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Weathering the Great Recession With Human Capital? Evidence on Labor Market Returns to Education From Arkansas

A CAPSEE Working Paper

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Abstract

The Great Recession was one of the sharpest economic downturns of the past century, with significant impacts across the U.S. labor market. Over past decades, one key feature of the U.S. labor market has been the high and stable returns to education. In this paper I estimate the returns to education for large samples of young workers in Arkansas over the period before, during, and after the Great Recession. I use linked education and Unemployment Insurance earnings data on almost 1 million individuals within the state. From both cross-sectional and longitudinal analysis, I find very modest effects of the Great Recession on the earnings gaps of workers with different levels of education. Over the period 2001 to 2012, there were large and stable returns to postsecondary education relative to high school completion, and these gaps were largely unaffected by the Great Recession. I do find employment shocks that differ by education level: for persons without a college education, employment shocks were stronger and they persisted beyond the end of the recession. Adjusting for these employment shocks, earnings gaps by education level increased over the period after 2007. I also find evidence that those who graduated from college during the Great Recession gained less than those who graduated before 2007. As with earlier recessions, postsecondary education served as an effective buffer against labor market shocks.

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1. Introduction

The Great Recession, which began in December 2007, was the "deepest downturn in the postwar era," with sharp declines in labor force participation, employment, and hours of work (U.S. Bureau of Labor Statistics, 2012). The downturn was also persistent, with an unemployment rate in 2012 that was still above its 2006 level. The recession's distinctive features have led to extensive discussion over whether the basic structure of the U.S. labor market has been altered (Elsby, Hobijn, & Sahin, 2010; Freeman, 2012; Larrimore, Burkhauser, & Armour, 2013; Rothstein, 2012).

One fundamental feature of the U.S. labor market has been the strong demand for human capital, leading to high returns to educational attainment over the long term (Goldin & Katz, 2008). These high returns are expected to hold firm during economic downturns; indeed, they may even grow as workers with less education disproportionately suffer job losses and wage cuts (Freeman, 2012). Yet, the novel and distinctive features of the Great Recession may make this presumption—strong, persistent, and robust returns to education—invalid. Alternatively, even if it is generally valid, the consensus may not hold for all levels of education or for individuals who entered the labor market at any time during the recession.

In this paper I investigate earnings and employment patterns for cohorts of young workers before, during, and after the Great Recession. I begin with a review of the general facts that have emerged about the labor market during the Great Recession and relate these to possible changes in cyclical returns to human capital. I then examine changes in the labor market for young workers over this period. For analysis, I use quarterly earnings data over the period 2001 to 2012 for cohorts of public school students in Arkansas. I utilize this large sample both in repeated cross-sectional analysis and as longitudinal data. I examine how the overall returns to educational attainment changed during and after the Great Recession; I also examine how the returns changed for different cohorts as they entered the labor market during the 2000s.

To briefly summarize the results, I find no evidence of a distinctive structural break in the returns to education during or since the Great Recession. In fact, the returns to different postsecondary awards appear to have been very stable over time. I do find that wage trajectories were flattened, but this flattening was greater for those with less education. I also find evidence of a sizeable drop in employment rates; again, those with less education experienced the most severe impacts. Combined, the earnings and employment impacts of the Great Recession modestly strengthened the returns to postsecondary education in Arkansas.

2. The Great Recession and the Wage Returns to Education

The Great Recession (GR)—which officially dates from December 2007 to June 2009—was an extremely strong negative shock to the labor market. The national unemployment effectively doubled: at the end of 2007 the unemployment rate was 5 percent; at its height in October 2009, it was over 10 percent. Unemployment grew rapidly during the GR and receded slowly (compared with earlier recessions) after its official end date.[1] The impact was especially strong in the construction sector, which explained 40 percent of the changes in the job-filling rate despite being less than 5 percent of total employment; by contrast, recruitment and job-filling rates were very stable in the government sector (Davis, Faberman, & Haltiwanger, 2012). The male–female unemployment rate differential increased sharply during the GR: at its height, the male unemployment rate was 2 percentage points higher than the female rate (having been equal at 5 percent before the GR). Notably, the pool of long-term unemployed expanded dramatically: the rate rose to a peak of 4.4 percent, a rate more than 1 percentage point higher than ever observed in the postwar period.

The GR had several novel features (Freeman, 2012). One was its duration—the peak-to-trough decline in economic activity was 18 months (longer than any postwar recession). Another was the persistence of after-effects: six years later, employment had still not reached pre-GR levels. Both these features led to the swelling of the long-term unemployed. The GR's disproportionate impacts on the construction industry and male workers were also distinct. Yet, unlike prior recessions, worker productivity actually increased, and the GR's effect on wages was muted. Over the period 2007 to 2011, wages were very stable, increasing by 0.3 percent in real terms, and patterns of wage adjustments were mixed, with evidence both of wage stickiness and wage flexibility (Elsby, Shin & Solon, 2013; Freeman, 2012). Using CPS data, Larrimore et al. (2013) showed that the decline in wage earnings over the GR was modest, in contrast to the strong impact on employment. Although overall wage growth was muted, there is some evidence of a wage penalty for new hires (Rothstein, 2012).

In this paper I focus on how the GR influenced the labor market returns to education, primarily for younger workers. Conventionally, recessions are expected to disproportionately affect lower-skilled workers. Several factors are at play. Obviously, more educated workers can apply for more jobs (at their skill level and below); with credentials, they can signal more effectively to employers and, with more general skills, change jobs or industries more rapidly (Herkenhoff & Ohanian, 2011). Also, those who are college-eligible may be able to defer entry into the labor market and so are more efficient job-searchers. The novel features of the GR may have even exacerbated these differences. First, more educated workers rely more on credentials than experience to signal productivity; hence, they are less likely to be prone to the hysteresis of long-term unemployment. Second, relatively few college-educated workers are employed in the construction industry and so would be less susceptible to job loss (Carnevale, Jayasundera, &

[1] Adjusting for demographic changes, the GR may have actually been even more severe than is generally thought (see Roberts & Terrell, 2014).

Cheah, 2012). Finally, the increase in worker productivity during the GR may indicate that more educated workers were displacing less educated workers.

An alternative proposition is that the GR compressed the returns to education. There is considerable evidence on the general shock of entering the labor market during an economic downturn; this shock reflects fewer job openings and greater sensitivity of wages for labor market entrants relative to those who are already employed. In past recessions the shock has persisted at least five years (see Kahn, 2009; Oreopoulos, von Wachter, & Heisz, 2012). Given the strength and duration of the GR, however, those who tried to wait it out in college may have been especially disadvantaged when they finally did enter the labor market.[2] Abel, Dietz, and Su (2014) reported that by making the transition into work more difficult, the GR increased underemployment (i.e., it increased work in positions for which a college degree is not required). Also, fewer high wage jobs may have been available; for example, Oreopoulos et al. (2012) found that the supply of high wage jobs is pro-cyclical. Hence, the returns to education may have fallen, especially for those with limited experience at the onset of the GR.

More generally, the effect of the GR on the returns to education may be obscured by historical labor market trends. Over recent decades, the trend has been toward skill-biased technological change (i.e., jobs becoming more cognitively demanding) and increased demand for workers in occupations and industries that require more education (Avery & Turner, 2012; Goldin & Katz, 2008; Oreopoulos & Petronijevic, 2013). Both effects would push the returns to education upward over time. However, this trend may have stalled or reversed in recent years. Beaudry, Green, and Sand (2013) identified a structural break after the year 2000, with fewer high-paying cognitive jobs and more low-paying routine jobs and falling average wages. Autor and Dorn (2013) described a polarizing labor market that may hollow out jobs for those in the middle (i.e., those with some college or two-year degrees). At the same time, more-educated workers have been replacing less-educated workers in these low-skill jobs, with the latter group exiting the labor market (Hershbein, 2012). Hence, wage growth and the education–earnings gradient may have flattened: highly educated workers now do low-skilled jobs, albeit more productively and for slightly higher pay. This downgraded work—in which workers seek employment rather than earnings—may be the new trend in the returns to college.

To date most studies have identified changes in employment rates by education level during the GR. Elsby et al. (2010, Table 1) estimated that the unemployment rate increased by 47 percent for high school dropouts and by 19 percent for high school graduates. Although impacted to a lesser extent, those with college degrees were not immune: over the GR, the unemployment rate of young workers with college degrees rose from 8 percent to 16 percent (holding at 13 percent by 2011); the employment-to-population ratio fell from 80 percent to 72 percent (holding

[2] A related factor is the relative rates of layoff to job-finding. If the fall in employment is disproportionately due to layoffs, the effects will be strongest for older workers. If the fall is disproportionately due to poor job-finding, this impinges on younger workers (Elsby et al., 2010).

at 75 percent by 2011). As found generally, the shock was even greater for males.[3] Looking at the group of all workers with "some college," Carnevale et al. (2012, Table 3) presented a more benign picture, with an overall job loss rate of 4 percent that was fully offset by a job gain rate of 4 percent in the following two years after the GR. Thus, employment shocks are an important component of the returns to education.

By comparison, limited evidence is available for the path of individual earnings by education across the GR (for other recessions, see Kahn, 2009; Oreopoulos et al., 2012). Recent evidence has found robust returns to completing college across North Carolina (Liu, Belfield, & Trimble, 2015), Washington State (Dadgar & Weiss, 2012), Kentucky (Jepsen, Troske, & Coomes, 2014); and Texas (Andrews, Li, & Lovenheim, 2012a, 2012b). However, these studies did not directly examine the employment and earnings impacts of the GR. In a general test using administrative data on cohorts of community college students in North Carolina, Liu et al. (2015) found no evidence of a decline in the education–earnings gradient for cohorts of workers entering the labor market before, during, and after the GR.

In summary, I expect an increase in the earnings gains from human capital during the GR. This gain would be driven primarily by employment effects, with wage gaps only slightly affected. However, individuals with limited experience (younger persons), who would be finding the transition into full-time employment more difficult, might experience a pay penalty from the GR.

3. Data

The dataset used in this study is from an administrative database on almost 1 million persons in Arkansas during the 2000s (up to 2012). The database includes data on all persons who progressed through the Arkansas education system (high school or college) during that time. For these persons, quarterly earnings data from Unemployment Insurance (UI) records are matched to data on highest education level. The UI earnings data are collected on a quarterly basis from UI-covered employers and include total earnings from all jobs. Earnings data are available from the first quarter of 2001 to the third quarter of 2012. In total, there are over 21 million quarterly earnings data points over this period.[4] For analysis, all earnings data are adjusted to 2010 dollars using the CPI. Experience is calculated based on any report of quarterly earnings (non-zero earnings in any given quarter is valued at 0.25 years of experience). Information on the Classification of Instructional Programs (CIP) code of the subject of study in

[3] The male college-educated unemployment rate went from 10 percent to 21 percent, compared with 6 percent to 12 percent for females; and the employment–population ratio went from 80 percent to 68 percent compared with 81 percent to 76 percent for females (Spreen, 2013, Tables 3 and 5).

[4] UI data are not subject to bias from imputation, self-reporting, and non-response. However, some workers are excluded (independent contractors, military personnel, and those working in the informal sector).

college is available as is the NAICS code for industry employment. The dataset allows an examination of the returns for large samples of workers within a single state both as cohorts and as panels of workers. I am able to exploit the availability of large samples of workers born in different years, who thus experienced the GR equipped with different levels of human capital and experience. However, the dataset has limited individual and contextual information to control for confounding factors.

Descriptive statistics as of 2011 are given in Appendix Table A.1. In 2011, two-thirds of the sample had non-zero earnings, with average quarterly earnings of $6,905 (standard deviation, $8,126). The average age of persons in the sample is 33. Most persons in the sample were born between 1975 and 1990 and so were entering the labor market before and at the start of the GR. By 2011, persons in the sample had on average 13 years of experience. Based on highest attainment, 9 percent of persons in the sample were high school dropouts, 41 percent were high school graduates, 23 percent had some college, and 27 percent had a postsecondary credential.

4. Methods

To examine the variety of effects of the GR on wages, I apply a series of approaches that utilize the cohort and longitudinal nature of the dataset.

The first approach is a straightforward Mincerian earnings specification using annual cohorts of earnings data that span the GR. The Mincerian earnings equation is specified as follows:

$$Y = \alpha + \beta \text{EDUC} + \gamma \text{EXP} + \delta \text{EXP}^2 \quad (1)$$

where Y is mean quarterly earnings per year, EDUC is a vector of binary variables indicating highest education level, and EXP is experience in years (derived from non-zero wage values). Equation (1) is estimated separately by sex and for each year from 2006 to 2011. I estimate these equations for young workers aged 18–32; to adjust for annual aging of the sample I create rolling cohorts of persons (e.g., those aged 18–32 in 2006, those aged 18–32 in 2007). Initially I restrict the sample to those with non-zero earnings; subsequently I estimate equation (1) using all persons with at least four quarters of earnings data over the period 2001–2012.[5]

Mincerian estimates do not control for unobserved ability or motivation that confounds the effect of education on earnings.[6] However, ability bias may be small and OLS specifications

[5] I use four quarters over 12 years as a proxy for an individual who has some attachment to the Arkansas labor market but who may not be able to find permanent work.

[6] A second bias may be a function of how graduates disproportionately reside in areas where incomes are higher but where prices are also higher. Price adjustments offset some of the return to college (Black, Kolesnikova, & Taylor, 2009).

robust (Altonji, Blom, & Meghir, 2012; Barrow & Malamud, 2015; but see Webber, 2014). Marcotte (2010) found that controlling for school quality and academic ability lowered returns to associate degrees by 19 percent for men but *raised* them by 10 percent for women. In the most extensive treatment, Carneiro, Heckman, and Vytlacil (2011) found results to be sensitive to the instruments applied and to expression of the returns in terms of local, average, or marginal treatment effects; in most but not all cases, the marginal returns are expected to be lower than the average returns. In an analysis similar to the one reported here, using administrative data from North Carolina, Liu et al. (2015, Table 1) found that the addition of controls for demographic characteristics, postsecondary institution attended, college ability, and student intentions has a negligible effect on the returns to postsecondary qualifications. Moreover, the current analysis is primarily of returns over time for cohorts of students; these biases are therefore salient to the extent that they have changed significantly across the analysis period.

The second approach is a fixed effects specification using earnings data across all quarters for the period 2001–2012 (Dadgar & Weiss, 2012; Jepsen et al., 2014). The fixed effects specification is:

$$Y_{it} = \alpha + \beta \text{AWARD}_{it} + \gamma \text{INCOLLEGE}_{it} + \delta \text{EXP}_{it} + \delta \text{EXP}^2_{it} + \varepsilon_i + \nu_i \quad (2)$$

Earnings for individual i in quarter t are a function of their postsecondary award, whether they are currently enrolled in college, and their work experience at that date. Given the span of the dataset, I can estimate quarterly earnings before, during, and after the student enrolls in and exits from college. Students are assigned postsecondary awards in the quarter after they graduate with that award and in all succeeding quarters. The advantage of the fixed effects specification is that I can include a dummy variable for each individual in the sample (ε_i). The individual fixed effect (ν_i) controls for all characteristics that are time-invariant (including ability and motivation). I estimate equation (2) for the entire sample and, for comparability with state-level studies cited above, only for persons who have attended college at some point.

To identify effects from the GR I estimate equation (2) with interactions for college enrollment, award status, and award receipt during the Great Recession (2008:Q1–4 and 2009: Q1–2). In a weak labor market, the opportunity cost of attending college should be lower. Also, if the returns to college grew during the GR, the interaction between award status and the GR time period should be positive. Lastly, students who received their awards during the GR should have had lower returns to these awards than the average return to an award. This last test refers to the penalty of graduating during a recessionary period (versus graduating during a non-recessionary period), and studies have found this penalty to be strong (Davis et al., 2012).

In addition, I apply the fixed effects specification to test for labor market changes for different cohorts since the GR. I divide the sample into two cohorts: those born in the academic years 1974–81, with earnings data from ages 31–38, and those born in the academic years 1982–89, with earnings data from ages 23–30. Almost all of the first cohort should have been able to participate fully in the labor market before the GR (being at least age 26 in 2007); almost all of

the second cohort will have had to spend a significant time in college before entering the labor market during the GR (being no more than age 25 in 2007). I examine whether patterns of labor market returns vary between these two cohorts (and test for different age divisions of the sample).

Subsequently, I examine how the GR may have affected those without postsecondary education. For these individuals, entry into the labor market is primarily determined by year of birth (rather than selected by endogenous labor supply decisions). I compare earnings trajectories for dropouts and high school graduates who were aged 18 just before, during, and after the GR.

The third approach looks at how employment rates across the education distribution were affected by the GR. Using longitudinal data on older workers I show some declines in employment rates for each education level but especially for those with low skills. To fully account for labor market changes over the GR, I re-estimate equations (1) and (2) to identify the employment-adjusted earnings differences by education level.

5. Results

Mincerian Earnings Functions

An overall picture of the returns to education in Arkansas is given in Table 1. These basic specifications include all persons with non-zero earnings data in 2011 and report coefficients for quarterly earnings by education level. (Despite limited controls, the models explain approximately one-quarter of the variation in quarterly earnings and, given the large sample, yield very small standard errors.) The results show strong positive returns to each accumulation of human capital. The returns to experience are also high, and the trend is only slowly declining; this reflects the relative youth of the sample.

Model (1) of Table 1 shows the returns relative to high school dropouts. These quarterly gaps are very large: the female (male) high school graduate premium is $2,743 ($3,308); the two-year degree premium is $4,004 ($4,923); and the premiums for four-year or advanced degrees are even larger. Model (2) shows the same estimation restricted to those with any college attendance. Completing any award in college has much higher returns than simply attending college. Specifically, compared to those with some college in 2011 female (male) diploma/certificate holders earned $462 ($1,096) more per quarter, and those with associate degrees earned $1,894 ($1,939) more. Predictably, returns for bachelor's and advanced degrees are even larger. This evidence for Arkansas is more emphatic than for other states (possibly in part because my specification includes fewer covariates). A notable finding for Arkansas is the high returns to certificates/diplomas compared with mixed evidence across other states (Bailey & Belfield, 2012).

Model (3) of Table 1 shows returns to associate degrees and certificates (including diplomas) separately by subject. As found in other states, the returns to community college in Arkansas vary significantly by subject. Clearly, there are strong returns to completing a field in the health professions. For students with associate degrees in health, the mean gain over a person with some college is, at $5,249 ($4,846), more than double the average return to an associate degree. A similar premium is evident for health certificates compared with the average gain for these awards. By contrast, other popular subjects have returns close to the average (although diplomas/certificates in mechanics and engineering show very high returns).

The results from the fixed effects estimations are given in Table 2. This specification controls for time-invariant characteristics of the sample to identify the effect of exiting college with a credential. The sample includes all non-zero earnings across the time period from 2001Q1 to 2012Q3. On average, each person has 22 quarters of earnings data.

The first estimation includes all persons, both college-enrollees and those who did not attend any college. For each quarter enrolled in college, the opportunity cost for female (male) Arkansas college students is a reduction in earnings of $209 ($384). Although sizeable, these opportunity costs are only 10–20 percent of average quarterly earnings: very high proportions of students are combining work and college. This fact has two implications. First, forgone earnings from college are quite small; the opportunity cost of college is therefore quite low. Second, many students maintain some labor market attachment while in college; this may mitigate the job search penalty of the GR. For each cumulative quarter in work, the earnings gain is $141 ($195). Again, although non-trivial, the loss from being in college and not gaining experience is modest. Finally, the fixed effects estimation shows strongly positive returns to longer awards. The returns to diplomas/certificates are mixed, but there are strong positive returns to exiting college with a degree: for associate degrees, earnings are $954 ($405) higher; and for those with bachelor's degrees, earnings are $2,681 ($2,943) higher.

The second specification includes only those individuals who attended a postsecondary institution. It yields very similar results in terms of opportunity costs and gains from experience. The returns to diplomas/certificates remain mixed, but the gains from associate degrees ($937 [$260]) and bachelor's degrees ($2,656 [$2,789]) remain substantial. Despite a model with fewer covariates, these results are similar to Liu et al. (2015). In Liu et al. (2015, Tables 6 & 7) the opportunity cost of college was $310–$580, the returns to experience were $100–$200, the returns to associate degrees were $1,130–$1,910, and the returns to bachelor's degrees were $3,000–$3,290 (2010 dollars).

Table 1. Quarterly Earnings Gains by Award Status in 2011

	Female			Male		
	(1) All	(2) College group	(3) College w. subjects	(1) All	(2) College group	(3) College w. subjects
Experience (yrs)	432	791	770	695	1,162	1,157
	[2]	[11]	[11]	[5]	[15]	[15]
Experience squared	–7	–29	–29	–11	–38	–38
	[0]	[1]	[1]	[0]	[1]	[1]
HS graduate	2,743	–	–	3,308	–	–
	[36]	–	–	[72]	–	–
Some college	2,368	–	–	3,597	–	–
	[38]	–	–	[71]	–	–
Diploma/ certificate	2,457	462	–	3,836	1,096	–
	[43]	[40]	–	[80]	[53]	–
Associate degree	4,004	1,894	–	4,923	1,939	–
	[44]	[42]	–	[87]	[66]	–
Bachelor's degree	6,891	4,490	4,460	10,031	6,213	6,212
	[49]	[45]	[45]	[105]	[75]	[75]
Advanced degree	9,568	7,513	7,475	14,819	10,349	10,348
	[69]	[83]	[84]	[188]	[185]	[185]
Certificates						
Health	–	–	823	–	–	1,342
	–	–	[58]	–	–	[156]
Mechanical engineering	–	–	1,226	–	–	2,040
	–	–	[348]	–	–	[100]
Transportation	–	–	348ns	–	–	–262ns
	–	–	[585]	–	–	[201]
Other subjects	–	–	239	–	–	800
	–	–	[46]	–	–	[65]
Associate degrees						
Health	–	–	5,249	–	–	4,846
	–	–	[91]	–	–	[278]
Humanities/ social science	–	–	1,287	–	–	1,655
	–	–	[70]	–	–	[143]
Business marketing	–	–	714	–	–	1,708
	–	–	[94]	–	–	[315]
Other subject	–	–	1,093	–	–	1,811
	–	–	[48]	–	–	[75]
R-squared	0.250	0.188	0.196	0.231	0.228	0.230
Observations	346,661	120,163	120,163	280,674	94,946	94,946

Note. Includes all persons, average non-zero quarterly earnings in 2011. OLS specification. Award status is highest award by 2011. All quarterly wages in 2010 dollars. Robust standard errors given in brackets. All coefficients statistically significant at $p < .01$, except *ns* (not statistically significant at $p < .05$).

Table 2. Quarterly Earnings Gains by College Award: Fixed Effects Full Sample

	Female		Male	
	Full Sample	College Sample	Full Sample	College Sample
In college	–209	–220	–384	–422
	[8]	[8]	[11]	[11]
Experience (cumulative quarters)	141	149	195	207
	[1]	[1]	[1]	[1]
Diploma/certificate	88	71	–213	–344
	[23]	[23]	[31]	[31]
Associate degree	954	937	405	260
	[25]	[25]	[42]	[42]
Bachelor's degree	2,681	2,656	2,943	2,789
	[23]	[23]	[35]	[34]
Higher degree	3,210	3,198	3,962	3,809
	[41]	[40]	[74]	[74]
R-squared	0.260	0.312	0.249	0.311
Individuals	524,149	239,189	446,774	181,128
Observations	12,177,780	5,985,519	9,300,929	4,210,808

Note. Earnings data from 2001Q1 to 2012Q3. Fixed effects specification. Award status identified for each quarter award is held. Quarterly wages in constant 2010 dollars (CPI). Model also includes experience squared. Constant term included. Robust standard errors in brackets. All coefficients statistically significant at $p < .01$.

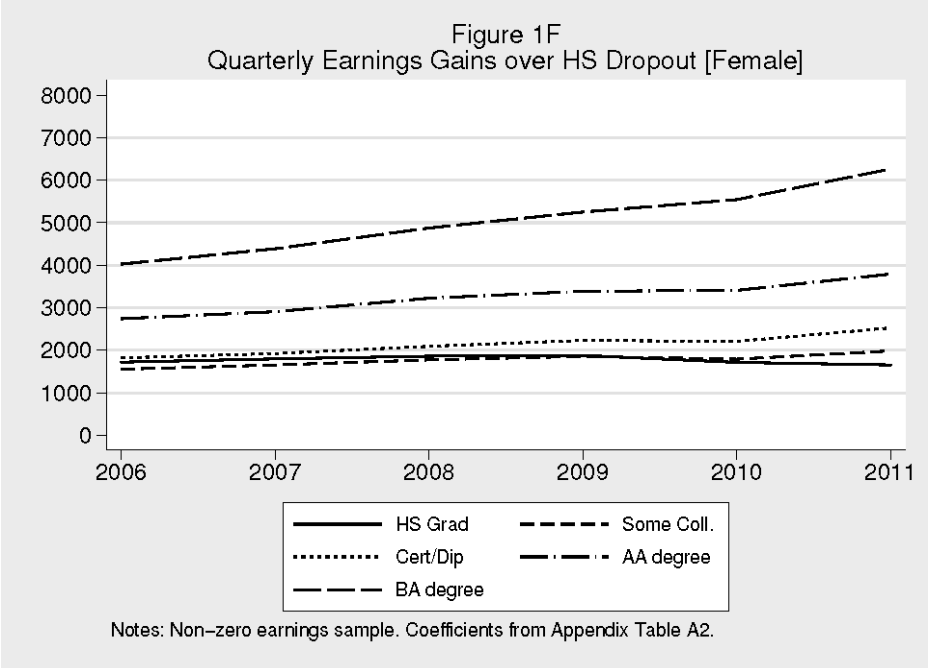
Using these fixed effects specifications, the rate of return to postsecondary degree completion in Arkansas is high. Using a conservative 15-year period after first enrollment, assuming lost income while studying and earnings gains after award completion as per the college sample in Table 2, and accounting for tuition based on local college sticker prices for in-state residents, the internal rate of return to completing an associate degree is 9 percent and to completing a bachelor's degree is 14 percent.[7]

Trends in the Education–Earnings Gradient

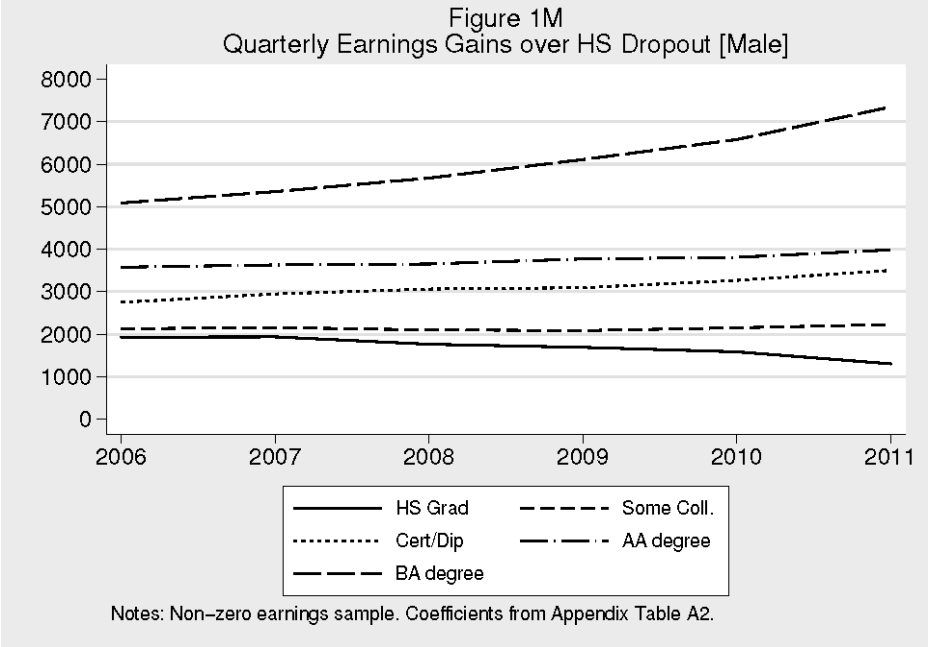
Mincerian estimation. The trend of earnings gaps over the period 2006 to 2011 is shown in Figure 1. This figure shows the earnings gaps over high school dropouts. The gaps are estimated as per Table 1 but with rolling windows of persons aged 18–32 in each calendar year. Thus, the trends are for cohorts over time, not individual workers aging over time. The education coefficients are reported in Appendix Table A.2 for model (1), Table A.3 for model (2), and Table A.4 for model (3).

[7] Details available from the author. These internal rates of return are based on current tuition levels. However, even if state support of higher education is declining, it is unlikely that these rates of return will fall below a threshold.

Figure 1. Quarterly Earnings Gains Over High School Dropout (Female and Male)



Notes: Non–zero earnings sample. Coefficients from Appendix Table A2.



Notes: Non–zero earnings sample. Coefficients from Appendix Table A2.

To adjust for the changing composition of the workforce I examine earnings trajectories per age cohort by education level. I track two age cohorts—those born in 1977–78 and those born in 1979–80—and examine their earnings from age 26 to age 32–35. For these cohorts the GR occurred after most of the sample had attained their highest level of education, so my focus is on how the returns to education may have changed over the course of the GR.

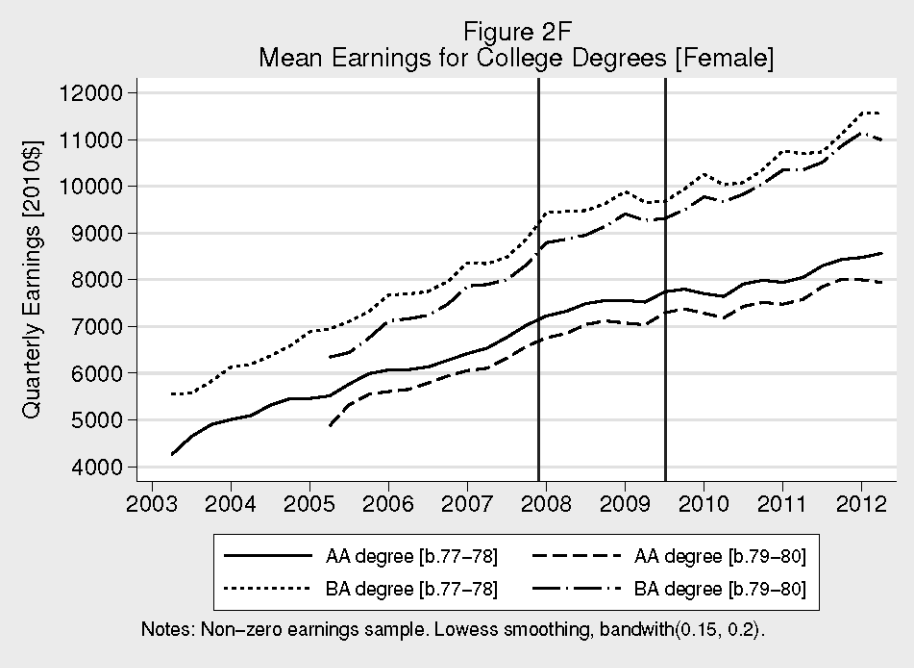
For the college graduates in these cohorts, panels of earnings trajectories are given in Figure 2; for the non-college group, the respective trajectories are in Figure 3. (In Figures 2 and 3, the official period of the Great Recession is bounded between the two vertical lines). The earnings trajectories for the college-educated cohorts show no clear break after 2007: the earnings of associate degree and bachelor's degree holders grew at a steady rate, although the trajectories flattened slightly for men after 2007. Similarly, there is little evidence of flattening in the earnings trajectories of the non-college cohorts. However, the trajectories for high school dropouts are almost flat throughout the entire time period: dropouts aged 35 have real wages that are almost unchanged from when they were 26. Overall, at least for persons with earnings, the trajectory of earnings growth did not shift clearly downward during (or after) the Great Recession.

Fixed effects specifications for college sample. Although there appear to be no general effects of the GR on the returns to education, there may be impacts for those entering the labor market during that time or for those who had not yet begun to establish their careers. To identify this impact I undertake two alternative investigations.

The first approach is to estimate the fixed effects specification of equation (2) with interactions for college enrollment, awards obtained, and awards held during the Great Recession. These results are given in Table 3, and again the sample is persons with non-zero earnings. Model (1) includes an interaction term for being enrolled in college.

Enrolling in college had an opportunity cost (of approximately $200–$500 per quarter), as per specifications in Table 2. But the interaction term indicates that the opportunity cost was significantly lower during the Great Recession (down by $240). In fact, for female students the lost earnings from enrolling in college during the GR were essentially zero. Thus, although the labor market was worse during the GR, the opportunity cost of attending college went down. Model (2) shows the interactions for awards held during the GR. The interaction terms for each type of award are positive. Having an award during the GR is more valuable than having an award in a stronger labor market. Finally, model (3) of Table 3 shows the effect of obtaining an award during the GR. For this group, the interactions for awards received during the GR are consistently negative: graduating during the GR reduces the benefits of a postsecondary award by approximately one-third to one-half.

Figure 2. Mean Earnings for College Degree Holder Cohorts (Female and Male)



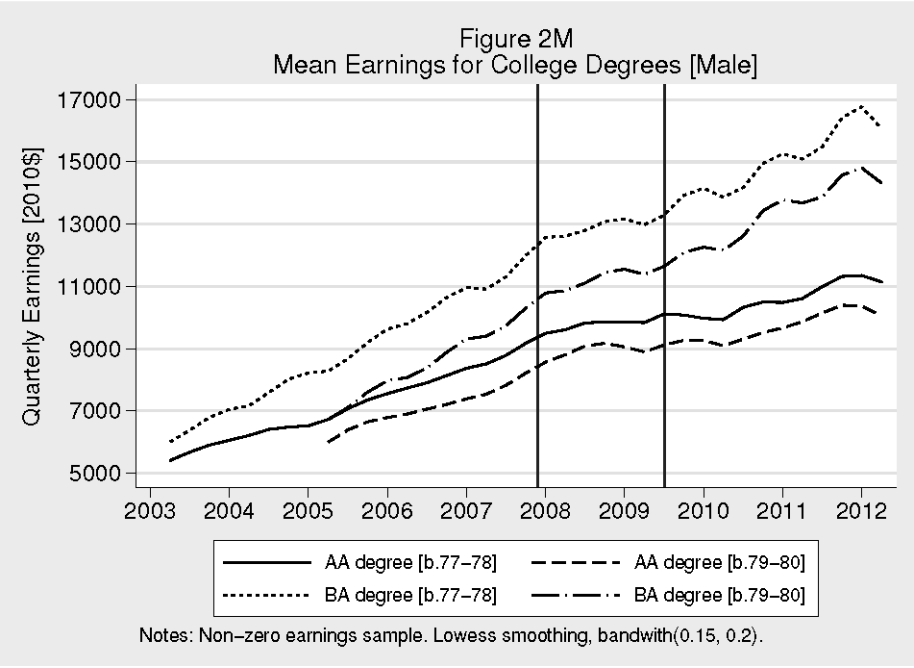
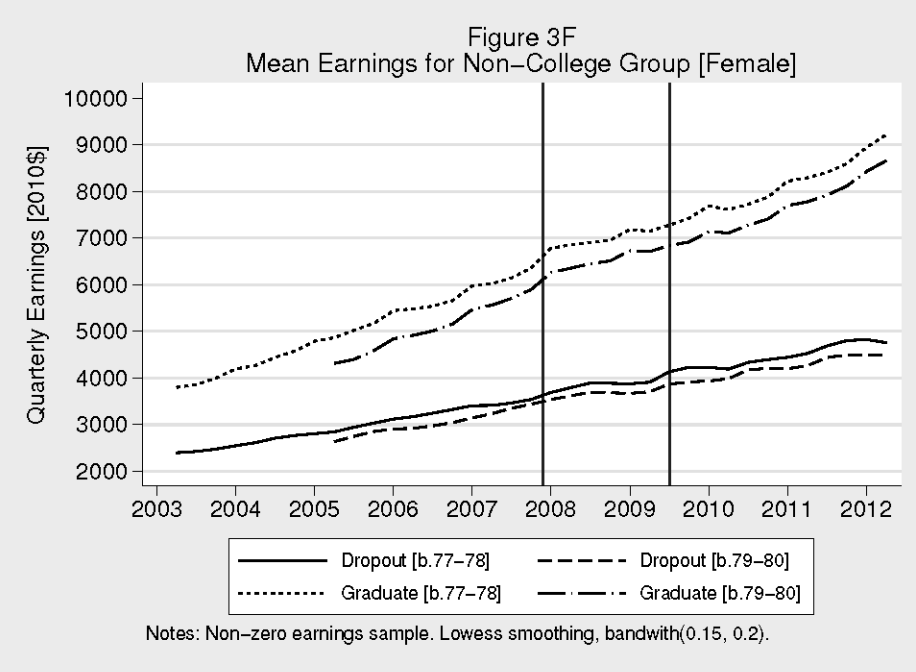


Figure 3. Mean Earnings for Non-College Cohorts (Female and Male)



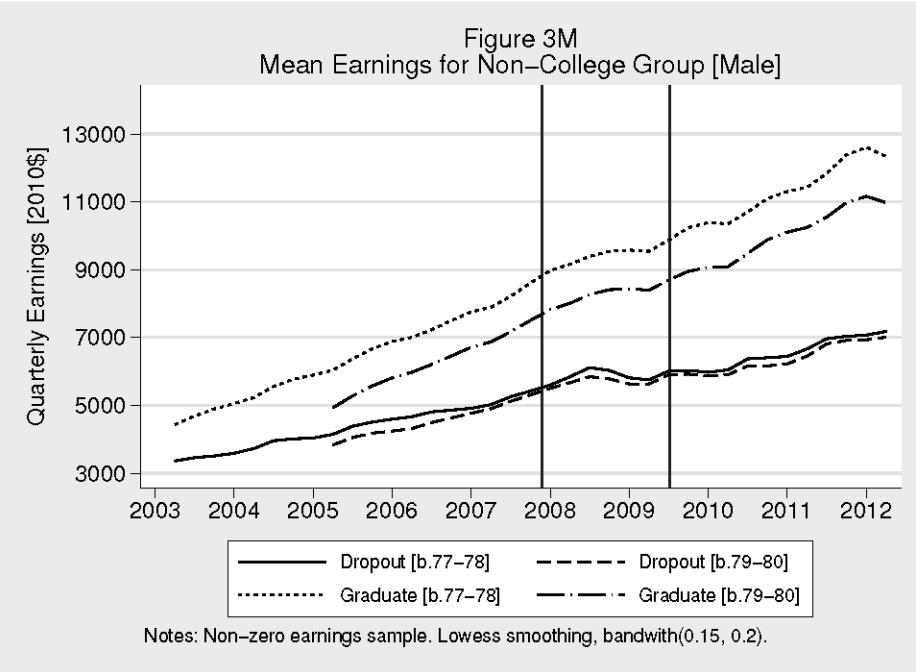


Table 3. Quarterly Earnings Gains by College Award: Fixed Effects College Sample Interactions

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
In college	–260	–219	–212	–459	–421	–414
	[8]	[8]	[8]	[11]	[11]	[11]
In college * GR	238	–	–	236		
	[10]	–	–	[15]		
Diploma/certificate	74	41[ns]	88	–341	–369	–324
	[23]	[23]	[23]	[31]	[31]	[31]
Diploma/certificate * GR	–	186	–	–	150	–
	–	[19]	–	–	[25]	–
Diploma/certificate in GR	–	–	–192	–	–	–222
	–	–	[38]			[53]
Associate degree	935	904	966	261	214	286
	[25]	[25]	[25]	[42]	[42]	[43]
Associate degree * GR	–	212	–	–	311	–
	–	[19]	–	–	[33]	–
Associate degree in in GR	–	–	–412	–	–	–361
	–	–	[42]	–	–	[74]
Bachelor's degree	2,644	2,616	2,724	2,779	2,756	3,821
	[23]	[23]	[23]	[34]	[34]	[74]
Bachelor's degree * GR	–	242	–	–	204	–
	–	[18]	–	–	[26]	–
Bachelor's degree in GR	–	–	–1,058	–	–	–1,230
	–	–	[40]	–	–	[60]
	–	–	–	–	–	–
R-squared	0.312	0.312	0.312	0.311	0.311	0.311
Individuals	524,149	239,189	239,189	446,774	181,128	181,128
Observations	12,177,780	5,985,519	5,985,519	9,300,929	4,210,808	4,210,808

Note. Earnings data from 2001Q1 to 2012Q3. Quarterly wages in constant 2010 dollars (CPI). Fixed effects specification. Award status identified for each quarter award is held. Interaction refers to award held during period 2008Q1–2009Q2. *In GR* refers to awards received during GR. Model also includes experience, experience squared, and higher degree. Constant term included. Robust standard errors in brackets. All coefficients statistically significant at $p < .01$, except *ns* (not statistically significant at $p < .05$)

The second approach is to apply the fixed effects specification for two separate, age-equivalent college-educated cohorts of workers. The first cohort was born between 1981 and 1983; for this cohort, I estimate equation (2) using earnings data from 2001 to 2007. The second cohort was born between 1985 and 1987; for this cohort I estimate equation (2) with data from 2006 to 2012. Thus, both cohorts are aged 18–26. While the first cohort did not experience the GR during the timeframe of my analysis, the second cohort did.

The earlier (pre-GR) cohort had higher earnings and more experience than the later (in-GR) cohort (see Appendix Table A.5). Female (male) quarterly average earnings were $3,608 ($4,332) for the earlier cohort and $2,964 ($3,540) for the later cohort. Some of this gap is explained by experience; the earlier cohort had an additional two quarters with non-zero earnings and had spent less time in college. However, employment quarters for the earlier cohort also appear to have been more highly paid than for the later cohort. Importantly, the cohorts are generally similar in terms of awards obtained (although, following recent trends in postsecondary enrollments, more of the later cohort were certificate-holders).

Table 4 shows the quarterly earnings gains by award based on the fixed effects specification for each cohort. Broadly, the coefficients are similar across the cohorts. The opportunity cost of college is much higher for the second cohort (even as both cohorts are the same age in the analysis). But the returns to experience are also much greater.

Table 4. Quarterly Earnings Gains by College Award Status: Fixed Effects Sub-Samples

	Female		Male	
	Early AY81–83	**Late AY85–87**	**Early AY81–83**	**Late AY85–87**
In college	–204	–666	–269	–531
	[18]	[25]	[20]	[32]
Experience (quarter)	123	229	172	267
	[3]	[7]	[4]	[9]
Diploma/certificate	527	86[ns]	538	122[ns]
	[82]	[89]	[85]	[120]
Associate degree	937	408	582	186[ns]
	[77]	[88]	[96]	[135]
Bachelor's degree	2,459	2,033	2,594	2,468
	[48]	[55]	[69]	[73]
Advanced degree	3,674	4,074	2,958	3,989
	[246]	[189]	[324]	[304]
R-squared	0.340	0.264	0.345	0.238
Individuals	24,755	21,440	19,982	17,861
Observations	376,009	273,923	285,994	220,323

Note. Sample is persons with some college. Earnings data from rolling seven-year windows (early 2001–2007; late 2005–2012). Award status identified for each quarter award is held. All quarterly wages in constant 2010 dollars (CPI). Model also includes experience squared. Constant term included. Robust standard errors in brackets. All coefficients statistically significant at $p < .01$, except *ns* (not statistically significant at $p < .05$).

For sub-baccalaureate awards, there is some evidence that returns are lower for the later cohort: obtaining a diploma/certificate is not associated with an increase in earnings; and for males there is not yet any boost from obtaining an associate degree (and the returns to this award

are attenuated for female students). However, the returns to bachelor's and advanced degrees are robust across the two cohorts. The quarterly earnings gain for having a bachelor's degree is almost identical for male students and very close for female students across the two cohorts. Overall, there is no clear evidence that the education–earnings gradients for the in-GR cohort were different from those for the pre-GR cohort.

To check that these results are not sensitive to the age cohort effects, I re-estimate equation (2) in three different ways using different samples and spans of earnings data. The first re-estimation uses the same sample split as in Table 4 but includes all available earnings data for these two cohorts. The second split is between those born in 1974–81 and those born in 1982–89. Aged at least 26 in 2007, the former cohort will have (largely) completed its postsecondary education by the onset of the GR whereas the latter cohort, aged on average 22–23 years old in 2007, entered the labor market coincidentally with the GR. These estimations include all earnings periods from 2001 to 2012. In the final re-estimation the split is narrower, looking at those persons born in 1974–77 and 1982–85 with only earnings data over an equivalent three-year window. These re-estimations are reported in Appendix Table A.6. The results yield very similar conclusions to those for Table 4: there is no evidence of a structural break over the GR.

Overall, it is unlikely that cohort selection effects are driving the results. Under most specifications, the returns to certificates are weak, the evidence for associate degrees is mixed although generally positive, and the returns to bachelor's degrees are consistent and large. The returns to education appear similar before, during, and after the GR.

High school completion. At least for college-educated workers, the returns to education in Arkansas held firm across the GR, in part because the opportunity cost of college has fluctuated pro-cyclically; also, working while enrolled has served as a useful hedge against a weak labor market, allowing for optimal time of entry into the labor market. However, non-college-bound high school graduates do not have this option: effectively they are entering the labor market at the same time as high school dropouts and their year of entry is determined by their year of birth.

To test for the impact of the GR on high school graduates who did not go to college, I compare earnings trajectories for cohorts who turned 18 in three distinct years: pre-GR (2006), during the GR (2008), and after the GR (2010). Again, I restrict the sample to persons with non-zero earnings. I anticipate that the first age group would have a steeper earnings trajectory than the second group. As noted above, the adverse effects of the GR persisted beyond its official date, so it is possible that the third age group would experience labor market outcomes as weak as those of the second age group. Of interest are the relative trajectories of high school dropouts and non–college-bound high school graduates across each of the age groups. If the returns to completing high school are unaffected by the GR, the gap between dropouts and graduates should be similar across each age group.

The earnings trajectories for employed high school dropouts are very similar across the three age groups (see Appendix Figure B.1). Strikingly, women (men) in each age group start out

with almost equivalent earnings at age 18 (approximately $1,750 [$2,000] per quarter). However, the earnings trajectories are modestly different: earnings growth is in fact fastest for the post-GR group and slowest for the pre-GR group. A similar pattern is evident for high school graduates (see Appendix Figure B.2): regardless of cohort, earnings at age 18 are $1,200–$1,300; however, the earnings trajectories for the three groups are identical, with increases of approximately $800 per year.

The net effect—the annual difference in average wages of graduates minus dropouts by age per cohort group—is shown in Figure 4. Initially, dropouts earn more than graduates (approximately $500 per quarter): for most of the time when they are age 18, many of the graduates are still in school. By age 19, earnings are equal, and at subsequent ages the earnings of graduates exceed those of dropouts. Here there is some evidence of an adverse impact on high school graduates entering the labor market during the GR: they take longer to reach earnings parity with dropouts and more slowly surpass the earnings of dropouts. The effect is clearest for male graduates, with earnings of 20-year-old graduates in 2012 still below those of 20-year-old dropouts. However, the earnings premium for graduates over dropouts is narrowest for the youngest cohort (aged 18 in 2010 and so composed of labor market entrants post-GR). Notably, this result is caused by a change in the earnings of dropouts; these individuals—or at least those who had jobs—did better after the GR than during or before it.

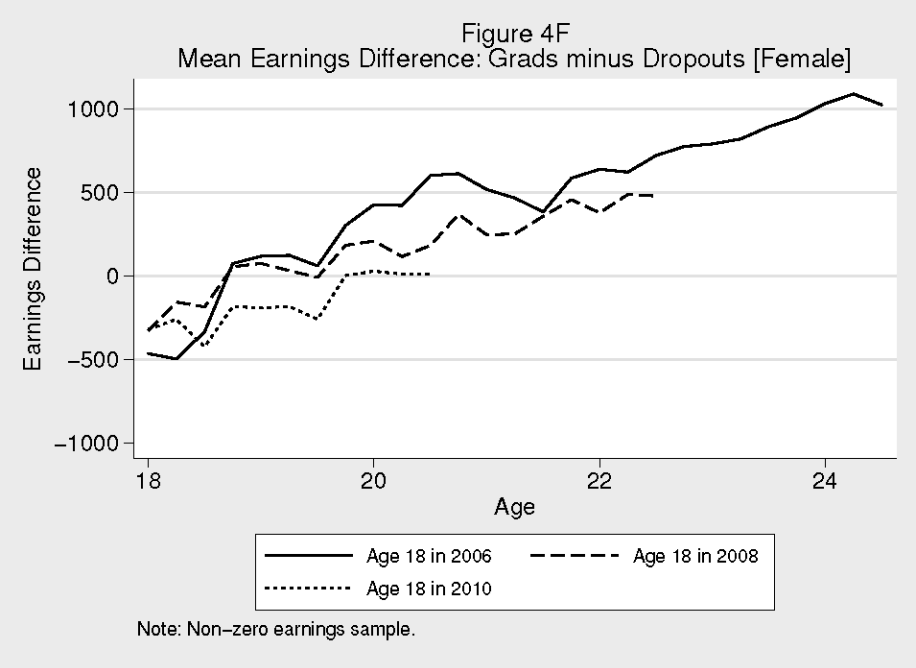
Education–Employment Gradients During the GR

For those with jobs, at least, there is little evidence of a structural break in the education–earnings gradient and indeed little evidence of downward wage adjustments for the college-educated. However, as noted above, one of the dominant features of the GR was the adverse impact on employment rates.

Figure 5 shows changes in employment rates for the cohorts born in 1977–78 and 1979–80; by 2012 these persons were aged 32–35.[8] For each education level there was a discernible downward shift in employment during the GR; the shift was greater for women but is evident for men too. From the official start to end of the GR, employment rates of female (male) associate degree holders and high school graduates fell by 3–4 (2–3) percentage points. The decrease was especially stark for high school dropouts: this group started with less than half of all persons employed, and the rates fell by 5–8 percentage points. Again, the GR appears to have had a persistent impact: employment rates fell through the GR and then failed to pick up after mid-2009.

[8] I exclude bachelor's degree-holders because many have zero earnings whilst in college.

Figure 4. Mean Earnings Difference: Graduates Minus Dropouts (Female and Male)



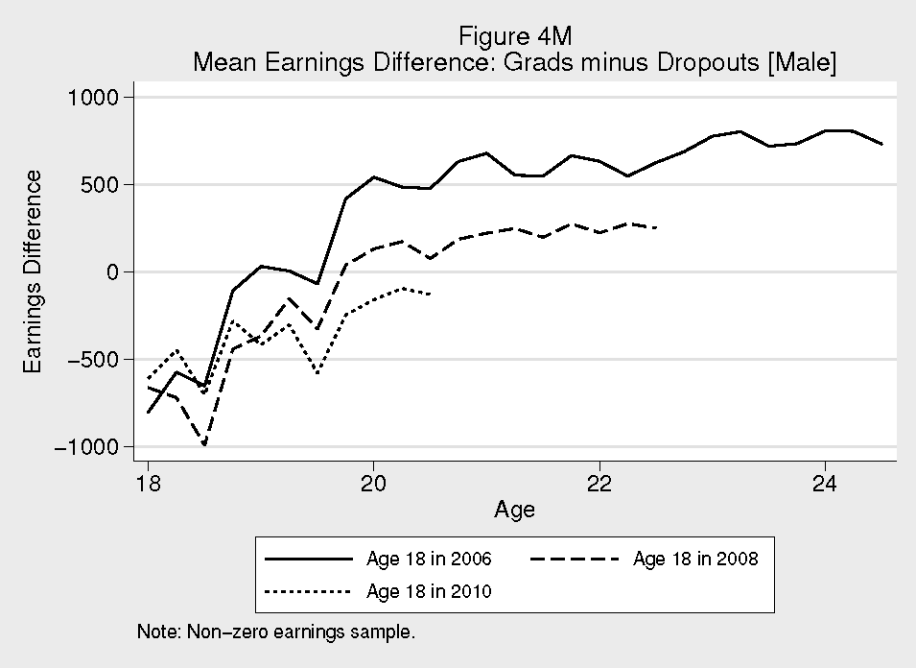
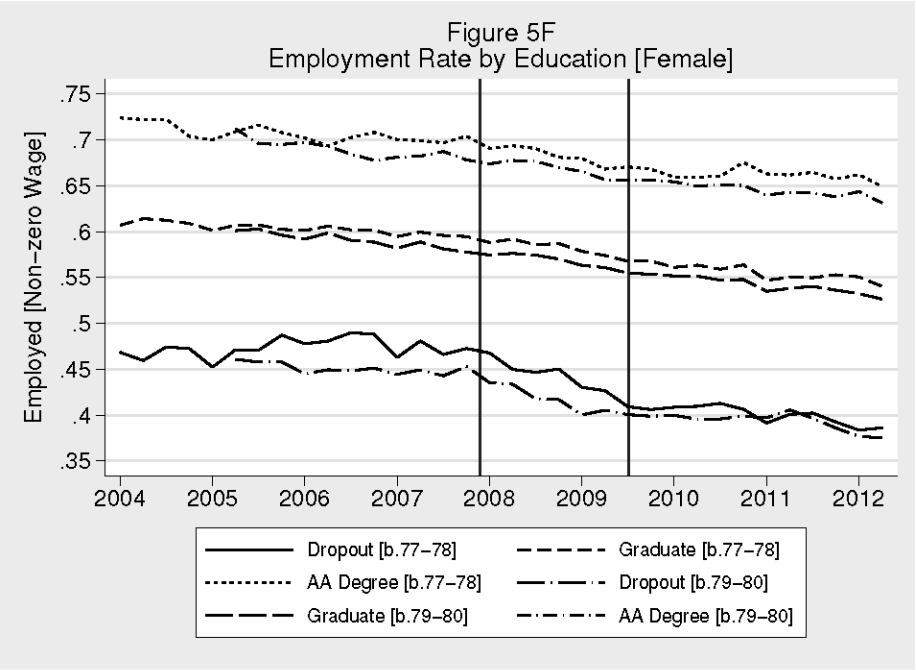
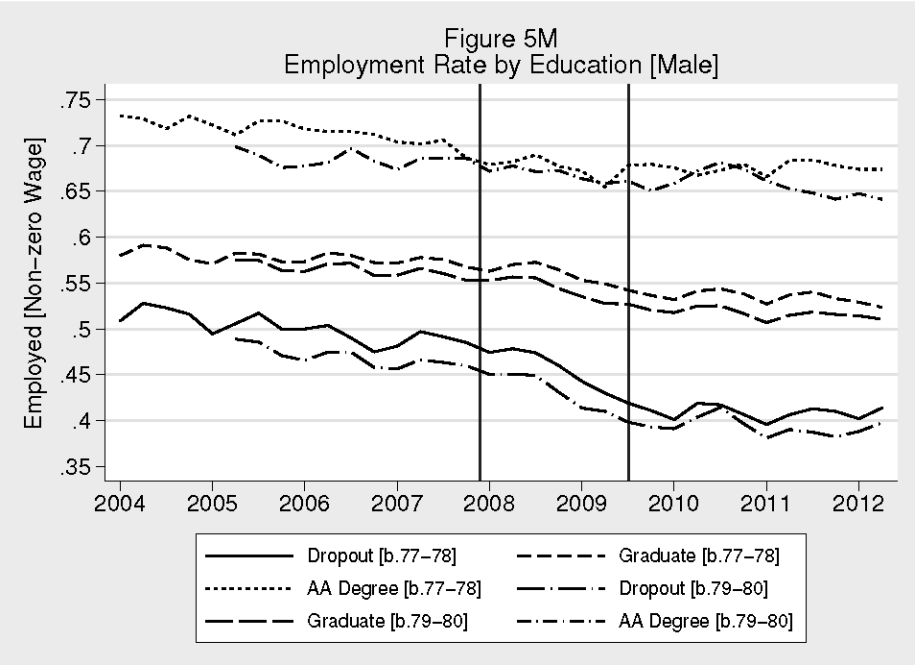


Figure 5. Employment Rate by Education (Female and Male)





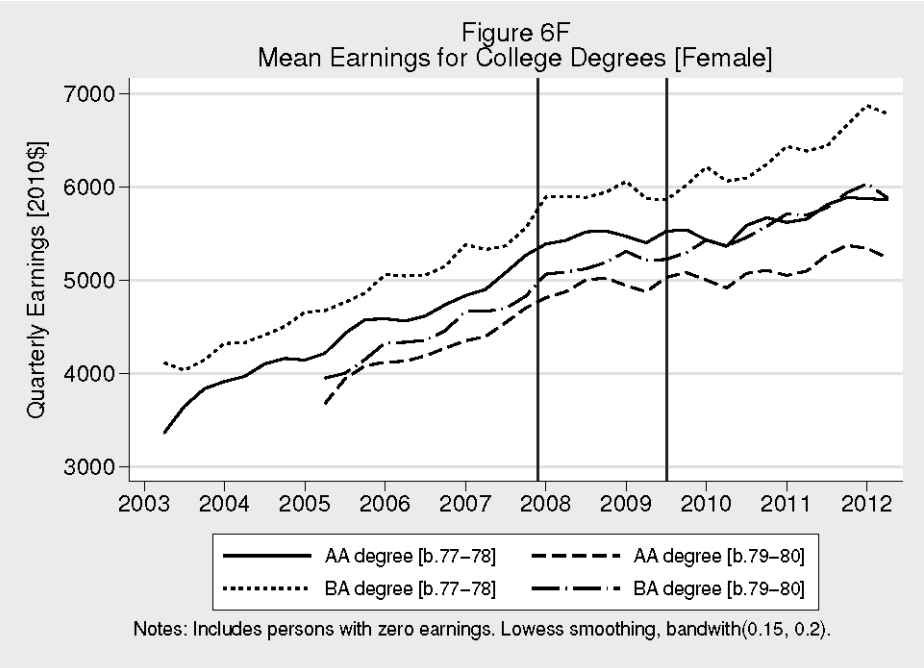
Education–Earnings Gradients Adjusted for Employment

I now combine the employment and earnings effects to see the overall effect of the GR on labor incomes. I assign zero earnings to all persons with missing earnings in a given quarter but at least four quarters of earnings over the period 2001–12 (when aged 18 or over). This assignment affects approximately one-third of the sample; so average earnings across all persons are two-thirds those of workers. I then re-estimate the specifications in Table 1 and Appendix Tables A.2–A.4. These new estimates are reported in Appendix Tables A.7 and A.8–A.10, respectively. Also, I re-derive earnings trajectories by cohort, adjusting for those persons with zero earnings.

Collectively, these new estimates preserve or modestly strengthen the returns to education identified above. Looking at the sample in 2011, I find the pattern of returns is the same with or without adjustments for employment (Table 1 versus Appendix Table A.7). For the rolling cohorts of those aged 18–32, the earnings gaps are now smaller in absolute value (Appendix Tables A.2–A.4 versus Appendix Tables A.8–A.10). But average income is much lower as well, so the gaps are now greater as a proportion of income. Looking only at workers, gains for associate degree holders over high school dropouts equaled 63 percent (77 percent) of average earnings. If all persons are included, the respective gains are much higher, at 86 percent (108 percent). A similar effect is evident when I restrict the sample to the college-educated. If the sample is just workers, then associate degree holders have earnings gains over college dropouts that are 30 percent of average earnings; if the sample includes all persons, the premium rises to 45 percent (50 percent) over average earnings.

Employment-adjusted earnings trajectories are given in Figures 6–8 for the various cohorts. These trajectories are of course all flatter than those given above in Figures 2–4. Persons aged 26–35 with associate degrees exhibit incrementally flatter earnings profiles during the GR while those with bachelor's degrees do not, and earnings growth for all degree holders picked up after the GR (Figure 6). However, earnings for those with the lowest education levels do appear to have shifted downward with the GR. This shift is shown in Figure 7. Indeed, earnings trajectories for persons with postsecondary education are flat and they do not begin to rise again even three years after the official end of the GR. Finally, adjusting for employment does not significantly alter the path of the earnings difference between dropouts and graduates. As shown in Figure 8, the paths are very similar for those high school students entering the labor market in either 2006, 2008, or 2010.

Figure 6: Mean Earnings for College Degrees (Female and Male)



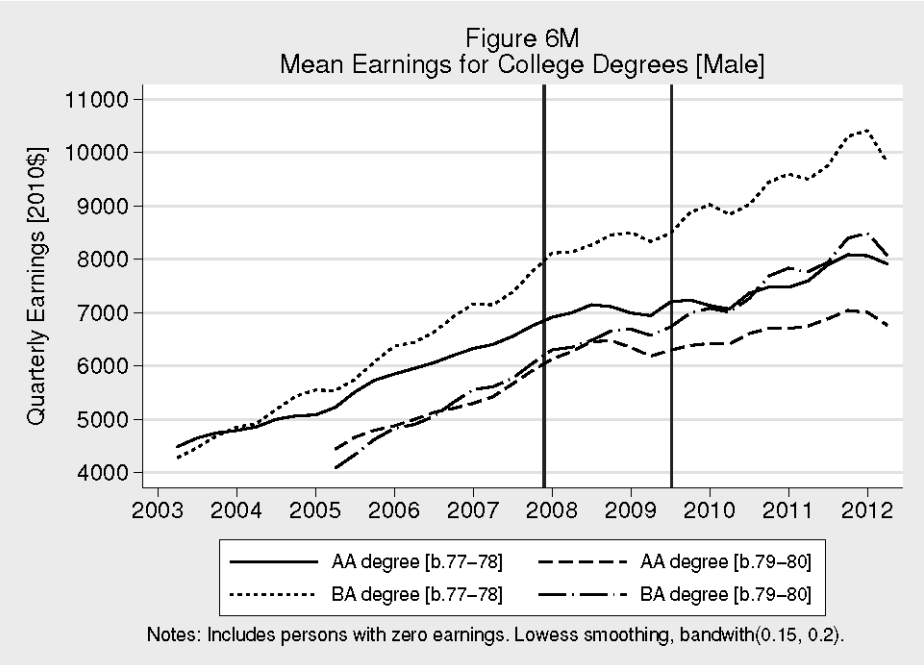
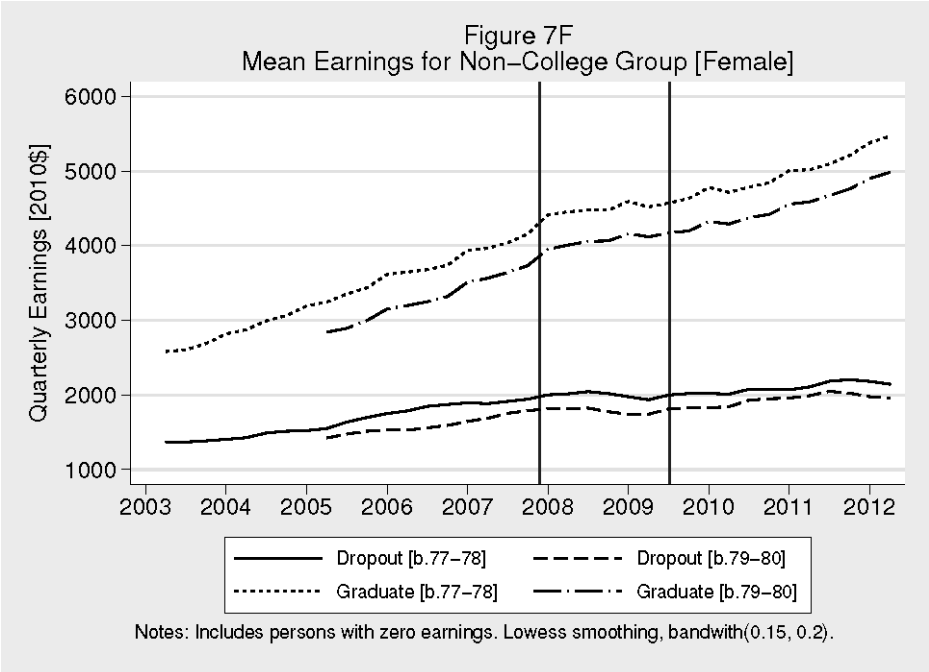


Figure 7. Mean Earnings for Non-College Group (Female and Male)



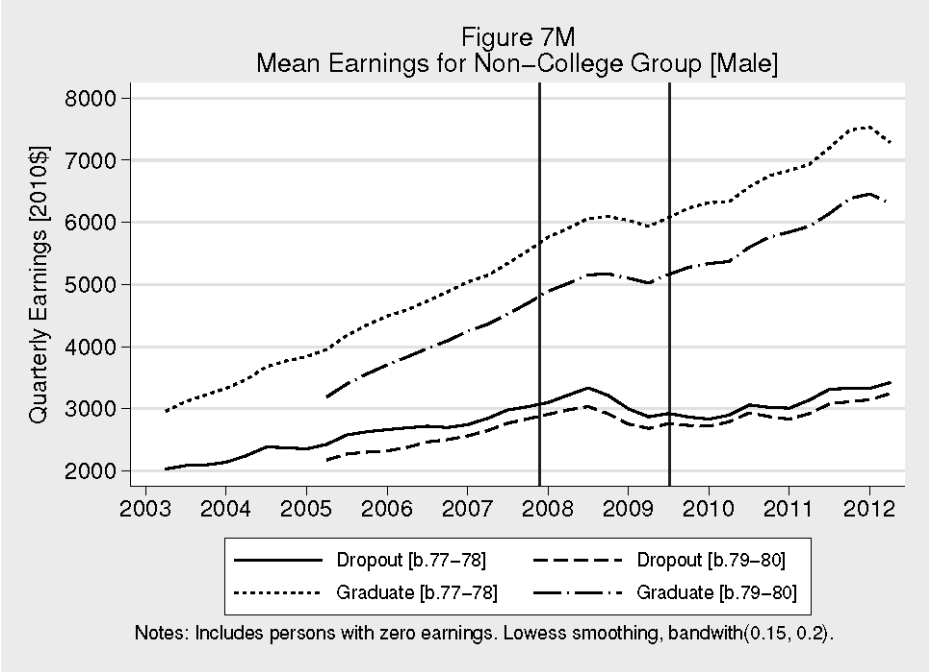
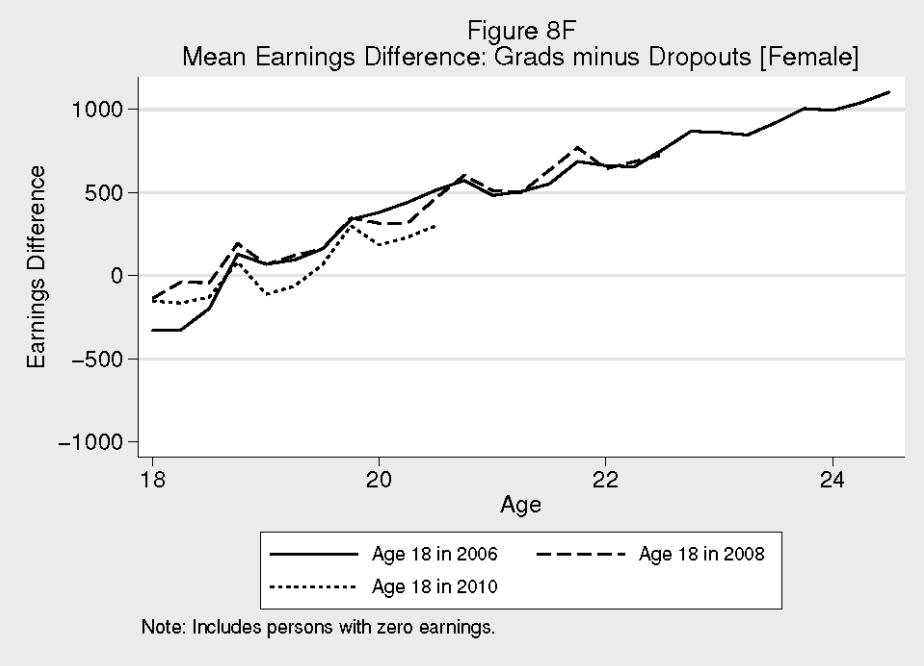
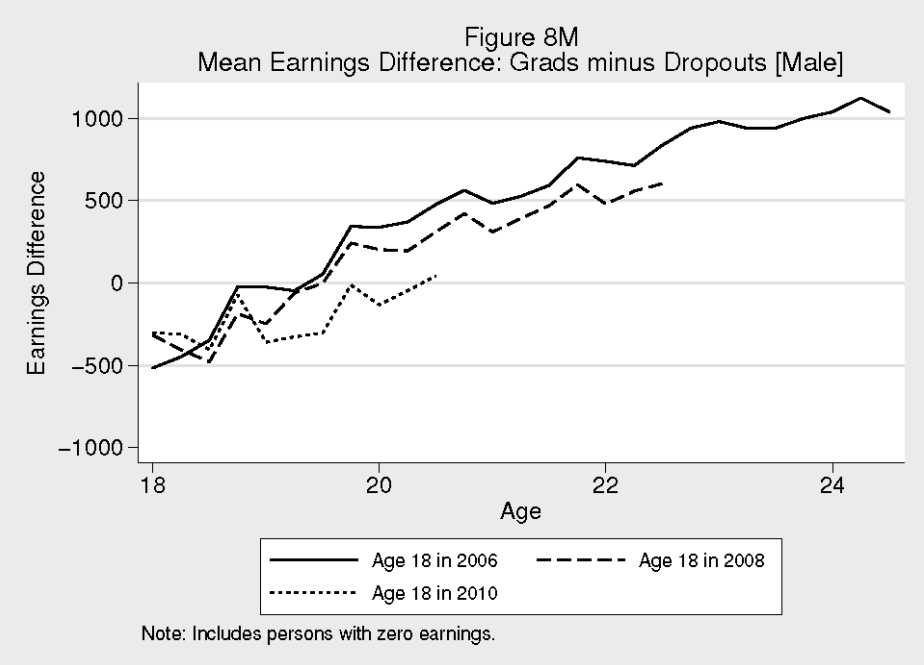


Figure 8. Mean Earnings Difference: Graduates Minus Dropouts (Female and Male)





6. Conclusion

The Great Recession was one of the strongest economic downturns of the last century. Its depth, duration, and pervasiveness had a substantial impact on the U.S. labor market. But much of this impact was on employment, not earnings. And much of the impact was felt in the same way other recessions have been felt: the greatest shocks were imposed on the least-skilled workers.

Thus, for workers in Arkansas the high returns to human capital and especially postsecondary education that were evident in the early 2000s persisted during the Great Recession and were maintained during its aftermath. Taking employment changes into account, there is evidence that these gains even modestly increased, with these increases being greatest for those with four-year degrees. Indeed, for those with bachelor's degrees and who were employed, the Great Recession had a very modest impact on earnings levels and earnings growth. These patterns are evident both in cross-sectional and longitudinal analysis.

Moreover, given the Great Recession's most notable feature—the increase in the long-term unemployed—even greater divergence in the education–earnings gradient is likely over the next few years. This evidence for Arkansas is consistent with national survey evidence of employment shocks excepting wage stability, although in this analysis the effects are even found for younger workers. Therefore, the more postsecondary education students of all ages acquired, the more successfully they weathered the Great Recession.

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Appendix A: Tables

Appendix Table A.1. Descriptive Statistics: Full Sample in 2011

	(1)	(2)
	Full Sample	**Persons With Non-zero Earnings in 2011**
Wage observation in 2011 (%)	64.5	100
Quarterly wage in 2011 (non-zero) ($)	6,905 (8,126)	6,905 (8,126)
Born before 1950 (%)	3.1	2.1
Born 1950–1959 (%)	8.0	7.8
Born 1960–1969 (%)	12.9	13.1
Born 1970–1979 (%)	23.7	23.1
Born 1980–1989 (%)	34.7	34.1
Born 1990–1996 (%)	17.6	19.8
Age in 2011	33.4 (12.5)	32.8 (12.2)
Experience (years)	14.2 (12.5)	13.5 (12.1)
Female (%)	54.0	55.3
Highest attainment		
High school dropout (%)	8.6	6.6
High school graduate (%)	40.7	42.6
Some college (%)	23.1	22.6
Certificate/diploma (%)	6.4	6.4
Associate degree (%)	5.1	5.9
Bachelor's degree (%)	10.1	9.9
Advanced degree (%)	5.6	6.1
Individuals	972,912	627,335

Note. Data are from Arkansas Research Center; standard deviations in parentheses.

Appendix Table A.2. Quarterly Earnings Gaps over High School Dropout by Year

	2006	2007	2008	2009	2010	2011
Female						
High school graduate	1,720 [38]	1,797 [45]	1,861 [48]	1,879 [52]	1,714 [60]	1,654 [68]
Some college	1,554 [39]	1,653 [45]	1,774 [48]	1,856 [52]	1,791 [60]	1,985 [69]
Diploma/ certificate	1,821 [44]	1,923 [51]	2,092 [55]	2,231 [58]	2,208 [66]	2,526 [74]
Associate degree	2,740 [44]	2,908 [50]	3,224 [54]	3,388 [59]	3,409 [67]	3,792 [76]
Bachelor's degree	4,027 [44]	4,388 [51]	4,876 [54]	5,252 [59]	5,544 [68]	6,263 [77]
Advanced degree	5,474 [57]	6,117 [65]	6,909 [71]	7,590 [80]	8,018 [88]	9,044 [101]
R-squared	0.223	0.183	0.250	0.268	0.279	0.232
Individuals	166,559	170,996	173,685	171,548	174,370	176,223
Male						
High school graduate	1,930 [42]	1,937 [50]	1,764 [59]	1,691 [67]	1,586 [75]	1,304 [91]
Some college	2,129 [41]	2,157 [49]	2,101 [59]	2,085 [66]	2,151 [75]	2,228 [91]
Diploma/ certificate	2,750 [50]	2,949 [59]	3,063 [71]	3,094 [75]	3,267 [84]	3,501 [101]
Associate degree	3,577 [57]	3,630 [64]	3,652 [76]	3,771 [93]	3,809 [93]	3,984 [108]
Bachelor's degree	5,087 [55]	5,355 [64]	5,673 [75]	6,110 [83]	6,580 [94]	7,346 [111]
Advanced degree	6,492 [87]	7,162 [100]	7,796 [114]	8,405 [126]	8,973 [138]	10,072 [167]
R-squared	0.262	0.261	0.259	0.262	0.269	0.282
Individuals	144,166	150,090	153,821	150,793	155,715	161,006

Note. Quarterly earnings are in 2010 dollars. Rolling windows of persons aged 18–32 (born between 1974–1994). Earnings functions controlling for experience and experience squared. Standard errors in brackets. All coefficients statistically significant at $p < .01$.

Appendix Table A.3. Quarterly Earnings Gaps Over Persons With Some College by Year

	2006	2007	2008	2009	2010	2011
Female						
Diploma/ certificate	279 [28]	280 [31]	332 [33]	392 [34]	443 [35]	590 [43]
Associate degree	1,158 [27]	1,220 [30]	1,415 [32]	1,501 [34]	1,590 [36]	1,790 [46]
Bachelor's degree	2,429 [27]	2,694 [31]	3,059 [32]	3,357 [34]	3,730 [37]	4,281 [47]
Advanced degree	3,870 [44]	4,415 [50]	5,084 [55]	5,689 [63]	6,211 [67]	7,096 [81]
R-squared	0.221	0.206	0.238	0.242	0.239	0.163
Individuals	115,280	115,271	113,029	107,011	101,808	93,752
Male						
Diploma/ certificate	636 [37]	807 [40]	977 [47]	1,036 [46]	1,172 [49]	1,383 [55]
Associate degree	1,447 [44]	1,482 [46]	1,576 [53]	1,728 [71]	1,730 [61]	1,877 [66]
Bachelor's degree	2,988 [39]	3,234 [44]	3,619 [50]	4,083 [55]	4,525 [62]	5,276 [70]
Advanced degree	4,390 [77]	5,042 [88]	5,745 [99]	6,394 [108]	6,963 [118]	8,107 [143]
R-squared	0.270	0.263	0.250	0.241	0.228	0.213
Individuals	89,568	90,343	88,976	84,130	81,043	75,861

Note. Quarterly earnings are in 2010 dollars. Rolling windows of persons aged 18–32 (born 1974–1994). Earnings functions controlling for experience and experience squared. Standard errors in brackets. All coefficients statistically significant at $p < .01$.

Appendix Table A.4. Quarterly Earnings Gaps Over Persons With Some College by Subject by Year

	2006	2007	2008	2009	2010	2011
Female						
Associate degree						
Humanities/	746	805	967	1,047	1,139	1,255
social science	[40]	[44]	[51]	[57]	[64]	[76]
Health	2,679	3,118	3,982	4,713	5,087	5,190
	[65]	[75]	[86]	[91]	[99]	[114]
Business	635	598	722	803	832	851
marketing	[63]	[69]	[78]	[88]	[102]	[115]
Other subject	760	768	798	722	860	1,225
	[34]	[35]	[35]	[36]	[38]	[50]
Diploma/certificate						
Health	441	472	573	797	895	839
	[41]	[45]	[50]	[51]	[56]	[65]
Mechanical	869	1,356	1,670	1,560	1,221	1,301
engineering	[253]	[287]	[374]	[373]	[337]	[384]
Trans	–671	–212ns	–703ns	–195ns	–942ns	763ns
	[279]	[324]	[366]	[534]	[680]	[885]
Other subject	160	137	163	125	181	443
	[35]	[39]	[41]	[41]	[42]	[49]
R-squared	0.227	0.213	0.247	0.255	0.251	0.170
Individuals	115,280	115,271	113,029	107,011	101,808	93,752
Male						
Associate degree						
Humanities/	1,199	1,356	1,435	1,497	1,382	1,599
social science						
	[80]	[95]	[118]	[116]	[131]	[146]
Health	2,331	2,751	3,741	4,750	5,053	5,436
	[192]	[231]	[257]	[271]	[280]	[317]
Business	1,309	1,476	1,280	1,653	1,799	2,075
marketing	[192]	[193]	[217]	[238]	[304]	[364]
Other subject	1,488	1,419	1,480	1,595	1,640	1,745
	[53]	[52]	[58]	[93]	[70]	[73]
Diploma/certificate						
Health	1,239	1,325	1,385	1,603	1,575	1,554
	[109]	[122]	[142]	[138]	[151]	[175]
Mechanical	1,333	1,680	1,905	1,903	2,181	2,389
engineering	[64]	[71]	[82]	[81]	[90]	[106]
Transportation	–893	–706	–479	–262ns	145ns	675ns
	[92]	[114]	[173]	[177]	[216]	[303]
Other subject	501	557	676	677	758	988
	[49]	[53]	[61]	[57]	[59]	[66]
R-squared	0.273	0.265	0.252	0.244	0.230	0.215
Individuals	89,568	90,343	88,976	84,130	81,043	75,861

Note. Quarterly earnings are in 2010 dollars. Rolling windows of persons aged 18–32 (born between 1974–1994). Earnings functions controlling for experience and experience squared. Models include bachelor's and advanced degrees as per Appendix Table A.2. Standard errors in brackets. All coefficients statistically significant at $p < .01$, except *ns* (not statistically significant at $p < .05$).

Appendix Table A.5. Descriptive Statistics: Fixed Effects Sub-Samples (Individual Level)

	Female		Male	
	Early AY81–83	**Late AY85–87**	**Early AY81–83**	**Late AY85–87**
Quarterly earnings ($)	3,608 [2,720]	2,964 [1,963]	4,332 [3,332]	3,540 [2,458]
Experience (qtrs)	13.9 [7.0]	12.0 [5.4]	12.9 [7.3]	11.4 [5.5]
Time in college (%)	27.9	31.8	26.5	29.7
Diploma/cert. (%)	5.3	6.1	6.4	7.3
Associate degree (%)	9.0	9.0	4.9	5.2
Bachelor's deg. (%)	20.7	21.1	19.7	19.6
Advanced deg. (%)	8.8	6.6	5.3	3.7
Individuals	24,755	21,440	19,982	17,861

Note. Sample only of persons with some college. All quarterly wages in constant 2010 dollars (CPI). Standard deviations in brackets. Data from 2001–2007 for early cohort and 2005–12 for late cohort.

Appendix Table A.6. Quarterly Earnings Gains by College Award Status: Fixed Effects Sub-Samples Alternative Windows

	Split (1)		Split (2)		Split (3)	
	Early AY81–83	Late AY85–87	Early AY74–81	Late AY82–89	Early AY74–77	Late AY82–85
Female						
In college	–275	–274	–435	–251	–346	–601
	[25]	[18]	[16]	[10]	[31]	[33]
Experience (qtrs)	162	168	150	165	100	221
	[3]	[3]	[2]	[1]	[4]	[8]
Diploma/ certificate	118[ns]	486	4[ns]	476	227[ns]	314
	[73]	[69]	[43]	[36]	[138]	[110]
Associate degree	964	1,111	799	1,005	646	324
	[77]	[76]	[47]	[39]	[125]	[109]
Bachelor's degree	2,866	2,907	2,273	2,873	1,082	850
	[56]	[54]	[38]	[30]	[99]	[91]
Advanced degree	5,231	5,392	3,856	5,095	1,589	1,736
	[155]	[189]	[75]	[101]	[174]	[138]
R-squared	0.414	0.440	0.330	0.430	0.074	0.068
Individuals	25,623	23,662	67,595	92,070	34,050	36,995
Observations	670,065	505,689	1,830,706	1,949,138	341,388	348,947
Male						
In college	–568	–440	–639	–448	–292	–521
	[30]	[23]	[22]	[13]	[38]	[43]
Experience (qtrs)	220	229	211	229	127	314
	[3]	[4]	[2]	[2]	[5]	[10]
Diploma/ certificate	–120[ns]	936	–757	695	–0[ns]	202[ns]
	[88]	[91]	[54]	[47]	[123]	[145]
Associate degree	258	798	–141[ns]	619	294[ns]	133[ns]
	[112]	[124]	[80]	[61]	[211]	[162]
Bachelor's degree	3,118	2,900	2,462	2,918	1,067	1,080
	[87]	[82]	[54]	[46]	[98]	[115]
Advanced degree	5,825	4,731	4,649	5,370	2,283	2,767
	[241]	[292]	[121]	[174]	[269]	[249]
R-squared	0.424	0.425	0.348	0.428	0.085	0.093
Individuals	20,839	19,801	53,298	76,144	29,685	31,596
Observations	515,841	400,545	1,379,770	1,530,608	291,424	290,437

Note. Sample only of persons with some college. For splits (1) and (2) earnings data from 2001Q1 to 2012Q3; for split (3), earnings data for early cohort from 2001Q1–2004Q1 and for late cohort from 2009Q3–2012Q3. Fixed effects specification. Award status identified for each quarter award is held. All quarterly wages in constant 2010 dollars (CPI). Model also includes experience squared. Constant term included. Robust standard errors in brackets. All coefficients statistically significant at $p < .01$, except *ns* (not statistically significant at $p < .05$).

Appendix Table A.7. Quarterly Earnings Gains by Award Status in 2011 (Incl. Zero Earners)

	Female			Male		
	All	College group	College w. subjects	All	College group	College w. subjects
Experience	321	339	324	460	583	581
(years)	[2]	[9]	[9]	[3]	[12]	[12]
Experience sqrd.	–5	–10	–10	–8	–17	–17
	[0]	[1]	[1]	[0]	[1]	[1]
High school	2,646	–	–	2,973	–	–
graduate	[27]	–	–	[46]	–	–
Some college	2,007	–	–	2,979	–	–
	[27]	–	–	[44]	–	–
Diploma/	2,406	775	–	2,760	831	–
certificate	[34]	[34]	–	[53]	[47]	–
Associate degree	3,792	1,983	–	4,762	2,205	–
	[36]	[37]	–	[67]	[62]	–
Bachelor's degree	5,003	2,609	2,585	7,118	3,680	3,695
	[38]	[36]	[36]	[73]	[59]	[59]
Higher degree	7,672	5,387	5,355	10,436	6,164	6,185
	[58]	[71]	[71]	[136]	[137]	[137]
Certificate						
Health	–	–	1,339	–	–	2,381
	–	–	[55]	–	–	[163]
Mechanical	–	–	1,223	–	–	2,309
Engineering	–	–	[333]	–	–	[95]
Transfer	–	–	–852[ns]	–	–	–2,565
	–	–	[412]	–	–	[106]
Other subjects	–	–	466	–	–	840
	–	–	[39]	–	–	[57]
Associate degree	–	–		–	–	–
Health	–	–	4,935	–	–	5,012
	–	–	[100]	–	–	[316]
Human social	–	–	1,236	–	–	1,639
science	–	–	[61]	–	–	[126]
Business	–	–	1,402	–	–	2,665
marketing	–	–	[92]	–	–	[305]
Other subjects	–	–	1,344	–	–	2,175
	–	–	[43]	–	–	[71]
R-squared	0.136	0.084	0.090	0.115	0.084	0.089
Observations	525,028	185,094	185,094	447,884	150,143	150,143

Note. All persons, average quarterly earnings in 2011. OLS specification. Award status is highest award by 2011. All quarterly wages in 2010 dollars. Robust standard errors given in brackets. All coefficients statistically significant at $p < .01$, except *ns* (not statistically significant at $p < .05$).

Appendix Table A.8. Quarterly Earnings Gaps Over High School Dropout by Year (Including Zero Earners)

	2006	2007	2008	2009	2010	2011
Female						
High school graduate	1,519	1,623	1,722	1,737	1,652	1,628
	[29]	[33]	[35]	[37]	[42]	[47]
Some college	1,404	1,472	1,568	1,613	1,587	1,672
	[29]	[33]	[35]	[37]	[41]	[47]
Diploma/certificate	1,749	1,888	2,081	2,195	2,253	2,489
	[35]	[40]	[43]	[44]	[49]	[55]
Associate degree	2,588	2,726	2,990	3,165	3,206	3,504
	[36]	[40]	[43]	[46]	[51]	[57]
Bachelor's degree	3,033	3,202	3,443	3,622	3,745	4,052
	[35]	[39]	[42]	[44]	[49]	[56]
Advanced degree	4,239	4,654	5,282	5,799	6,171	6,821
	[47]	[53]	[59]	[65]	[72]	[83]
R-squared	0.119	0.098	0.121	0.126	0.125	0.101
Individuals	235,603	244,390	252,633	258,973	262,271	261,827
Male						
High school graduate	1,591	1,590	1,488	1,432	1,331	1,240
	[34]	[40]	[46]	[48]	[53]	[63]
Some college	1,774	1,768	1,725	1,709	1,712	1,797
	[34]	[39]	[46]	[47]	[53]	[63]
Diploma/certificate	2,259	2,413	2,510	2,489	2,641	2,939
	[43]	[49]	[58]	[58]	[64]	[75]
Associate degree	3,280	3,328	3,344	3,461	3,523	3,760
	[52]	[57]	[66]	[76]	[75]	[86]
Bachelor's degree	3,739	3,770	3,858	4,082	4,225	4,530
	[46]	[52]	[59]	[62]	[69]	[80]
Advanced degree	4,480	4,750	5,154	5,545	5,745	6,359
	[69]	[79]	[90]	[98]	[108]	[129]
R-squared	0.132	0.124	0.116	0.114	0.107	0.101
Individuals	213,278	223,772	233,522	241,377	245,808	246,983

Note. Quarterly earnings are in 2010 dollars. Rolling windows of persons aged 18–32 (born between 1974–1994). Earnings functions controlling for experience and experience squared. Standard errors in brackets. All coefficients $p > .01$.

Appendix Table A.9: Quarterly Earnings Gaps Over Persons With Some College by Year (Including Zero Earners)

	2006	2007	2008	2009	2010	2011
Female						
Diploma/certificate	353	424	524	591	671	816
	[25]	[28]	[30]	[30]	[31]	[37]
Associate degree	1,167	1,234	1,394	1,515	1,568	1,772
	[25]	[27]	[29]	[31]	[33]	[40]
Bachelor's degree	1,598	1,687	1,809	1,919	2,052	2,263
	[23]	[26]	[27]	[29]	[32]	[38]
Advanced degree	2,805	3,138	3,640	4,084	4,462	5,020
	[39]	[44]	[49]	[56]	[61]	[73]
R-squared	0.115	0.101	0.106	0.103	0.096	0.070
Individuals	160,931	163,346	163,287	159,693	152,917	143,887
Male						
Diploma/certificate	490	654	799	807	964	1,188
	[34]	[37]	[43]	[41]	[44]	[50]
Associate degree	1,513	1,570	1,633	1,764	1,825	1,986
	[43]	[45]	[51]	[62]	[58]	[63]
Bachelor's degree	1,996	2,020	2,140	2,360	2,500	2,738
	[34]	[37]	[41]	[44]	[49]	[56]
Advanced degree	2,744	3,006	3,443	3,831	4,037	4,600
	[62]	[70]	[80]	[87]	[96]	[117]
R-squared	0.132	0.117	0.100	0.090	0.074	0.061
Individuals	130,214	132,629	132,963	130,832	125,984	118,999

Note. Quarterly earnings are in 2010 dollars. Rolling windows of persons aged 18–32 (born between 1974–1994). Earnings functions controlling for experience and experience squared. Standard errors in brackets. All coefficients $p > .01$.

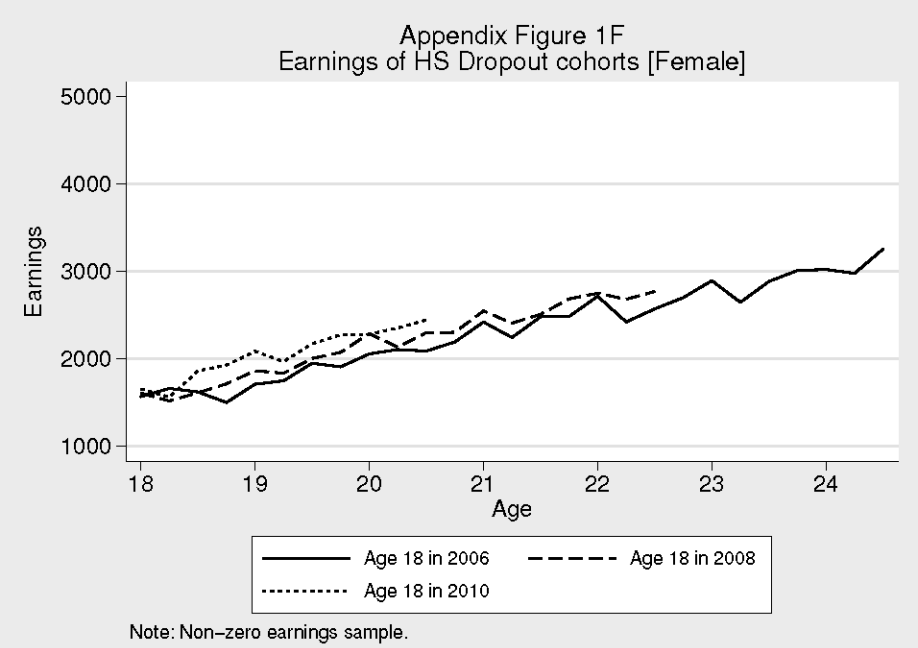
Appendix Table A.10. Quarterly Earnings Gaps Over Persons With Some College by Subject and by Year (Including Zero Earners)

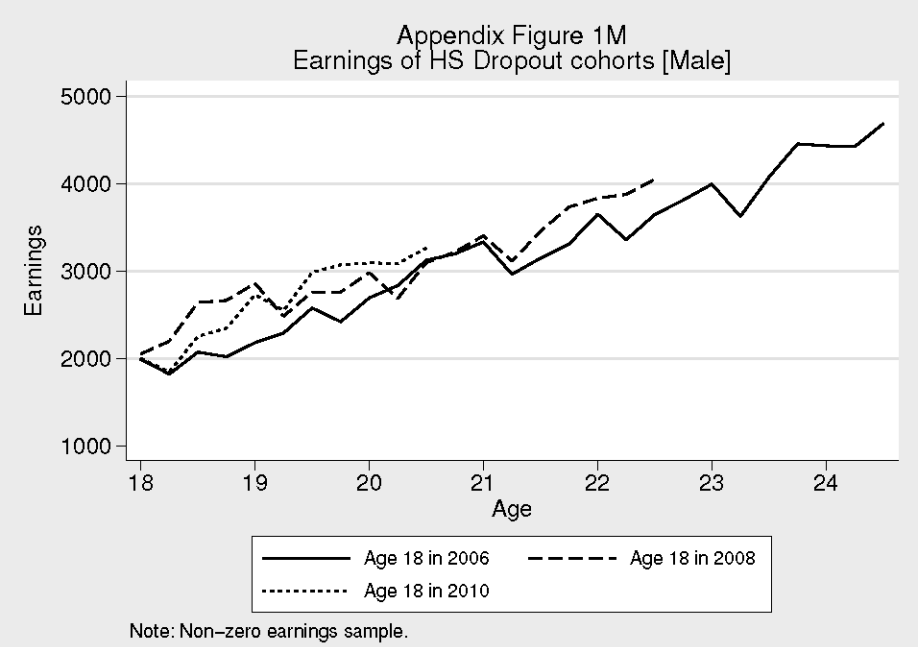
	2006	2007	2008	2009	2010	2011
Female						
Associate degree						
Humanities/ soc.	742	795	918	1,031	1,075	1,166
science	[37]	[41]	[47]	[52]	[58]	[66]
Health	2,586	2,957	3,745	4,550	4,672	4,757
	[67]	[77]	[92]	[101]	[112]	[127]
Business	857	877	1,060	1,293	1,411	1,386
marketing	[63]	[69]	[80]	[90]	[103]	[116]
Other subject	816	845	844	792	909	1,301
	[31]	[32]	[32]	[32]	[34]	[44]
Diploma/certificate						
Health	698	824	1,048	1,342	1,439	1,383
	[39]	[43]	[48]	[50]	[55]	[63]
Mechanical	962	1,319	1,435	1,231	1,133	1,077
engineering	[241]	[284]	[347]	[338]	[326]	[364]
Transportation	–874	–245ns	–251ns	–648ns	–1,099	–623ns
	[233]	[309]	[343]	[402]	[425]	[572]
Other subject	132	172	216	190	290	545
	[31]	[33]	[35]	[34]	[36]	[41]
R-squared	0.120	0.106	0.114	0.114	0.106	0.075
Individuals	160,931	163,346	163,287	159,693	152,917	143,887
Male						
Associate degree						
Humanities/soc.	1,089	1,164	1,225	1,386	1,507	1,527
science	[76]	[88]	[106]	[106]	[118]	[131]
Health	2,599	2,974	3,951	5,001	5,167	5,535
	[202]	[241]	[281]	[311]	[339]	[387]
Business marketing	1,610	2,022	1,893	2,324	2,563	2,945
	[189]	[200]	[225]	[245]	[300]	[357]
Other subject	1,623	1,609	1,623	1,664	1,706	1,911
	[52]	[52]	[56]	[79]	[65]	[71]
Diploma/certificate						
Health	1,843	1,978	2,125	2,425	2,574	2,640
	[111]	[126]	[145]	[145]	[160]	[183]
Mechanical	1,515	1,790	1,953	1,915	2,154	2,381
engineering	[63]	[71]	[81]	[80]	[89]	[103]
Transportation	–1,531	–1,564	–1,642	–1,816	–1,823	–1,850
	[70]	[83]	[109]	[103]	[119]	[152]
Other subject	436	550	672	646	755	983
	[44]	[47]	[54]	[50]	[52]	[59]
R-squared	0.139	0.122	0.105	0.095	0.079	0.066
Individuals	130,214	132,629	132,963	130,832	125,984	118,999

Note. Quarterly earnings are in 2010 dollars. Rolling windows of persons aged 18–32 (born between 1974–1994). Earnings functions controlling for experience and experience squared. Models include bachelor's and advanced degrees as per Table A.2. Standard errors in brackets. All coefficients $p > .01$, except *ns* (not statistically significant at $p < .05$).

Appendix B: Figures

Appendix Figure B.1. Earnings of High School Dropout Cohorts (Female and Male)





Appendix Figure B.2. Earnings of High School Graduate Cohorts (Female and Male)