The Value of Education Produced at the University of Nevada, Las Vegas

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Executive Summary

During academic year 2009-10, UNLV educated more than 28,000 students—about 21,000 on a full-time equivalent basis. In the process, UNLV awarded 5,403 degrees. These degrees included 3,628 bachelor's degrees, 1,278 master's degrees, 140 Doctor of Philosophy (PhD) degrees, 145 Juris Doctor (JD) degrees, 78 Doctor of Dental Medicine (DDM) degrees, 35 initial licensure program (PPD) degrees, and 16 Educational Specialist degrees. All these degrees will mean higher lifetime earnings for the students.

UNLV also provided education to a number of students who will not complete degrees at UNLV. These students either transferred to other schools or dropped out of higher education before earning a degree. Nonetheless, all those students will have higher expected lifetime earnings as the result of their UNLV education.

Using a 4 percent real discount rate and accounting for the opportunity cost of student time in school, the net present value of the increases in the income streams that resulted from the education provided by UNLV in academic year 2009-10 was $2.369 billion.

Higher education also confers benefits to society beyond higher lifetime earnings. Individuals with greater educational attainment are more likely to have healthy lifestyles and to engage in less criminal activity. Those differences yield additional benefits to society that are not reflected in lifetime earnings and not included in our analysis. The exclusion of these benefits biases downward our estimates of the economic benefits resulting from UNLV's educational production.

To conduct its educational mission in academic year 2009-10, the university incurred costs of $270 million. Some of these educational costs were covered by tuition and fees paid by the students. Some were met with federal funding. Some funding came from the state of Nevada.

In comparing the value of the education that UNLV produced in the 2009-10 academic year to the costs, we find the university returned $8.77 in discounted present value for every dollar it spent on its educational mission. Alternatively, the real rate of return on UNLV's educational expenditures is an estimated 15.34 percent.

1. Introduction

In the pursuit of its multiple missions, a large public university, like UNLV, contributes much to its state's economy. These contributions include the fruits of the education, research and public service the university provides. One particularly meaningful measure of a university's contribution to its community is the economic value of the education that the university provides.

In this study, we evaluate the economic value of the education that UNLV provided to the state of Nevada in academic year 2009-10. Similar to the manner in which we might evaluate a business, we assess UNLV's contribution by comparing the market value of its output to its operating costs.

For a university like UNLV, such an exercise requires enumerating its educational production and then relating that educational attainment to lifetime earnings to obtain an estimate of the total value of the education produced in a single academic year. Evaluating the costs requires sorting through the university's budget to determine which costs can be attributed to the university's educational mission and which costs result from other missions.

Conducting these exercises, we find that UNLV produced an educational output in academic year 2009-10 that has a present value of $2.369 billion. The university's instructional costs were $270 million in the same year. That is a return of $8.77 in discounted present value for every dollar of the university's expenditure on its educational mission.

2. UNLV's Educational Production

During academic year 2009-10, UNLV educated more than 28,000 students—about 21,000 on a fulltime equivalent basis. In the process, UNLV awarded 5,403 degrees. These degrees included 3,628 bachelor's degrees, 1,278 master's degrees, 140 Doctor of Philosophy (PhD) degrees, 145 Juris Doctor (JD) degrees, 78 Doctor of Dental Medicine (DDM) degrees, 35 initial licensure program (PPD) degrees, and 16 Educational Specialist degrees. All these degrees will mean higher lifetime earnings for the students.

UNLV also provided education to a number of students who will not complete degrees at UNLV. These students either transferred to other schools or dropped out of higher education before earning a degree. Nonetheless, all those students will have higher expected lifetime earnings as the result of their UNLV education.

In fact, UNLV's educational production is complex, involves numerous people and takes a number of years to complete. To earn the typical undergraduate degree, a person spends what amounts to four full-time years (with summers off) as a student at UNLV. At any point in time, UNLV is educating undergraduate students with freshman through senior standing and graduate students in programs that grant master's, PhD, JD and other more specialized degrees.

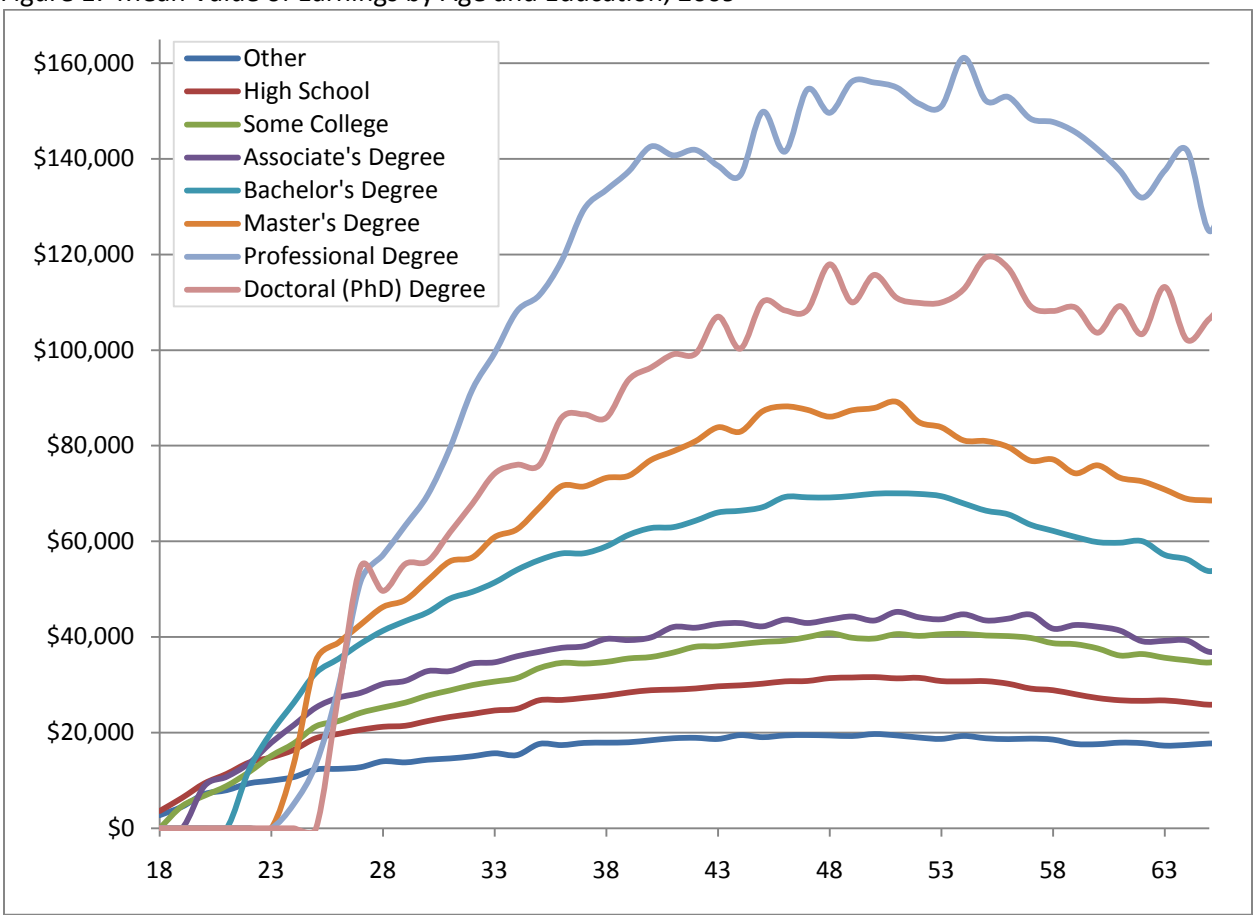
In any given year, UNLV's educational output consists of a mix of courses taught and degrees awarded. Much of the coursework will lead to degrees granted by the university in future years. Some will not because the students transfer to other institutions or drop out. Adding to the complexity, UNLV also accepts transfers and confers degrees to students who have completed a portion of their coursework elsewhere. UNLV's educational process can be represented in a steady state by focusing on the degrees

it grants and making adjustments for transfers and dropouts. (See the Appendix: A Steady-State Evaluation of University Output.)

3. Educational Attainment and Lifetime Earnings

Increased educational attainment from high school through a professional degree or a PhD increases an individual's earnings at each stage of life. In 2009, for instance, a person at age 48 with a high school diploma earned on average about $10,000 more per year than a high school dropout of the same age (Figure 1). At age 48, someone with a professional degree (such as a JD or MD) earned on average about $130,000 more per year than a high school graduate with no college education.

Figure 1. Mean Value of Earnings by Age and Education, 2009



Source: Authors' calculations based on the 2009 American Community Survey.

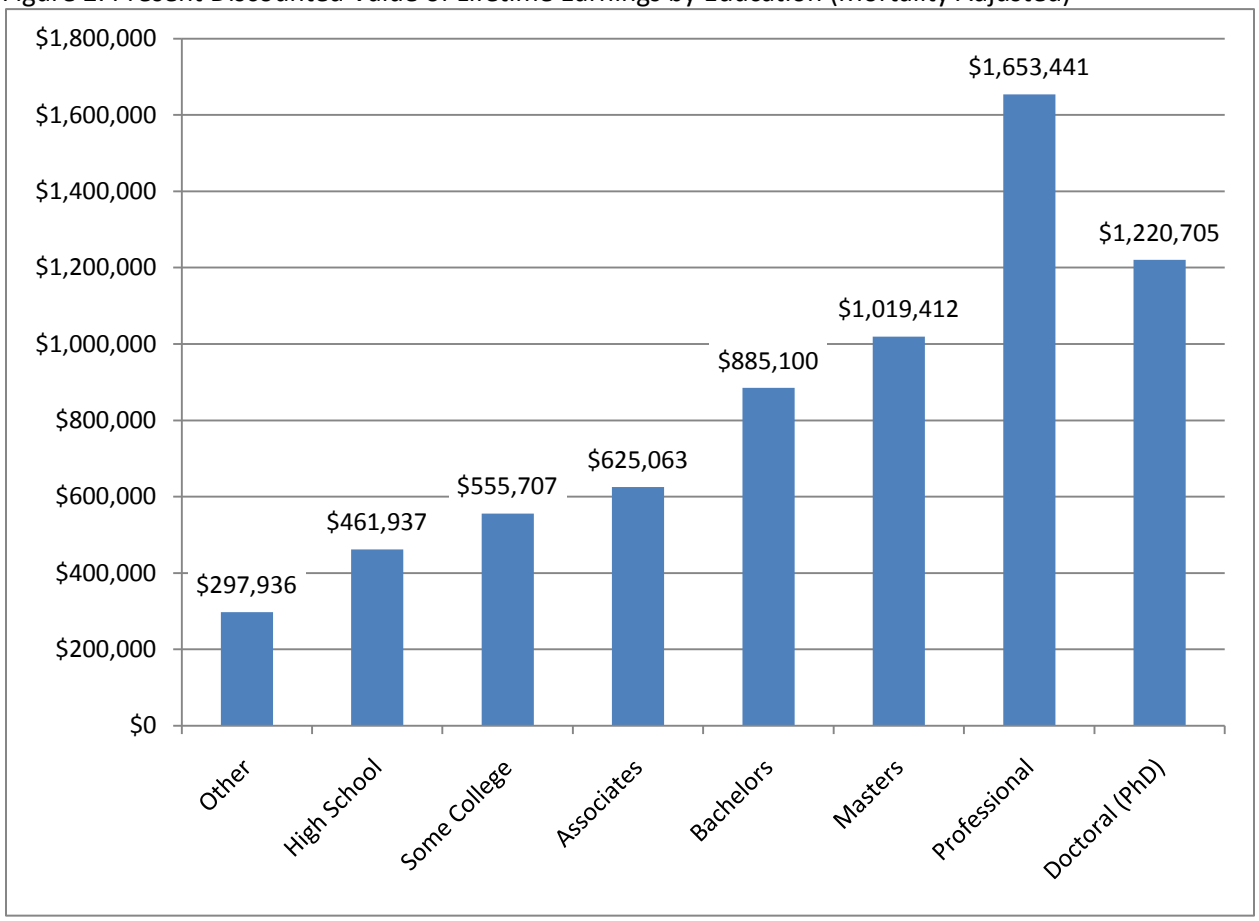
Of course, students pursuing more education must spend more time in school and often have incomes close to zero in their late teens and early 20s. In that regard, the pursuit of an education is an investment that is expected to return a higher future income.

As the first step in estimating the present discounted value of the lifetime earnings associated with each standard of educational attainment, we construct expected income profiles using the 2009 American Community Survey. Although we recognize that the world could change substantially over the next 40-50 years, we use the 2009 incomes by education and age to construct expected income profiles for today's students without making any adjustments for possible future changes in the real wages for

various age groups and educational attainment. The lack of such adjustments likely undervalues the expected return to education because over the past 50 years the relative wages of more highly educated workers have increased by substantially more than the wages for those who are less educated.

The U.S. government recommends the use of a real discount rate between 2 and 7 percent for purposes of evaluating long-term public investment. Using a value close to the midpoint, we adopt a 4 percent real discount rate to evaluate the present value of the income stream associated with each level of educational attainment. In the process of calculating the present discounted value, we account for mortality by adjusting downward the expected earnings at each age based on projected life expectancy. As shown in Figure 2, our calculations generate estimates for someone 18 years old of expected lifetime earnings that have a present discounted value that ranges from $298 thousand for a high school dropout to $1.653 million for someone with a professional degree. Clearly, education pays a lifetime of dividends to those who pursue it.

Figure 2. Present Discounted Value of Lifetime Earnings by Education (Mortality Adjusted)



Source: authors' estimates

3.1 Social External Benefits Associated with Educational Attainment

A more educated population also generates benefits for society as a whole. Educational attainment is also linked to improved health outcomes, reduced propensity to commit crime and reduced reliance on the welfare and unemployment systems. All of these gains reduce the costs that individuals impose on

society. Valuing these effects requires linking educational attainment to the improved outcomes and then to estimates of the reduction in social costs. Such estimates are outside the scope of the present study, and their exclusion biases downward our estimated value of UNLV's educational production.

4. Valuing UNLV's 2009-2010 Educational Production

For purposes of evaluating the total market value of the education provided by UNLV, we link UNLV's 2009-10 educational production to our estimates of the present discounted value of lifetime earnings for various levels of educational attainment. Because UNLV has a relatively steady enrollment and production of degrees, its educational production can be represented as a steady-state process. In this process, the total number of degrees granted in any given year is taken to represent all those students who are in the process of completing their degrees. In steady-state, each graduating senior represents the students who are completing the university's freshman, sophomore, junior and senior years of instruction. Each student earning an advanced degree represents students who are in the earlier stages of the same program. Adjustments are made to account for the transfers and dropouts. (See the Appendix: A Steady-State Evaluation of University Output.)

Combining UNLV's 2009-10 educational production with the projected income profiles at a 4 percent real discount rate yields a present value of $2.369 billion (Table 1). Lower discount rates yield higher present values, and higher discount rates yield lower present values.

Table 1. Present Discounted Value
of UNLV's 2009-10 Educational Production

Discount Rate	Value of Production
2.0%	$3,711,065,573
3.0%	$2,950,334,969
4.0%	**$2,369,148,133**
5.0%	$1,919,697,053
6.0%	$1,567,924,615
7.0%	$1,289,339,123

Source: authors' calculations

5. UNLV's 2009-10 Instructional Costs

In academic year 2009-10, UNLV had total operating costs of $289,000,767. Most, but not all, of these costs can be attributed to the university's educational mission. Our assessment is that $243,994,955 of the university's operating costs in academic year 2009-10 were the result of the university's educational mission.

To determine the university's costs of providing education, we look at expenditures in three categories: instructional activities, other overhead-using activities and overhead activities. As shown in Table 2, expenditure on instructional and related activities accounted for $166,219,837 in academic year 2009-10. Other overhead-using activities accounted for $11,870,763, and university overhead accounted for $110,910,167. Assuming that university overhead is apportioned to education in proportion to the total of all overhead-using activities, the amount of overhead attributable to instructional activities was

$103,517,366 in academic year 2009-10. Consequently, $269,737,203 was the full cost of the university maintaining its educational mission in academic year 2009-10.

Table 2. UNLV Expenditures for Academic Year 2009-10

Expenditure Categories	Expenditures
Instructional Activities	**$166,219,837**
Instruction	$145,224,612
Scholarships and Fellowships	$5,132,110
Instructional-Related Student Services	$15,863,115
Other Overhead-Using Activities	**$11,870,763**
Public Service	$992,151
Research	$4,001,069
Student Life	$1,119,134
Intercollegiate Athletics	$5,758,409
General University Overhead	**$110,910,167**
Academic Support	$41,143,988
Facilities Management	$45,908,234
Institutional Support	$23,857,945

Sources: UNLV, authors' calculations

6. The Net Benefits of UNLV's Educational Production

To obtain the net benefits of UNLV's educational production, we simply subtract the instructional costs from the present discounted value of UNLV's educational production in the same academic year. At a 4 percent real discount rate, the net benefit of UNLV's 2009-10 educational production is $2.099 billion (Table 3). Alternatively, we find the real rate of return on UNLV's educational expenditures to be 15.34 percent.

Table 3. Net Present Discounted Value of UNLV's 2009-10 Educational Production

Discount Rate	Net Value of Production
2.0%	$3,441,328,369
3.0%	$2,680,597,766
4.0%	**$2,099,410,930**
5.0%	$1,649,959,850
6.0%	$1,298,187,411
7.0%	$1,019,601,919

Source: authors' calculations

7. Conclusions

During academic year 2009-10, UNLV educated more than 28,000 students—about 21,000 on a full-time equivalent basis. In the process, UNLV awarded 5,403 degrees. These degrees included 3,628 bachelor's degrees, 1,278 master's degrees, 140 PhD degrees, 145 JD degrees, 78 DDM degrees, 35 PDD degrees, and 16 Educational Specialist degrees. A number of UNLV's students will not complete degrees

at UNLV. In all these cases, the education provided at UNLV will mean higher lifetime earnings for the students.

Evaluating the gains in lifetime earnings resulting from the education that UNLV produced in academic year 2009-10, we estimated the university's educational production had a present discounted value $2.369 billion in that year (when evaluated at a 4 percent real discount rate). During the same year, the university's instructional costs were $270 million. Combined, those figures yield an impressive net present value of $2.099 billion or a return of $8.77 (in present discounted value) for every dollar that the university spent in pursuit of its educational mission. Alternatively, we estimate the real rate of return on UNLV's educational expenditures to be 15.34 percent.

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Appendix
A Steady-State Evaluation of University Output

In any given year, a university's educational output is complex, consisting of courses taught and degrees awarded. Much of the coursework will lead to degrees granted by the university in future years. Some will not because the students transfer to other institutions or drop out. Universities also accept transfers and confer degrees to students who have completed a portion of their coursework elsewhere.

For a university with a relatively constant enrollment and production of degrees, the total educational production can be represented as being in a steady state, where the number of degrees granted in any given year is a good proxy for all those students who are in the process of completing degrees. In steady state, each graduating senior represents the university's freshman, sophomore, junior and senior years of instruction. Adjustments can be made to account for the steady-state transfers and dropouts.

A.1 Undergraduate Education

At the undergraduate level, the value of a university's annual production can be described as:

$$\sum_{y=1}^{4} N_y \cdot \left(PV_y + PVS_y\right) - \sum_{y=1}^{3} T_y \cdot \left(PV_y + PVS_y\right)$$

where N_1, N_2 and N_3 are the number of people who complete a year of schooling, two years of schooling and three years of schooling, respectively; N_4 is the number of people who complete a bachelor's degree; PV_y is the present value of the income associated with completion of year y of schooling in comparison to a high school education; PVS_y is the present value of the external social benefit associated with year y of higher education in comparison to high school education; T_y is the number of transfers into the school who have achieved year y of schooling before arriving at the university.

The net number of dropouts or transfers out with class standing y, equals N_y–T_y. With substitution, we are able to rewrite the value of the university's annual production of undergraduate education as a combination of degrees awarded and net transfers or dropouts as follows:

$$N_4 \cdot (PV_4 + PVS_4) + \sum_{y=1}^{3} NT_y \cdot \left(PV_y + PVS_y\right)$$

where NT_y is the is the net number of transfers or dropouts with class standing y.

A.2 Graduate Education

For graduate students, the value of a university's annual production can be described as:

$$\sum_{y=5}^{7} N_y \cdot \left(PV_y + PVS_y\right)$$

where 5 represents master's degrees; 6 represents professional degrees; and 7 represents PhD degrees. The typical graduate program does not accept transfer credits, and measures of the market value of graduate degrees do not recognize the partial fulfillment of such degrees. Therefore, we exclude any measures for transfers or dropouts.

A.3 Net Value of Educational Production

The net present value of educational production is the present discounted value of the lifetime earnings differentials and the external social benefits yielded by the university's provision of education less the opportunity cost of student time as follows:

$$\sum_{y=4}^{7} N_y \cdot \left(PV_y + PVS_y\right) + \sum_{y=1}^{3} NT_y \cdot \left(PV_y + PVS_y\right) - \sum_{y=1}^{7} N_y \cdot OC_y$$

where OC_y is the opportunity cost of student time.

A.4 Approximating Net Transfers and Dropouts

In steady state, the net number of transfers out and dropouts from a university at any given class standing may be approximated through a comparison of the number degrees awarded with the number of credit hours taught at each level. In particular, we can exploit the fact that four years of instruction, consisting of 30 instructional hours each, with coursework structured sequentially from the freshman through senior year are required to complete a bachelor's degree.

For each degree awarded, for each transfer out after completion of the senior year, for each transfer out after the junior year, and each transfer out after the sophomore year, the freshman year must be completed. Therefore, the net number of students transferring or dropping out after completion of the freshmen year can be approximated as follows:

$$ANT_1 = H_1/30 - DA - ANT_4 - ANT_3 - ANT_2$$

where ANT_y is the approximate number of students transferring or dropping out after completion of year y, H_1 is the number of instructional hours the university provides at the freshman level and DA is the number of bachelor's degrees awarded.[1]

Similarly, the students transferring or dropping out after completion of the sophomore year can be approximated as follows:

$$ANT_2 = H_2/30 - DA - ANT_4 - ANT_3$$

where H_2 is the number of instructional hours the university provides at the sophomore level.

Similarly, the net number of students transferring or dropping out after completion of the junior year can be approximated as follows:

[1] Although we generally expect ANT_4 to be close to zero, we allow for the possibility that students transferring out or dropping out may take senior-level courses.

$$ANT_3 = H_3/30 - DA - ANT_4$$

where H_3 is the number of instructional hours the university provides at the junior level.

Similarly, the net number of students transferring or dropping out after completion of the senior year, but without completing a degree, can be approximated as follows:

$$ANT_4 = H_4/30 - DA$$

where H_4 is the number of instructional hours the university provides at the senior level.

For purposes of evaluating the university's educational production, ANT_3 and ANT_4 can be combined to obtain an approximation of the net number of upper-level transfers out and dropouts.