	1997	2007	2017	2020
Graduate degree				
Lower bound	0.316***	0.311***	0.314***	0.324***
	(0.0272)	(0.0221)	(0.0178)	(0.0188)
Upper bound	0.400***	0.361***	0.417***	0.416***
	(0.0235)	(0.0332)	(0.0177)	(0.0206)
Observations	16469	30366	31934	29940

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- We keep only the individuals with Bachelor's degree or above.
- Intervals are closer to OLS estimate now. The effect still seems stable.

Heckman Selection Model

Table 6: Heckman Selection Model results

	1997	2007	2017	2020
log of wage income				
indicator for graduate education	0.231***	0.225***	0.330***	0.328***
	(0.0168)	(0.0117)	(0.0115)	(0.0117)
Some college or AA degree	-0.395***	-0.422***	-0.456***	-0.405***
	(0.0106)	(0.00794)	(0.00865)	(0.00939)
High school diploma	-0.599***	-0.603***	-0.610***	-0.583***
	(0.0104)	(0.00802)	(0.00897)	(0.00976)
High school dropouts	-1.076***	-1.112***	-1.118***	-1.096***
	(0.0131)	(0.0104)	(0.0129)	(0.0147)

Compared with OLS

- There's a rise in effect between 2007 and 2017 from around 23% to 33%.
- Compared to OLS, the effect of graduate degree is lower in 1997 and 2007. On the contrary, we get very similar coefficient for 2017 and 2020.
- This is reflected in the significance of the coefficient on inverse Mills ratio.

Regarding work experience

Work experience	0.0745***	0.0753***	0.0735***	0.0686***
	(0.000844)	(0.000661)	(0.000739)	(0.000811)
Square of experience	-0.00125***	-0.00128***	-0.00122***	-0.00114***
	(0.0000176)	(0.0000137)	(0.0000148)	(0.0000160)

- Wage reaches maximum when one has 30 years of experience (holding other factors fixed), which seems pretty reasonable when we consider "prime earning years".

Extending Results

Our results suggest the marginal premium on graduate education is relatively stable.

- However, the upper bound in the restricted regression is markedly lower in 2007.
- This suggests that an average bachelor's degree holder has a similar marginal earnings benefit of earning a graduate degree than they did in 1997.
- This is despite the increase in supply of advanced degree holders.

Conclusions

What causes this general stability in the premium?

- Two general hypotheses: signalling (i.e. sheep skin effect of having the piece of paper that says PhD, MA, etc.) or human capital (skill development.)
- This could be due to skill-biased technical change or de-valuing of BA/BS degrees.
- We control for experience but unclear how premium changes for students fresh out of college, etc.
- For the non-restricted model, the bottom 20 percent of advanced degree holders could hold degrees in nonselective fields.

Future Areas of Research

- Ideally, work with a more detailed sample of US households.
- Would like information on the type of degree, school, etc.
- It's possible that pay for certain professions (e.g. teaching, engineering) is tied almost mechanically to years of education
- Some MA, MS programs are very new and employers might not know the "value" in them yet (e.g. data science.)
- Consider implication of part-time students, students with children, etc.

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Any Questions?
Thank you for your attention.