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ABSTRACT

Education and Earnings in Arkansas

This paper presents the first analysis for Arkansas using 2024 CPS data to examine education's impact on earnings and returns to investment. Average returns are 7.7%, higher for women (9%). University education yields even more: 8.8% overall, 8.1% for men, and 10.8% for women. With full discounting, private returns are 11.5% and social returns 6.6%, suggesting social benefits may be undervalued. The key takeaway is that investing in better and broader access to education offers strong individual and societal returns, making it one of the most effective ways to boost economic outcomes.

JEL Classification: I26, J24, J31

Keywords: returns to education, human capital, wage differentials, earnings function, Arkansas

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1. Introduction

Expenditures on education—whether by the state or by households—have long been viewed as investment flows that contribute to the accumulation of human capital (Becker 1964; Schultz 1961; Deming 2022). Once education is framed as an investment, a natural and pressing question arises: how profitable is this investment compared to other alternatives? Answering this question helps inform the allocation of public resources across different levels of education and sheds light on individual choices regarding the pursuit—or avoidance—of certain educational paths. Since the emergence of human capital theory, economists have produced thousands of estimates assessing the returns to education across various regions, levels of schooling, and types of training (for a comprehensive review, see Psacharopoulos and Patrinos 2018).

There have been few estimates of the economic returns to education in Arkansas, and none directly comparable to the broader literature. However, Belfield (2015) estimates large, stable returns to postsecondary education relative to high school completion. Using linked education and Unemployment Insurance earnings data for nearly 1 million young workers in Arkansas, Belfield (2015) finds that the earnings gaps between workers with different educational levels were largely unaffected by the Great Recession (2007–2009). Specifically, he observes significant and consistent returns to postsecondary education, despite the economic downturn. Additionally, another study by Hoogerheide and van Dijk (2006) estimates the average rate of return to schooling in Arkansas at 9.7 percent.

Several studies have estimated the returns to higher education across different U.S. states. Altonji and Znu (2025) find that graduate degrees in Texas yield average returns of 15.9 percent, with higher earnings effects for women. Damon and Glewwe (2011) assess public subsidies to higher education in Minnesota and conclude that they increase university attendance among marginal students, with benefits outweighing public costs. In Ohio, Minaya et al. (2024) estimate returns to master's degrees at 14 percent. Liu et al. (2025) report that associate degrees in North Carolina yield returns of 16 percent for women and 5 percent for men. Turner (2016) examines community college outcomes for Colorado welfare recipients and finds that women who attend college after entering welfare experience substantial earnings gains. Goetz and Rupasingha (2003) use state-level earnings functions (rather than Mincerian or full-discounting methods) and place Arkansas below the national average in returns to higher education. Carnoy (1972) estimates returns to schooling in Puerto Rico, while in Canada, Stager (1996) analyzes university returns in Ontario, and Ammermüller and Weber (2005) estimate returns to education by region (Länder) in Germany.

This paper examines the relationship between education and earnings in Arkansas, with a focus on how this relationship varies across employment sectors and between sexes. Using Mincerian earnings functions (Mincer 1974) applied to a sample of 900 workers, the analysis reveals that each additional year of schooling yields an average return of 7.7 percent—identical for males (7.7 percent) but higher for females at 8.9 percent. For university education, returns increase significantly, with an overall rate of 8.8 percent: 8.1 percent for males and 10.8 percent for females, indicating that women benefit more from university education. When fully discounting for university education, private returns are estimated at 11.5 percent, while social returns are 6.6 percent, suggesting that the broader societal benefits of higher education may be underestimated. The key implication of these findings is that enhancing and expanding educational opportunities would represent the most efficient and profitable investment in human capital.

1.1 The Education System

Arkansas' demographic profile includes key characteristics that influence its educational development. From 2010 to 2020, the state's population grew by over 7 percent to 3.1 million, with 62 percent White, 12 percent African American, 19 percent Hispanic, 6 percent Asian, and 1 percent Native American. The under-18 population decreased by 1 percent, while the adult population grew by 10 percent (U.S. Census Bureau, 2021). The K-12 school-age population slightly declined from 514,000 to 513,000 between 2010 and 2020 (NCES, 2023). Additionally, the percentage of public high school graduates enrolling in Arkansas higher education decreased from 51 percent in 2017 to 42 percent in 2021, likely due to the impact of the COVID-19 pandemic (Arkansas Division of Higher Education, 2023). There has also been a slight decline in the school-age population from 2020 to 2023 (U.S. Census Bureau, 2025).

Arkansas ranks near the bottom of states in terms of the percentage of the population with a high school or college degree. However, the job market remains strong, with high employment and low unemployment. The labor force participation rate has been rising in the past two years (Arkansas Division of Workforce Services, 2024). Education quality has remained stable but is among the lowest in the nation, with only 28 percent of fourth graders performing at or above the National Assessment of Educational Progress (NAEP) proficient level, compared to the national average of 35 percent (NCES, 2022).

Since 2011, Arkansas has spent 10 to 25 percent less on education than the national average, though its funding formula is well-structured, similar to states like Texas and Tennessee (McGee, 2024). Adjusted for cost of living, per-pupil spending is closer to the national average, particularly between 2011 and 2015. Arkansas's spending ranks in the middle compared to neighboring states—higher than Mississippi and Texas, but lower than Louisiana and Missouri. Recently, spending has risen, particularly with increased state funding for teacher salary raises, narrowing the gap with the national average. The LEARNS Act has also contributed to this trend, increasing teacher salaries and adding nearly $183 million in state funding.

2. Methods and Data

The costs and benefits of investing in education can be evaluated much like other investments. Costs include expenses such as building schools and running them, while benefits are measured in the labor earnings graduates accumulate over their lifetimes. To prioritize these investments, we calculate the net present value of lifetime earnings and the internal rate of return (IRR). The IRR can be viewed from either a private or social standpoint: the private rate of return helps gauge education demand and assesses its impact on equity, while the social rate of return accounts for the full cost of education, representing the state's return on public investment.

2.1 Private Rate of Return

The private rate of return is calculated by considering an individual's foregone earnings while studying, as well as any fees or expenses. The main cost is typically the earnings lost for being in school. Private benefits are the additional earnings received by more educated individuals compared to those with less education, usually at adjacent levels (eg, university versus secondary school graduates). The private internal rate of return is estimated by finding the discount rate (*r*) that equalizes the discounted benefits and costs at a given time, as shown in equation (1) for university education:

$$\sum_{t=1}^{42} \frac{(W_u - W_s)_t}{(1+r)^t} = \sum_{t=1}^{42} (W_s + C_u)_t (1+r)^t \tag{1}$$

where (W_u - W_s) is the earnings differential between a university graduate (subscript u) and a secondary school graduate (subscript s, the control group); C_u represents the direct costs of university education (tuition, fees, books); t is the time period; and W_s denotes the student's foregone earnings while being in school.

2.2 Social Rate of Return

The social rate of return differs from the private rate by including society's costs, such as public spending on education (building rentals, faculty salaries). It assumes wages reflect the marginal product of labor and include both direct costs and foregone earnings. Ideally, social benefits would account for non-monetary effects like lower fertility or improved health, though estimates typically focus on observable monetary costs and benefits due to limited data. Social returns are usually lower than private returns, as public costs are included in the calculations, lowering the return to investment. Discounting age-earnings profiles is the most accurate method for estimating returns but requires comprehensive data.

2.3 The Earnings Function Method

This method is also known as the Mincerian method (Mincer 1974) and involves the fitting of a function of log-wages (lnW), with years of schooling (S), years of labor market experience (EX) and its square as independent variables:

$$lnW_{it} = \alpha + \beta S_{it} + \gamma_1 EX_{it} + \gamma_2 EX^2_{it} \qquad (2)$$

In this semi-log specification, the coefficient on years of schooling, β, can be interpreted as the average private rate of return to one additional year of schooling, regardless of the educational level this year of schooling refers to (see equation 2):

$$\beta = \frac{\partial lnW}{\partial S} = \frac{Relative\ earnings\ differential}{Education\ differential} = \left[\frac{W_u - W_s}{W_s}\right]\frac{1}{\Delta S} = \frac{W_u - W_s}{\Delta S \cdot W_s} = r \qquad (3)$$

where W_u and W_s are the earnings of those with u and s years of schooling, and ΔS the difference in years of educational attainment between the two groups.

The earnings function method can be used to estimate returns to education at different levels by converting the continuous years of schooling variable (S) into a series of dummy variables, say D_s and D_u, to denote the fact that a person has completed the corresponding level of education, and that, of course, there are also people in the sample with less than secondary education in order to avoid matrix singularity. Then, after fitting an extended earnings function using the above dummy variables instead of years of schooling in the earnings function, the private rate of return to levels of education can be derived from the following formulas (4 and 5):

$$r_s = \frac{\beta_s}{S_s} \quad (4)$$

$$r_u = \frac{\beta_u - \beta_s}{S_u - S_s} \quad (5)$$

where S_s and S_u stand for the total number of years of schooling for each successive level of education (secondary education completed and university education completed).

2.4 Data

The information used in this analysis comes from the March Current Population Survey (CPS) 2024 for Arkansas. For the purposes of this analysis, all workers between the ages of 18 and 65, with positive labor market earnings, were selected. Descriptive statistics are provided in Table 1. More than half the sample was male (53%), and the average age was 42 years. Labor market experience was constructed as a function of age and schooling (age 6 being the entrance age to primary education). The average level of experience is 21.6 years, and the average number of hours worked per week is 42. The mean annual earnings were $64,364 for each worker.

Years of schooling were constructed as a continuous variable by combining the individual's highest level of formal education attended and the last grade completed at that particular level. The sample appears to be relatively well educated, with an average level of schooling of 14 years. Education was also measured as a string of dummy variables, indicating the fact that a person belongs to a particular educational level. About 6 percent of the sample has less than secondary education, 45 percent have at least secondary schooling, and 49 percent have tertiary education. Women are more educated than men. For example, 55 percent have a tertiary degree, compared to 43 percent for men. They also have 0.25 of a year more schooling.

Table 1: Summary Statistics by Sex

Variable	Overall	Males	Females
Sex (%)		53.0	47.0
Age (years)	41.6	41.5	41.8
Years of schooling	14.0	13.7	14.4
Education Level (%):			
Less than secondary	6.2	7.8	4.5
Secondary	44.7	48.8	40.0
Tertiary	49.1	43.4	55.6
Experience (years)	21.6	21.8	21.4
Experience-squared	620.7	629.9	610.3
Log wage	3.2	3.2	3.1
Annual earnings	$64,364	$72,793	$54,859
Hours per week	42.4	43.6	41.1
Sample size	900	477	423

Source: CPS 2024

Earnings estimates by educational level, overall and by sex, are presented in Table 2. This initial description of the earnings distribution shows that the most significant earnings differentials are due to education. Workers who have completed university studies earn two times more than workers with less than secondary education, and at least 1.5 times more than workers with secondary education. Sharp differentials are also observed between males and females. On average, females earn about 75 percent of male earnings.

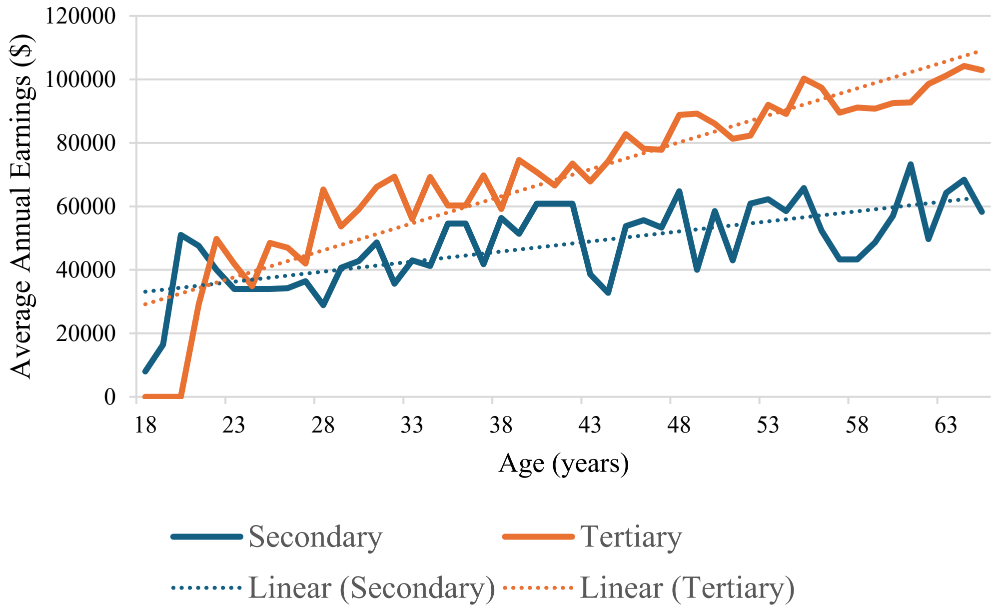
Table 2: Mean Earnings by Educational Level and Sex ($year)

	Overall	Male	Female
Less than secondary	$38,660	$41,064	$33,979
Secondary	$51,794	$59,801	$40,754
Tertiary	$79,054	$93,089	$66,691
Overall	$64,364	$72,793	$54,859

Source: CPS 2024

Figure 1 shows the life-cycle earnings potential of Arkansas workers by the level of schooling completed. For those with high school or less their earnings appear to remain relatively flat throughout the course of their working years. With tertiary education, earnings start out similarly, then steadily increase with each additional year in the workforce. Peak earning years also appear to come earlier.

Figure 1: Average Earnings by Age and Level of Education Completed (smoothed averages)



3. Results

Earnings functions are estimated in an attempt to explain the earnings variance in the sample (see Table 3). The overall private rate of return of 7.7 percent is similar to what has been found in most countries, though lower than the average for the United States (Card 2018; Psacharopoulos and Patrinos 2018). Although women earn less than do men, the returns to investments in education for females are 1.2 percentage points higher than for males. This result is typical in most countries (Dougherty 2005).

Table 3. Rates of Return to Schooling, Mincerian Estimates (%), 2024

	All	Men	Women
All wage workers	7.7	7.7	8.9
Heckman Two-Step			10.3
Education level			
Secondary	2.0	2.5	1.7
Higher	8.8	8.1	10.8

Source: CPS 2024. See full results in Annex Tables 1-3.
Notes: All coefficients are statistically significant at the 1% level or better; standard errors in parentheses

Earnings function using dummy variables for different levels of education are also estimated. Using equations (4) and (5), the coefficients are converted to rates of return. The implied returns to secondary education are very low at just 2 percent. The returns to university are high, at 8.8 percent. The returns to university are higher for females, at 10.8 percent compared to 8.1 percent for males. This could account for the higher levels of schooling for women.

We also improve on the estimate of returns to women's education by accounting for selection (Heckman 1979), another critique of typical rate of return estimates. We use the number of children younger than age 12 in the household and being married (or in a civil union) as exclusion restrictions. This estimation procedure addresses the issue of sample selection bias into the labor force which is more important for women than for men. We use the Heckman Two-Step procedure. In the first step we estimate the labor force participation equation for women and compute the Inverse Mills Ratio (IMR) or λ (lambda) term. The Inverse Mills Ratio is used to adjust for sample selection bias in econometric models. It helps account for the non-random nature of the sample by adding a term in the second step of the two-stage Heckman estimation correction procedure. In the second stage, we estimate the Mincerian wage equation by Ordinary Least Square (OLS) by including the λ as an additional variable. The resulting estimates of the returns to education are then consistent. The estimation equations:

$$Prob\ (P = 1) = \Phi(Z\gamma) \qquad (6)$$

where P is equal to one if woman is a wage earner and zero otherwise; Φ is the cumulative density function, Z includes individual characteristics that influence women's choice, and γ are the parameters to be estimated. From this we compute λ:

$$\lambda = \varphi(Z\gamma) / \Phi(Z\gamma) \qquad (7)$$

where $\varphi(.)$ is the probability density function of the standard normal distribution. The second step involves including the λ into equation (1):

$$lnW_{it} = \alpha + \beta S_{it} + \gamma_1 EX_{it} + \gamma_2 EX^2_{it} + \rho\lambda \qquad (8)$$

where $\rho\lambda$ is the term that corrects for selection bias, where λ is the IMR and ρ represents the coefficient of the bias term.

The results are that first, the selectivity corrected estimate for women is substantially larger than the OLS estimate. We used the number of children under 12 living in the family and being married as exclusion restrictions, which are frequently invoked in the female labor force participation decision. We find that the variable estimates are not significant, indicating that there is no selection bias, and we can rely on OLS estimates (Rubera and Tellis 2014).

However, λ can be insignificant even when sample selection bias exists. If a sample is small, Heckman models are unlikely to produce significant λ's – even in the presence of sample selection bias. Researchers are cautioned against using either significant or insignificant λ's as an indicator of whether or not sample selection bias exists (Certo et al. 2016). Nevertheless, the Heckman model does appear to produce unbiased coefficient estimates, even with small samples.

In our case then, the returns to women's schooling are at least as high as the OLS estimate of 8.9 percent or as high as the selectivity-corrected estimate of 10.3 percent.

3.1 Decomposition

In order to better understand the differences in returns by sex, the gross differential between men and women earnings is decomposed into two components: the portion of the overall differential attributable to differences in productive characteristics and the proportion attributable to the pay structure, which is sometimes described as discrimination (Blinder 1973; Oaxaca 1973).

For two groups, men (M) and women (F), the earnings equation can be written as:

$$lnW_M = X_M\beta_M + \epsilon_M \qquad (9)$$

$$lnW_F = X_F\beta_F + \epsilon_F \qquad (10)$$

where W_M and W_F are male and female earnings; X_M and X_F are the vectors of characteristics (education, experience) for men and women; β_M and β_F are the vectors of coefficients representing how those characteristics are rewarded for men and women. The wage gap between men and women can then be expressed as:

$$lnW_M - lnW_F = (X_M - X_F)\beta_M + X_F(\beta_M - \beta_F) \qquad (11)$$

where $(X_M - X_F)\beta_M$ is the explained part, which shows the portion of the wage gap due to differences in characteristics between men and women; and $X_F(\beta_M - \beta_F)$ is the unexplained part, representing the difference due to how characteristics are valued (the differences in coefficients between men and women). This part is often interpreted as capturing potential discrimination. It is equivalent to estimating potential wages using men's coefficients from the earnings function and sex-specific years of schooling and experience.

The results from the decomposition are displayed in Annex Table 4. In order to arrive at each of these estimates, the decomposition method requires choosing either a sex-specific mean of productive characteristics or the men's mean productive characteristics. Depending on the group mean chosen, the estimates for each of the decomposition components can vary, creating the so-called “index-number” problem. For the Arkansas sample, this is not an issue, as the entirety of the gross earnings differential is “unexplained” meaning that it is due to the pay structure, that for the same qualifications, women are always paid less. Therefore, the upper-bound value for potential discrimination is high, though there is a need for further investigation with a larger sample.

3.2 Estimating the Returns to Education Using Quantile Regression Analysis

Are some workers receiving considerably lower returns? Do these differences increase by the level of wages earned, thus hiding significant unobserved skill differences? The typical mean regression models assume that one additional year of education may only influence the mean of the conditional wage distribution. That is, typical wage equations allow us to estimate the mean effect of education on wages. That is, the rate of return to schooling for the average individual. However, the average individual may not be of interest for policy purposes. Fortunately, it is also possible to estimate the variance in returns around this mean.

The quantile regression method estimates the effect of education on wages at different parts of the wage distribution (Buchinsky 1998; Koenker and Hallock 2001). The wage distribution reflects not only education but also unobservable factors, including ability and social skills. Those at the bottom of the wage distribution are liable to have little education but also a lesser endowment of unobservable skills. In other words, the effects of education on earnings may not be independent of these unobservable skills. If the effect of education on earnings is independent of unobservable skills, we should observe constant returns throughout the wage distribution. Otherwise, we should observe a larger effect at the bottom of the wage distribution or at the top; or a larger effect at the top depending on whether education compensates or complements the unobservable skills.

The quantile regression model (Buchinsky 1994) can be outlined as:

$$lnW_{it} = X_{it}\beta_\theta \quad (12)$$

$$X_{it}\beta_\theta = (Quantile)_\theta(lnw_{it}|X_{it}) \quad (13)$$

where X_i is a vector of exogenous variables; β_θ is the vector of parameters; $(Quantile)_\theta(lnw_i|X_i)$ is the θth conditional quantile of *lnw* given X, with $0<\theta<1$. The θth quantile is derived by solving the problem (using linear programming):

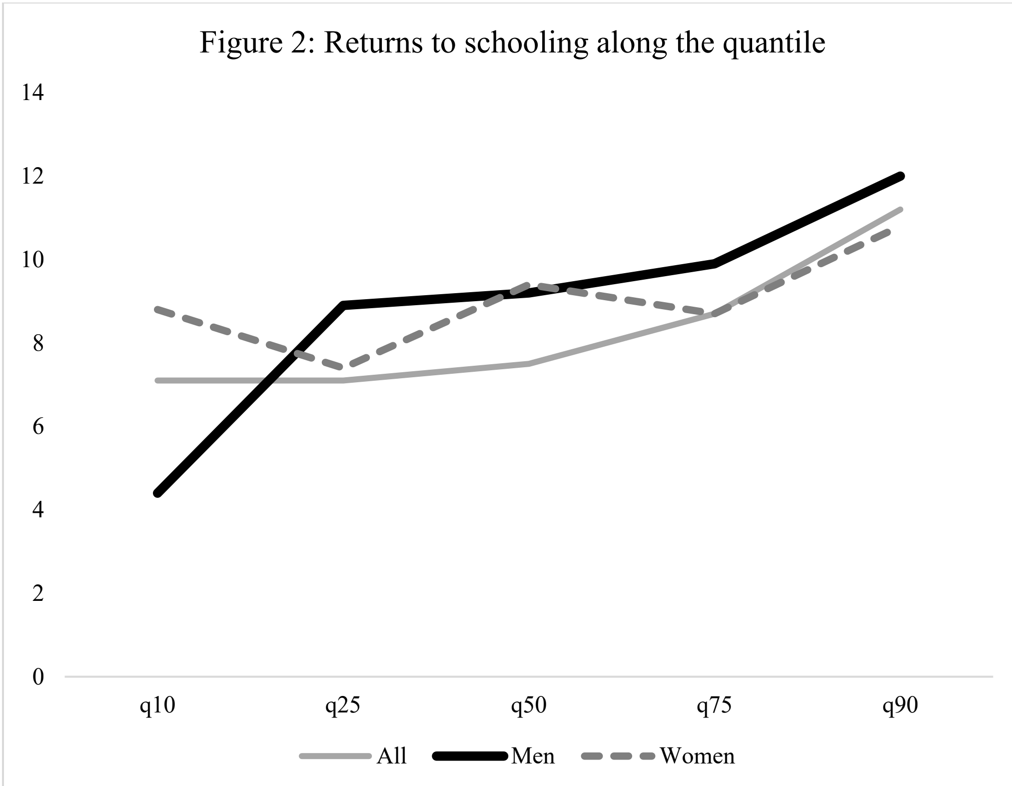
$$\text{Min } \Sigma\rho_\theta(lnw_{it} - X_{it}\beta_\theta) \quad (14)$$

$$\beta \in R^k{}_{it} \quad (15)$$

where $\rho\theta(\varepsilon)$ is the check function defined as $\rho\theta(\varepsilon) = \theta\varepsilon$ if $\varepsilon\geq0$, and $\rho\theta(\varepsilon) = (\theta 1)\varepsilon$ if $\varepsilon<0$. Standard errors are bootstrap standard errors. The median regression is obtained by setting θ=0.5 and similarly for other quantiles. As θ is varied from 0 to 1, the entire distribution of the dependent variable, conditional on X, is traced.

The estimates of the rate of return to education at different points of the conditional wage distribution provide evidence of significant differences in returns at the upper and lower level of the income distribution are large (Figure 2). This is the case for the United States and for most other countries (Buchinsky 1994; Fersterer and WinterEbmer 2003; Fiszbein et al. 2007).

Overall, the curve is fairly flat from the 10^{th} to the 50^{th} quantile. After that, it increases considerably. Men in higher quantiles of the distribution have higher returns to schooling compared to those who are in the lower quantiles. In fact, the returns to schooling at 10^{th} quantile are insignificant.



Source: CPS 2024. See full results in Annex Table 5.

For men, the wage gap remains consistently positive, indicating that the returns to education increase as one moves from the lower to the higher end of the wage distribution. In contrast, the pattern for women differs, with returns fluctuating across the 10th to 75th quantiles. However, at the highest quantile, the returns for women are notably higher than at the lowest quantile.

Although women exhibit a higher average return to education, the returns for men at the upper quantiles slightly surpass those for women. The greater returns at the higher levels suggest a complementarity between education and observable characteristics, implying that raising the level of education uniformly may exacerbate income inequality.

Quantile regression analysis reveals that individuals in higher wage quantiles, particularly men, experience greater returns to education compared to those in lower quantiles. Therefore, policies aimed at improving the quality of education and investing in those with fewer unobservable skills and lower abilities—through compensatory education—could potentially mitigate this trend.

Given the potential for increased income inequality resulting from expanded education, one research priority should be to explore how enhancing the quality of education for less-skilled individuals could affect earnings inequality. Another important area of research would be identifying specific interventions that improve school quality—measured through test scores—for less-skilled students in Arkansas.

3.3 Returns to education by other methods

For the full discounting method, due to the relatively small sample size of wage earners in the survey, it was necessary to smooth the age-earnings profile following age-quadratic method of Psacharopoulos and Mattson (1998). Each average earnings value from the age-earnings profile was regressed onto age and age-squared variables, separately, for each level of education, in the form:

$$lnW_{it} = \alpha_0 + \beta_1 Age_{it} + \beta_1 Age^2_{it} + \epsilon_{it} \qquad (16)$$

The predicted values from each of these regressions are reported in Annex Table 6. To facilitate the full discounting calculations, foregone earnings for those with secondary schooling were assumed to end at age 19, and foregone earnings for those with higher education were assumed to end at age 23. The internal rate of return formula was then applied to each complete age-earnings profile by level of education to obtain the level-specific returns.

The social rate of return to schooling is based on the private age-earnings profile, with the public cost of education per student subtracted from the age-earnings profile for each year of schooling the state would have paid for at each level of educational attainment (Annex Table 7). Without the ability to account for the positive externalities of schooling, the social returns estimates are always lower than the private returns estimates.

The private rate of return to university education is estimated at 11.5 percent, which is higher than the estimate of 8.8 percent derived at through the earnings function method (Table 4). This also gives us a net present value of $1,103,683. This is a healthy rate of return, above any discount rate or alternative use of one's money, such as the stock market (Zhang et al. 2024).

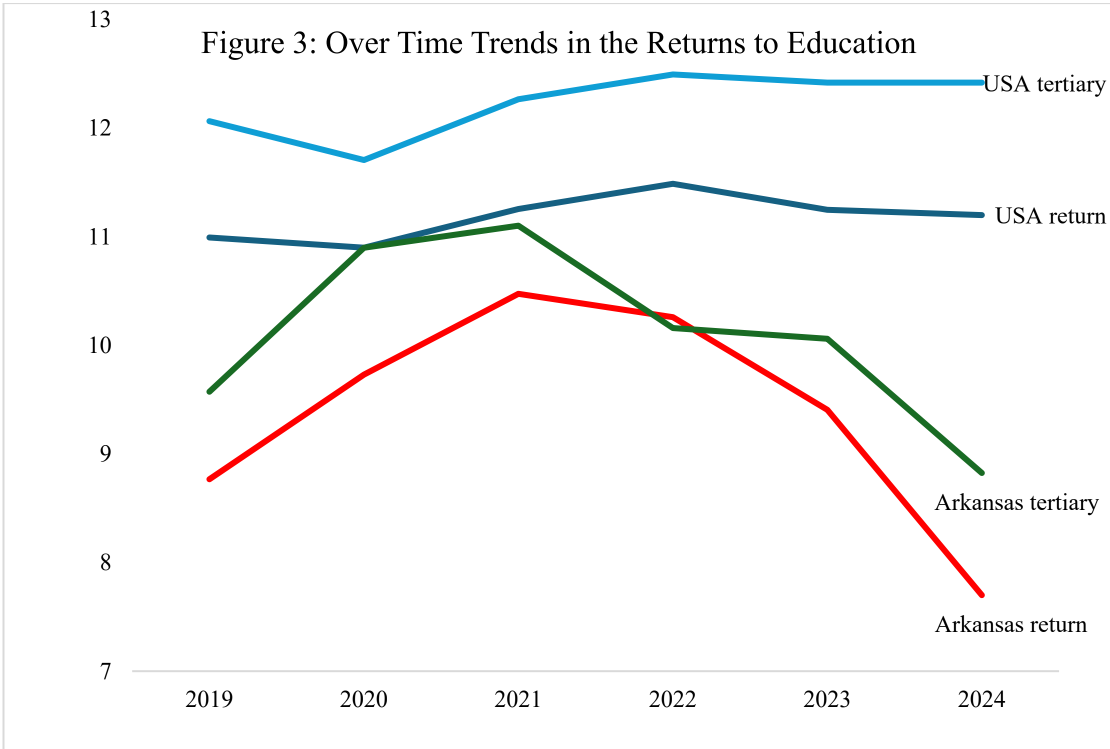
The social returns to schooling are estimated at 6.6 percent. This is because the only difference from private returns, in the absence of external benefits evidence, is the state subsidy that goes to education. Therefore, the social returns are likely underestimated.

Table 4: Full Discounting Returns to University (%)

Private	11.5
Social	6.6

3.4 Over time trends

Over the past five years, the returns to schooling were initially increasing during the pandemic years, but then they started to fall drastically in Arkansas. This is in contrast to the rest of the United States, where the returns increased during the pandemic, but stayed high in the years since (Figure 3). The same is true for the returns to university education. They increased in the United States during the pandemic but remained high thereafter. In Arkansas, the returns to university education initially increased substantially, by 16 percent between 2019 and 2021, from 9.6 percent to 11.1 percent. They have since decreased in Arkansas to a level below pre-pandemic rates. The difference in returns at the university level is now 3.6 percentage points, or a 30% difference.



It is of concern that the returns are trending downwards in Arkansas when this is not the case nationally. Several factors could be contributing to this decline in Arkansas, such as shifts in the labor market demand within the state; changes in the availability or quality of education; or economic factors specific to Arkansas, such as industrial composition or local job market challenges.

Returns to education are often linked to higher productivity and income for people. When returns decrease, it suggests that the economic benefits of education – better jobs, higher wages – are shrinking. If Arkansas residents see less financial reward for pursuing higher education, the state could struggle to attract or retain skilled workers.

For students, the decision to pursue higher education is largely influenced by the expected return to education. If returns continue to fall, fewer people may choose to invest in further education, leading to a less educated workforce in the future. This could exacerbate income inequality, as people without higher education tend to have lower lifetime earnings. Education is a driver of social mobility, allowing people from lower-income backgrounds to improve their socioeconomic status. A decline in the returns to education might hinder this pathway, perpetuating cycles of poverty and limiting opportunities for social advancement in Arkansas.

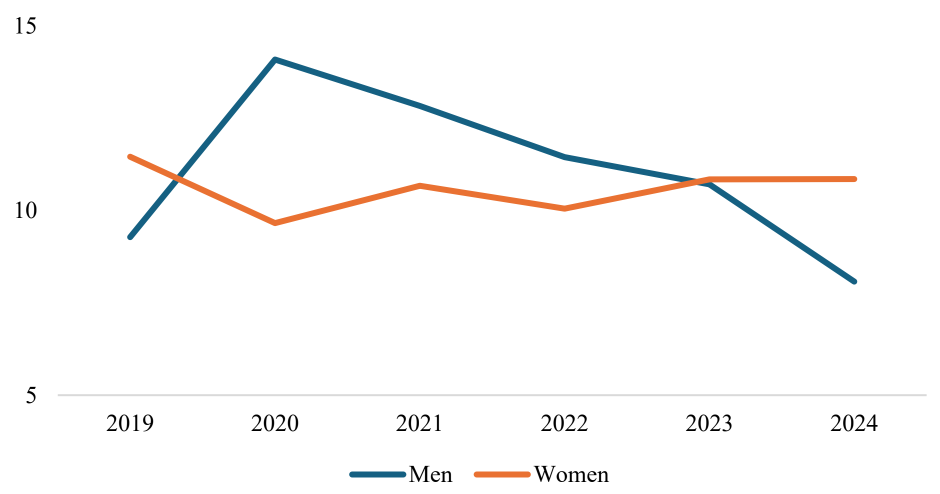
The decline in returns could indicate a mismatch between the skills being taught in schools and universities and the demands of the labor market. If employers do not value the education provided, this suggests that educational institutions may need to adapt their programs to better prepare students for available jobs. Low returns may also indicate low investment in employment sources that require higher levels of education, such as technology-intensive sources, indicating that the mismatch between the skills taught in school and the skills required by the labor market may be reduced by attracting investment from sectors requiring higher levels of education.

Lower earnings among the population translate to reduced tax revenues for the state. A less prosperous population could strain public services, such as healthcare, infrastructure, and education funding, creating a cycle where the state struggles to invest in areas that could boost future returns.

The divergence between Arkansas and the rest of the country suggests a state-specific problem that could have long-term negative effects on economic growth, workforce development, and social equality. While national trends show sustained returns to education, Arkansas risks falling behind, which could lead to deeper structural challenges. This issue may warrant intervention through policy changes, educational reforms, or targeted economic development strategies. Addressing this disparity is crucial, as it may have long-term impacts on the state's economic growth and competitiveness. Policy interventions, such as targeted investment policies, workforce development initiatives that are demand-driven rather than supply-driven, or investment in higher education, could help reverse this trend and align Arkansas' educational returns more closely with national standards.

The only bright spot is that women's returns to university education have remained stable and relatively high during this whole period (see Figure 4). Sustained investment in women's education continues to be a good investment.

Figure 4: Returns to University



3.5 Screening

Central to human capital theory is the notion that education directly augments individual productivity and, therefore, earnings. The alternative to this explanation is that education serves to sort individuals into higher productivity jobs, by signaling or screening more productive individuals (Arrow 1973).

According to screening theories, those with more schooling tend to earn more not solely because schooling makes them more productive, but because schooling acts as a credential. Recent analyses, exploiting data that allow researchers to disaggregate earnings by years of completed schooling, has questioned the linearity of the earnings function approach, suggesting that there are significant discontinuities associated with diploma years, thus suggesting evidence of sheepskin effects in the returns to schooling and hence screening (Bedard 2001).

The so-called sheepskin effects of education ask whether it is years of schooling or the highest qualifications that are more important (Jaeger and Page 1996). We estimate a string of dummy variables for schooling and look for discontinuities associated with specific schooling levels (Hungerford and Solon 1987).

There are significant increases associated with particular years of schooling that would represent the attainment of high school (Table 5). There are indications of sheepskin effects at the primary and secondary level, but there is also a spike at 10 years of schooling. There is an indication of sheepskin effects at 16 years of schooling which could represent the attainment of a tertiary degree. However, there are no spikes at MA and PhD levels. Others have found evidence of thresholds associated with non-certificate years (Belman and Heywood 1991), where all studies show diploma effects. Overall, for Arkansas, there is some evidence of sheepskin effects, but there are also significant earnings increases for non-diploma years as well. It could be said that education serves both to enhance productivity and as a productivity signal (Jaeger and Jones 2024).

Table 5: Estimated Coefficients (and Standard Errors) in Regression of Log Hourly Earnings as Step Function of Years of Schooling

Years of schooling	Estimated coefficient	Standard error	Implied step size
6	0.431	0.415	
8	0.596	0.369	0.165
9	0.368	0.319	-0.228
10	0.396	0.451	0.028
11	0.435	0.290	0.039
12	0.607	0.264	0.172
13	0.692	0.267	0.085
14	0.821	0.269	0.129
16	1.012	0.264	0.191
18	1.137	0.271	0.125
20	0.932	0.286	-0.205
EX	0.032	0.007	
EXSQ	0.000	0.000	
Constant	1.979	0.270	
R2	0.149		
N	900		

3.6 Limitations

One limitation of our analysis of the returns to schooling is the use of the CPS, which, although representative at the state level, may be limited due to its design. The CPS sample size may be insufficient for precise estimates, necessitating the pooling of multiple years of CPS data to increase sample size and improve the reliability of state-level estimates. Despite this effort, we acknowledge that future analyses may benefit from exploring alternative data sources, such as the American Community Survey (ACS) or state-specific surveys, to improve precision. Additionally, our analysis is focused on Arkansas, but we recognize the potential mobility of workers—those currently employed in Arkansas may have originated from other states, and Arkansas-born or educated individuals may have migrated elsewhere, complicating the interpretation of returns to schooling in the state.

Moreover, the relationship between schooling and earnings in our analysis does not necessarily imply causality, as pointed out by Heckman, Lochner, and Todd (2006) and Card (2001). To address the limitations of traditional estimates of returns to education, researchers have used exogenous reforms, such as increases in compulsory schooling, as instruments to identify causal effects (Acemoglu and Angrist 2000; Acemoglu and Pischke 2001; Kennedy 2023; Liu 2024; Stephens and Yang 2014). Employing such an approach allows for a more robust estimation of the returns to education, offering a valuable comparison to conventional estimates and previous studies. In future work, we plan to use the 1994 extension of compulsory schooling in Arkansas as an instrument to assess the impact of expanded educational opportunities on the relative rewards to schooling.

4. Conclusion

This paper, the first to analyze the relationship between education and earnings in Arkansas using 2024 CPS data, calculates the rates of return on education at various levels. The findings align with results from other states and countries. The average return to an additional year of schooling is nearly 8 percent, with women experiencing a higher return of 9 percent.

University education proves to be a profitable investment, yielding an overall return of 8.8 percent. Returns are notably higher for women at 11 percent, compared to 8 percent for men, which may explain the higher educational attainment among women in the state. When using the full discounting method for university education, private returns stand at 11.5 percent, while social returns are 6.6 percent, suggesting that the broader societal benefits of higher education may be underestimated. The key implication of these findings is that expanding and improving educational opportunities represents the most efficient and profitable investment in human capital.

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Annex Table 1. Basic Earnings Functions by Sex, 2024

	Overall	Male	Female
Schooling	0.077	0.077	0.089
	(0.008)	(0.012)	(0.011)
Experience	0.033	0.036	0.028
	(0.007)	(0.010)	(0.008)
Experience-squared	-0.0005	-0.0005	-0.0004
	(0.0001)	(0.0002)	(0.0002)
Constant	1.681	1.752	1.429
	(0.130)	(0.190)	(0.171)
R-squared	0.136	0.124	0.190
N	900	477	423

Source: CPS 2024

Notes: All coefficients are statistically significant at the 1% level or better; standard errors in parentheses

Annex Table 2: Extended Earnings Functions

	Overall	Male	Female
Secondary	0.243	0.300	0.203
	(0.092)	(0.124)	(0.133)
Tertiary	0.596	0.623	0.637
	(0.092)	(0.126)	(0.131)
Experience	0.034	0.038	0.028
	(0.007)	(0.010)	(0.008)
Experience-squared	-0.0005	-0.0006	-0.0004
	(0.0001)	(0.0002)	(0.0002)
Constant	2.356	2.375	2.288
	(0.105)	(0.150)	(0.145)
R-squared	0.130	0.120	0.193
N	900	477	423

Source: CPS 2024

Notes: All coefficients are statistically significant at the 1% level or better; standard errors in parentheses

Annex Table 3: Heckman Selection Correction for Females Returns to Schooling

Earnings	
Education	0.103
	(0.026)
Experience	0.040
	(0.013)
Experience-squared	-0.0008
	0.0003
Constant	1.110
	0.595
First stage	
Children (no. under 12)	-0.048
	(0.049)
Married, in union	-0.151
	(0.095)
Education	0.127
	(0.018)
Experience	0.050
	(0.009)
Experience-squared	-0.0014
	(0.0002)
Constant	-1.311
	(0.248)
Lamda (IMR)	0.213
	(0.387)
Rho	0.313

Annex Table 4: Male-Female Wage Decomposition

Determinants of wage differentials evaluated at male pay; earnings functions means (X) and coefficients (β), for males (M) and females (F)					Earnings differential: $lnW_M - lnW_F = (X_M - X_F)\beta_M + X_F(\beta_M - \beta_F)$			
					Contribution of each variable to earnings differential:		As % of total earnings differential	
					Endowments	Pay structure		
	X_M	X_F	β_M	β_F	$(X_M - X_F)\beta_M$	$X_F(\beta_M - \beta_F)$	Endowments	Pay structure
Constant	1.000	1.000	1.752	1.429	0.000	0.323	0	198
Schooling	13.679	14.404	0.077	0.089	-0.056	-0.172	-34	-106
Experience	21.824	21.352	0.036	0.028	0.017	0.168	10	103
Experience-sq	629.853	610.317	-0.001	0.000	-0.011	-0.105	-6	-65
Total	3.250	3.087	1.864	1.546	-0.050	0.213	-31	131
Log hourly wage	3.250	3.087			$lnW_M - lnW_F$	0.163		
N	477	423			$(X_M - X_F)\beta_M$	-0.050		
R-sq	0.124	0.190			$X_F(\beta_M - \beta_F)$	0.213		

Annex Table 5: Quantile Regressions, Returns to Schooling, Overall and by Sex

	All	Male	Female
		OLS	
education	0.0771***	0.0775***	0.0893***
	(9.31)	(6.24)	(8.44)
experience	0.0326***	0.0355***	0.0278***
	(4.87)	(3.49)	(3.39)
experience2	-0.000472**	-0.000535*	-0.000366*
	(-3.24)	(-2.43)	(-2.03)
_cons	1.681***	1.753***	1.430***
	(12.88)	(9.23)	(8.36)
N	900	477	423
		q10	
education	0.0710***	0.0436	0.0882***
	(6.31)	-1.56	(4.94)
experience	0.0228*	0.0382**	0.00689
	(2.26)	-2.95	(0.57)
experience2	-0.000285	-0.000668*	0.0000974
	(-1.20)	(-2.24)	(0.32)
_cons	1.177***	1.534***	1.012***
	(8.25)	-4.01	(3.48)
		q25	
education	0.0706***	0.0878***	0.0739***
	(8.11)	-6.3	(6.16)
experience	0.0310***	0.0295**	0.0262***
	(5.07)	-2.95	(3.39)
experience2	-0.000505***	-0.000468*	-0.000374*
	(-3.78)	(-2.13)	(-2.13)
_cons	1.495***	1.407***	1.392***
	(10.15)	-6.79	(6.64)
		q50	
education	0.0753***	0.0915***	0.0937***
	(11.37)	-8.39	(9.92)
experience	0.0296***	0.0345**	0.0291**
	(4.77)	-2.81	(3.20)
experience2	-0.000454***	-0.000501	-0.000429*
	(-3.56)	(-1.93)	(-2.14)
_cons	1.776***	1.604***	1.370***
	(17.63)	-9.48	(9.27)

Annex Table 5: Quantile Regressions, Returns to Schooling, Overall and by Sex (cont'd)

		q75	
education	0.0870***	0.0992***	0.0869***
	(7.05)	-9.5	(6.32)
experience	0.0353***	0.0383***	0.0335**
	(3.51)	-7.59	(2.82)
experience2	-0.000471*	-0.000546***	-0.000451
	(-2.18)	(-4.68)	(-1.45)
_cons	1.829***	1.781***	1.698***
	(11.33)	-12.73	(7.91)
		q90	
education	0.112***	0.120***	0.108***
	(12.89)	-12.15	(3.59)
experience	0.0319*	0.0282	0.0329**
	(2.48)	-1.54	(2.81)
experience2	-0.000416	-0.000399	-0.000332
	(-1.76)	(-1.10)	(-1.29)
_cons	1.865***	1.937***	1.700***
	(9.01)	-7.75	(4.04)
N	900	477	423

t statistics in parentheses

="* p<0.05 ** p<0.01 *** p<0.001"

Annex Table 6: Quadratic Age-earnings Profiles and Private Rate of Return Estimation ($)

Age	Secondary (1)	University (2)	University/Secondary (2-1)
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	32599	0	-32599
20	34016	0	-34016
21	35398	0	-35398
22	36745	0	-36745
23	38056	49955	11898
24	39333	52336	13004
25	40574	54650	14076
26	41780	56895	15116
27	42950	59073	16122
28	44086	61182	17096
29	45187	63223	18036
30	46252	65196	18944
31	47282	67101	19819
32	48277	68938	20661
33	49237	70707	21470
34	50161	72407	22246
35	51051	74040	22989
36	51905	75605	23700
37	52724	77101	24377
38	53508	78529	25022
39	54256	79890	25633
40	54970	81182	26212
41	55648	82406	26758
42	56292	83562	27270
43	56900	84650	27750
44	57473	85670	28197
45	58010	86622	28611
46	58513	87506	28993
47	58980	88321	29341
48	59412	89069	29656
49	59809	89748	29939
50	60171	90360	30188
51	60498	90903	30405
52	60789	91378	30589
53	61046	91785	30739
54	61267	92124	30857
55	61453	92395	30942
56	61604	92598	30994
57	61719	92733	31013
58	61800	92800	31000
59	61845	92798	30953
60	61855	92729	30873
61	61830	92591	30761
62	61770	92386	30616
63	61675	92112	30437
64	61544	91770	30226
65	61379	91360	29982

Annex Table 7: Cost per Student/Year

Secondary	$13,959
University	$34,100

Sources: Hanson 2025; McGee 2024