

Post Schooling Wage Growth: Investment, Search and Learning Part I

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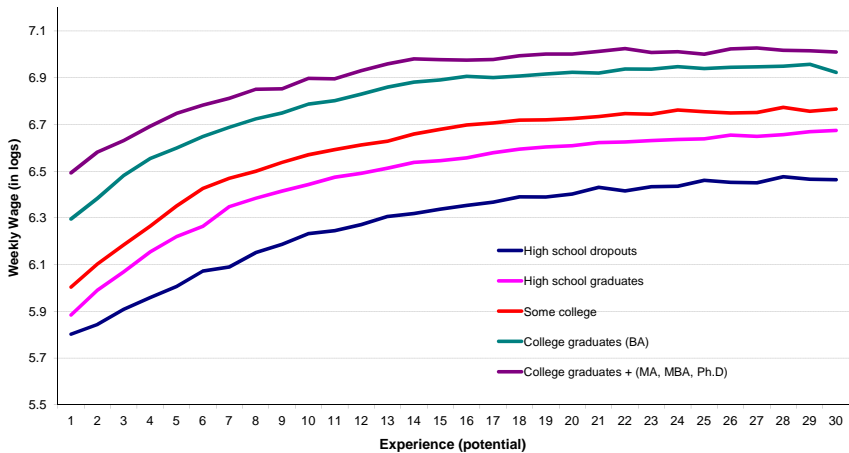


Figure 1: Mean Weekly Wages (in Logs) by Education and Experience, White Males, Full-Time Full-Year Workers, CPS, March Supplement, 1964-2002

- The sharp growth in wages is associated with a sharp increase in labor supply and regularity of employment, as indicated by the life-cycle profiles of the proportion of workers who work full time, full year (among those who worked some time during the year) and average weekly hours (for those with positive hours).
- Workers with higher levels of schooling work more and reach a steady level much earlier than do less educated workers (see Figures 2a and 2b).
- Thus, hours and wages move together over the life cycle, and earnings grow faster than wages.

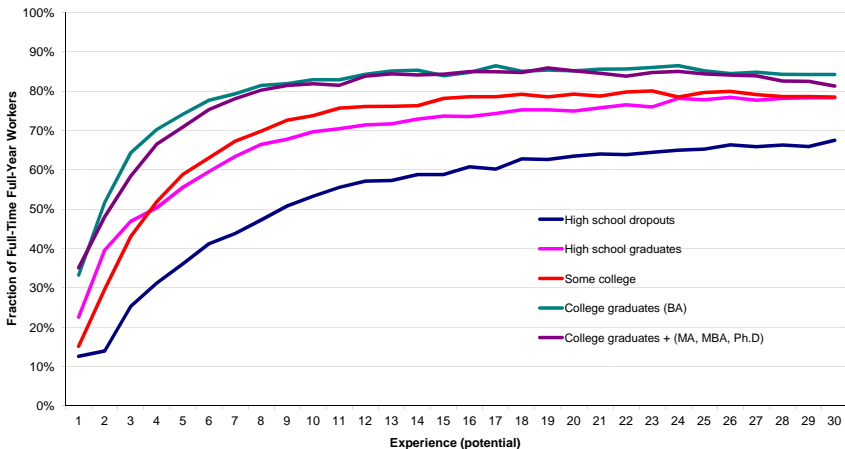


Figure 2: Fraction of Full-Time Full-Year Workers and Average Weekly Hours of Employed Workers by Education and Experience among Employed, White Males, CPS, March Supplement, 1964-2002

Figure 2a: Fraction of Full-Time Full-Year Workers

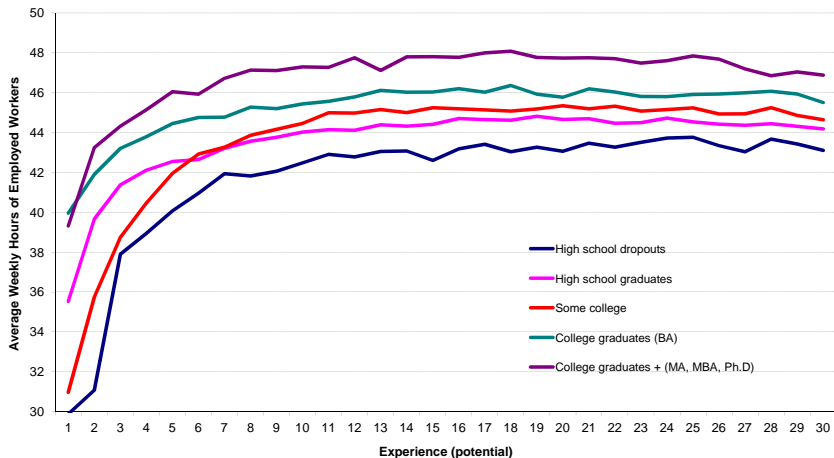


Figure 2: Fraction of Full-Time Full-Year Workers and Average Weekly Hours of Employed Workers by Education and Experience among Employed, White Males, CPS, March Supplement, 1964-2002

Figure 2b: Average Weekly Hours of Employed Workers

Cohorts and Cross-Sections

- In fact, the economy is not stationary.
- The wage structure has undergone major changes beginning in the late 1970's, when workers with high level of schooling started to gain relative to those with low levels of schooling, mainly as a result of the decline in the wages of low-skill workers [see Katz and Autor (1999)].
- Such changes in returns to skill imply different wage profiles for different cohorts, where workers born in the same year are followed over time, and for cross sections, where workers with different experience (and time of entry into the labor force) are observed at a given year.

- Figures 3a and 3b show the wage-experience profiles for the cohort of high school graduates born in 1951-1955 and the cohort of college graduates born in 1946-1950, respectively.
- These two groups entered the labor market at roughly the same time, 1971-1975.
- Added to the graphs is the evolution of the cross section wage-experience profiles from 1971 to 2000 in five year intervals, where each such cross section profile shows the mean wages of workers with the indicated schooling and experience in a given time interval.
- These figures make it very clear that cohort-based wage profiles are affected by changes in market conditions that shift the cross section profiles over time.
- These shifts differ by level of schooling.

- High school graduates of *all* experience levels earned lower wages during the period 1970-2000, which is the reason why the mean wage profile of the cohort of high school graduates born between 1951 to 1955 exhibits almost no wage growth after ten years in the labor market (see Figure 3a).
- In contrast, workers with a college degree or more maintained their earning capacity over time.
- Consequently, as seen in Figure 3b, the cross section and cohort wage profiles of college graduates are quite similar and rise throughout most of the worker's career.

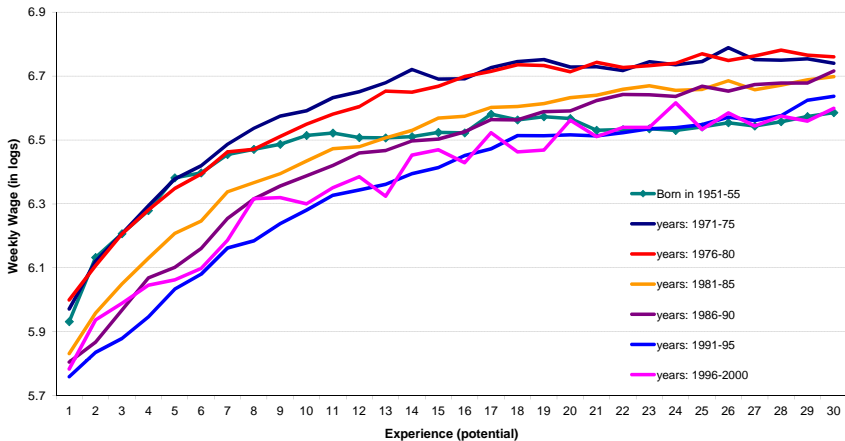


Figure 3: Cohort and Cross-Section Wage Profiles for High School Graduates and College Graduates, White Males, CPS March Supplement, 1964-2002
 Figure 3a: High School Graduates

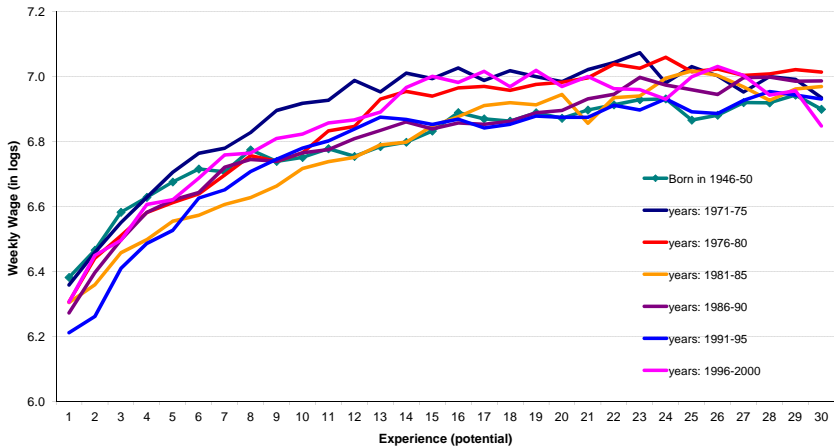


Figure 3: Cohort and Cross-Section Wage Profiles for High School Graduates and College Graduates, White Males, CPS March Supplement, 1964-2002

Figure 3b: College Gradautes

- Although the cross section profile is, by construction, free of time effects, its shape is not necessarily a reflection of life cycle forces because cohorts “quality” can change over time.
- An important reason for this is that schooling is embodied in the worker early in life and the quality of that schooling may depend on the size of the cohorts with each level of schooling and the state of knowledge at the time of entry.
- It is impossible to separately identify time cohort and life cycle effects unless one uses some a priori identifying assumptions.

Panel Data

- Panel data follows the *same* group of individuals over a period of time, in contrast to cohort data, where different individuals are sampled in every period.
- Having repeated observations for the same individual allows one to calculate individual rates of wage growth and examine their variance.
- The panel also allows examination of individual transitions among different employers and occupations.

- Figures 4a and 4b show the average wage profiles constructed from PSID and NLSY data.
- Basically, the patterns resemble the synthetic cohorts displayed in figures 3a and 3b, except that the panel profiles are less likely to taper off and decline late in the life cycle for workers with less than a college degree.
- Note that the NLSY sample follows few birth cohorts that are close to each other, at the early stage of the life-cycle, while the PSID covers many cohorts at all stages of the life cycle.
- Therefore, the NLSY profiles are less concave than the corresponding PSID profiles, which show a pattern that is more similar to the CPS cross section profiles.

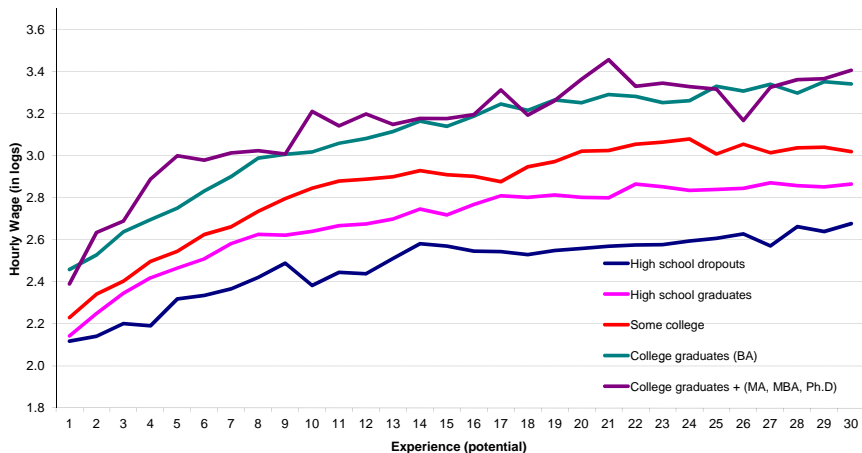


Figure 4: Mean Hourly Wages (in Logs) by Education and Experience, White Males Working at least 1000 Annual Hours, PSID, 1968-1997 and NLSY 1979-2000
 Figure 4a: PSID, 1968-1997

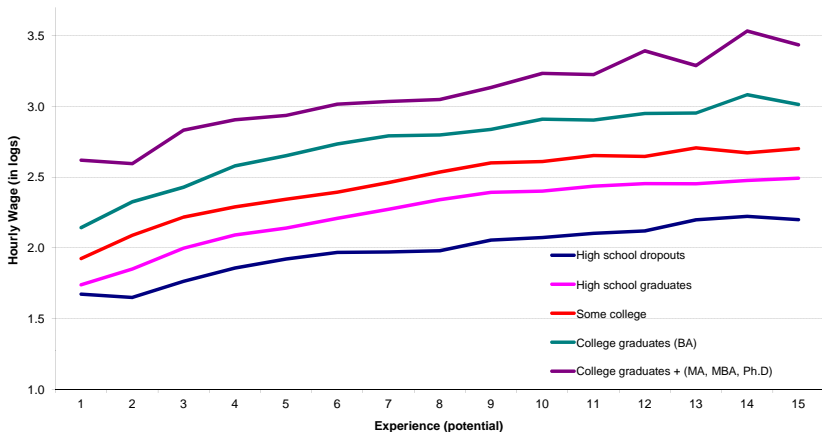


Figure 4: Mean Hourly Wages (in Logs) by Education and Experience,
 White Males Working at least 1000 Annual Hours, PSID, 1968-1997 and NLSY 1979-2000
 Figure 4b: NLSY, 1979- 2000

- Figures 5a and 5b display the life cycle patterns of the monthly proportions of CPS workers that changed occupation and industry, while Figure 5c shows the annual proportions of NLSY workers who changed employers.
- We see that for all these dimensions of mobility, transitions decline quickly with potential experience and are generally more frequent among the less educated, especially at the early part of their careers.
- The impact of schooling on movement across employers is weaker than on transitions across occupations or industries.
- Similar findings are reported by Topel and Ward (1992), Hall (1982), Blau and Kahn (1981), Mincer and Jovanovic (1981), Abraham and Farber (1987) Wolpin (1992) and Farber (1999).

- An interesting feature of the transitions among employers is that the proportion of movers initially rises, suggesting a period of experimentation on the job, and continues at a relatively high rate of about 15 percent per year until the end of the worker's career.

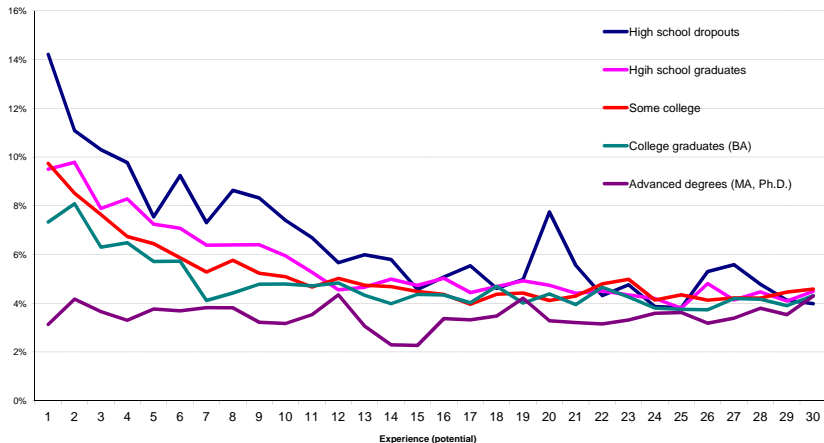


Figure 5: Proportion of Workers who Changed Occupation, Industry or Employers by Education and Experience, White Males, Full-Time Workers, CPS ORG 1998-2002, and NLSY 1979-2000

Figure 5a: Proportion of Workers who Changed Occupation (within one month), CPS-ORG, 1998-2002

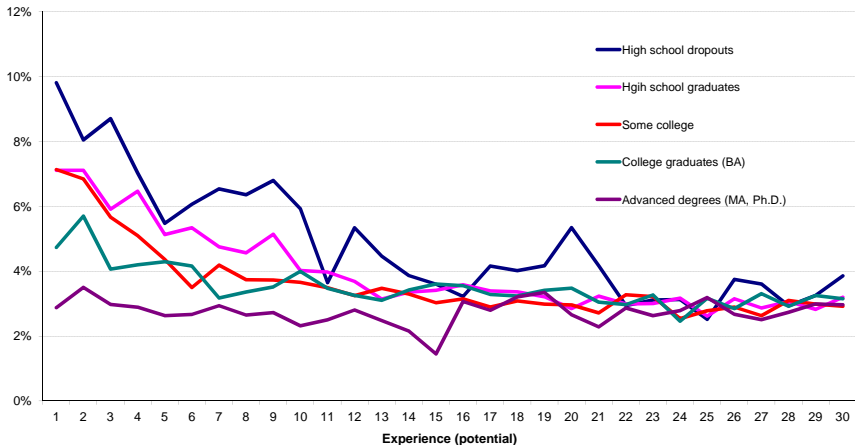


Figure 5: Proportion of Workers who Changed Occupation, Industry or Employers by Education and Experience, White Males, Full-Time Workers, CPS ORG 1998-2002, and NLSY 1979-2000

Figure 5b: Proportion of Workers who Changed Industry (within one month), CPS-ORG, 1998-2002

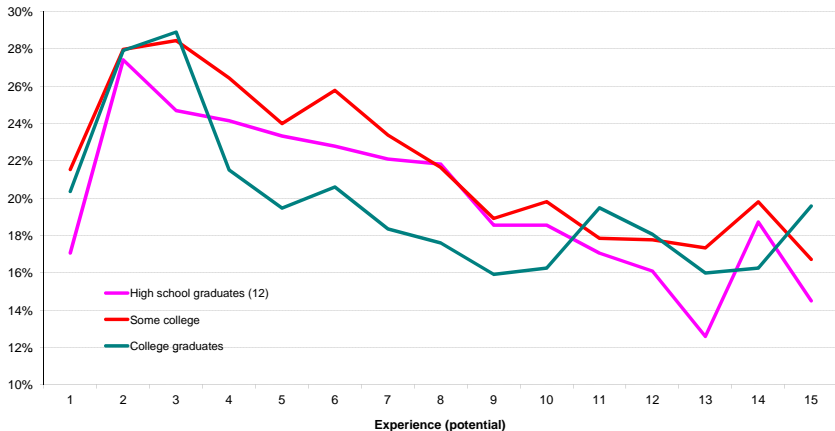


Figure 5: Proportion of Workers who Changed Occupation, Industry or Employers by Education and Experience, White Males, Full-Time Workers, CPS ORG 1998-2002, and NLSY 1979-2000

Figure 5c: Proportion of Workers who Changed Employers (within one year), NLSY, 1979-2000

Individual Growth Rates

- Table 1 summarizes the main results on wage growth.
- For each individual, we calculate annual wage growth and then present the averages and standard deviations of these rates, by experience and schooling.
- For comparison, we also present the predicted average growth rates that would be implied for the same individuals by using Mincer's quadratic specification for wage levels.
- We report these figures for the CPS short panel as well as the PSID and the NLSY samples.
- We include only observations in which workers were fully employed in the two consecutive years for which wage growth is calculated (see Appendix).

Table 1:
The Average Annual Wage Growth by Education, Experience, Specification and Data Source

Expirience	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 (0.003)	0.039 (0.029)	0.032 (0.001)	0.056 (0.010)	0.033 (0.001)	0.063 (0.010)	0.036 (0.002)	0.063 (0.011)	0.029 (0.003)	0.077 (0.017)
	PSID	0.028 (0.003)	0.043 (0.007)	0.030 (0.002)	0.057 (0.003)	0.038 (0.003)	0.065 (0.005)	0.039 (0.003)	0.076 (0.004)	0.032 (0.006)	0.110 (0.021)
	NLSY	0.024 (0.006)	0.065 (0.010)	0.034 (0.003)	0.071 (0.004)	0.046 (0.004)	0.081 (0.005)	0.052 (0.005)	0.082 (0.005)	0.055 (0.009)	0.096 (0.012)
11-15	CPS-ORG	0.016 (0.002)	0.007 (0.034)	0.022 (0.001)	0.033 (0.011)	0.022 (0.001)	0.055 (0.012)	0.022 (0.001)	0.045 (0.012)	0.018 (0.001)	0.053 (0.020)
	PSID	0.019 (0.002)	0.030 (0.007)	0.020 (0.001)	0.021 (0.004)	0.026 (0.002)	0.021 (0.005)	0.027 (0.002)	0.029 (0.005)	0.022 (0.004)	0.013 (0.016)
	NLSY	0.013 (0.002)	0.024 (0.008)	0.023 (0.001)	0.019 (0.004)	0.026 (0.002)	0.024 (0.007)	0.035 (0.004)	0.067 (0.009)	0.039 (0.009)	0.123 (0.018)

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The Average Annual 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
16-25	CPS-ORG	0.010 (0.001)	0.052 (0.021)	0.013 (0.000)	0.022 (0.007)	0.012 (0.000)	0.026 (0.008)	0.009 (0.001)	0.026 (0.009)	0.009 (0.001)	0.015 (0.012)
	PSID	0.011 (0.001)	0.010 (0.004)	0.012 (0.001)	0.010 (0.003)	0.015 (0.001)	0.014 (0.004)	0.017 (0.001)	0.026 (0.004)	0.014 (0.003)	0.019 (0.009)
	NLSY	0.003 (0.004)	0.035 (0.009)	0.014 (0.003)	0.038 (0.005)	0.009 (0.005)	0.065 (0.013)	0.021 (0.009)	0.111 (0.015)	0.025 (0.022)	0.044 (0.035)
25 +	CPS-ORG	-0.002 (0.003)	0.025 (0.017)	-0.004 (0.001)	0.011 (0.007)	-0.005 (0.001)	0.002 (0.008)	-0.014 (0.002)	-0.002 (0.011)	-0.009 (0.003)	0.012 (0.013)
	PSID	-0.003 (0.001)	0.004 (0.003)	-0.005 (0.002)	0.006 (0.003)	-0.005 (0.003)	0.010 (0.005)	-0.003 (0.004)	0.000 (0.005)	-0.001 (0.005)	0.011 (0.006)
	NLSY	-0.015 (0.012)	0.034 (0.042)	-0.003 (0.007)	0.034 (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. Standard errors are in parentheses

- The average worker's career is characterized by three very different phases.
- The first, decade-long phase is characterized by a sharp growth of wages.
- The second, five-year long phase is characterized by moderate wage growth; the late phase of a career has zero or negative growth.
- The growth rates are substantially higher for workers with higher levels of schooling.
- This general pattern is revealed in *all* the data sets that we use.
- However, the CPS short panel shows somewhat lower rates of wage growth because of the absence of time effects.

- The average annual growth rates of wages in the initial ten years for the most-educated group are 7.7 in the CPS short panel, and 11.0 and 9.6 in the PSID and NLSY panels, respectively.
- These rates are quite close to the wage growth associated with schooling.
- However, the contribution of experience declines with the level of schooling; for high school graduates, average growth rates during the first decade of post schooling experience are 5.6, 5.7 and 7.1 in the CPS, PSID and NLSY, respectively.

- There is a sharp decrease in wage growth with labor market experience.
- As one moves across experience groups for the highly educated, the wage growth in the CPS short panel declines from 7.7 to 5.3 and then to 1.5.
- In the PSID sample, wage growth declines from 11.0 to 1.3 and then rises slightly to 1.9.
- The NLSY sample shows no such reduction mainly because it represents few cohorts, all of which gain from the continuous rise in skill prices.
- For some college and below, we see a decline of wage growth with experience in all samples because these groups gained less from the increase in skill prices.

- Differences in average growth rates by schooling levels are substantial.
- For instance, in the CPS and PSID samples, workers with advanced degrees enjoy a wage growth that is twice as high as that of workers with less than high school degree (.077 vs .039 and .110 vs. .043, respectively) during the first decade of their career.
- This important interaction is not captured by the standard Mincer specification; we allow for it here because we estimate the experience coefficients separately for each education group.

- As seen in Table 1, the averaged individual growth rates are generally higher than the wage growth obtained from Mincer's quadratic specification, especially at the early part of a career.
- As noted by Murphy and Welch (1990), the quadratic specification overestimates early wages and underestimates late wages.
- As a consequence of this misspecification, early growth rates are substantially biased downwards.

- The variability in the rates of wage growth follows a U-shape pattern with respect to schooling.
- That is, the standard deviations are lower for workers with high school degree than for workers with more schooling or less, suggesting that, in this regard, the middle levels of schooling are less risky.
- However, there is no systematic pattern for the standard deviations of wage growth by level of experience.

- In Table 2a we show, for each experience and education group, the proportion of observations with a rise, a decline and no change in *reported nominal* wage; for each such subsample, we calculate the average change in *real* hourly wage.
- Using the CPS short panel, we see that, given a nominal increase, the average real hourly wage grows at a hefty rate of 25 percent per year.
- The corresponding figure for wage reduction is even larger, -33 percent per year.
- As experience increases, the proportion of gainers (workers with a wage rise) declines and the proportion of losers (workers with a wage decline) rises.

- However, the conditional means of their respective wage changes remain remarkably similar across experience groups.
- Similarly, as we compare education groups, the main reason for the higher growth rate among the educated is the larger proportion of workers with a nominal wage rise; but given such a change, the average increase is *independent* of the level of schooling.

Table 2a:
Annual Wage Growth Rates and Proportions of Gainers and Losers, by Education and Experience;
CPS-ORG, 1998-2002

	Experience	<u>High School Graduates</u>		<u>Some College</u>		<u>College Graduates</u>		<u>Advanced Degrees</u>	
		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.

- The same patterns are seen in Table 2b for the NLSY and PSID samples, where due to the smaller size of these samples we classify the data only by experience.
- Again, the main reason for the reduction of wage growth with experience is the decline in the proportion of gainers, while the conditional means remain the same (except for gainers in the PSID who show some decline).

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
<i>All</i>							
	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.

- Finally, Table 2c shows the interaction between gainers, losers, movers and stayers.
- It is seen that, compared to stayers, workers who change employers are more likely to be losers and suffer a larger reduction in wages if they lose.
- However, movers obtain higher wage increases if they gain.
- In this respect, the current job provides workers with some insurance.
- Taken together, the patterns displayed in Figure 3 strongly suggest that the average wage growth is influenced by the arrival of positive or negative shocks.
- It is the nature of such shocks (positive or negative) rather than their size that changes over the life cycle.

Table 2c:
Annual Wage Growth and Proportions of Gainers, Losers, Movers and Stayers in the NLSY, by Experience Groups

	Experience	<i>All</i>		<i>Stayers</i>		<i>Movers</i>	
		Fraction	Wage growth	Fraction	Wage growth	Fraction	Wage growth
<i>All</i>	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
<i>Gainers (wage up)</i>	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
<i>No wage change</i>	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
<i>Losers (wage down)</i>	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.

The Questions

Based on this preliminary glance at the data, the following questions arise:

- What causes the large wage growth at the initial phase of a 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?

In the next section, we examine some theoretical models that address these issues. In the subsequent (and last) section, we present further evidence and discuss the support for these explanations that is provided by the data.