

# Life cycle wages

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# Introduction

The material is drawn from the following survey:

- ▶ Rubinstein, Y., & Weiss, Y. (2006). Post schooling wage growth: Investment, search and learning. In E. Hanushek & F. Welch (Eds.), *Handbook of the economics of education* (Vol. 1, p. 1 - 67). Elsevier.

# Basic Facts

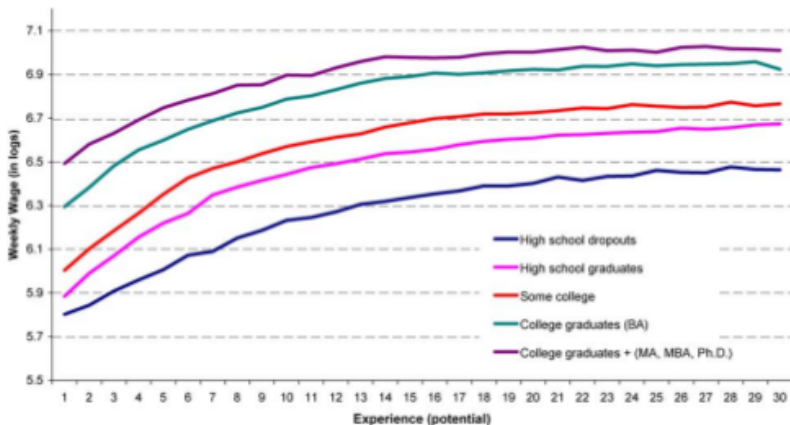


Figure 1. Mean weekly wages (in logs) by education and (potential) experience, white males, full-time full-year workers (52 weeks), CPS, March supplements, 1964–2002.

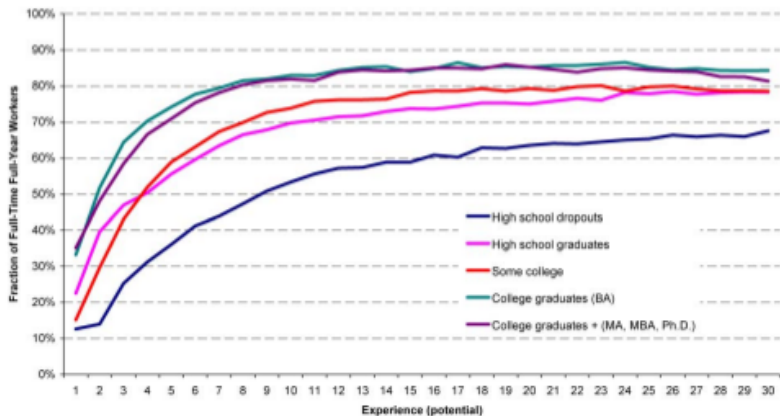


Figure 2a. Fraction of full-time full-year workers and average weekly hours of employed workers by education and experience, CPS, March supplements, 1964–2002.  
 Fraction of full-time full-year workers.

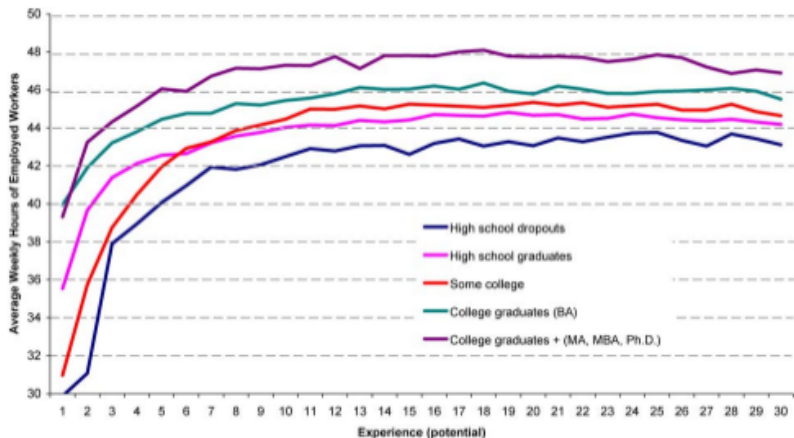


Figure 2b. Fraction of full-time full-year workers and average weekly hours of employed workers by education and experience, CPS, March supplements, 1964–2002.

Average weekly hours of employed workers.

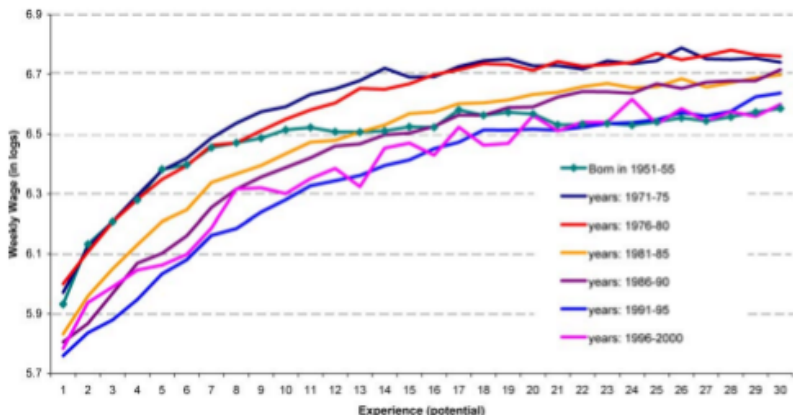


Figure 3a. Cohort and cross-section wage profiles for high school graduates and college graduates, white males, CPS, March supplements, 1964–2002.  
High school graduates.



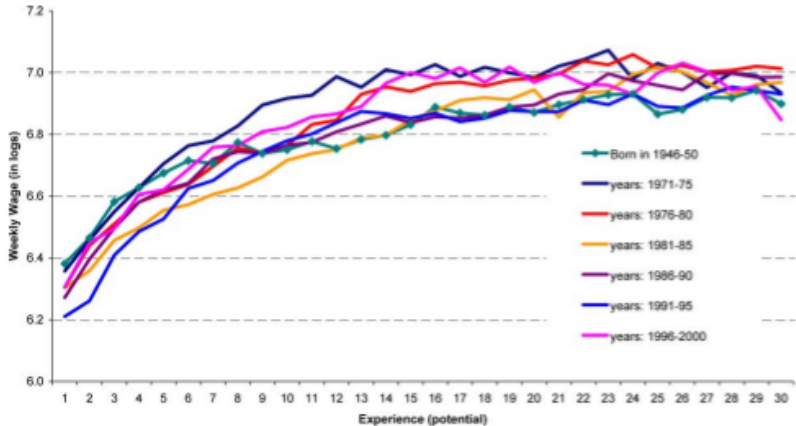


Figure 3b. Cohort and cross-section wage profiles for high school graduates and college graduates, white males, CPS, March supplements, 1964–2002.  
College graduates.

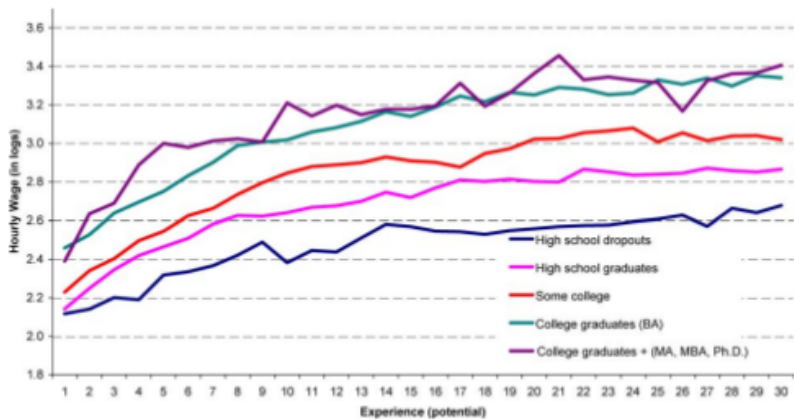


Figure 4a. Mean hourly wages (in logs) by education and experience, PSID, 1968–1997 and NLSY, 1979–2000.  
PSID, 1968–1997.

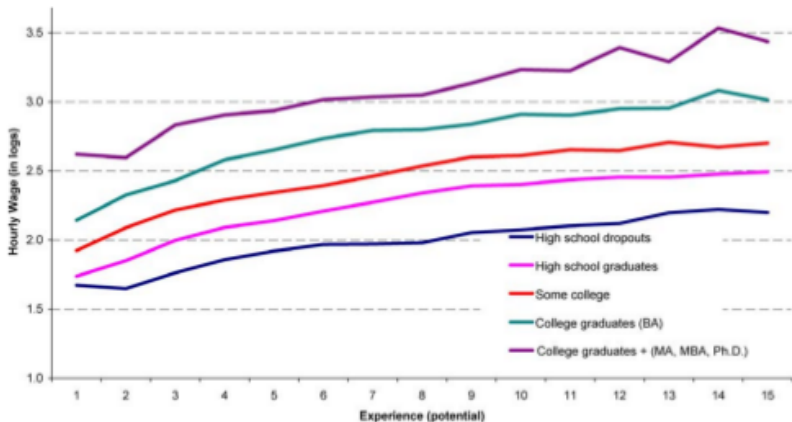


Figure 4b. Mean hourly wages (in logs) by education and experience, PSID, 1968–1997 and NLSY, 1979–2000.  
NLSY, 1979–2000.

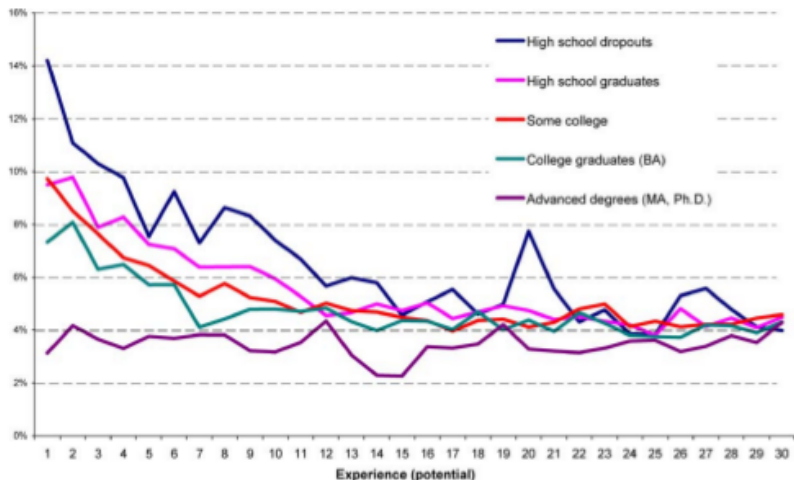


Figure 5a. Proportion of workers who changed occupation, industry or employers by education and experience, full-time workers, CPS-ORG, 1998–2002, and NLS Y, 1979–2000.

Proportion of workers who changed occupation (within one month), CPS-ORG, 1998–2002.

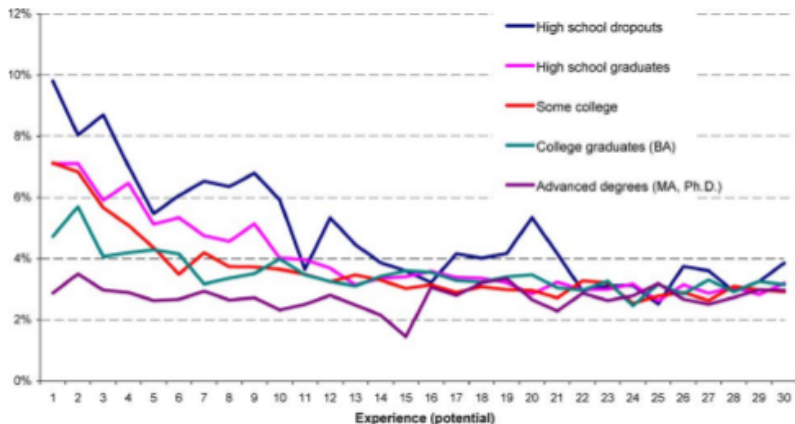


Figure 5b. Proportion of workers who changed occupation, industry or employers by education and experience, full-time workers, CPS-ORG, 1998–2002, and NLSY, 1979–2000.  
 Proportion of workers who changed industry (within one month), CPS-ORG, 1998–2002.

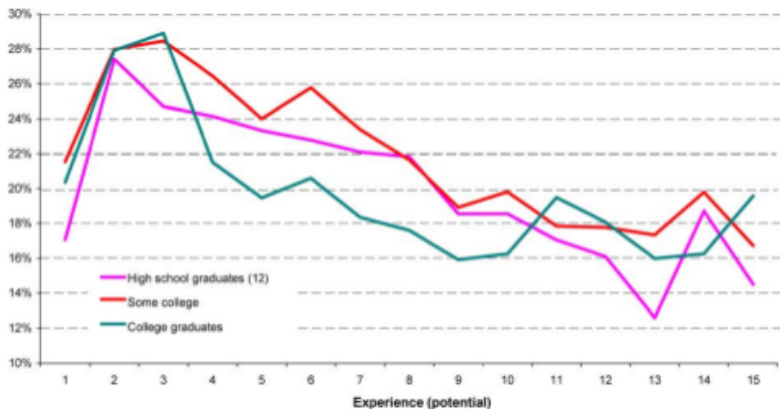


Figure 5c. Proportion of workers who changed occupation, industry or employers by education and experience, full-time workers, CPS-ORG, 1998–2002, and NLSY, 1979–2000.  
Proportion of workers who changed employers (within one year), NLSY, 1979–2000.

Table 1  
The average wage growth by education, experience, specification and data source

| Experience | Data source | Education categories |         |          |         |              |         |                   |         |           |         |
|------------|-------------|----------------------|---------|----------|---------|--------------|---------|-------------------|---------|-----------|---------|
|            |             | Less than HSG        |         | HSG (12) |         | Some college |         | College graduates |         | MA, Ph.D. |         |
|            |             | Level                | Dif     | Level    | Dif     | Level        | Dif     | Level             | Dif     | Level     | Dif     |
| 0-10       | CPS-ORG     | 0.024                | 0.039   | 0.032    | 0.056   | 0.033        | 0.063   | 0.036             | 0.063   | 0.029     | 0.077   |
|            |             | (0.003)              | (0.029) | (0.001)  | (0.010) | (0.001)      | (0.010) | (0.002)           | (0.011) | (0.003)   | (0.017) |
|            | PSID        | 0.028                | 0.043   | 0.030    | 0.057   | 0.038        | 0.065   | 0.039             | 0.076   | 0.032     | 0.110   |
|            |             | (0.003)              | (0.007) | (0.002)  | (0.003) | (0.003)      | (0.005) | (0.003)           | (0.004) | (0.006)   | (0.021) |
|            | NLSY        | 0.024                | 0.065   | 0.034    | 0.071   | 0.046        | 0.081   | 0.052             | 0.082   | 0.055     | 0.096   |
|            |             | (0.006)              | (0.010) | (0.003)  | (0.004) | (0.004)      | (0.005) | (0.005)           | (0.005) | (0.009)   | (0.012) |
| 11-15      | CPS-ORG     | 0.016                | 0.007   | 0.022    | 0.033   | 0.022        | 0.055   | 0.022             | 0.045   | 0.018     | 0.053   |
|            |             | (0.002)              | (0.034) | (0.001)  | (0.011) | (0.001)      | (0.012) | (0.001)           | (0.012) | (0.001)   | (0.020) |
|            | PSID        | 0.019                | 0.030   | 0.020    | 0.021   | 0.026        | 0.021   | 0.027             | 0.029   | 0.022     | 0.013   |
|            |             | (0.002)              | (0.007) | (0.001)  | (0.004) | (0.002)      | (0.005) | (0.002)           | (0.005) | (0.004)   | (0.016) |
|            | NLSY        | 0.013                | 0.024   | 0.023    | 0.019   | 0.026        | 0.024   | 0.035             | 0.067   | 0.039     | 0.123   |
|            |             | (0.002)              | (0.008) | (0.001)  | (0.004) | (0.002)      | (0.007) | (0.004)           | (0.009) | (0.009)   | (0.018) |
| 16-25      | CPS-ORG     | 0.010                | 0.052   | 0.013    | 0.022   | 0.012        | 0.026   | 0.009             | 0.026   | 0.009     | 0.015   |
|            |             | (0.001)              | (0.021) | (0.000)  | (0.007) | (0.000)      | (0.008) | (0.001)           | (0.009) | (0.001)   | (0.012) |
|            | PSID        | 0.011                | 0.010   | 0.012    | 0.010   | 0.015        | 0.014   | 0.017             | 0.026   | 0.014     | 0.019   |
|            |             | (0.001)              | (0.004) | (0.001)  | (0.003) | (0.001)      | (0.004) | (0.001)           | (0.004) | (0.003)   | (0.009) |
|            | NLSY        | 0.003                | 0.035   | 0.014    | 0.038   | 0.009        | 0.065   | 0.021             | 0.111   | 0.025     | 0.044   |
|            |             | (0.004)              | (0.009) | (0.003)  | (0.005) | (0.005)      | (0.013) | (0.009)           | (0.015) | (0.022)   | (0.035) |
| 25+        | CPS-ORG     | -0.002               | 0.025   | -0.004   | 0.011   | -0.005       | 0.002   | -0.014            | -0.002  | -0.009    | 0.012   |
|            |             | (0.003)              | (0.017) | (0.001)  | (0.007) | (0.001)      | (0.008) | (0.002)           | (0.011) | (0.003)   | (0.013) |
|            | PSID        | -0.003               | 0.004   | -0.005   | 0.006   | -0.005       | 0.010   | -0.003            | 0.000   | -0.001    | 0.011   |
|            |             | (0.001)              | (0.003) | (0.002)  | (0.003) | (0.003)      | (0.005) | (0.004)           | (0.005) | (0.005)   | (0.006) |
|            | NLSY        | -0.015               | 0.034   | -0.003   | 0.034   |              |         |                   |         |           |         |
|            |             | (0.012)              | (0.042) | (0.007)  | (0.041) |              |         |                   |         |           |         |

Notes: The numbers in the "dif" columns are cell means and standard deviations. The numbers in the "level" columns are growth rates as implied by the estimated coefficients of the experience and experience squared terms in Mincer's wage equation.

Table 2a  
Annual wage growth rates and proportions of gainers and losers, by education and experience; CPS-ORG, 1998–2002

|                    | Experience | High school graduates |             | Some college |             | College graduates |             | Advanced degrees |             |
|--------------------|------------|-----------------------|-------------|--------------|-------------|-------------------|-------------|------------------|-------------|
|                    |            | Fraction              | Wage growth | Fraction     | Wage growth | Fraction          | Wage growth | Fraction         | Wage growth |
| All                | 0–10       | 1.000                 | 0.056       | 1.000        | 0.063       | 1.000             | 0.063       | 1.000            | 0.077       |
|                    | 11–15      | 1.000                 | 0.033       | 1.000        | 0.055       | 1.000             | 0.045       | 1.000            | 0.053       |
|                    | 16–25      | 1.000                 | 0.022       | 1.000        | 0.026       | 1.000             | 0.026       | 1.000            | 0.015       |
|                    | 26–40      | 1.000                 | 0.011       | 1.000        | 0.002       | 1.000             | –0.002      | 1.000            | 0.012       |
| Gainers (wage up)  | 0–10       | 0.602                 | 0.259       | 0.621        | 0.255       | 0.643             | 0.263       | 0.667            | 0.253       |
|                    | 11–15      | 0.588                 | 0.254       | 0.589        | 0.254       | 0.602             | 0.259       | 0.590            | 0.274       |
|                    | 16–25      | 0.562                 | 0.264       | 0.582        | 0.257       | 0.567             | 0.268       | 0.567            | 0.250       |
|                    | 26–40      | 0.546                 | 0.264       | 0.555        | 0.261       | 0.536             | 0.287       | 0.545            | 0.265       |
| No wage change     | 0–10       | 0.048                 | –0.022      | 0.043        | –0.035      | 0.055             | –0.025      | 0.080            | –0.003      |
|                    | 11–15      | 0.048                 | –0.017      | 0.056        | 0.001       | 0.081             | –0.026      | 0.090            | –0.038      |
|                    | 16–25      | 0.049                 | –0.018      | 0.053        | –0.036      | 0.090             | –0.031      | 0.083            | –0.007      |
|                    | 26–40      | 0.053                 | –0.028      | 0.055        | –0.037      | 0.085             | –0.026      | 0.099            | –0.020      |
| Losers (wage down) | 0–10       | 0.349                 | –0.289      | 0.336        | –0.279      | 0.301             | –0.350      | 0.253            | –0.361      |
|                    | 11–15      | 0.363                 | –0.306      | 0.355        | –0.267      | 0.317             | –0.343      | 0.320            | –0.329      |
|                    | 16–25      | 0.389                 | –0.325      | 0.364        | –0.334      | 0.342             | –0.359      | 0.349            | –0.363      |
|                    | 26–40      | 0.401                 | –0.314      | 0.391        | –0.361      | 0.378             | –0.405      | 0.356            | –0.366      |

Notes: Gainers (losers) had a nominal wage increase (decrease) between subsequent wage observations.  
Fraction is the share within experience groups.



Table 2b  
Annual wage growth and proportions of gainers and losers by experience groups and data source

|                    | Experience | CPS-ORG  |             | NLSY     |             | PSID     |             |
|--------------------|------------|----------|-------------|----------|-------------|----------|-------------|
|                    |            | Fraction | Wage growth | Fraction | Wage growth | Fraction | Wage growth |
| All                | 0-10       | 1.000    | 0.062       | 1.000    | 0.077       | 1.000    | 0.063       |
|                    | 11-15      | 1.000    | 0.044       | 1.000    | 0.033       | 1.000    | 0.024       |
|                    | 16-25      | 1.000    | 0.024       | 1.000    | 0.049       | 1.000    | 0.015       |
|                    | 26-40      | 1.000    | 0.007       | —        | —           | —        | —           |
| Gainers (wage up)  | 0-10       | 0.627    | 0.259       | 0.718    | 0.176       | 0.726    | 0.163       |
|                    | 11-15      | 0.593    | 0.254       | 0.644    | 0.144       | 0.689    | 0.122       |
|                    | 16-25      | 0.568    | 0.264       | 0.662    | 0.168       | 0.667    | 0.118       |
|                    | 26-40      | 0.547    | 0.264       | —        | —           | —        | —           |
| No wage change     | 0-10       | 0.053    | -0.023      | 0.071    | -0.044      | 0.040    | -0.040      |
|                    | 11-15      | 0.065    | -0.020      | 0.097    | -0.040      | 0.048    | -0.030      |
|                    | 16-25      | 0.065    | -0.023      | 0.082    | -0.041      | 0.056    | -0.046      |
|                    | 26-40      | 0.066    | -0.029      | —        | —           | —        | —           |
| Losers (wage down) | 0-10       | 0.319    | -0.312      | 0.211    | -0.221      | 0.234    | -0.228      |
|                    | 11-15      | 0.342    | -0.309      | 0.259    | -0.217      | 0.263    | -0.224      |
|                    | 16-25      | 0.367    | -0.339      | 0.255    | -0.232      | 0.277    | -0.220      |
|                    | 26-40      | 0.388    | -0.351      | —        | —           | —        | —           |

Notes: Gainers (losers) had a nominal wage increase (decrease) between subsequent wage observations. Fraction is the share within experience groups.

Table 2c  
Annual wage growth and proportions of gainers, losers, movers and stayers in the NLSY, by experience groups

|                    | Experience | All      |             | Stayers  |             | Movers   |             |
|--------------------|------------|----------|-------------|----------|-------------|----------|-------------|
|                    |            | Fraction | Wage growth | Fraction | Wage growth | Fraction | Wage growth |
| All                | 0–10       | 1.000    | 0.077       | 0.800    | 0.082       | 0.200    | 0.052       |
|                    | 11–15      | 1.000    | 0.033       | 0.833    | 0.039       | 0.167    | 0.001       |
|                    | 16–25      | 1.000    | 0.049       | 0.833    | 0.055       | 0.167    | 0.014       |
| Gainers (wage up)  | 0–10       | 0.718    | 0.176       | 0.739    | 0.170       | 0.625    | 0.208       |
|                    | 11–15      | 0.644    | 0.144       | 0.662    | 0.140       | 0.549    | 0.174       |
|                    | 16–25      | 0.662    | 0.168       | 0.680    | 0.162       | 0.568    | 0.207       |
| No wage change     | 0–10       | 0.071    | –0.044      | 0.070    | –0.046      | 0.074    | –0.034      |
|                    | 11–15      | 0.097    | –0.040      | 0.100    | –0.038      | 0.080    | –0.049      |
|                    | 16–25      | 0.082    | –0.041      | 0.083    | –0.040      | 0.079    | –0.045      |
| Losers (wage down) | 0–10       | 0.211    | –0.221      | 0.191    | –0.210      | 0.301    | –0.250      |
|                    | 11–15      | 0.259    | –0.217      | 0.238    | –0.209      | 0.370    | –0.244      |
|                    | 16–25      | 0.255    | –0.232      | 0.237    | –0.218      | 0.353    | –0.283      |

Notes: Gainers (losers) had a nominal wage increase (decrease) between subsequent wage observations.  
Movers (stayers) changed (did not change) employer between subsequent wage observations.  
Fraction is the share within experience groups.

## Questions

- ▶ What causes the large wage growth at the initial phase of the career?
- ▶ Why does wage growth decline?
- ▶ What are the interrelationships between wage growth, job change and labor supply?
- ▶ What causes the large variance in individual wage growth and who are the gainers and losers?

# Models

## Implications

- ▶ Investment
- ▶ Investment in school and on the job
- ▶ Search
- ▶ ...

# *Investment*

## Implications

- ▶ For a constant  $R$ , investment declines as the worker ages and approaches the end his working life.
- ▶ Earnings rise along an optimal investment path. This is caused by two effects that reinforce each other; positive investment increases earning capacity and declining investment induces a rise in its utilization rate.

## Implications

- ▶ If  $R$  varies with time, workers that expect exogenous growth in their earning capacity invest at a higher rate and their wage rises at a higher pace. Investment declines if the rate of growth in the rental rate decreases.



*Investment in school  
and on the job*

## Implications

- ▶ Specialization in schooling occurs, if at all, in the first phase of life. It is followed by a period of investment on the job. In the last phase of the life cycle, there is no investment at all.
- ▶ During the schooling period, there are no earnings, yet human capital is accumulated at the maximal rate  $(1 + \gamma)$ . During the period of investment on the job, earnings are positive and growing. In the last phase (if it exists), earnings are constant.

## Implications

- ▶ A worker leaves school at the first period in which (10) is reversed. At this point it must be the case that  $I_t^* < 1$ , which means that at the time of leaving school, earnings must jump to a positive level. This realistic feature is present only because we assume different production (and cost) functions in school and on the job, whereby accumulation in school is faster but requires a larger sacrifice of current earnings.

## Implications

- ▶ A person with a larger initial stock of human capital,  $K > 0$ , will stay in school for a shorter period and spend more time investing on the job. He will have higher earnings and the same earnings growth throughout life.
- ▶ A person with a larger scholastic learning ability,  $\gamma$ , will stay in school for a longer period and spend less time investing on the job. He will also have higher earnings and the same earning growth throughout life.

*Search*

## Implications

- ▶ A job has an option value to the worker. In particular, he can maintain his current wage and move away when he gets a better offer. Consequently, earnings rise whenever the worker switches jobs and remain constant otherwise.
- ▶ The higher the worker's current wage, the more valuable is the current job; hence, the offers that the workers accepts must exceed a higher reservation value. Therefore, the quit rate and the expected wage growth decline as the worker accumulates work experience and climbs up the occupational ladder.

## Implications

- ▶ A straight-forward extension is to add involuntary separations. Such separations are usually associated with wage reduction and are more likely to occur at the end of the worker's career, which may explain the reduction in average wages towards the end of the life cycle.

# Appendix



# *References*

Rubinstein, Y., & Weiss, Y. (2006). Post schooling wage growth: Investment, search and learning. In E. Hanushek & F. Welch (Eds.), *Handbook of the economics of education* (Vol. 1, p. 1 - 67). Elsevier.