

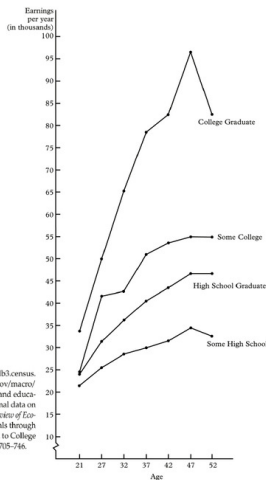
Post-Schooling Investments in Human Capital

- The age-earnings profile: basic facts
- The life-cycle pattern of on the job training.
- Men and women's life-cycle earning profiles

The age-earnings profile: basic facts

- Four basic facts about the age-earnings profile:
 - ① Earnings rise with education.
 - ② The age-earnings profile is concave.
 - ③ Fanning out: educational differences in earnings increase with age.
 - ④ Gender differences: men's age-earnings profile is more concave, there is more fanning out.

Figure 9.3: Money Earnings (Mean) for Full-Time, Year-Round Male Workers, 2005

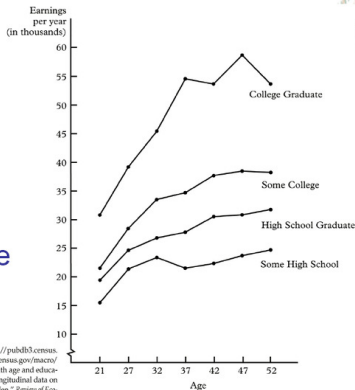


¹³Data in these figures are from the U.S. Bureau of the Census website: http://pubdb3.census.gov/macro/032006/perinc/new04_010.htm (for males) and http://pubdb3.census.gov/macro/032006/perinc/new04_019.htm (for females). These data match average earnings with age and education in a given year and do not follow individuals through time. For a paper using longitudinal data on individuals, see Richard W. Johnson and David Neumark, "Wage Declines and Older Men," *Review of Economics and Statistics* 78 (November 1996): 740-746; for a paper that follows cohorts of individuals through time, see David Card and Thomas Lemieux, "Can Falling Supply Explain the Rising Return to College for Younger Men? A Cohort-Based Approach," *Quarterly Journal of Economics* 116 (May 2001): 705-746.

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9-2

Figure 9.4:
Money Earnings
(Mean) for
Full-Time,
Year-Round Female
Workers, 2005



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9-3

- Why is the age earnings profile concave?
- Why is steeper for college graduates?
- Why is it steeper for men?
- All three facts can be explained using a simple model of human capital accumulation after completion of formal schooling.

Explaining the Concavity of the Age-Earnings Profile

Accounting identity model (Mincer, 1974)

- Use theory to restrict the functional form of the earnings function. Based on Ben-Porath, 1967.
- Workers acquire human capital both in school and on the job.
- Worker must pay in full the price of *general training*
 - General training can be transferred across firms.
 - Competition across firms implies that no firm will ever pay for general training.
 - Not necessarily so for *firm-specific training*.

- Earnings are equal to rental rate on accumulated stock of human capital, minus cost of current investment.
- It makes sense to accumulate human capital early in the life-cycle:
 - Longer horizon over which to reap benefits.
 - Accumulated stock of HC is low.
- Individual devotes himself full-time to schooling up to age s
- After completing schooling, continue to invest in human capital, but at a linearly declining rate

An Alternative Explanation for the Concavity of the Age Earnings Profile

- Jovanovic (JPE, 1979a).
- Heterogeneous workers and jobs: *match quality*.
 - Some workers better matched to some jobs than others.
 - Match quality is not observed.
- Firms observe output at every period:

$$output = f(\text{match quality, random noise})$$

- Based on observed output, firms and workers update beliefs about match quality.

- Expected wage is a weighted average of prior mean of match quality and observed productivity.
- As tenure increases, information about match quality becomes more precise.
 - Good matches: wages increase, match more likely to survive.
 - Poor matches: wages flat or decrease, match dissolves (quits/firing).
- Easy to see that model predicts increasing wages over time, but at a declining rate → Concavity of the wage profile.

- Mincer's original formulation assumed a quadratic in experience ($\text{experience} = \text{Age} - \text{schooling} - 6$).
- Is this the right functional form?
- Murphy and Welch (JOLE 1990) experiment with different functional forms.
 - Regressions of log weekly earnings from the CPS, 1963-1986.
 - Fit quadratic, cubic, and quartic functions of experience, separately for each education category (HSD, HSG, Some College, College Grad).

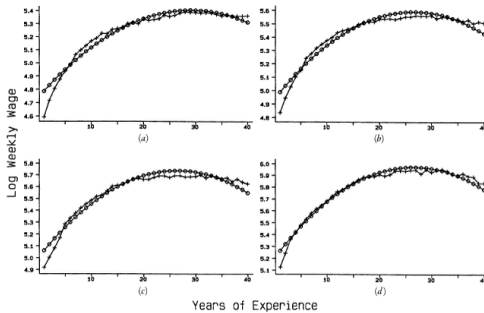


FIG. 3.—Quadratic and actual earnings profiles: *a*, 8–11 years of schooling; *b*, high school graduates; *c*, 13–15 years of schooling; *d*, college graduates

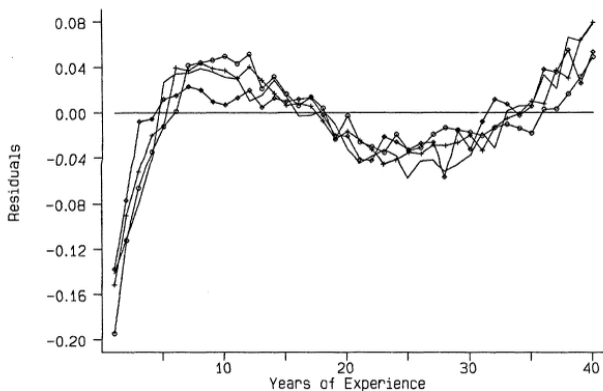


FIG. 4.—Residuals from quadratic specification: ○ = 8–11 years of schooling; + = high school graduates; □ = 13–15 years of schooling; plain line = college graduates.

Quadratic systematically underestimates earnings at low levels of experience, and between 20–30 years.

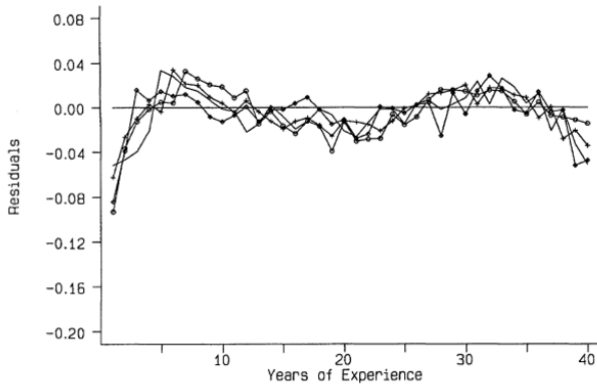


FIG. 5.—Residuals from cubic specification: O = 8–11 years of schooling; + = high school graduates; □ = 13–15 years of schooling; plain line = college graduates.

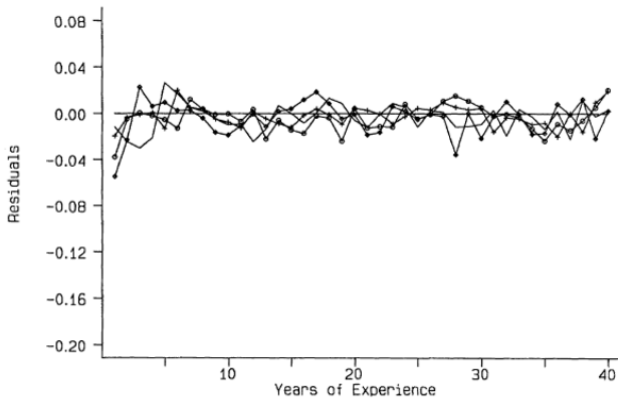


FIG. 6.—Residuals from quartic specification: ○ = 8–11 years of schooling; + = high school graduates; □ = 13–15 years of schooling; plain line = college graduates.

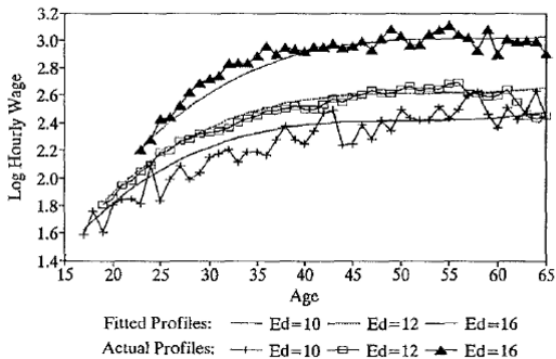
Cubic and quartic specifications seem to do a much better job of fitting the earnings-experience profile.

- Interactions between schooling and experience are important.
- Card (1999) uses 1994-1996 CPS data and fits:

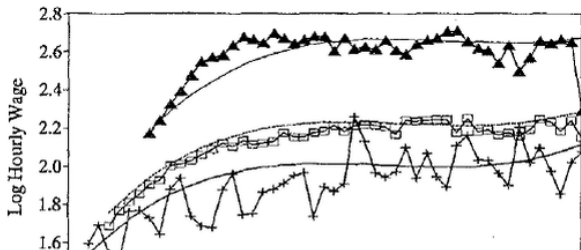
$$\ln \text{HourlyWage} = \alpha + \beta S + \gamma_1 X + \gamma_2 X^2 + \gamma_3 X^3 + u$$

i.e., forces experience profile to be the same for all education groups:

a. Hourly Wage Profiles for Men



b. Hourly Wage Profiles for Women



- Accumulation of human capital does not stop with the end of formal schooling.
- "On the job training"
 - formal training programs (courses in C++, teaching enrichment seminars, restaurant administration., etc.)
 - conferences, seminars, meetings, etc.
 - learning by doing, supervision and mentoring from older workers, etc.

- On the job training can be either *general* or *firm specific*.
- General training: training that can be easily transferred to other firms:
 - Word processing skills.
 - Programming skills.
 - learning how to drive (or fly an airplane).
- Firm specific training: training that is specific to a particular firm:
 - learning a firm's organizational hierarchy.
 - learning how to speak to your boss and to your assistants.
 - learning how to operate a tank.

Who pays for training?

- General training:
 - firm has no incentive to pay for general training.
 - worker will acquire training at firm's expense, then move to other firm that offers higher wages.
 - Therefore, only workers will pay for general training.
- For example, by accepting lower wages during training period
 - medical interns
 - lawyers
 - firms that offer "free MBA" effectively offer lower wages to employees before training.

- Specific training

- Firm's incentive: pay for training, get more productive worker, but don't pay higher wages after training.
- Worker: no incentive to pay for training, because he can be laid off, and lose his investment.
- Solution: long-term contract where firm and worker share the costs and benefits of training.

$$\bar{w} < w_2 < VMP_2$$

- Plenty of evidence of firm-specific training:

- workers with more seniority at the firm less likely to quit (but could also be match quality).
- workers with more seniority less likely to be laid off
- workers who are laid off don't fully recover their wages, even several years after layoff.

- Jacobson, Lalonde and Sullivan, "Earnings Losses of Displaced Workers", AER, 1993.

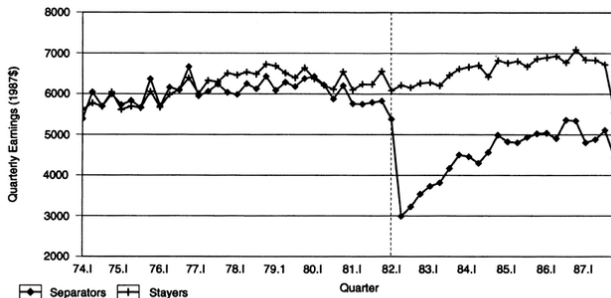
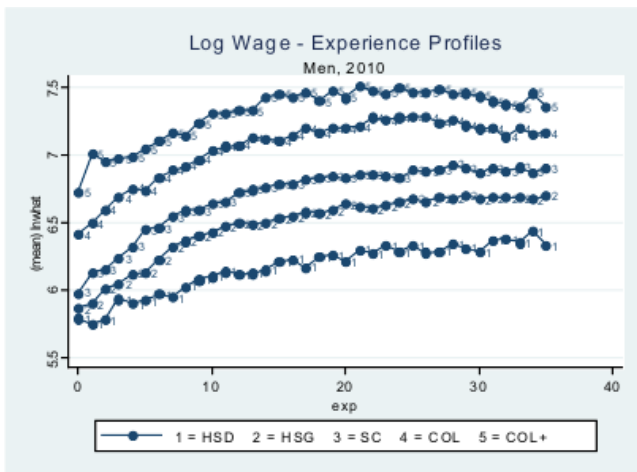


FIGURE 1. QUARTERLY EARNINGS (1987 DOLLARS) OF HIGH-ATTACHMENT WORKERS SEPARATING IN QUARTER 1982:1 AND WORKERS STAYING THROUGH QUARTER 1986:4

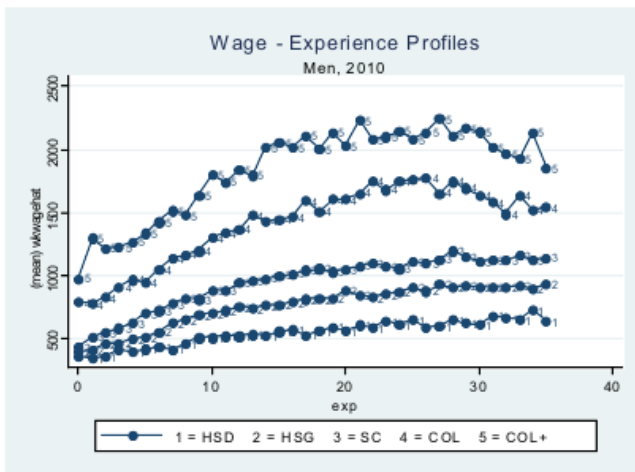
On the job training and the age-earnings profile

- Regardless of whether training is general or specific, the prediction is that workers will have lower wages and more on the job training when young.
- The higher the investment in on the job training, the steeper the wage profile:
 - more time spent in training now, less time spent on productive activities, lower wages today.
 - more time spent in training now, larger increase in productivity in the future, higher future wages.

- Like any form of investment, on the job training is more likely when:
 - length of the horizon is long
 - individual is future oriented
 - costs are low, benefits are high.
- Young people invest more in training:
 - longer time horizon
 - costs of learning are low ("you can't teach an old dog new tricks")
- Therefore, wage profile is concave.
- Wage profile is more concave for highly educated workers:
 - low costs of learning
 - lower discount rates



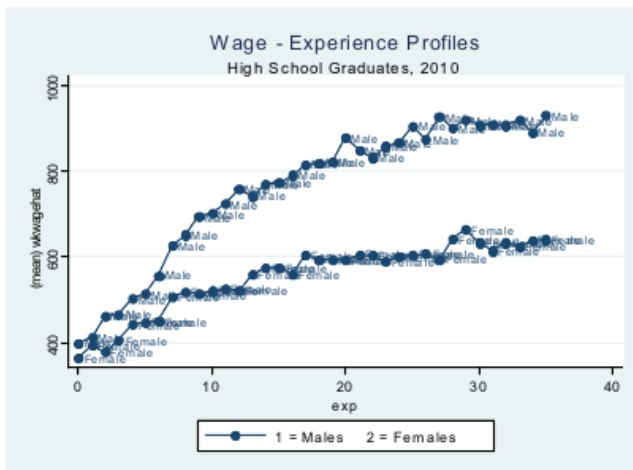
Fanning out of the log wage profile



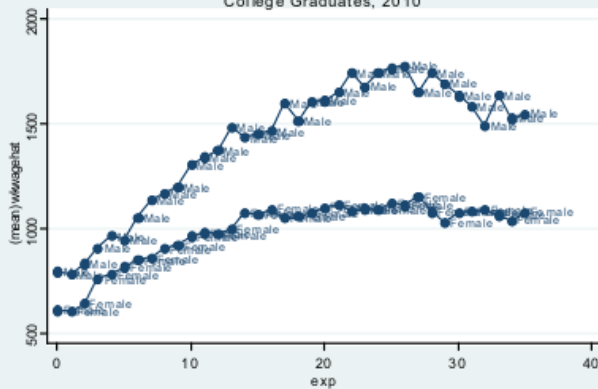
More evident if you look at wages, not log wages.

Gender Differences in the Age-Earnings Profile

- Female age-earnings profile is less concave.



Wage - Experience Profiles College Graduates, 2010



- Human capital explanation: women invest less in on-the-job training.
- In fact, women more likely to work part-time, and have shorter workweeks, even within narrowly defined occupation groups.



Table 9.2: Labor Force Participation Rates, Part-Time Employment Status, and Hours of Work in the United States, by Gender (2005)



	Women	Men
Labor force participation rate, age 20 and over	60.4%	75.8%
Percent of employed who worked full time ^a	68.9%	83.2%
Average weekly hours of work, by occupation:		
Management, business and financial	43.0	47.2
Professional specialty	41.2	44.4
Office/administrative support	39.9	42.0
Sales	41.2	45.7
Installation and repair	40.8	43.4

^aFor year 2006.

Sources: U.S. Bureau of Labor Statistics website: <http://data.bls.gov/PDQ/servlet/SurveyOutputServlet> (labor force participation rate); <ftp://ftp.bls.gov/pub/special.requests/lf/aat23.txt> (full-time employment); U.S. Bureau of Labor Statistics, *Employment and Earnings* 53 (January 2006), Table 23 (hours of work).

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9-4

- Why women invest less in OJT?
 - shorter time horizon because of career interruption.
 - career interruptions also make investment in HC depreciate more rapidly.
 - expected discrimination: benefits of investment are smaller.
- Over time, as traditional gender roles change, we would expect to see that women's age-earnings profiles more similar to men's.
 - More investment in formal schooling
 - More on the job training, steeper age-earnings profile.

Table 9.3: Percentages of Women among College and University Graduates, by Degree and Field of Study, 1971 and 2004

Percentage of Women among:	Bachelor's Degree		Master's Degree	
	1971	2004	1971	2004
Total	43.4%	57.5%	40.1%	58.9%
Business majors	9.1	50.3	3.9	42.0
Computer science majors	13.6	25.1	10.3	31.2
Education majors	74.5	78.5	56.2	76.7
Engineering majors	0.8	18.8	1.1	21.4
English majors	66.7	68.9	61.0	69.1
Health professionals	77.1	86.5	55.9	78.5
First professional degree ^a			6.3	49.2

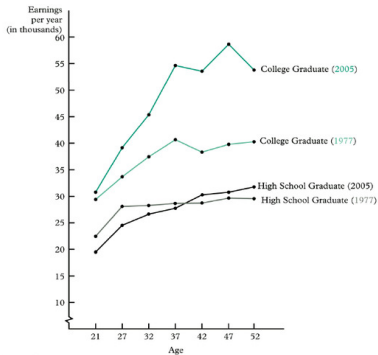
^aDegrees in this category are largely doctor's degrees in law, medicine, and dentistry.

Sources: U.S. National Center for Education Statistics, *Digest of Education Statistics 1993* (1993), Tables 235, 269, 271–273, 275, 278; *Digest of Education Statistics 2005* (2006), Tables 252, 257.

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9-6

Figure 9.6: The Increased Concavity of Women's Age/Earnings Profiles



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9-5

Wage - Experience Profiles Women High School Graduates

