



The Economics of UW-Madison White Paper #1

The Return to A Bachelor's Degree from UW-Madison*

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Executive Summary

- We estimate the net private return to a bachelor's degree from UW-Madison by subtracting both the direct and the opportunity costs from the median discounted value of lifetime earnings among individuals with a bachelor's degree from UW-Madison.
 - The direct cost includes tuition, fees, and costs for required course material and educational supplies at UW-Madison.
 - The opportunity cost is measured by the discounted value of lifetime earnings of high school graduates without any college education.
- The return is substantial for both Wisconsin residents and nonresidents.
 - Relative to the median discounted value of lifetime earnings of high school graduates, the net private **return to a bachelor's degree from UW-Madison is about \$760,000 for Wisconsin residents** when the interest rate is 5%.
 - **The internal rate of return, the interest rate at which the net private lifetime return equals zero, is over 22% for Wisconsin residents and over 16% for nonresidents.** The relatively small differences between the two groups suggest that the direct cost from tuition and fees are swamped by the earnings premium associated with a bachelor's degree from UW-Madison over an individual's working life.
 - Relative to the 90th percentile of the discounted value of lifetime earnings of high school graduates, the net private return to a bachelor's degree from UW-Madison is about \$340,000 for Wisconsin residents when the interest rate is 5%, and the internal rate of return is over 11%.
- The true private return is likely to be higher when other factors are included. Our baseline calculation ignores financial aid and grants, the beneficial effect of college education on future unemployment, and the consumption value provided by the Wisconsin Badgers and other on campus activities.

This article estimates the net private return to a bachelor's degree from UW-Madison. We define the net private return as the difference between the median discounted value of lifetime earnings among individuals with a bachelor's degree from UW-Madison and both the direct and the opportunity costs of obtaining a bachelor's degree from UW-Madison. The direct cost includes tuition, fees, and costs for required course material and educational supplies at UW-Madison. In our baseline estimates, the opportunity cost is measured by the median discounted value of lifetime earnings among high school graduates without any college education.

In later analyses, we also measure the opportunity cost using either the 75th or the 90th percentile of the discounted value of lifetime earnings among high school graduates without any college education, and consider other factors ignored from the baseline estimates, including financial aid and grants for college education, the impact of college education on the unemployment rate, the consumption value of college education, and the social return to college education.

Overall, we find the return is substantial for both Wisconsin residents and nonresidents. Even when the 90th percentile of the discounted value of lifetime earnings of high school graduates is used as a measure of the opportunity cost, the net private return to a bachelor's degree from UW-Madison is still about \$340,000 for Wisconsin residents when the interest rate is 5%, and the internal rate of return is over 11%. Moreover, we find the returns for nonresidents are not much lower. This suggests that the direct cost from tuition and fees are swamped by the earnings premium associated with a bachelor's degree from UW-Madison over an individual's working life.

It is important to note that our estimates are based on the median earnings of all individuals with a bachelor's degree from UW-Madison. The actual returns could vary significantly across majors. We will address this in a subsequent paper.

1 Baseline Estimates

According to the U.S. Census Bureau, among those who graduated from UW-Madison with a bachelor's degree between 2016 and 2018, the median earnings in the first year after graduation is \$44,836 (measured in 2020 dollars, as is the case for all other earnings reported in this article). We use this number to calculate the return to a bachelor's degree from UW-Madison in four steps.

First, we set the working life of individuals with and without a bachelor's degree from UW-Madison. According to Rutledge et al. (2018), the average retirement age is 62.8 for male high school graduates and 65.7 for male college graduates. Accordingly, for an individual who enters the labor market right after high school, we assume his/her working life runs

from ages 18 to 62. Because it takes about 4 years to obtain a bachelor's degree from UW-Madison,¹ we assume that, if the same individual starts undergraduate study at UW-Madison right after high school, he/she would receive a bachelor's degree at 22, and the working life would run from 22 to 65.

Second, we estimate the median earnings at age 18 of high school graduates who enter the labor market without any college education. Using data from the Current Population Survey (CPS), we focus on high school graduates born in 1994-1996, who were 22 years old in 2016-2018 and thus would have received a bachelor's degree had they attended UW-Madison right after high school. Let $y_{h,18}$ be the median earnings among those who worked at least 1500 hours in their first year after high school. We find $y_{h,18} = \$20,289$, and use it as an estimate of the potential earnings at age 18 of a high school graduate who could have attended UW-Madison and received a bachelor's degree at age 22. For comparison, we denote the median earnings at age 22 of individuals with a bachelor's degree from UW-Madison as $y_{c,22} = \$44,836$.

Third, we project earnings at later ages using CPS data. Let $y_{i,a}$ and $y_{i,a+1}$ be the annual earnings of individual i at ages a and $a+1$, respectively. We use the median of $\frac{y_{i,a+1}}{y_{i,a}}$ across high school graduates (with no college education) who worked at least 1500 hours at both ages as an estimate of the earnings growth between ages a and $a+1$ for an individual who starts working right after high school, and denote it as $g_{h,a+1}$. With initial earnings $y_{h,18}$ and the age-specific earnings growth $g_{h,a+1}$, we set the median earnings of high school graduates at age $a \in [19, 62]$ to

$$y_{h,a} = y_{h,18} \prod_{s=19}^a g_{h,s} \quad (1)$$

where $\prod_{s=19}^a g_{h,s}$ is the cumulative product of $g_{h,s}$ from $s = 19$ to $s = a$.

Similarly, we use the median of $\frac{y_{i,a+1}}{y_{i,a}}$ across college graduates (with a bachelor's degree but no graduate or professional degree) who worked at least 1500 hours at both ages as an estimate of the earnings growth between ages a and $a+1$ for an individual with a bachelor's degree from UW-Madison, and denote it as $g_{c,a+1}$. With initial earnings $y_{c,22}$ and the age-specific earnings growth $g_{c,a+1}$, we set the median earnings of UW-Madison graduates at age $a \in [23, 65]$ to be

$$y_{c,a} = y_{c,22} \prod_{s=23}^a g_{c,s} \quad (2)$$

Figure 1 plots the estimated median earnings. For high school graduates, the median earnings peak at around \$38,000 in their 40s. For UW-Madison graduates, the median

¹<https://www.wisc.edu/about/facts/>

earnings peak at around \$115,000 in their 50s.

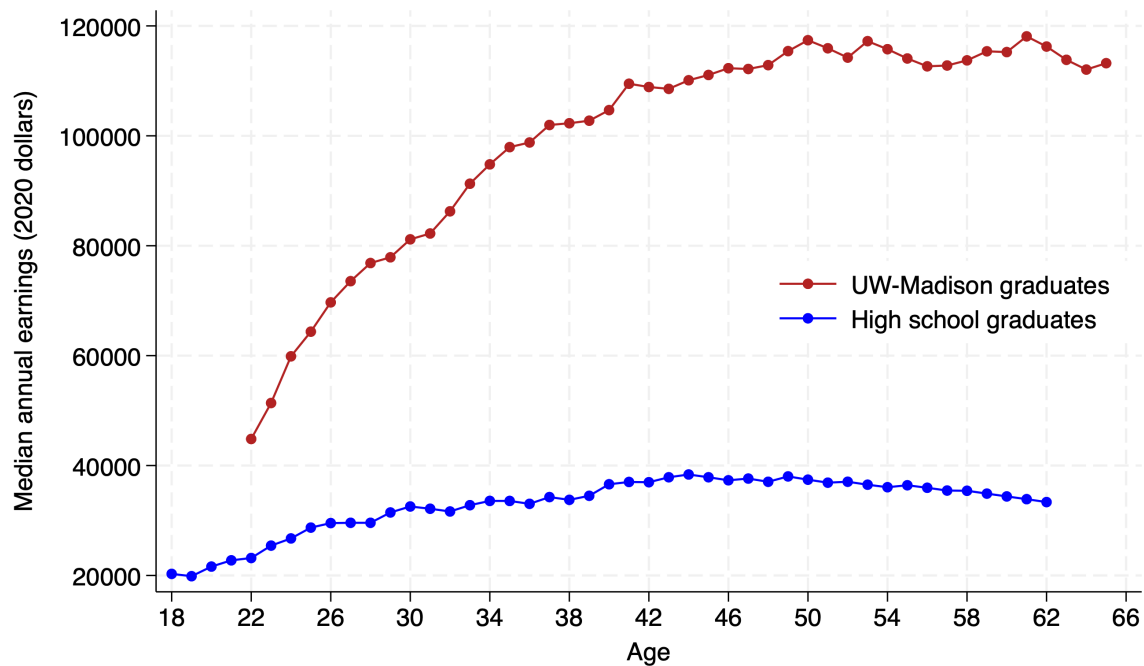


Figure 1: Median earnings: UW-Madison graduates vs high school graduates

Finally, let r be the interest rate, and D be the direct cost measured by the sum of tuition, fees and costs of required course material and educational supplies at UW-Madison. We calculate the return to UW-Madison as

$$R = \sum_{a=22}^{65} \frac{y_{c,a}}{(1+r)^{a-18}} - \sum_{a=18}^{21} \frac{D}{(1+r)^{a-18}} - \sum_{a=18}^{62} \frac{y_{h,a}}{(1+r)^{a-18}} \quad (3)$$

where the first term is the median discounted value of lifetime earnings among individuals with a bachelor's degree from UW-Madison, the second term is the discounted value of the direct cost of obtaining a bachelor's degree from UW-Madison, and the last term is the median discounted value of lifetime earnings among high school graduates with no college education, which is our baseline measure of the opportunity cost of obtaining a bachelor's degree from UW-Madison.

Figure 2 plots the estimated returns R for different interest rates r and two values of the direct cost D : \$12,246 and \$40,134. These were the costs in 2020-21 for Wisconsin residents and nonresidents, respectively. The costs for other years are similar.²

Since the direct cost D has to be paid upfront, while the benefits measured by the difference in earnings $(y_{c,a} - y_{h,a})$ are accrued later and discounted more heavily, the return R

²<https://financialaid.wisc.edu/cost-of-attendance/>

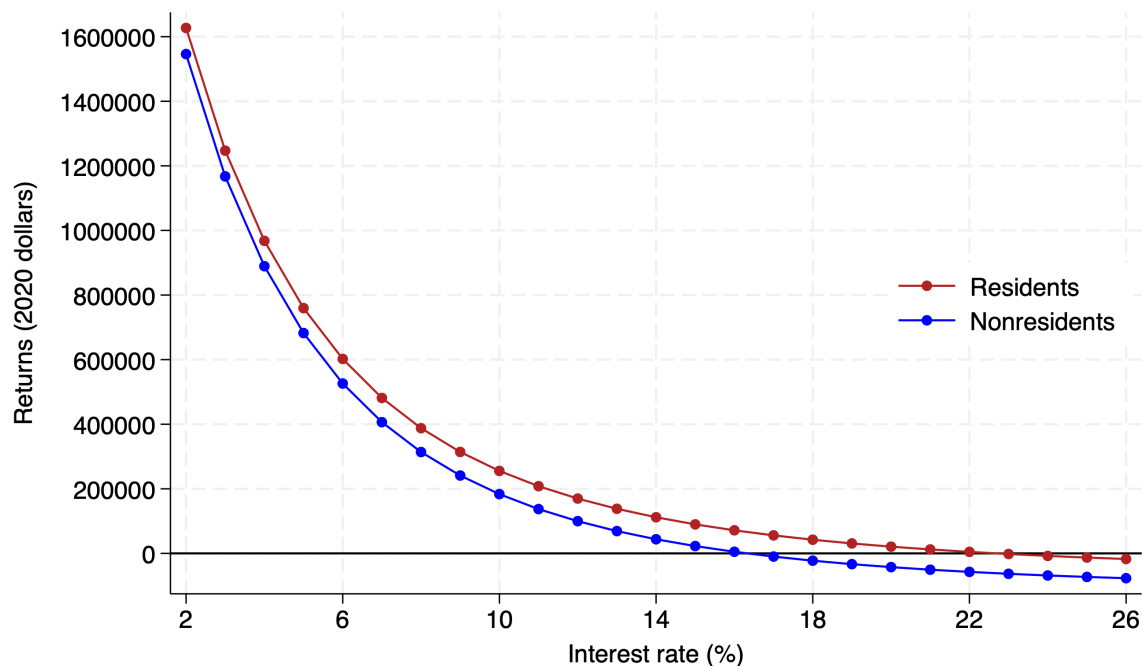


Figure 2: Returns to a bachelor’s degree from UW-Madison

is decreasing in the interest rate r for both Wisconsin residents and nonresidents. When the interest rate is 2%, the return is about \$1.6 million for Wisconsin residents. This decreases to about \$760,000 when the interest rate is 5%, and to about \$260,000 when the interest rate is 10%. The internal rate of return, defined as the interest rate at which the return is $R = 0$, is over 22% for Wisconsin residents.

Due to the difference in the direct cost D , the return R is lower for nonresidents than residents at each interest rate. However, the difference between the two groups is relatively small. For example, when the interest rate is 5%, the return to nonresidents is about \$680,000, compared to \$760,000 for residents. The internal rate of return for nonresidents is over 16%, compared to 22% for residents.

Overall, the estimates suggest that a bachelor’s degree from UW-Madison is an investment with substantial high returns for both Wisconsin residents and nonresidents. Moreover, the relatively small differences in returns for the two groups indicate that the direct cost D , the majority of which are tuition and fees, are swamped by the earnings premium ($y_{c,a} - y_{h,a}$) associated with a bachelor’s degree from UW-Madison over an individual’s working life.

2 Factors not included in the baseline estimates

It is important to note that our baseline estimates abstract from many important factors. We now discuss some of these factors.

2.1 Selection

Not every high school graduate attends UW-Madison. The competitive nature of the admissions process suggests that UW-Madison graduates are positively selected, in the sense that the median UW-Madison graduate could earn more than the median high school graduate even without a bachelor's degree from UW-Madison. If this is the case, part of the returns estimated above could reflect some inherent differences between the median UW-Madison graduate and the median high school graduate, rather than the causal impact of a bachelor's degree from UW-Madison on an individual's earnings.

To address this, we re-define $y_{h,a}$ as the 75th percentile of the earnings distribution among high school graduates at age a , and use the same equation (3) to estimate the return R . The resulting estimate would be the causal effect of a bachelor's degree from UW-Madison if, at the time of high school graduation, the potential earnings of the median UW-Madison graduate is at the 75th percentile of the earnings distribution of all high school graduates who did not attend college. In practice, we inflate the median earnings (the blue line in figure 1) by a factor of $\frac{\$27,768}{\$20,289} = 1.37$, where \$27,768 is the 75th percentile of the earnings distribution described above whose median is \$20,289. We also repeat the process by re-defining $y_{h,a}$ as the 90th percentile of the earnings distribution among high school graduates at age a , and operationalize this by inflating the median earnings (the blue line in figure 1) by a factor of $\frac{\$35,534}{\$20,289} = 1.75$, where \$35,534 is the 90th percentile of the earnings distribution described above whose median is \$20,289.

Figure 3 plots the resulting estimates for Wisconsin residents ($D = \$12,246$). Now that the opportunity costs represented by $y_{h,a}$ are higher, for each interest rate, the returns R are lower than the red line in figure 2. However, they are still substantial. For example, when the interest rate is 5%, the return R is about \$550,000 when $y_{h,a}$ is the 75th percentile, and it is about \$340,000 when $y_{h,a}$ is the 90th percentile. The internal rate of return is over 16% when $y_{h,a}$ is the 75th percentile, and it is over 11% when $y_{h,a}$ is the 90th percentile.

While we do not know what the precise earnings of UW-Madison graduates would be had they never received any college education, the alternative estimates presented in figure 3 suggest that the return to a bachelor's degree from UW-Madison is indeed substantial. This is consistent with other findings in the economics literature that address the potential selection in college admissions more rigorously. For example, Zimmerman (2014) finds that, in Florida, relative to high school graduates with GPA just below the admissions

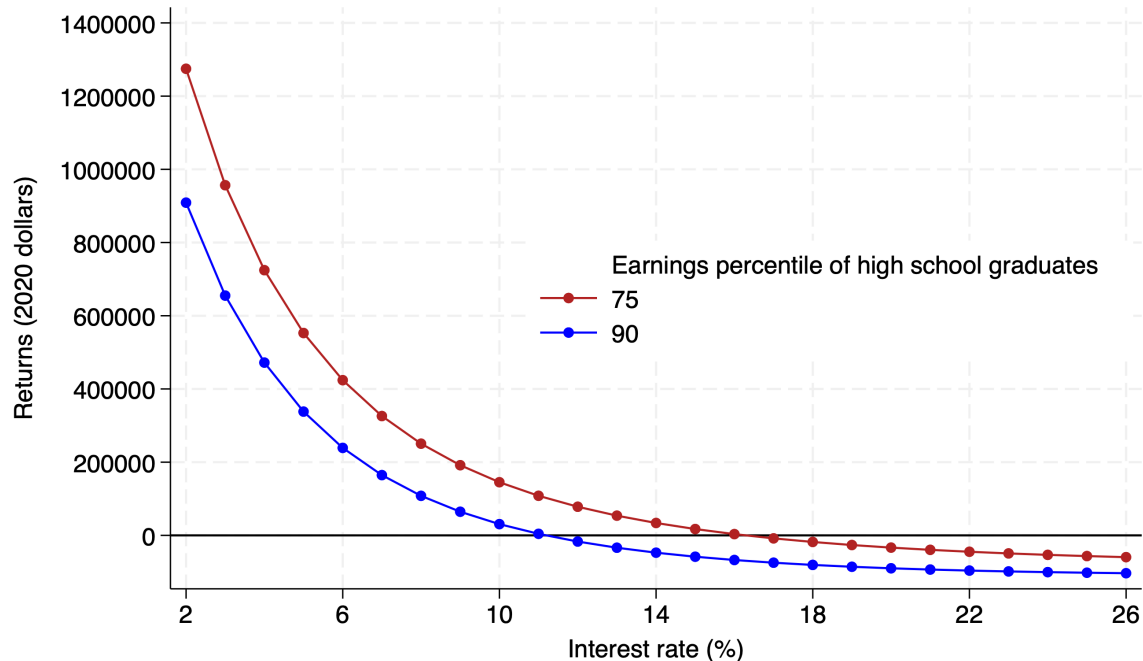


Figure 3: Returns to a bachelor’s degree from UW-Madison: alternative estimates for Wisconsin residents

threshold at Florida International University (FIU), high school graduates with GPA just above the admissions threshold are more likely to attend FIU and other universities in the state and earn 22% more 8-14 years after high school completion. After accounting for the direct and indirect (time) costs of college attendance, Zimmerman (2014) finds that the average rate of return for the marginally admitted students is over 13.5%. The return to a bachelor’s degree from UW-Madison is probably higher because, among others, Dillon and Smith (2020) find the return to college is increasing in college quality, and UW-Madison is at the upper end of the college quality distribution.

2.2 Financial aid and grants

When calculating the return R , we use the direct cost D posted by UW-Madison that does not account for financial aid and grants. Using data from the Integrated Postsecondary Education Data System (IPEDS), figure 4 shows that 48% of undergraduates at UW-Madison receive financial aid and/or grants, and the average amount received is over \$12,000. By reducing the direct cost D , the estimated return R would be higher when financial aid and grants are considered.

2.3 Unemployment

When calculating the return R , we use earnings $y_{h,a}$ and $y_{c,a}$ estimated using individuals who worked at least 1500 hours a year. By focusing on earnings of full-time workers, we

	Percent receiving aid	Average amount of aid received
All undergraduate students		
Any grant or scholarship aid	48%	\$12,757
Pell Grants	15%	\$4,847
Federal student loans	22%	\$6,157
Full-time, first-time, degree/certificate-seeking undergraduate students		
Any student financial aid	58%	
Grants or scholarship aid	47%	\$11,171
Federal grants	24%	\$5,773
Pell Grants	15%	\$4,893
Other federal grants	24%	\$2,725
State or local grants and scholarships	16%	\$2,736
Institutional grants and scholarships	29%	\$12,048
Student loan aid	26%	\$9,299
Federal student loans	25%	\$5,191
Other student loans	6%	\$18,988

Figure 4: Student financial aid at UW-Madison: 2021-22

Source: Integrated Postsecondary Education Data System (IPEDS).

ignore another benefit of college education: it reduces the probability of being unemployed in the future. As shown in figure 5, the unemployment rate is decreasing in educational attainment. Incorporating this effect could raise the estimated returns to a bachelor's degree from UW-Madison but would require modeling outside the scope of this report.

2.4 Other benefits of UW-Madison

In addition to the earnings premium, an individual may also receive other benefits from UW-Madison that are not included in the return R estimated above. For example, college remains a great place to find a partner. One analysis reveals that 28% of couples on Facebook attended the same college (Jacobs, 2013). Kirkebøen et al. (2022) show that this sorting reflects a causal effect of college, as opposed to the selection of who goes to which college. This suggests that attending UW-Madison could increase the probability of marrying a UW-Madison graduate. This could have an additional effect on one's household income, among others.

UW-Madison is also fun and has significant consumption (in addition to the investment) value. In particular, the effective value of consumption at UW-Madison could be larger than measured consumption expenditures, because students often have easy access to athletic and entertainment facilities on campus, and there are often free or inexpensive leisure and entertainment opportunities available exclusively to students. Gong et al. (2021) find that the average annual consumption value of college ranges from about \$12,000 to about \$15,000, which increases the average rate of return to college by 14-

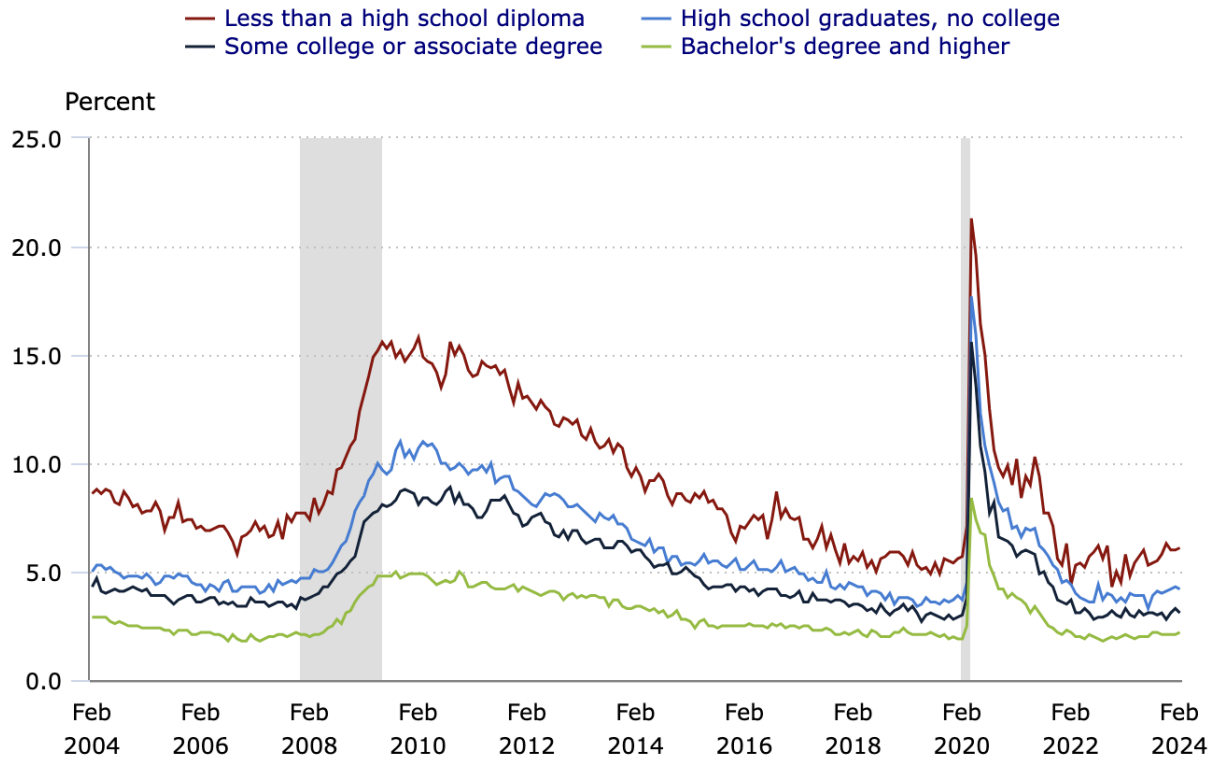


Figure 5: Unemployment rates by educational attainment

Source: U.S. Bureau of Labor Statistics.

18%. Thanks to Badgers sports, the consumption value of UW-Madison is undoubtedly higher.

It's worth noting that the returns estimated above are private returns for individuals who attend UW-Madison, rather than the social returns that also capture the social values from externalities and other channels. For example, Moretti (2004) finds evidence for knowledge spillovers where an increase in the share of college-educated workers in a labor market also raises the wages of workers in the same labor market who do not have any college education. Incorporating these and other spillovers could lead to even larger returns to a bachelor's degree from UW-Madison.

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