WHITE PAPER

Department of Economics, University of New Mexico

Understanding the Undergraduate Value Proposition at the University of New Mexico

Rajan Bishwakarma and Robert P. Berrens

July 7, 2018

R. Bishwakarma is a Ph.D. student, and R. Berrens is a professor in the Department of Economics, University of New Mexico. All errors and opinions expressed are solely our own. Research support was graciously provided through a 2017-18 fellowship to R. Bishwakarma by the Center for Regional Studies, at the University of New Mexico. An early version of this research was presented to the UNM Budget Leadership Team (BLT) in Fall 2017. We appreciate useful early comments on preliminary research from various BLT members and UNM Regent Tom Clifford.

Executive Summary

To help broaden discussions beyond simple college affordability and rising tuition, the objective of this investigation and econometric analysis is to explore UNM's Main Campus undergraduate value proposition. Expressed as the difference between what they can expect to get spent on them (average annual student-centered expenditures per FTE), and what the average full-time undergraduate student actually pays in tuition and fees, ***UNM represents an exceptional undergraduate value proposition***. This annual difference was $14,500 in 2016-17, and in constant 2017 dollars it ranged from approximately, $13,500 to $15,500 over the prior decade, despite significant fiscal challenges at UNM.

Viewed as a ratio, annual student-centered expenditures (the sum of instructional, academic support, and student services) per FTE to annual out-of-pocket costs for tuition and mandatory fees for the average full-time, degree-seeking undergraduate remained more than 10/1 in 2016-17; this ratio eroded slightly in 2017-18 with changes to the NM Legislative Lottery Scholarship, but may partially recover with changing scholarship payouts in 2018-19. To place in context, student-centered expenditures at UNM are approximately 86 percent of the national average for four-year public institutions (The College Board, 2017d), 72 percent for large research universities (Carnegie classifications R1 and R2), and 91 percent of the average for our NM Higher Education Department peer universities; further, when comparing with the national average of out-of-pocket tuition and fees, the average, full-time UNM undergraduate pays 39 percent of the national average for *all* four-year public colleges and universities (The College Board, 2017a). Finally, this strong undergraduate value proposition at UNM is connected to evidence that the average 20-year return on investment (ROI) to a UNM degree is at or above the national average, while the levels of student debt and percent of students with debt are both below national averages.

This strong undergraduate value proposition is driven by several factors: (i) NM state support for higher education to UNM has declined in real terms over the last decade, but remains strong relative to other states; (ii) the NM Legislative Lottery Scholarship continues to contribute to a very low net price for many UNM students; and (iii) internally, despite some high-profile concerns, UNM Main Campus has done a good job of protecting and directing spending into key student-centered expenditure categories, and keeping administrative expenditures in check, relative to industry benchmarks.

To understand how student-centered expenditures are connected to student success outcomes (retention, graduation rates, and early career salaries), we investigate using a 2015 national, cross-sectional sample of research universities (R1 and R2). Controlling for other factors, our econometric analysis demonstrates statistically significant positive relationships between various (aggregated and disaggregated) student-centered expenditure variables and various student success outcome measures. For example, faculty salaries (the primary component of instructional expenditures) are shown to always be a statistically significant and positive determinant across all student-success outcome measures (retention, graduation rates and early career salaries), with a relatively large marginal impact. In percentage terms, average UNM faculty salaries remain significantly lower relative to HED peer comparisons and our sample comparisons (85 percent for the R1-Public university sample, and 86 percent for the full set of research universities [R1+R2]). Further, academic support and student services expenditures are also shown to be positive and statistically significant determinants for select outcomes measures. The level of expenditures on education-related services clearly matters for student outcomes. To place in context, UNM significantly trails its R1-Public universities comparisons on these expenditure levels, but is higher (and often much higher) than all other public colleges and universities in NM.

To be clear, for some measures of student-success outcomes UNM appears to be under-performing with respect to the predictions from econometric models (e.g., significantly so for the six-year graduation rate). However, internal UNM data show significant recent improvement in the key measure of four-year graduation rate (now 29%), which almost exactly matches the expectation of our best-fitting econometric model for an R1-Public research university matching UNM's characteristics. The implication is that ***UNM is making cost-effective use of resources in producing four-year graduation outcomes*** for students, families and other stakeholders.

Table of Contents

1 Introduction

Expressed as the annual average difference between what they can expect to get spent on them as undergraduate students, and what they are responsible for paying (for educational services), the University of New Mexico (UNM) represents an exceptional undergraduate **value proposition**. Perhaps not surprisingly, this value proposition is neither broadly recognized nor well understood. Sorting through combinations of price and quality has become an increasingly difficult task for students and their families (e.g., Massy, 2016; Archibald and Feldman, 2017). For a growing percentage of prospective students, choosing a college requires incurring student debt, and represents perhaps the first major economic decision of their lives. Hence, it is critical to be able to offer them a detailed answer to the question: what value can they expect to get for their money?

While only one of the several value propositions offered by a large public research university, the objective of this investigation and econometric analysis is to explore the undergraduate value proposition, with a focus on the UNM Main Campus. After reviewing trends at UNM in student-success outcomes, pricing (tuition and fees), and core expenditures, we offer our measure of the undergraduate value propostion. As one of many possible measures with varying limitations, we focus on the annual average difference between student-centered expenditures (i.e., the sum of instructional, academic support, and student services expenditures) per full-time equivalent (FTE) student and the average net price (tuition and mandatory fees) paid by a resident, full-time, degree-seeking undergraduate. If student-centered expenditures are to be taken as a benefits proxy or indicator, then it is important to link these expenditures (and the activities they represent) to the outcomes of interest. Thus, we build on a production function approach and prior evidence (e.g., Webber and Ehrenberg, 2010) to implement a vareity of

econometric models using a national (US), cross-sectional sample of over 220 large research univeristies for 2015.

Econometric results show that various measures (aggregated and disaggregated) of student-centered expenditures (i.e., instruction, academic support, and student services) are positive statistical determinants of the primary student-success outcomes we want to produce: retention, graduation rates (four- and six-year) and early-career earnings. We use our best fitting econometric models to explore the question of how UNM performs given current levels of expenditures, while controlling for student, institutional and state characteristics. Of note, recent improvements in the four-year graduation rate at UNM appear to almost exactly match the expectation of our best-fitting econometric model for an R1-Public research university with UNM's characteristics. Finally, along the way we also explore issues and questions related to: the level of student debt; the net present value of a UNM degree (and return on investment); and the range of expected costs for further improvements in student-success outcomes.

Rising tuition captures headlines, as students and their families bear a greater share of the financial burden for attending public colleges and universities. This emergent pattern in the state of New Mexico (NM) over the last decade or more is similar to that seen in the majority of the US states, albeit to a somewhat lesser degree in NM. As NM confronts the challenge of financing higher education, new models of self-sufficiency are being investigated for the public research universities (e.g., Massy, 2016; State Higher Education Executive Officers [SHEEO], 2017). Legitimate questions about affordability must be balanced with consideration of the value propositions the universities generate and ways to protect them from being eroded.

Despite rising tuition and fees, and attendant cost-shifting onto students and families, we argue that the exceptional undergraduate value proposition offered by UNM remains one of the best economic investment opportunities that many NM residents will ever be presented with. A

primary motivating concern is that inordinate focus on affordability, or largely misplaced concerns about student debt, will discourage rather than encourage many prospective students and families from accessing this exceptional value proposition. We think it is critically important to begin to shift this conversation (e.g., see Barnds, 2012). At the same time, the ongoing challenges for UNM are to continue to provide broad public access to this value proposition, continuously demonstrate that we are efficiently allocating resources towards student-centered activities, keep administrative and institutional support expenditures in check against accepted benchmarks (e.g., American Council of Trustees and Alumni [ACTA], 2017), and meet or exceed expectations for student-success outcomes (i.e., retention and graduation rates).

2 Background

Over the last decade, declining state support in New Mexico has increased the burden on students and their families to pay for access to higher education. At the state level, New Mexico has been and continues to be highly supportive of higher education (SHEEO, 2017), albeit with a highly-distributed campus system that is often seen as relatively inefficient (New Mexico Legislative Finance Committee [LFC], 2017), given significant economies of scale in administrative and institutional support costs. At the flagship state university, the recent change trend in state support is seen in a 10 percent cumulative reduction, in nominal terms, over the 10 year period from 2008-09 to 2017-18 in annual Instruction and General (I&G) state appropriations to the University of New Mexico (UNM), Main Campus, Academic Affairs.[1]

---

[1] To summarize reductions in state appropriations to UNM, we begin most broadly, including the UNM Health Sciences, Branch Campuses and the Main Campus (including Academic Affairs, and Institutional Support Services [e.g., KNME-TV, Athletics and Research and Public Service Projects). Over the 10-year period, Fiscal Year (FY) 2008-09 to FY 2017-18, there was approximately $43 million in reduced state appropriations annually (from $334,842,800 to $291,823300, with an aggregate reduction of -12.84%).

Narrowing to UNM Main Campus, Academic Affairs, under the direction of the Provost's Office, over the 10-year period, FY 2008-09 to FY 2017-18, there was approximately $19 million in reduced state appropriations annually (from $194,525,100 to $175,823,200, with a compound annual growth rate of -1.12%). While the decadal trend is downward, it masks some up-and-down variability, where there has been an 8.81% cumulative reduction in just the last two years (FY 2015-16 to FY 2017-18); this translates into a $15.44 million annual reduction to Main Campus, Academic Affairs (from $191,264,000 to $175,823,200).

Staying with the UNM Main Campus, Academic Affairs, the two combined primary revenue streams are: (i) state appropriations; and (ii) tuition and fees paid by students. Combined, the FY 2008-09 budget was $280,400,027, with 69% from state appropriations and 31% from tuition and fees. By FY 2017-18, this had grown in nominal terms to $310,977,997, with 57% from state appropriations and 43% from tuition and fees. Starting from a smaller proportion of the total, tuition and fee increases have had to increase by a larger percentage (compound annual growth rate of +5.54% over the 10-year period, 2008-09 to 2017-18 to partially replace lost state appropriations). Using FY 2018-2019 budgeted projections, the combined revenues are expected to be $316,193,000.

We can look at the net overall change to the Main Campus, Academic Affairs budget, over the last decade. In nominal terms, the pooled Main Campus, Academic Affairs budget grew by $30,577,970, with a compound annual growth rate of 1.16%. This compound annual growth rate of 1.16% can be compared to the CommonFund Higher Education Price Index (HEPI), which grew at a rate of 1.75%. Thus, in inflation adjusted real terms the Main Campus, Academic Affairs budget has lost ground over the decade at a CAGR about -0.6%.

If we take into account budget projections for FY 2018-2019, then in real terms (constant 2017 dollars, using the HEPI) there is missing $30 million dollars in annual revenues for the UNM Main Campus, when combining I&G state appropriations with pooled tuition. (From $280 million to $316, but requiring about $345.5 million to have stayed constant over the 11 years.)

State appropriations to Academic Affairs I&G is the slice of overall state support that is most directly tied to delivery of UNM-Main Campus educational services, and the 10 percent cumulative reduction to this slice is slightly less than the overall 12.4 percent reduction to UNM-Main Campus, which includes all the auxiliary and general administrative components (exclusive of the UNM Health Sciences Center [HSC]).

This loss of state appropriations to Main Campus, Academic Affairs has been incrementally replaced by increasing tuition and fees, which has shifted the percentage dependency on state appropriations from 69 percent in 2008-09 to 57 percent in 2017-18 (and again projected to by 57% in 2018-19 projected budget). These tuition and fee increase have been steep for students in percentage terms (given that tuition and fees started as a smaller proportion of the budget), with around 5 percent annual growth rate. But, in real terms the Academic Affairs budget has lost ground, at a compound annual rate of about -0.6 percent over the prior decade. Further, this represents only part of the changing pattern of state support for higher education in NM, and its impact on students. There have also been recent reductions in (although it is currently expected to partially increase back in academic year 2018-19) in the percentage of tuition covered from the NM Legislative Lottery Scholarship (NMLSS) program, which supports about 40 percent of the undergraduates at UNM. If we take into account budget projections for FY 2018-2019, then in real terms (constant 2017 dollars) relative to FY 2008-09 there is now an approximate annual reduction of $30 million dollars of available revenues for the UNM Main Campus, when combining I&G state appropriations with pooled tuition.

This shifting of a greater slice of the costs of higher education from state taxpayers onto students (and their families) mirrors broad trends that have been seen across most states. The difference is that for most large public research universities the reduction in percentage reliance on state appropriations has been much larger. That is, they are much farther down a path of self-

sufficiency that is increasingly dependent on undergraduate student tuition and fee revenues to cover costs. Elsewhere, this gradual cost shifting – or altering of who pays what proportion, has played out over several decades, and has contributed to a changing landscape for public higher education.

These changes include the way colleges and universities: (i) set their posted tuition and fees, offer merit discounting, and introduce differential tuition; (ii) select the composition of its student body; (iii) alter the composition of its labor force (e.g., greater use of part-time or contingent labor for teaching, etc.); and (iv) alter expenditure patterns in delivering educational services (see discussions in: Fethke and Policano, 2012; Eherenberg, 2012; American Academy of Arts and Sciences, 2015a-d; Bowen and McPherson, 2016; Massy, 2016; Archibald and Feldman, 2017). At the same time, there has been increasing entry by new providers into the higher education marketplace, especially from the for-profit sector. Less able to rely on state appropriations, many public universities turn to marketing and branding efforts to help quality differentiate themselves as they compete for students (including, and perhaps especially, non-resident or out-of-state students who might pay at higher rates).[2] Less able to rely on state appropriations, public universities try to be nimble in their pricing patterns to capture enough revenue to cover costs (Ehrenberg, 2012), all while an externally-appointed board may control and review these pricing decisions to justifiably protect affordability for state residents. Together, all this has led to assertions that for a large public research university like UNM, traditional business-as-usual financial or budget models no longer apply, or that large public research

[2] Universities have to differentiate their products (e.g., delivering undergraduate education) to gain competitive advantage in an increasingly-crowded, and highly competitive higher education marketplace. These strategies to differentiate university experiences may be tailored to attract certain demographics and include but are not limited to pricing and financial aid (i.e., low cost to attend), employability and return on investment, undergraduate experiences, etc.

universities must be somehow "re-engineered" or re-designed to have a sustainable academic business model (Fethke and Policano, 2012; American Academy of Arts and Sciences, 2015d; and Massy, 2016).[3]

Against this complicated background, a natural question for current or prospective students and their families in exploring UNM might be: *How good of a deal are we getting?* As students and their families are being asked to shoulder a bigger proportion of the burden of paying for college, are monies at UNM being directed towards student success – sustaining or enhancing student outcomes? Or worse, are students paying more for less? Across a growing array of post-secondary education options, there may be a tendency to simply focus on the posted tuition (where only a small fraction of students might ever pay this full rate), or highly visible college rankings (often based largely on the characteristics of recent cohorts of incoming students), or perhaps athletic, social or cultural aspects, etc. These are all considerations. But, economic considerations are still critical parameters, especially in a state badly in need of increased investments in people (or what economists call human capital) and improved economic development, though sometimes harder to sort through. This difficulty holds whether it be external observers in the larger community, or prospective students. Further, it is widely recognized that understanding combinations of price and quality are increasingly difficult in higher education (e.g., Massy, 2016; Archibald and Feldman, 2017). This adds uncertainty to choosing a college, and makes it difficult to assess how a college or university is performing.

From the university's perspective, in helping students and their families sort through these choices, the question is what value proposition(s) are being offered? Or, how might we

[3] The academic business model, as described by Massy (2016), creates multiple values from the perspective of an institute within its primary mission of educating citizens, preservation and exchange of knowledge and culture, affordability and diversity, research and scholarship, etc.

even render such a proposition? For example, if a typical first-time undergraduate student enrolled at UNM and began paying $1,560 in 2016 (in constant 2017 dollars) out-of-pocket (excluding grants but not loans) annually in tuition and fees, then what should they expect to happen – in terms of their annual slice of resources expended on them, and then how might this connect to expected outcomes?

The objective of this analysis is to investigate what we will refer to as the UNM Main Campus undergraduate *value proposition* (Dranove and Marciano, 2005; Barnds, 2012; and Massy 2016). Our approach includes the following steps: (i) review recent trends at UNM in critical student outcome measures, such as retention, the four-year graduation rate, and the six-year graduation rate; (ii) review recent trends in expenditure categories at UNM, using broad, national standard reporting categories for cores expenses; (iii) review recent trends in both the posted tuition and fees, as well as the average net price for tuition and fees that students actually pay at UNM, in both nominal and real terms (constant 2017 dollars), including a discussion of affordability and debt; (iv) articulate the undergraduate value proposition that UNM offers, by comparing per full time equivalent (FTE) expenditures annually on student-centered activities against the net price for tuition and fees that an average full-time student pays, and to show the trend in this comparison over the last decade, in real terms (constant 2017 dollars);[4] (v) econometically estimate models of retention rate and graduation rates (separately for four-year and six-year), using a 2015 national, crosss-ectional sample of 222 research universities including UNM, to show the effect of expenditure categories, while controlling for student

[4] The full-time equivalent (FTE) of students is a single value providing a meaningful combination of full-time and part-time students. It is calculated as:

FTE = full-time enrollment headcount + multiplying factor * part-time enrollment headcount.

Where, the multiplying factor is 0.403543 for public universities and 0.392857 for private not-for-profit universities (U.S. Department of Education National Center for Education Statistics [NCES], 2016).

characteristics and other factors; (vi) econometrically estimate models of median early career salaries, using the same national, cross-sectional sample of research universities including UNM, to show the effect of expenditure categories, while controlling for student mix and other factors. The latter two steps (v and vi) allow us to make comparisons to see how UNM fares, relative to modeled expectations. We close with discussion and conclusions.

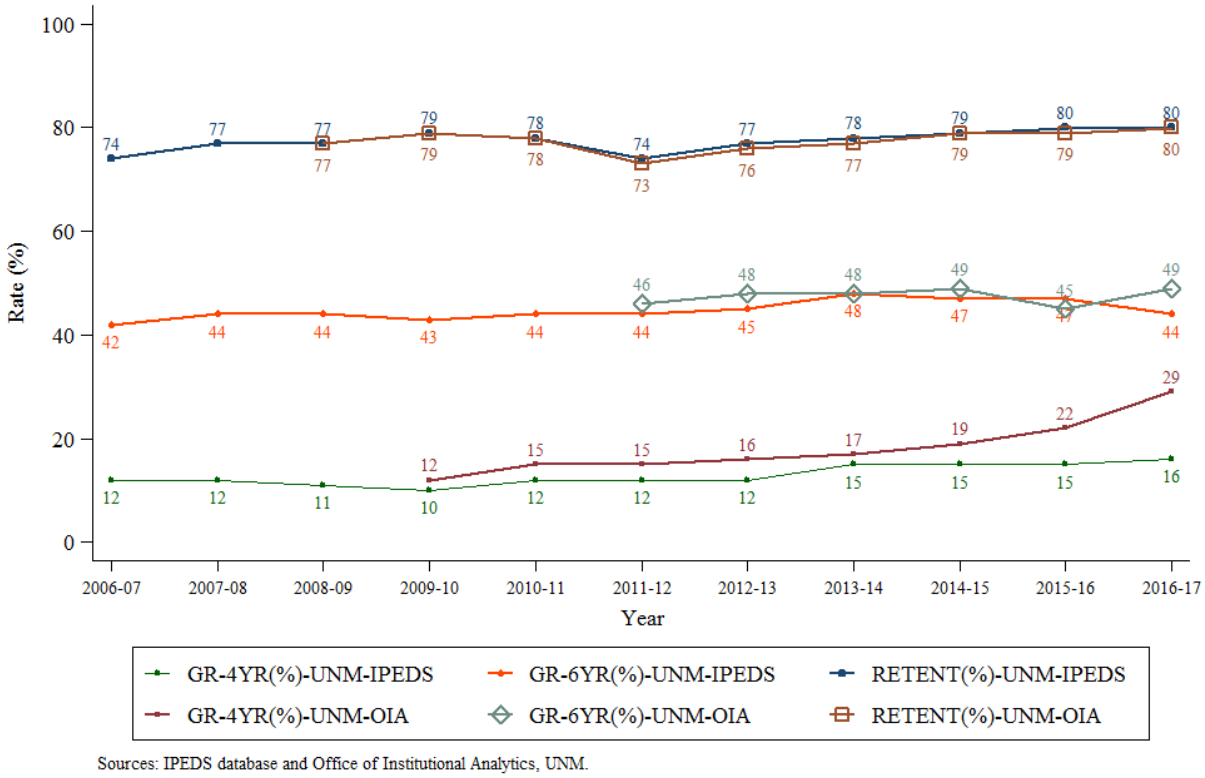
3 Recent Trends at UNM

To better understand the undergraduate value proposition at UNM, we first begin by reviewing some key trends. Institutional inputs and outcome measures are both key focal areas when it comes to understanding the "quality" of undergraduate education (National Academies of Sciences, Engineering, and Medicine, 2016). We review UNM-Main Campus trend in outcomes (student success measures), inputs (as represented by core expenditures in critical categories), pricing trends, (tuition and fees), and close with a discussion of affordability and student debt.

3.1 Outcomes

Starting with the three student-success outcomes, in Figure 1, we depict trends in the four-year graduation rate (GR-4YR), six-year graduation rate (GR-6YR) and retention rate (RETENT) for the UNM-Main Campus from 2006-07 to 2016-17 using both the Integrated Postsecondary Education Data System (IPEDS) and the data published by the Office of Institutional Analytics (OIA) at UNM (UNM-OIA). Contrasting any notion of declining student outcomes, on several measures UNM has progressed over the past 11 years, with some yearly variability. The retention rate has increased by six percentage points (or 8%), from 74 percent to 80 percent. The six-year graduation rate shows a two percentage point (4.7%) increase over the 11 years. The four-year graduation rate shows a four percentage point (33%) increase over the 11 years.

Figure 1: Trends in Four-Year Graduation Rate (GR-4YR), Six-Year Graduation Rate (GR-6YR) and Retention Rate (RETENT) for Degree Seeking Undergraduates at University of New Mexico – Main Campus



Sources: IPEDS database and Office of Institutional Analytics, UNM.

While these are all positive, turning to the internal OIA data, rather than provisionally-reported IPEDS data, the recent progress in the critical, four year graduation is both notable, and worthy of national attention.[5] For the cohort entering in AY 2013-14, the four-year graduation rate is at 29 percent, which is 12 percentage points higher compared to the cohort enrolled three years prior. The presumption here is that this increase in the four-year rate may transmit into the six-year rate (as perhaps beginning to show Figure 1 for 2016-17), and that if these improvements

[5] In Figure 4, the IPEDS data and OIA-UNM data have different values particularly for four-year graduation rate. Although OIA reports by entering cohort year and IPEDS reports by graduation year, both data must have same values. The minor discrepancies we observe between two data sources occurs as there are always a few retroactive changes after the data have been reported to IPEDS. Data for AY 2015-16 and 2016-17 are provisional data – meaning institutions may submit revised data in subsequent data collection year which are edited and published as a revised version. This can explain the variation we observe between UNM-OIA and UNM-IPEDS.

are sustained and reported, then the IPEDS reported-data for UNM will catch up with the OIA-based results.

Although the four-year graduation rate based on OIA data points towards where UNM wants to be, we cannot disregard the fact that relatively lower graduation rate adds financial burden not only to the students and their families (including forgone wage from additional time to graduate) but to the institution and the state. One of the underlying causes for lower graduation rates is resource constraints to both students and institution.[6] From a broader national perspective, students drop out or work extended hours to pay for the colleges (DeRuy, 2015) and this is more pervasive among Hispanics and Native American students (Shapiro et al., 2017).

Nationally, there is sustained evidence that students from lower income households are less likely to graduate or more likely to take longer to graduate; and the graduation gap is wider than the enrollment gap among low income versus high income households (NCES, 2015). To help illustrate the connection between household income and student outcomes, we look at an overly-simplified relationship. Using data from over 220 research universities in the US, we present the simple binary relationship between the percentage of federal need-based Pell Grant recipients (PELL%), as a crude proxy for family income background, with three student-success measures. Figures 2, 3 and 4 present the relation between PELL% with retention rate, four- and six-year graduation rates, respectively, for first-time, full-time students based on IPEDS data.[7]

---

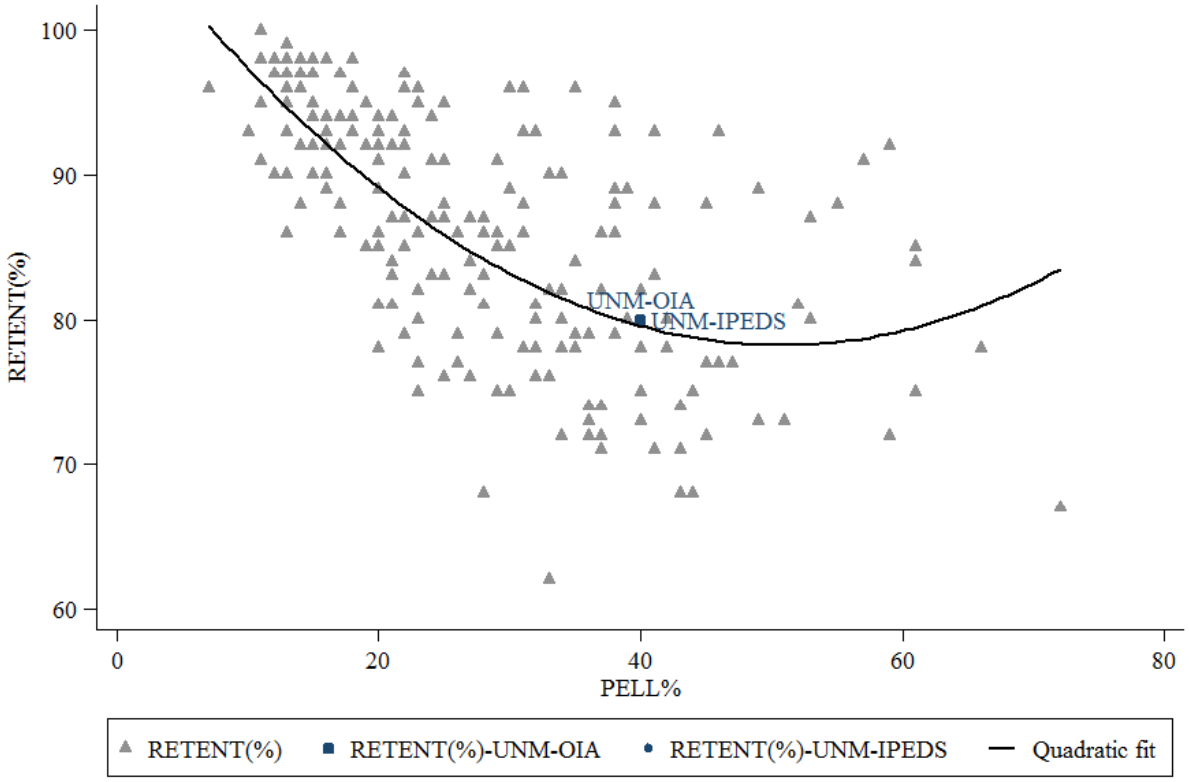
[6] Other factors include college preparedness, availability of critical resources, gender, career goals, etc.. In addition, expected graduation rates are lower for minority or under-represented groups (Shapiro et al., 2017).

[7] We run a linear regression of student success measures (i.e. RETENT, GR-4YR and GR-6YR) on PELL% and (to allow for non-linearity) the quadratic of PELL% using IPEDS data for AY 2014-15. The grey triangles represent the scatter plot of the actual values from our sample. Econometrically, we can represent the model in the following functional form:

$$Y_i = \alpha_i + \beta_i PELL\%_i + \gamma_i (PELL\%)_i^2 + \epsilon_i,$$

Where Y is the either the RETENT, GR-4YR or GR-6YR for an institution, i. α and ϵ are the intercept and the error term (Stata Corp, 2015). This model assumes quadratic influence of PELL% (i.e., the effect is at a decreasing rate).

Figure 2: Actual Retention Rate as of Fall 2015, and Percent of Students Receiving Pell Grants for Academic Year 2014-15, for R1 and R2 Universities



Note: Curve is plotted to raw data using *qfit* command from StataCorp.
Source: IPEDS and OIA-UNM.

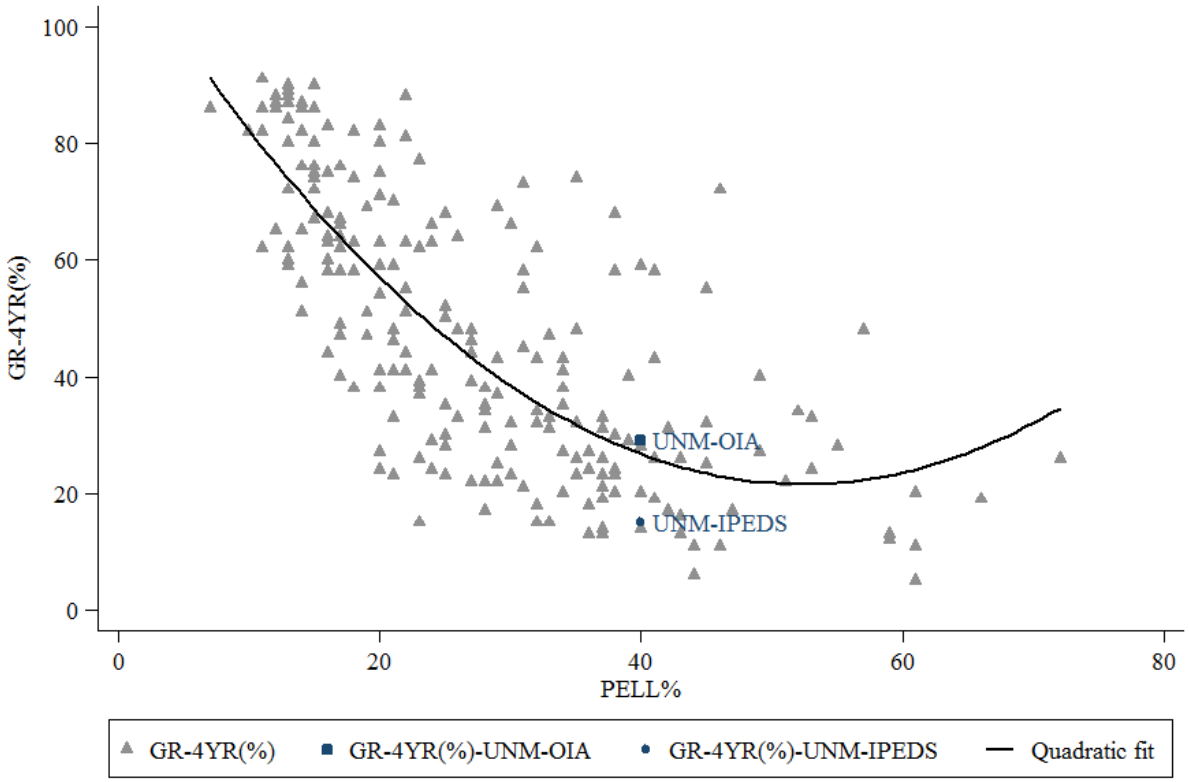
In Figure 2, we present the relationship between retention rate (RETENT) and the percentage of students receiving Pell grants (PELL%) for the academic year (AY) 2014-15 for our sample. This sample consists of (i) Doctoral Universities with the highest research activity (R1), which includes, UNM, and (ii) Doctoral-granting universities with higher research activity (R2), as classified by the Carnegie Commission on Higher Education. As expected, the figure illustrates the inverse correlation between RETENT and PELL%, i.e., a higher percentage of Pell Grant recipients in an institution leads to lower retention rate. The anticipated level of retention

---

The solid line represents the predicted values from the linear regression. A larger vertical distance between UNM value and solid line means greater difference in predicted vs. actual graduation rate.

rate for a given PELL%, as represented by the solid line, suggests that UNM is performing better than the expectation (Figure 2). In Figure 3, showing the fitted relationship between four-year graduation rate (GR-4YR) and PELL% for the AY 2014-15 for our R1+R2 sample, the performance of UNM depends on the data source. According to the IPEDS data, UNM is underperforming relative to the expectation, i.e., the actual GR-4YR is lower than the predicted GR-4YR. Considering the internal OIA data, current GR-4YR exceeds what the model predicts. Figure 4 shows the relationship between six-year graduation rate (GR-6YR) and percentage of students receiving Pell Grants (PELL%) for the AY 2014-15 for the R1+R2 sample universities; regardless of the data source. UNM is slightly underperforming the predicted value.

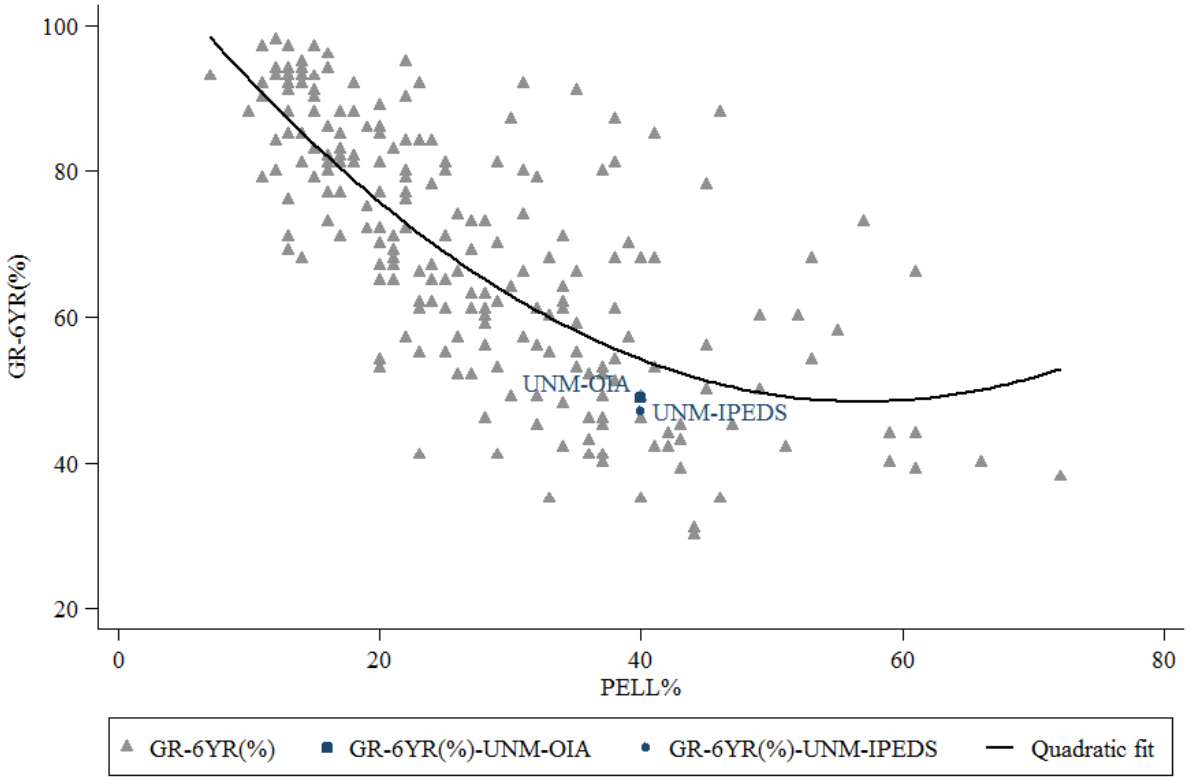
Figure 3: Actual Four-Year Graduation Rate as of August 2015, and Percent of Students Receiving Pell Grants for Academic Year 2014-15, for R1 and R2 Universities



Note: Curve is plotted to raw data using *qfit* command from StataCorp.
Source: IPEDS and OIA-UNM.

The general results in Figures 2, 3 and 4 support the notion that family income characteristics matter when it comes to student success (and this is critical to a low-income state like New Mexico). Further, while this simplified initial exploration is somewhat mixed, the *prima facie* case is that UNM is generally performing near expectations. But, the major limitation of this initial set of relationships, which do not adjust for a fuller set of student or institutional characteristics, is that it is a naïve representation of much more complex relationship. Of particular interest for this analysis is how internal spending patterns, across key categories, matter in affecting student outcomes, while controlling for other factors.

Figure 4: Actual Six-Year Graduation Rate as of August 2015, and Percent of Students Receiving Pell Grants for Academic Year 2014-15, for R1 and R2 Universities



Note: Curve is plotted to raw data using *qfit* command from StataCorp.
Source: IPEDS and OIA-UNM.

3.2 Core Expenditure Categories

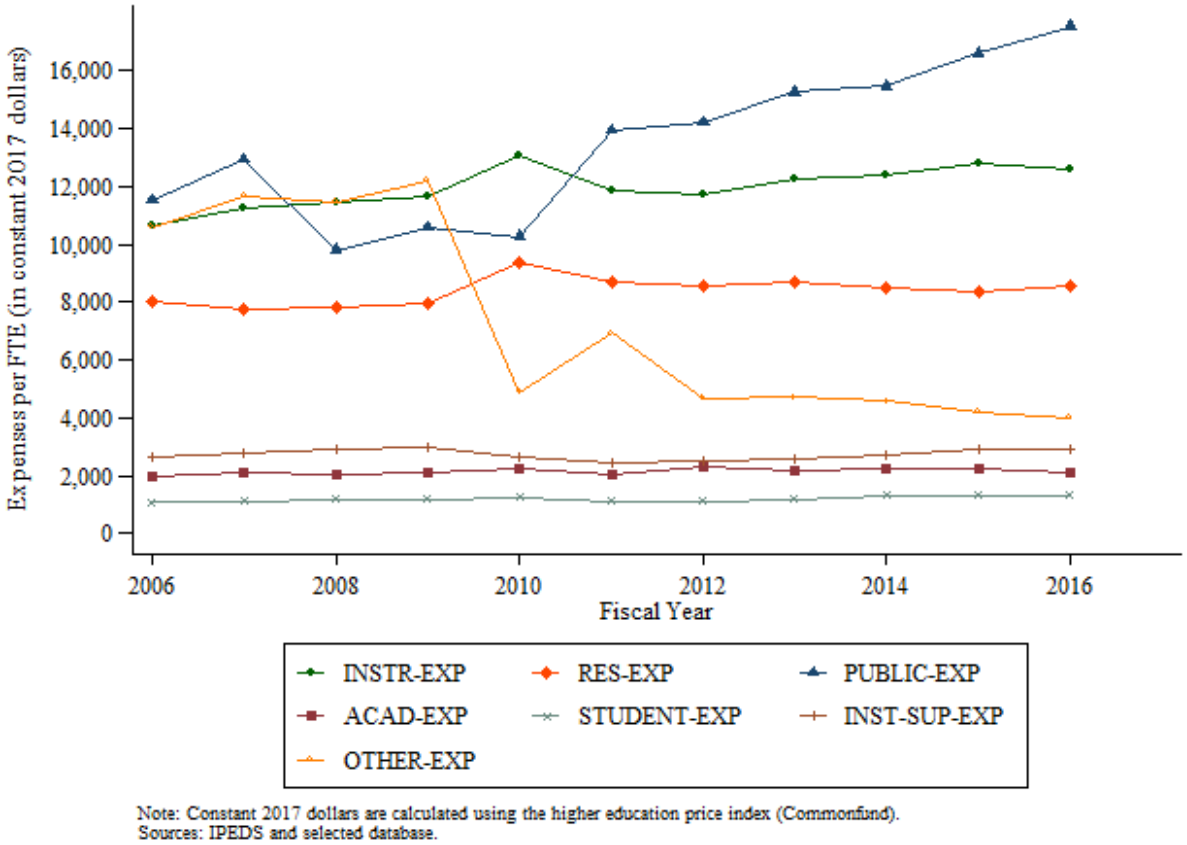
We turn next to exploring the trends in core expenditures, particularly student-centered expenditures, which are critical to enhance student-success outcomes (Webber and Ehrenberg, 2010; National Academies of Sciences, Engineering, and Medicine, 2016). This is crucial because a gradual decline in state financial support leaves UNM with limited alternatives. That is, in order to maintain the current level of student-centered expenditures, UNM has to generate replacement revenues through tuition and fees (only partial over last decade), or internally reallocate spending towards student-centered expenditures (e.g., through substitution, use of reserves or depreciation of capital).

Figure 5 provides the trends in core expenditure categories, per FTE of students, for the last ten years in constant 2017 dollars.[8] What we refer to as "student-centered expenditures" (i.e., the sum of instructional expenses [INSTR-EXP], academic support expenses [ACAD-EXP], and student support expenses [STUDENT-EXP]) are generally increasing as an aggregate over the years, except around fiscal year (FY) 2009, where we see some fluctuations (perhaps due to the economic recession of 2008). Disaggregating, from FY 2006 to FY 2016, the INSTR-EXP, STUDENT-EXP, and ACAD-EXP increased by 18, 24 and 10 percent, respectively. Comparatively, the most prominent negative change has been on the OTHER-EXP (62%), and the biggest positive change is on the PUBLIC-EXP (52%), where these two broad, catch-all

[8] Expenditures incurred in academic institutions are broadly grouped into seven categories, namely, instructional expenses (INSTR-EXP), academic support (ACAD-EXP), student services expenses (STUDENT-EXP), research expenses (RES-EXP), institutional support expenses (INST-SUP-EXP), public service expenses (PUBLIC-EXP) and other expenses (OTHER-EXP). Detailed definition of each expenditure categories can be found in the Integrated Postsecondary Educational Data System (IPEDS) online glossary (NCES, 2016). A short summary is available in Table 2.

categories have essentially offset each other. The smallest positive change, only by 7 percent, has been on the RES-EXP.

Figure 5: Core Expenses Trends for University of New Mexico – Main Campus



Note: Constant 2017 dollars are calculated using the higher education price index (Commonfund).
Sources: IPEDS and selected database.

Given loss in real revenues to UNM Main Campus over the preceding decade, the evidence from Figure 5 nevertheless indicates that UNM avoided any reduction in student-centered expenditures per FTE. This supports the argument that UNM has kept a strong focus on its undergraduate educational mission over what has been a difficult financial decade. At a surface level, we take this as a positive result for UNM. But, what is unclear without further exploration is whether this has been realized through an internal reallocation of resources, elimination of inefficiencies, covered through use of savings and depreciating of capital (e.g.,

reduced building renewal and replacement expenditures), or some combination. Thus, we encourage further investigation.

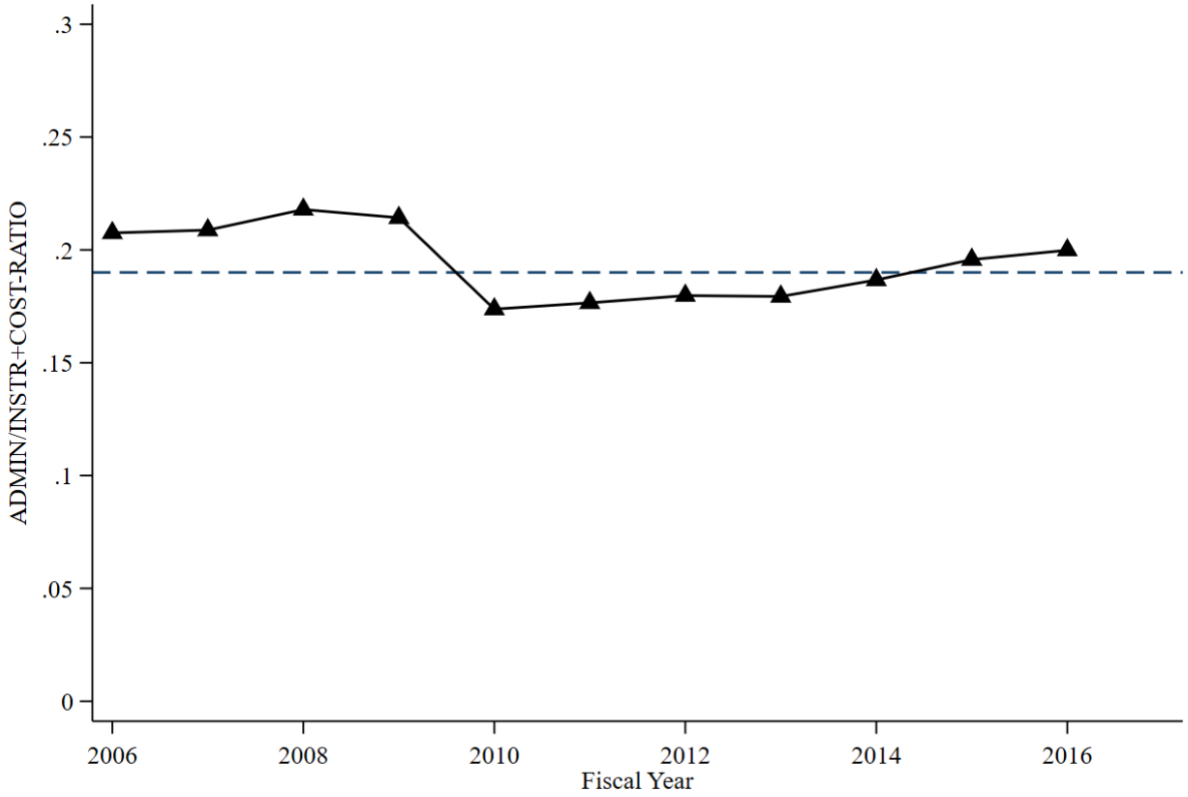
To some extent, the core-expenditure patterns reflect how an institution of higher education allocates its limited resources. Beyond that, understanding the operating cost in relationship to educational-related expenditures show the priorities of the institutions (i.e., primary mission of educating) and institutional efficiency. For universities like UNM, this is important in two ways. First, operational cost are reflective in tuition and fees, thus, the institution draws scrutiny from parents and students. Second, being a public university demands higher accountability as it receives state funding. Thus, a primary question is whether UNM efficiently allocates its limited resources to achieve its primary mission (see discussion in LFC, 2017).

As a starting point for exploring resource allocation, the American Council of Trustees and Alumni (ACTA, 2017) has recently offered one measure of benchmarking against industry standards for general administrative costs compared to more directly-focused instructional expenditures at a university. Figure 6 displays recent trends in ACTA's preferred ratio of Administrative Costs (Institutional Support (INST-SUP-EXP, per FTE) to Instruction-Related Costs (INSTR-EXP + ACAD-EXP, per FTE)[9] (ADMIN/INSTR+COST-RATIO). Over last decade at UNM, the ratio hovers between 0.17 to 0.22; i.e., UNM spent 17 to 22 cents on administrative costs for every dollar it spent on instructional and academic support costs. As shown, for UNM Main Campus, over the last decade this ratio fluctuates slightly above and

[9] Note that the ACTA (2017) version of "Instruction-Related" costs leaves out the category of student services expenditures, which we include in our SC-EXP measure.

below to the benchmark of 0.19, set by American Council of Trustees and Alumni (ACTA) for R1 universities with relatively small enrollments (ACTA, 2017).

Figure 6: Ratio of Administrative Costs (Institutional Support, per FTE) to Instruction-Related Costs (Instructional Expenses + Academic Support, per FTE) – University of New Mexico – Main Campus



Note: 2016 benchmark set by American Council of Trustees and Alumni (ACTA) for R1 universities with samll enrollment.
Source: IPEDS.

Our inference is that UNM Main Campus has done a relatively good job in keeping its general administrative costs in check, against this particular industry benchmark. But, economies of scale in general administrative costs are clearly present in higher education, and recent declining enrollments at UNM over the last several years are reason to watch this measure extremely closely going forward.[10]

[10] The ACTA (2017) administrative cost ratio has also been applied in NM (see LFC, 2017). For comparison, given widely distributed public institutions of higher education in NM, in Appendix Table A3, we

3.3 Pricing: Tuition and Fees

Before exploring the value proposition, an essential step is to look at trends in some important, but limited pricing measures that focus on affordability. Most concepts of affordability are based on what college should cost, not what students can afford to pay (Lumina Foundation, 2015). Often the conversation on college affordability revolves around the "sticker price" (i.e., posted tuition), which in many instances is often taken as a signal of quality (i.e., a higher price is associated with better quality). Price discounting, often for merit or other student characteristics, results in few students paying the full sticker price, and the degree of price discounting varies great across institutions. Further, this sticker price alone, without room and board, books, etc., does not accurately reflect college affordability (Blagg et al., 2017). Unfortunately, many prospective students rule out colleges based on their sticker price (ACTA, 2017; DiSalva, 2017), which may or may not include room and board or other expenses.

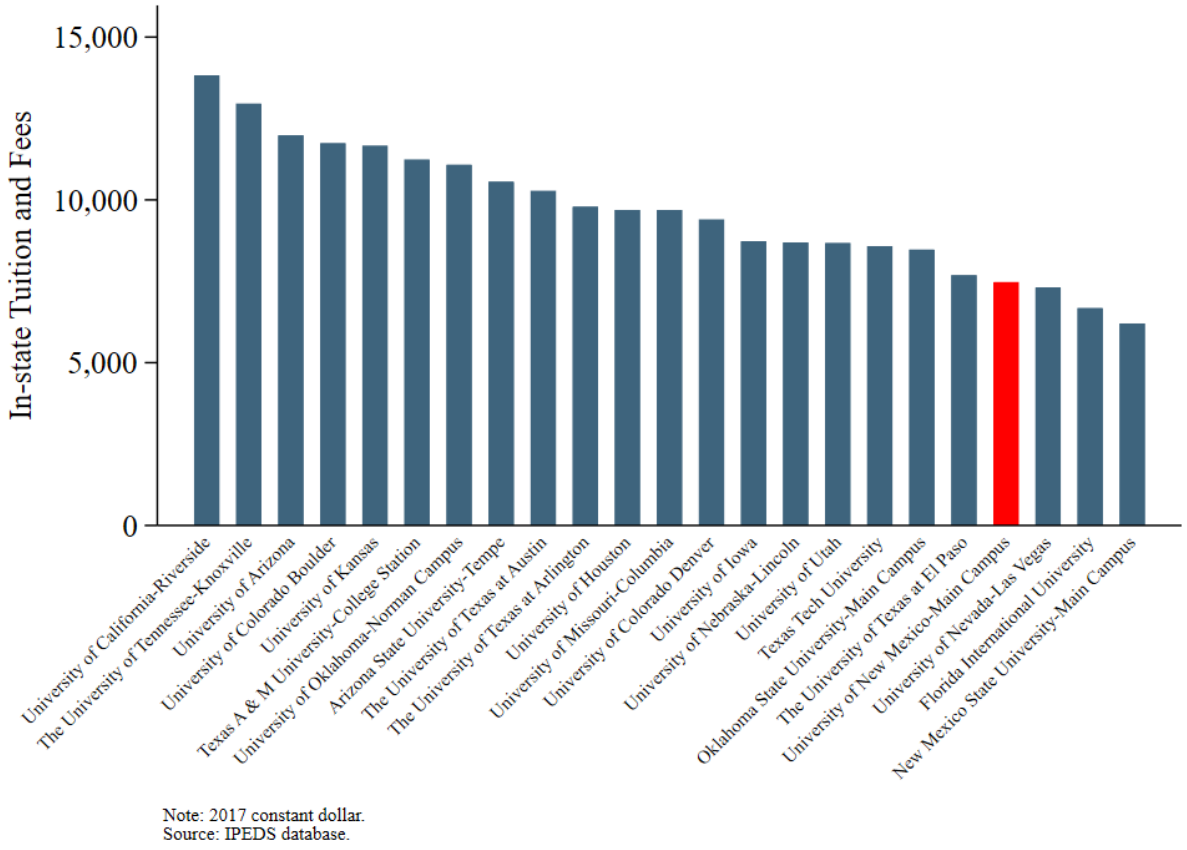
To begin we look at "sticker price" comparisons for UNM, recognizing that while commonly focused on public debates and discussions, sticker price conveys limited information about what students actually pay, which complicates any comparisons. Nonetheless, in Figure 7, we compare the sticker price among the 22 peer universities of UNM, as selected by the NM

---

illustrate the typically much higher ADMIN/INSTR+COST-RATIO for the many small public institutions in NM. For FY 2015, UNM has slightly higher ratio (by 0.0057) than the benchmark set by American Council of Trustees and Alumni (ACTA). Further, economies of scale appears to be clearly present, in Appendix Figure A1, where we plot 2015 ADMIN/INSTR+COST-RATIO with undergraduate population (UG-POP), i.e., this shows economies of scale at larger universities. Notably NMSU, our in-state peer university, has slightly lower ratio even though UNM has larger undergraduate enrollment. However, the final caveat for UNM Main Campus, is that our IPEDS data includes some HSC educational expenditures and student counts, and there is generally no accepted standardization (excluding versus including) for how this occurs across the many large public research universities with a health sciences center (some treated separately, and some not in IPEDS). Thus, supporting the concept of benchmarking generally, we urge caution in relying solely on this initial measure.

Higher Education Department (HED).[11] Despite complexity in measuring affordability, a comparison of UNM's undergraduate, full-time tuition and fees rate for AY 2016-17 against the 22 peer universities shows that UNM has the fourth lowest (with only University of Nevada – Las Vegas, Florida International and New Mexico State University lower).

Figure 7: Full-Time, In-State Tuition and Fees Rate for AY 2016-17 for Peer Universities of UNM



Note: 2017 constant dollar.
Source: IPEDS database.

We can further compare sticker price for tuition and fees with the net price. The out-of-pocket tuition and fees are the actual amount students pay for their education. Due to various external scholarships and grants, and the standard practice of price discounting (e.g., for merit

[11] Peer institutions are selected as a means to provide benchmark for various analyses and assessments of the institutions. NM-HED selects these universities based on similar geography, demography and academics. Peer institutions used for IPEDS comparisons are different from NM-HED peer institutions (UNM-OIA).

awards, etc.), the posted tuition and fees (the sticker price) at any university are not what students typically pay out-of-pocket. The difference, sticker price minus any award, grants, scholarship or price discounting, is referred to as the net price – the actual out-of-pocket tuition and fees by paid undergraduate students. For UNM students, significant components of external grants and scholarships include the both the federal Pell Grant, and the state's New Mexico Legislative Lottery Scholarship (NMLSS). However, the focus here is not on the net price all inclusive (e.g., including room and board, books from commercial vendors, travel, etc.). Instead, the focus is on the net price for tuition and fees, which is the effective price that each university is charging an individual student for attending and receiving educational services.[12]

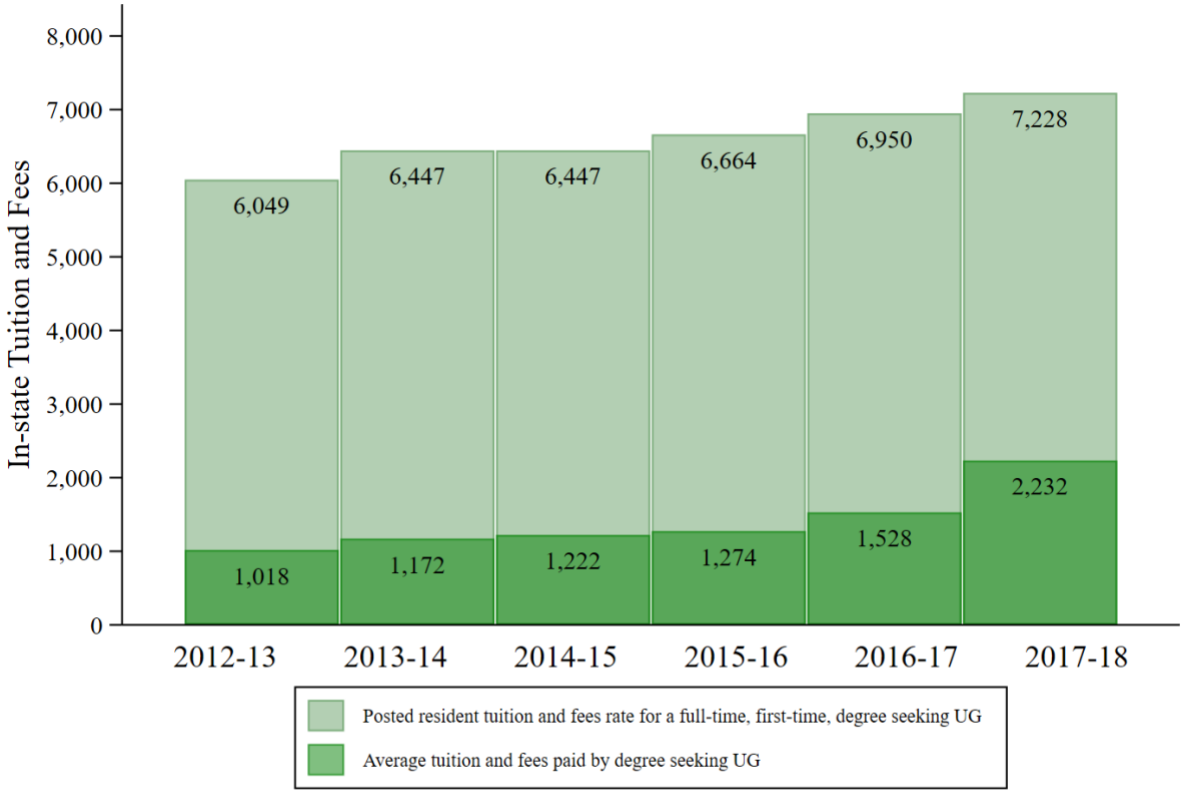
To understand net price at UNM, Figure 8 presents trend information at UNM in nominal dollars, while Figure 9 presents the same trends in constant 2017 dollars. Figure 8 presents the trends over time for the posted tuition and fee rate, and the actual amount paid, on average, by full-time, degree-seeking undergraduates. The prices are in nominal dollars. The net price is between 17 to 22 percent of the sticker price. Comparing net to sticker price ratio of four-year public institutions in 2016, an average undergraduate at UNM pays 22 percent of the sticker price whereas the national average, for public four-year universities, is 41 percent (The College Board, 2017a).[13] At many large public universities, this gap is driven by the common practice of merit discounting. At UNM, the gap is heavily driven by the effect of the NM Legislature Lottery

[12] Of course, the net price of tuition and fees represents only a slice of the full cost of college attendance. Students incur additional costs on books, transportation, room and board, etc. Room and board charges are rising faster than inflation (Blagg et al., 2017). Similarly, the college text books and supplies has increased exponentially in the last decade (Diem, 2012).

[13] For AY 2016-17, the average published tuition and fees for full-time in-state undergraduate at a public 4 years institution is $9840 and net tuition and fees is $4,010 (The College Board, 2017a).

Scholarship (NMLSS); but even with the NMLSS, this comparison shows that UNM clearly uses merit discounting much less than the typical large public university).[14]

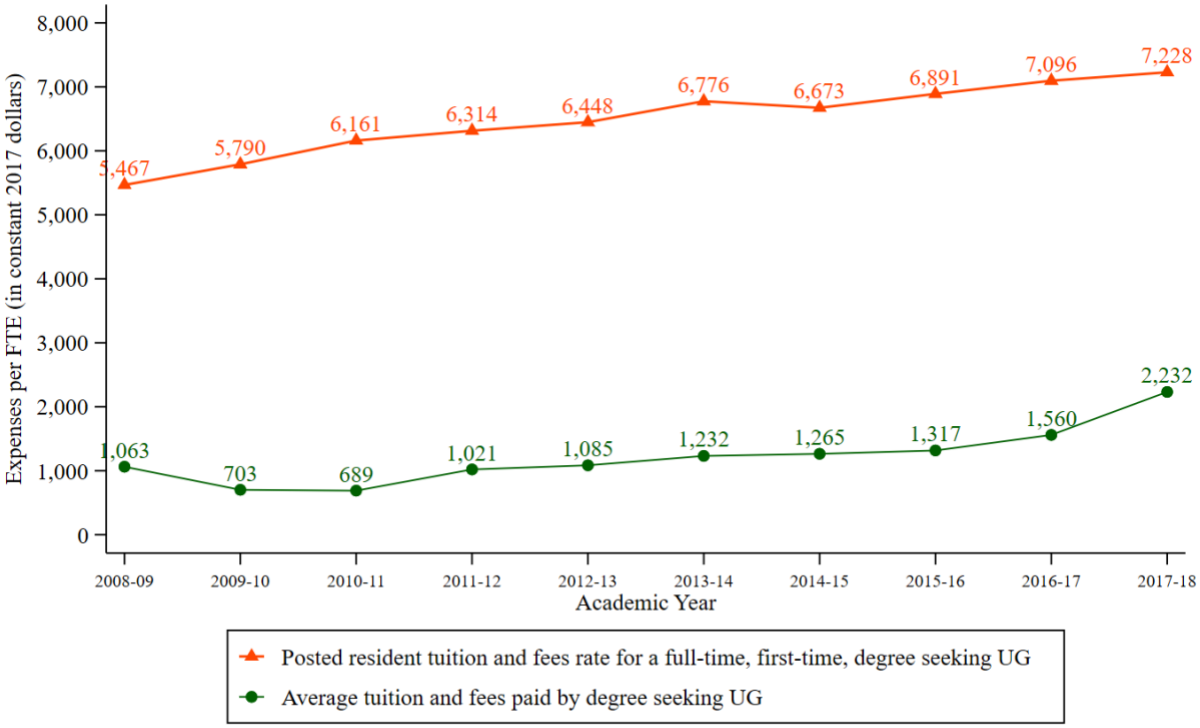
Figure 8: Trends in Nominal Average Tuition and Fees Paid by Degree Seeking Undergraduates, and Posted Undergraduate Resident Tuition and Fees at University of New Mexico – Main Campus



Note: Nominal dollars. 2017-18 is the projected value.
Source: Bursur's Office, UNM.

[14] The New Mexico Legislative Lottery Scholarship (NMLSS) is a merit based scholarship, but has historically been applied with very modest eligibility criteria. NM residents qualify for the NMLSS if they earn a high school diploma or equivalent in New Mexico. Students could receive the award up to seven semesters, provided they enroll full-time, continuously while maintaining a cumulative 2.5 GPA. Historically, the NMLSS had covered 90% to 100% of tuition. However, given available funds, the NMLLS only covered approximately 60 percent of tuition at UNM for AY 2017-18, but is expected to increase back to over 80 percent for 2018-2019. Not only has NMLLS reduced the financial burden for the students, NMLLS award has significantly and positively influenced graduation rates. Recent research indicates that it particularly benefits low-income, high achieving high school students, while the opposite is true for lower-achieving students (Erwin and Binder, 2018).

Figure 9: Trends in Constant 2017 dollars, for Average Tuition and Fees Paid by Degree Seeking Undergraduate and Posted Undergraduate Resident Tuition and Fees Rate at University of New Mexico – Main Campus



Note: Constant 2017 dollars are calculated using the higher education price index (Commonfund) for Posted resident tuition and fees rate, and .
Sources: Bursar's Office, University of New Mexico.

Turning to constant 2017 dollars, Figure 9 displays the recent trends in average tuition and fees paid by degree-seeking undergraduate, and the sticker price for in-state, first-time, full-time degree-seeking undergraduate in the last ten years. As shown in real dollar terms, the average tuition and fees paid by degree-seeking undergraduate students have increased by almost 47 percent from AY 2008-09 to AY 2016-17, yet it only accounts for 22 percent of the sticker price. In addition, as shown in the figure, the net price increased in AY 2017-18. The expected value for the AY 2017-18 is $2,232 which is 43 percent higher from the previous year (i.e., AY 2016-17). The sharp up-tick for 2017-18 includes a tuition increase, but also shows the clear effect of significant changes to the NM Legislative Lottery Scholarship (NMLSS). The upcoming academic year 2018-19, is harder to project for net price, as NMLLS recipients at

UNM will collect $2,294 per student recipient/semester, which is higher than previous year. This will cover roughly 85% of UNM tuition for New Mexico resident (Whitt, 2018), as opposed to roughly 60% in 2017-18

3.4 Affordability and Student Debt

While the final net price remains to be determined, UNM students are clearly seeing upward pressure on net price, and this raises concerns about affordability. There are several points of note. First, although public debate focuses on tuition and fees, we reiterate that the total annual costs of going to college for most UNM students are typically not dominated by tuition and fees, but rather other expenditures such as room and board, books and supplies, and transportation.[15] Second, it should be clear that sticker price conveys limited information and complicates any comparisons; the large gap between sticker price and actual (or net) price for tuition and fees demonstrates the increasing difficulty for many students and families in comparing across universities (Massy 2016).

Just as with any complex investment, the question is what does one hope to get for their money? Students' expectations can vary by the college or university they wish to attend, the major they choose, their performance at school, and the job market they enter, if and when they graduate, etc. For any prospective student, these are risky investments with uncertain outcomes or realized values. The investments often require some degree of borrowing in the form of student loans. Increased cost-shifting in public higher education onto students and their families, due to the move away from a *low-tuition, high-public subsidy* model both nationally and in NM,

[15] At UNM, the expected room and board is $9,864 for any undergraduate students in AY 2017-18. Although these costs vary with personal circumstances and are an estimate; nevertheless, room and board cost is higher than the posted tuition and fees (and much higher than net price paid). Likewise, estimated books and supplies cost is $1,126, and transportation is $1,892 (UNM Admissions Office). Interestingly, both costs are close to net price paid by average undergraduate in AY 2016-17.

raises legitimate concerns about rising student debt burdens. Students and their families are increasingly borrowing to finance higher education investments.

As background, currently in the US, more than 40 million people combine to collectively owe more than 1 trillion dollars in student debt (Dynarksi, 2014). But what to make of their individual investments? Much of the national media focus on this issue has been misplaced on student debt growth overall, and a possible student debt bubble or crisis (e.g., see discussion in Avery and Turner, 2012; Dynarski, 2014). A first point is that the long-term aggregate debt growth is heavily driven by long term growth (turning slightly down more recently) in the number and percent of individuals pursuing post-secondary education. In examining the total student loan origins in the US from 1992-2011, investigation by the College Board shows that growth in aggregate student debt is driven by increases in the total number of individuals enrolled in college as well as increases in the percentage of students who borrow and the amount they take out (The College Board, 2017c). More modestly, the growth in per borrower student debt in constant 2013 dollars increased from $21,200 to $25,500, and the percentage of students borrowing grew from 54% to 59%, for the period 2000-2012 at all Public 4-year universities and colleges. More recently the average cumulative debt per borrower (per degree recipient) was $26,800 (15,900), in 2014-15 (The College Board, 2017b). Concerns about student debt are exacerbated for students enrolled in the *for-profit sector*, where in 2012-13 the average student debt was $39,950 per borrower or 57% higher (versus, $25,500 in 2012-13) than for students attending public four year universities or colleges.

For the state of New Mexico, our student debt has typically been considerably below national averages. For example, as reported by the TICAS (The Institute of College Access and Success, 2017) *Project on Student Debt*, for the class of 2016, state averages for debt at graduation ranged from a low of $20,000 (Utah) to a high of $36,350 (New Hampshire), and new

graduates' likelihood of having debt varied from 43 percent (Utah) to 77 percent (West Virginia). New Mexico ranked 49th (second lowest) in terms of average student debt ($21,373) and 34th in terms of percent borrowing (55%). At UNM, most recently, our average cumulative student debt per borrower has been approximately $22,900 (with 49% of student borrowing) (PayScale, 2018). While student debt is below national average, as a state, New Mexico ranks 4th in student loan default rate at 17 percent, which is 4 percentage points higher than the national average (Urban Institute, 2018). Various data shows that the high student loan default rate in New Mexico is heavily driven by community colleges, technical schools, and for-profit institutions which are all typically much higher than the state average; whereas, the default rate for UNM was 13 percent in 2014 (U.S. Department of Education, Federal Student Aid, 2018), which is near the overall national average, but high for a large public research university. For example, comparing with HED peer universities, UNM has the second highest default rate, only lower than New Mexico State University. However, the data complication for UNM is that the Main Campus is aggregated with the full UNM system including branch campuses, which have much lower graduation rates and would typically be expected to have much higher student loan default rates. There is no standardization for whether or not branches are included in reporting of student loan default rates for large public research universities, making comparisons to our HED peers difficult.

Many prominent economists reviewing this issue are concerned that with very strong return on investment (ROI) results for higher education, student borrowing may actually not be high enough for attending public institutions (where ROIs tend to be high), while borrowing may be too much for private *for-profit* sector enrollment (where ROIs tend to be low). This perspective is captured by Avery and Turner (2012, pg. 189):

> The claim that student borrowing is "too high" across the board can—with the possible exception of for-profit colleges—clearly be rejected. Indeed, media coverage proclaiming a "student loan bubble" or a "crisis in student borrowing" even runs the risk of inhibiting sound and rational use of credit markets to finance worthwhile investments in collegiate attainment"

Similarly, Dynarksi (2014) argues that there is *no* student debt crisis in the US, and that debt levels are *not* large relative to expected payoffs; however, she recognizes a variety of possible policy improvements (e.g., extending time periods, and income-based options) for easing current restrictions on loan repayment terms.

In closing, while proportionately less so than for public universities in most other states on this measure, UNM students are increasingly paying a higher share of the cost of college. And, as noted earlier, it is argued that price and quality combinations are becoming notoriously difficult to assess for students and families (Massy, 2016) in making comparisons across college options. Further, for most students, college will likely be their first major investment decision, and one of the most important they will ever make. We have to help them make sense of whether such investments and borrowing are worthwhile. All these concerns are part of the justification for trying to convey, in transactional terms, our value proposition for undergraduates.

4 Value Proposition

It is not uncommon to hear discussions of the value proposition(s) offered by public universities and colleges. In many cases, it is argued that the value proposition for public higher education is declining or being eroded (e.g., Association of Governing Boards of Universities and Colleges, 2014). While there are multiple value propositions at any university (Massy, 2016), the undergraduate value proposition is our focus here. Understanding the undergraduate value proposition is both critical and problematic. Critical in a sense that it involves a larger share of tuition revenues and state grants. Thus, it attracts the attention of external stakeholders. Problematic in the sense that an undergraduate's goals are complex, and price and quality are difficult to compare (Massy, 2016). At its core, it has been argued that value proposition refers to some net difference between expected benefits received and costs of enrolling, and then how this compares to alternative options (Dranove and Marciano, 2005).[16] Thinking of the value proposition provides a kind of annual net benefit measure for the average undergraduate, which students and families can use to evaluate what they can expect to receive. With our focus on the UNM Main Campus, we want to examine the broadly targeted expenditures made by UNM in providing educational services to the average full-time undergraduate, against what those students typically pay out-of-pocket for those educational services.

[16] At a broad philosophical level, Kingwell (2013) sums up the value of higher education - "When it comes to valuing education, no ratings system or outcomes table can actually penetrate the mystery of why learning is good." In quantitative analysis, economists have measured the benefits of higher education. Besides personal well-being (college educated individuals are generally wealthier, healthier, and overall have better quality of life), a population with a high percentage of college education tends to produces positive externalities. For example, they are less likely to participate in welfare program or criminal activities, and are more likely to vote and be philanthropist, etc. Therefore, true expected social benefits of higher education is difficult to measure. While this literature is too voluminous to summarize here, please see McMahon (2009).

Thus, for this analysis, the annual undergraduate value proposition (VP) is proffered as the difference between what a university spends per FTE on student-centered expenditures ($SC\text{-}EXP$) and what the average full-time student pays out-of-pocket on tuition and fees ($NET\text{-}PRICE_{T+F}$).

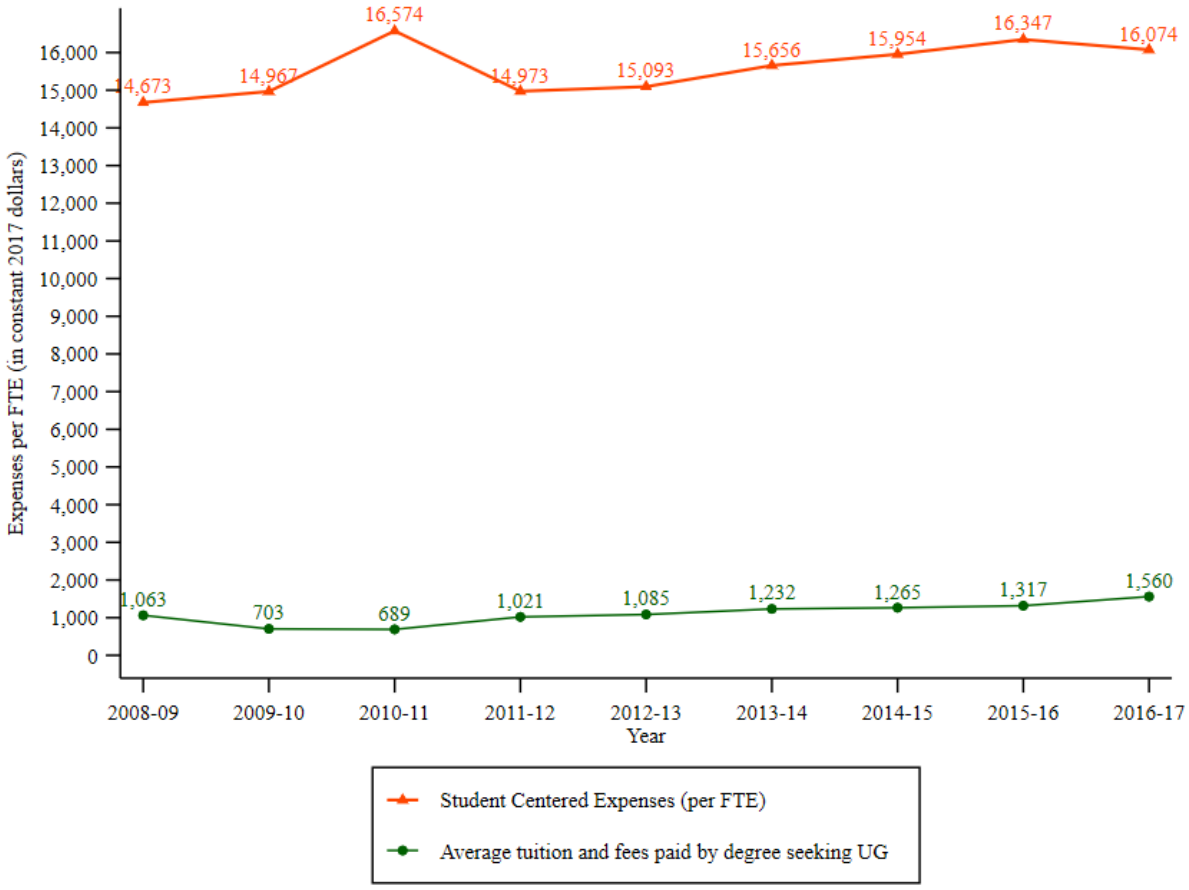
(1) $$VP = SC\text{-}EXP - NET\text{-}PRICE_{T+F}$$

Our value proposition (VP) presents an annual average for undergraduate students. Like any average measure, the question is the statistical distribution underneath it. For example, for the $NET\text{-}PRICE_{T+F}$, sources of likely variation might include: the school or program a student is enrolled in, the year in college (i.e., 1, 2, 3, 4, or more), financial aid received (e.g., whether or not a student receives scholarship), and other student characteristics.

Based on this general framework (1), we measure the value proposition (VP) at UNM. Earlier, we explored recent trends in out-of-pocket tuition and fees paid by the average UNM undergraduate (i.e., their cost of attending, exclusive of room and board, books, and other incidentals) and the trends in the core expenditures at UNM per FTE (i.e., a presumed proxy for benefits received). Now, in order to understand the value proposition, i.e., the net difference between average benefits-received proxy and costs of attending, we present Figure 10. The orange line represents the trends in student-centered expenses (SC-EXP) per FTE in constant 2017 dollars. The green line represents the average tuition and fees paid by resident, first time, full-time, degree-seeking undergraduates in constant 2017 dollars. In AY 2016-17, UNM spent $16,074 per FTE in SC-EXP (the sum of INSTR-EXP, ACAD-EXP, and STUDENT-EXP). On the other hand, the average tuition and fees paid by the full time, degree-seeking undergraduate is $1,560 (value reported in constant 2017 dollars). In terms of monetary value, UNM spent

$14,514 more than what an average undergraduate student paid, representing a ratio of 10:1 in 2016-17. Thus, one can argue that students at UNM are getting an exceptional deal.[17]

Figure 10: Trends in Student-Centered Expenses (per FTE) and Average Tuition and Fees Paid by Degree Seeking Undergraduate at University of New Mexico – Main Campus



Note: Student Centered Expenses are for the fiscal year whereas average tuition and fees are for the academic year.
Constant 2017 dollars are calculated using the higher education price index (Commonfund).
Sources: IPEDS and Bursar's Office, University of New Mexico.

In constant 2017 dollars, this annual difference was approximately $14,500 in 2016-17, and ranged from approximately, $13,500 to $15,500 over the decade 2008-09 to 2016-17, despite

[17] In Appendix Figure A2, we plot ratio of the student-centered expenses to average tuition and fees paid by degree seeking, resident undergraduate at UNM for last 9 years. The trend shows that the ratio varies significantly, ranging from 24:1 in 2010 to 10:1 in 2016. That is to say, undergraduate value proposition varies by $13,610 to $15,884. Unfortunately, the ratio is recently decreasing, generating concern for an eroding value proposition.

significant fiscal challenges. Taken as a ratio, annual student-centered expenditures to annual out-of-pocket costs for tuition and mandatory fees for the average full-time, degree-seeking undergraduate has eroded slightly in 2017-18, with changes to the New Mexico Legislative Lottery Scholarship, but remained more than 10/1 in AY 2016-17. Our review of SC-EXP and net tuition measures shows that ratios of greater than 5/1 would be extremely rare, and it is more common to see ratios of 3/1, 2/1 or even nearing 1/1. To help place in context, student-centered expenditures (the sum of instructional, academic support, and student support) at UNM are approximately 86 percent of the national average for four-year public institutions (The College Board, 2017d), approximately 72 percent of that for large research universities (R1+R2), and 91 percent of the average of HED peer universities; then, when comparing with the national average of out-of-pocket tuition and fees, the average, full-time UNM undergraduate pays 39 percent of the national average for four-year public colleges and universities (The College Board, 2017a).

The exceptional value proposition at UNM is one measure of the average annual transactional value of undergraduate educational opportunity. Arguing that this is a kind of annual net benefit measure is dependent on showing that SC-EXP (and its subcomponents) are positive determinants of relevant student success measures, as has been demonstrated elsewhere (e.g., Webber and Ehrenberg, 2010, with 2005 national data). We turn to this question next, where we include UNM in a 2015 sample of 222 large research universities, and estimate econometric models of student success measures as a function of key student expenditure categories (e.g., SC-EXP, and separately its sub-components) while controlling for other characteristics. In the following sections, we first present a modeling framework, and then estimate various econometric models of student success outcomes. Finally, this will allow us to make comparisons to see how UNM fares, relative to modeled expectations.

5 Modeling Considerations

Using a general production function approach (e.g., Webber and Eherenberg, 2010), we explore evidence for whether expenditure categories are significant (and positive or negative) in determining: (i) retention rate and graduation rates (GR-4YR and GR-6YR); and (ii) early career earnings (EC-SAL) for graduates at R1 and R2 schools. Like any goods or services, a combination of inputs (proxied by expenditure categories) are used to produce outputs (student-success outcomes), while controlling for various other characteristics (e.g., as seen in the simple binary analysis of Pell Grants effects in Figures 2, 3 an 4). The student-success outcomes depend on a number of factors, which can be broadly categorized into (i) student characteristics, including family characteristics, (ii) institutional inputs, and (iii) institutional features. Below, we discuss our modeling approach and identification strategy.

5.1 Do Expenditures Help Explain Graduation Rates at Research Universities?

Whether or not an individual student who enters UNM will graduate (G) is a binary or dichotomous outcome, where $G = 1$ (Yes) and $G = 0$ (No). The probability ($\pi(G = 1)$) that a student in a given entering cohort graduates is expressed by the graduation rate. We will call this GR, and let GR-4YR and GR-6YR delineate the 4-year and 6-year graduation rates, respectively. We follow Webber and Ehrenberg (2010) in positing that the production function for the graduation rates at school i (GR_i) can be modeled as a function of institutional inputs (X), institutional features (Y), and student characteristics (Z).[18]

[18] As discussed in Webber and Ehrenberg (2010), estimation using a production function strategy has several key assumptions. First, the model does not account for substantial geographical variation in institutional inputs (measured in terms of expenditure) as host of economic factors like cost of living, comes into play. That is to say, cost of inputs varies by geographic location. Second, students are not randomly assigned to colleges and universities, rather, high achieving perspective students go through a competitive admission process to enroll in prestigious universities (so does the university in selecting them). As these students are sorted into elite universities,

(2) $$GR_i = f\,(X_i, Y_i, Z_i)$$

Assuming a mean zero error term and a normal distribution, a reduced form of Equation 2 might be estimated via ordinary least squares (OLS) regression or a linear probability model. More appropriately, since the graduation rate is a probability, we would want to model GR as a nonlinear function, whose predictions are bound between 0 and 1. For binary data, say at the individual student level, this probability of graduating, $\pi(G_i = 1)$, can be modeled by the familiar logistic function:

(3) $$\pi(G_i = 1) = \frac{e^{f(X_i, Y_i, Z_i)}}{1 + e^{f(X_i, Y_i, Z_i)}}$$

With aggregate rate data rather than student-level observations, we treat graduation rate as a probability, and transform Equation 3 algebraically to the "log-odds model", which is then estimated with least squares regression:

(4) $$\log\left[\frac{GR_i}{1 - GR_i}\right] = f\,(Xi, Yi, Zi)$$

where this is mapped back to the probability equation in 3 (see, Johnston, 1984; Lardaro, 1993)

For our set of explanatory factors in the production function (2), the vector of student characteristics (Z) includes factors such as: the mean 25th percentile score on the ACT test math component (ACT-MATH25); a school's median household income HH-INC; and the percent of Pell Grant recipients (PELL%). The vector of institutional features (Y) includes: percent of female (FEMALE%), percent of white (WHITE%), percent of Hispanic (HISPANIC%), percent

there is less random variation in their graduation rates or other student-success outcomes. This is taken into account partially by focusing on particular Carnegie classifications (e.g., R1 and/or R2, rather than all four-year institutions). Third, the production function varies for students within same institutions. That is, same combination of inputs will yield different results among students, hence the problem arises when inferring individual or student behavior from these aggregate university level data.

of Asian (ASIAN%), percent of stem (STEM%) and an indicator variable whether an institution is the highest research activity (R1) or the higher research activity (R2). The vector of institutional inputs (X) includes instructional expenditure (INSTR-EXP), academic-support expenditure (ACAD-EXP), student service expenditure (STUDENT-EXP), research expenditure (RES-EXP), and average faculty salary (FAC-SALARY).

Assuming fitted estimation results for our conformable vectors of coefficients (i.e., $X\beta$, $Y\Phi$ and $Z\Omega$), and treating graduation rate as a probability allows us to algebraically use Equation 3 to make predictions on graduation rate for UNM (or any other school in the sample), and compare against observed results.

We follow the same approach as outlined above for all three classic outcome rates: retention rate (RETENT), four-year graduation rate (GR-4YR), and six-year graduation rate (GR-6YR).

5.2 Do Expenditures Help Explain Early Career Salaries?

We also model the relationship between median early-career earnings (0-5 years after graduation) as function of a similar set of factors in Equation 2, except that we include a vector of state characteristics (S) in state j. Chosen state characteristics mostly focus on the labor market in state j where an institution i is located. Here the dependent variable is the log of early career median salary (EC-SAL):

(5) $$Log\ (EC\text{-}SAL)\ =\ f\ (X_i, Y_i, Z_i, S_j)$$

The explanatory variables are the same as in the retention and graduation rate models, with the addition of a set of variables that attempt to control for state economy that graduates enter. The state characteristics evaluated include the state unemployment rate (UE-RATE), as well as several alternative economic indicators: rank of the state based on concentration of the

online job (LABOR-MKT-RANK) and the rank of the state based on concentration of the online ads for STEM graduates (STEM-MKT-RANK).

6 Empirical Analysis

6.1 Data

To implement our strategy for examining the determinants of student-success outcomes, we compile data from various sources. These sources include: The Integrated Postsecondary Education Data System (IPEDS), the Bursar's Office at the University of New Mexico Main Campus; Pay-Scale's College Salary Report, Chetty et al., (2017); Carnevale et al., (2015); National Conference of State Legislatures (2015); U.S. Bureau of Labor Statistics; The College Board; and the Commonfund Institute.

The primary data source, IPEDS, collects self-reported institutional-level data, by means of annual survey specific to institutional characteristics, enrollment, financial aid, admission, human resources, revenues, expenses, and student outcomes, from post-secondary institutions in the United States. It gathers data from the institutions that participate in any federal financial assistance program authorized by Title IV of the Higher Education Act of 1965, including the institutions in territories under its jurisdiction. As classified by the Carnegie Commission on Higher Education 2015, we use the provisional data for AY 2014-15 and the fiscal year 2015 for (i) Doctoral Universities with the highest research activity (R1), which includes, UNM; and (ii) Doctoral-granting universities with higher research activity (R2). R1 and R2 labels are assigned based on a measure of research activity among the institutions that award at least 20 research or scholarship doctorates (excluding professional practice doctoral degrees) in AY 2013-14. Although this creates a sample of universities comparable to UNM, our results cannot be generalized to all the many post-secondary institutions in NM or the broader US. Moreover, from the initial sample of 222 R1+R2 universities, five schools are dropped because of missing four-

and six-year graduation rate.[19] Furthermore, expenditure categories, student's characteristics, institutional characteristics and demographic characteristics are obtained from the IPEDS database. A detailed definition of these variables can be accessed at the IPEDS online glossary.[20] [21] In cases of missing average ACT scores, SAT scores are used to compute corresponding ACT scores using College Board's SAT-ACT Concordance Tables.

The second data source, Pay-Scale's 2016 College Salary Survey, is used to acquire information on STEM% and EC-SAL. EC-SAL, early career median salary, is the median salary of the alumni who have five or fewer years of experience. Pay-Scale reports the salary information for 1,388 institutions in the US (but not on the territories under its jurisdiction). Only graduates who are working in the US, employed full-time, not on active military duty, and paid an hourly wage or an annual salary are included. The report excludes equity (stock) compensation, the cash value of retirement benefits or value of other non-cash benefits (e.g., healthcare). STEM% is the percentage of Bachelor's degree awarded in the science, technology, engineering or mathematics (STEM) fields, which is computed from the IPEDS reporting. Like any sample, it comes with some concerns over sampling bias and methodology but remains one

---

[19] City University of New York Graduate School and University Center; Claremont Graduate University; Naval Postgraduate School; Rockefeller University and Teachers College at Columbia University.

[20] The definition can be accessed at https://surveys.nces.ed.gov/ipeds/VisGlossaryAll.aspx. A shorter version of the definition is provided in the summary statistics tables.

[21] A limitation of using IPEDS's expenditure data stems from the fact that institutional expenditure varies from institution to institution in how it is collected and reported (Pike et al., 2011). For example, Webber and Ehrenberg (2010) mention that departmental research expenditures that are not externally funded are reported by some institution within the instruction expenditure categories, whereas other institutions report them within research expenditure categories. Accordingly, public schools report expenditure following the guideline of Governmental Accounting Standards Board (GASB), whereas private schools (including private not-for profit) use the Financial Accounting Standards Board (FASB). These two methods may create differences in how certain revenues and expenses are reported (Pike et al., 2011). For details on how these accounting standards alter core expenditure reporting, see NCES (2017b).

of the largest and most prominent national salary data sources for comparing institutes. For example, the larger schools have the bigger sample size as the sample size varies from 30 to 20,000. The median sample size for the included institutions is 489 profiles. The schools are broken down by the degree levels, thus excludes the alumni who pursue or receive an advanced degree.

Information on household income is collected using online resources from Chetty et al.. (2017). Chetty et al. (2017) computed the median annual household pre-tax income when a child was age 15-19 using income tax return (1040 forms) and third-party information returns (e.g., W-2 forms, unemployment benefits, etc.) using the administrative data from Internal Revenue Service. The income is adjusted to constant 2015 dollars using urban Consumer Price Index (CPI-U). From this rich dataset, the authors calculate the school's median household income. One drawback is that some branch campuses like University of California system have the same household income.

The U.S. Bureau of Labor Statistics (2016) website was used to assemble data on unemployment rate (UE-RATE) and urban consumer price index. Likewise, LABOR-MKT-RANK and STEM-MKT-RANK are extracted from Carnevale et al., (2015). Carnevale et al. (2015) use online job ads as a real-time proxy for labor demand using the labor market data provider, Burning Glass Technologies (BGT). BGT browses more than 15,000 websites and compiles job ads into one comprehensive database. States are ranked based on the concentration of online job ads for college graduates in a state relative to the state's employment of college graduates in relation to the national average.[22] In addition, the information on the whether or not

[22] There are major criticisms in using online job ads as a reflection of the actual labor market: (i) the online job openings only captures 60-70% percent of the total job opening; (ii) certain occupations are more likely than others to have online job posting (e.g., educational biased is present in the online job markets posting as the ads

a state legislature uses any type of performance-based funding for higher education, PER-FUND, is extracted from the National Conference of State Legislatures.

Finally, the information related to the University of New Mexico, such as the average tuition and fees paid by degree-seeking undergraduate students, posted undergraduate resident tuition and fees, retention rate and graduation rates, was provided by the Bursar's Office and the Office of Institutional Analytics (UNM).

6.2 Descriptive Statistics

Table 1 provides definitions and descriptive statistics for our four outcome variables of interest. RETENT is the retention rate for full-time undergraduate students from their freshmen to sophomore years. The mean value for the full R1+R2 sample is 86.09 percent, and 87.95 percent for the R1-Public sample. With a 2015 value of 80%, UNM falls within one standard deviation of both the full R1+R2 sample and R1-Public sample values.[23] GR-4YR is the four-year graduation rate for undergraduates. With a 2015 value of 15 percent, this is below the national average for R1+R2 schools of 47.02 percent, and the R1-Public mean value of 47.52 percent. We test the equivalency of the mean with the UNM value using one sample *t*-test, and rejected the null hypothesis of equivalency at 1 percent significance level (See Table A2). GR-6YR is the six-year graduation rate, where the mean for the full sample is 68.51 percent; the mean for the R1-Public sample is 71.19 percent. For UNM the 2015 value is 47 percent, which is statistically significant lower at the 1 percent significance level. Finally, EC-SAL is the median

distribution is skewed towards math and science than towards agriculture; the ads are more targeted towards college educated job seekers than high school graduates.) Another issue with the data requirement is: only 52 percent of online job ads have education requirements. For complete information on the methodology see Carnevale et al., (2015). Also, there is no rank for the institutions in the territories under US jurisdiction like Puerto Rico.

[23] As discussed earlier (see footnote 4), there is a slight variation between the data from IPEDS and the information provided by the OIA-UNM. Except when stated, we report using IPEDS data.

early career salary in 2015 for sample graduates of a university, as taken from Pay-Scale data for the year 2015-16. For the full R1+R2 sample, the median value is $51,014 ($52,748 in constant 2017 dollars), with a standard deviation of $6,897. The median value for the group of R1-Public schools is $49,749 ($51,440 in constant 2017 dollars), with a standard deviation of $4,575. For the year 2015, the UNM value is $40,700 ($42,084 in constant 2017 dollars).[24]

Table 2 presents definitions and descriptive statistics for the core expense categories as classified in the IPEDS database. INSTR-EXP is the instruction expenses per FTE in thousands of 2015 dollars. For UNM, the 2015 value is 12.38 (12.83 in constant 2017 dollars) which is within one standard deviation for full R1+R2 sample and 19 percent less than the mean of the R1-Public sample. The second variable of interest is the ACAD-EXP – academic support expenses per FTE in thousands of 2015 dollars. The mean value for the full R1+R2 sample is 5.56, and 4.43 for the R1-Public sample (5.76 and 4.59 in constant 2017 dollars). For UNM, the value is less than 50 percent of the mean of the R1+R2 sample and R1-Public universities and is at 2.15 (2.23 in constant 2017 dollars).

[24] Unless stated, we test the equivalency of sample mean with the UNM value using one sample *t*-test, and reject the null hypothesis that the mean of sample is equal to UNM value (See Appendix Table A2).

Table 1: Outcome Variables

Variable	Variable Description	R1+R2 Mean Values (st. dev) [N]	R1-Public Mean Values (st. dev) [N]	UNM Value in 2015
RETENT	The full-time retention rate is the percent of the fall full-time cohort from 2014, minus exclusions from the fall full-time cohort, that re-enrolled at the institution as either full- or part-time in the fall 2015. IPEDS, Fall Enrollment component.	86.09 (8.380) [217]	87.95 (6.154) [80]	80
GR-4YR	Graduation rate, 4 year, is the percent of students entering an institution as a full-time, first-time, degree seeking undergraduate students who completed a bachelor's degree within 4 years by August 2015. The Integrated Postsecondary Education Data System (IPEDS), Graduation Rate Component.	47.02 (23.36) [216]	47.52 (16.69) [80]	15
GR-6YR	Graduation rate, 6 year, is the percent of students entering an institution as a full-time, first-time, degree seeking undergraduate students who completed a bachelor's degree within 6-years by August 2015. IPEDS, Graduation Rate Component.	68.51 (17.24) [217]	71.19 (12.66) [80]	47
EC-SAL	Early career median salary of surveyed graduates from an institution in $2016 dollars. Includes full-time employees with five years of experience or less in their career or field. Only includes salary or hourly wage, bonuses, profit sharing tips, and other cash earnings as applicable. Payscale, Inc.	51014.21 (6896.812) [197]	49748.8 (4575.3) [80]	40700

Table 2: Explanatory Variables –Expenditure Categories (N=217)

Variable	Variable Description	R1+R2 Mean Value (st. dev.)	R1-Public Mean Value (st. dev.)	UNM Value in 2015
INSTR-EXP	Instruction expenses per FTE (full-time equivalent enrollment is the sum of the institutes' FTE undergraduate enrollment and FTE graduate enrollment.) for fiscal year 2015, in thousands of 2015 dollars. Includes general academic instruction, occupational and vocational instruction, community education, preparatory and adult basic education, and regular, special, and extension sessions. Also includes expenses for both credit and non-credit activities. It excludes expenses for academic administration where the primary function is administration (e.g., academic deans). The Integrated Postsecondary Education Data System (IPEDS), Finance Component.	18.70 (17.57)	14.68 (6.012)	12.38
ACAD-EXP	Academic support expenses per FTE for fiscal year 2015, in thousands of 2015 dollars. Includes expenses that support the institution's primary missions of instruction, research, and public service. IPEDS, Finance Component.	5.563 (7.135)	4.427 (2.400)	2.150
STUDENT-EXP	Student service expenses per FTE for fiscal year 2015, in thousands of 2015 dollars. Includes expenses for admissions, registrar activities, and activities whose primary purpose is to contribute to student's emotional and physical well-being and to their intellectual, cultural, and social development outside the context of the formal instructional program. IPEDS, Finance Component.	2.900 (2.588)	1.929 (0.970)	1.253
RES-EXP	Research expenses per FTE for fiscal year 2015, in thousands of 2015 dollars. Includes expenses for activities specifically organized to produce research outcomes and commissioned by an agency either external to the institution or separately budgeted by an organizational unit within the institution. IPEDS, Finance Component.	10.35 (14.87)	9.562 (6.214)	8.082
INST-SUP-EXP	Institutional support expenses per FTE for fiscal year 2015, in thousands of 2015 dollars. Includes expenses for day-to-day operational support of the institutes, like general administrative services, central executive-level activities concerned with management and long range planning, legal and fiscal operations, space management, employee personnel and records, logistical services such as purchasing and printing, and public relations and development. IPEDS, Finance Component.	5.349 (5.498)	3.350 (1.478)	2.843
PUBLIC-EXP	Public service expenses per FTE for fiscal year 2015, in thousands of 2015 dollars. Includes expenses for activities established primarily to provide non-instructional services beneficial to individuals and groups external to the institutions. IPEDS, Finance Component.	2.062 (2.849)	3.266 (3.911)	16.04
OTHER-EXP	All other core expenses per FTE for fiscal year 2015, in thousands of 2015 dollars. Includes scholarships and fellowships expenses, and other expenses and deductions not included in core expenses (i.e., instruction, student services, academic support, research expenses, and institutional support expenses). IPEDS, Finance Component.	1.866 (2.929)	2.015 (1.257)	4.063

Table 3 presents two expenditure variables constructed from the core expenses categories outlined in Table 2. SC-EXP, the sum of INSTR-EXP, ACAD-EXP, and STUDENT-EXP, is the student-centered expenses per FTE in thousands of 2015 dollars. We call it the student-centered expenditure because these expenses are directly related to the core academic mission of instruction and student services, which in turn influence student success outcomes. Compared to the mean value of $27,161 ($28,138 in constant 2017 dollars) for R1+R2 universities, UNM spends $15,779 ($16, 347 in constant 2017 dollars) which is 33% less than the mean of R1-Public sample.

Table 3: Explanatory Variables –Constructed Expenditure Information (N=217)

Variable	Variable Description	R1+R2 Mean Value (st. dev.)	R1-Public Mean Value (st. dev.)	UNM Value in 2015
SC-EXP	Student-centered expenses per FTE for fiscal year 2015, in thousands of 2015 dollars: the sum of INSTR-EXP, ACAD-EXP and STUDENT-EXP.	27.161 (23.74)	21.03 (8.348)	15.779
ADMIN/INSTR+ COST RATIO	Ratio of the INST-SUP-EXP to sum of INSTR-EXP and ACAD-EXP.	0.223 (0.101)	0.181 (0.0591)	0.196

Similarly, another constructed variable of interest is ADMIN/INSTR COST RATIO, which is the ratio of the institutional support expenses, INST-SUP-EXP, to the sum of INSTR-EXP and ACAD-EXP. It tells how much an institute spends on institutional support compared to every dollar it spends on instructional support. If the ratio is closer to zero, an institution spends less on administrative cost than what it spends on instruction which is an indicator of efficiency. While in 2015 UNM spends 19 cents on administrative costs for every dollar it spends on instruction, the ratio is lower than the mean of R1+R2 sample (the difference is statistically significant at 5 percent significance level) – meaning, compared to the sample, UNM is spending more efficiently, and it has been able to prioritize the expenses to focus on the things enhancing

student success. However, the mean of cost ratio for UNM is slightly higher than the R1-Public sample.

Table 4: Explanatory Variables – Select Student Characteristics

Variable	Variable Description	R1+R2 Mean Value (st. dev.)	R1-Public Mean Value (st. dev.)	UNM Value in 2015
ACT-MATH25	ACT Math 25th percentile score for first-time students (undergraduate) enrolled in Fall 2015 courses for credit, who are recognized by the institution as seeking a degree or occupational programs. In case of unreported ACT scores, the score was computed from SAT Math 25th percentile score using SAT-ACT Concordance Tables, College Board. (The College Board, 2009) IPEDS, Admission Component.	23.45 (4.078) [217]	23.40 (2.785) [80]	20
ACT-COMP25	ACT Composite 25th percentile score for first-time students (undergraduate) enrolled in Fall 2015 courses for credit, who are recognized by the institution as seeking a degree or occupational programs. IPEDS, Admission Component.	23.85 (3.972) [203]	23.61 (2.493) [75]	20
PELL%	Percent of undergraduate students awarded Pell grant aid for the academic year 2014-15. IPEDS, Student Financial Aid Component.	27.87 (12.54) [217]	28.54 (10.07) [80]	40
STEM%	Percent of Bachelor's degrees that are awarded in Science, Technology, Engineering and Mathematics from IPEDS data for the year 2015.	25.54 (15.85) [197]	23.84 (9.674) [80]	17
HH-INC	Median parent household income in 2015 dollars. Parent income is defined as the mother's family income plus the father's family income over the five years when the college attending child is aged 15-19 (Chetty et al., 2017).	108.8 (31.81) [217]	102.4 (17.27) [80]	73.90

Table 4 provides definitions and descriptive statistics for the student characteristics that are important in determining their academic successes. ACT-MATH25 and ACT-COMP25 are the ACT 25th percentile score for math and composition for the first-time students enrolled in fall 2015. Both samples, the R1+R2 and R1-Public, have higher mean value than UNM where UNM mean is at 20. The third characteristics, PELL%, is the percentage of undergraduate students awarded Pell Grants for the AY 2014-15. 40 percent of the UNM students received Pell Grants whereas the mean for R1+R2 is 27.87 percent and 28.54 percent for R1-Public sample. In addition to PELL%, we also include HH-INC, household income, as a measure of student's socio-economic status. HH-INC is the median parent's household income in thousands of 2015 constant dollars. Parent's income is defined as the mother's family income plus the father's family income over the five years when the college attending child was aged 15-19. Compared to the mean value of R1+R2 and R1-Public sample, the value for UNM is more than one standard deviation lower at $ 73,900 ($76,413 in constant 2017 dollars).

Table 5 presents the demographic characteristics of the student population. FEMALE% is the percentage of female students enrolled for credit during 12-months of the AY 2014-15. While the mean of R1+R2 sample being at 51.29 percent and R1-Public sample at 50.57 percent, UNM has a higher percent of student body that is female (55.25%). In terms of ethnic and racial composition, HISPANIC%, the percent of Hispanic or Latino students, is the largest group at UNM, which is about four times larger than the mean of R1+R2 sample and the R1-Public sample. Similarly, UNM serves a large percent of Native American students; compared to the mean value for the R1+R2 sample (0.549%), and R1-Public sample (0.397%), the percent of Native American students at UNM (NAT-AMER%) is 6.144 percent. On the other hand, the percent of African American (BLACK%), the percent of white (WHITE%) and the percent Asian (ASIAN%) at UNM is lower than the R1+R2 and R1-Public samples.

Table 5: Explanatory Variables – Demographic Characteristics (N=217)

Variable	Variable Description	R1+R2 Mean Value (st. dev.)	R1-Public Mean Value (st. dev.)	UNM Value in 2015
FEMALE%	Percent of female students enrolled for credit during 12-months of academic year 2014-15. IPEDS, Enrollment Component.	51.29 (7.588)	50.57 (4.772)	55.25
WHITE%	Percent of white students enrolled for credit during the 12-month period for the academic year 2014-2015. Includes a person having origins in any of the original peoples of Europe, the Middle Easter or North Africa. IPEDS, Enrollment Component.	55.89 (19.43)	56.75 (18.07)	35.59
HISPANIC%	Percent of Hispanic or Latino students enrolled for credit during the 12-month period for academic year 2014-2015. Includes a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. IPEDS, Enrollment Component.	11.01 (11.82)	11.98 (10.71)	44.63
BLACK%	Percent of African American students enrolled for credit during the 12-month period for academic year 2014-2015. Includes a person having origins in any of the black racial groups of Africa. IPEDS, Enrollment Component.	9.396 (13.67)	7.102 (6.051)	2.592
NAT-AMER%	Percent of Native American students enrolled for credit during the 12-month period for academic year 2014-2015. Includes a person having origins in any of the original peoples of North and South America (including Central America) who maintains cultural identification through tribal affiliation or community attachment. IPEDS, Enrollment Component.	0.549 (1.526)	0.397 (0.805)	6.144
ASIAN%	Percent of Asian students enrolled for credit during the 12-month period for academic year 2014-2015. Includes a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian Subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam. IPEDS, Enrollment Component.	8.623 (8.514)	10.72 (10.06)	3.053

Table 6 presents definitions and descriptive statistics for various institutional characteristics. Beside faculty to student ratio and faculty salary, which are often perceived as a quality marker, we also include the type and student population size. In our R1+R2 sample, 52 percent of the universities are the Doctoral Universities with the highest research activity (R1) while 71.4 percent of the full sample composed of the public institutions. Concerning the student population size, we include UG-POP, the unduplicated headcount for the total number of undergraduate students enrolled for credits for the AY 2014-15. For UG-POP, the mean value for the R1+R2 sample is 18,984, and the mean value for R1-Public sample is 28,654. Compared to the mean of R1-Public, UNM has fewer undergraduate headcount by almost 5,000 students. As in UG-POP, we observe similarity in the unduplicated headcount of graduate students (GRAD-POP). Moreover, FAC-SALARY is the weighted average salary of $1000 per month for the full-time, non-medical, instructional staff as of 2015. With the value of $8909 ($9,212 in constant 2017 dollars), UNM falls behind one standard deviation from the mean of the R1-Public sample. The difference is statistically significant at 1 percent significance level (See Table A2). The mean value for the complete sample of R1+R2 is $10,400 ($10,754 in constant 2017 dollars). FAC-STUDENT-RATIO, the student-to-faculty, is 19 to 1 at UNM whereas the mean value is almost 16:1 and 18:1 for R1+R2 sample and R1-Public sample, respectively.

Table 6: Explanatory Variables – Institutional Characteristics (N=217)

Variable	Variable Description	R1+R2 Mean Value (st. dev.)	R1-Public Mean Value (st. dev.)	UNM Value in 2015
R1	Indicator variable where 1 indicates R1-designated university and 0 indicates R2 - designated university. R1=Doctoral university: Highest research activity and R2 = Doctoral university: Higher research activity (Classification based on framework developed by the Carnegie Commission on Higher Education. Doctoral universities include institutions that award at least 20 research/scholarship doctoral degree (does not include professional practice doctoral levels). IPEDS.	0.525 (0.501)	1 (0)	1
PUBLIC	Indicator variable where 1 indicates public university and 0 indicates private not-for-profit university. Public: An institute whose program and activities are operated by publicly elected or appointed school officials and which is supported primarily by public funds. Private not-for-profit: An institution in which the individual(s) or agency in control receives no compensation, other than wages, rent, or other expenses for the assumption of risk.	0.714 (0.453)	1 (0)	1
FAC-SALARY	Weighted average salary $1000 per month of full-time, non-medical, instructional staff as of 2015. IPEDS, Human Resource Component.	10.40 (2.347)	10.50 (1.479)	8.909
FAC-STUDENT-RATIO	Total FTE (full-time equivalent enrollment) students not in graduate or professional programs divided by total FTE instructional staff not teaching in graduate or professional programs in Fall 2015. IPEDS, Fall Enrollment component.	15.92 (4.744)	18.23 (3.233)	19
UG-POP	Unduplicated headcount for the total number of undergraduate students, enrolled for credit, for the 2014-2015, 12 month academic year. IPEDS Enrollment.	18983.7 (11242.5)	28645.4 (9447.1)	23846
GRAD-POP	Unduplicated headcount for the total number of graduate students, enrolled for credit, for the 2014-2015, 12 month academic year. IPEDS Enrollment.	7325.5 (4830.6)	9549.4 (3638.6)	8538

Finally, in Table 7, we provide definition and descriptive statistics of the state characteristics in which the universities are located. Primarily, we are interested in two state characteristics: (i) the employment status, where a higher unemployment rate is a sign of weaker economy; and (ii) whether a state has performance-based funding model for four-year institutions, i.e., if a state has performance-based funding model, it incentivizes institutions to help student successfully complete degree program. For employment status, we provide three measures to illustrate the changing labor market. First two employment measure evaluate the online job markets, and the third measure uses the unemployment rate from Bureau of Labor Statistics. LABOR-MKT-RANK is rank of the state based on the concentration of the online job ads for college graduates in a state relative to the state's employment of college graduates in relation to the national average in the second quarter of 2013. Granted lower rank is better; New Mexico ranks 34 out of 50 US states.[25] Similarly, using the same study, we present the STEM-MKT-RANK (similar ranking but for the STEM jobs), and New Mexico occupies the last place.[26] In 2015, the unemployment rate for New Mexico (UE-RATE) was higher by one standard deviation, i.e., with the national average at 5.2 percent, New Mexico has the unemployment rate of 6.8 percent. Finally, PER-FUND is the performance-based funding for the higher education – meaning the state has laws in place for the public 4-year institutions, that the state funding is based on the performance rather than the traditional way of allocating funding based on the number of total enrollment. Almost 60 percent of the states have some form of performance-based funding legislation for four-year institutions, including New Mexico.

[25] It does not include the universities in the territories under US jurisdiction like Puerto Rico.
[26] No ranking is provided for the state of Mississippi, or US territories.

Table 7: Explanatory Variables – State Characteristics

Variable	Variable Description	All States Mean Value (st. dev.)	NM Value in 2015
LABOR-MKT-RANK	Rank of the state based on concentration of online job ads for college graduates in a state relative to the state's employment of college graduates in relation to the national average in second quarter of 2013. Lower rank is better. (Carnevale et al., 2015)	24.52 (15.12) [50]	34
STEM-MKT-RANK	Rank of the state based on concentration of online job ads for STEM graduates in a state relative to the state's employment of college graduates in relation to the national average in second quarter of 2013. Lower rank is better. (Carnevale et al., 2015)	23.56 (15.06) [49]	49
PER-FUND	Presence of performance based-funding for higher education as of July, 2015. Indicator variable where 1 indicates that an institution is located in a state that has a funding formula or policy in place to allocate a portion of funding based on performance indicators for four-year institutions. 0 = otherwise. National Conference of State Legislatures	0.596 (0.495)	1
UE-RATE	U-3 unemployment rate (people counted as unemployed if they did not work for pay during the week and are actively looking for work during the preceding 4 weeks) in 2015. Bureau of Labor Statistics	5.204 (1.456) [52]	6.8

6.3 Regression Modelling Results

6.3.1 Graduation and Retention Rates

Based on the theoretical framework of Equation 4, our econometric approach involves using Equation 6 to estimate the effect of expenditures on retention rate (RETENT), four-year graduation rate (GR-4YR), and six-year graduation rate (GR-6YR).

$$(6) \qquad \log\left[\frac{GR_i}{1-GR_i}\right] = \alpha + \beta_1 INSTR\text{-}EXP_i + \beta_3 ACAD\text{-}EXP_i + \beta_4 STUDENT\text{-}EXP_i + \beta_5 RES\text{-}EXP_i + \Phi Y_i + \Omega Z_i + \epsilon_i$$

Where, $\log\left[\frac{GR_i}{1-GR_i}\right]$ is the log-odds ratio of the outcome variables of interest for an institution i. The vector Y_i controls for various institutional characteristics, and the vector Z_i controls for the student characteristics, as they vary cross-sectionally for different universities in the sample. ϵ_i is the random error. To emphasize, using student-level data would provide greater micro-level variation due to student characteristics; however, institutional level data provides variation based on the characteristics of an institution. Ideally, student level data would better infer the individual behavior. Using student level data also alleviates the endogeneity concern (Webber and Ehrenberg, 2010).[27] Equally important, panel data method would be ideal to employ institutional or state fixed effects. Webber and Ehrenberg (2010) argue that, during four-years, there is little variability within an institution. Thus, cross-sectional estimation should produce equally robust estimations for four-year graduation and retention rates. Furthermore, the regression is weighted by the total undergraduate enrollment headcount. This takes into consideration size differences, where large universities are different than the smaller universities (e.g., should have less random variation in their graduation rates (Webber and Ehrenberg, 2010)). As an alternative, to test for sensitivities to the weighting scheme, in the Appendix (see Tables A4-A7) we also provide a full set of matching results weighted by FTE enrollment, where no qualitative differences are seen.

Table 8, Table 9, and Table 10 present the log-odds logit regression results using Equation 6 for the three dependent variables described in Table 1. The dependent variables are the log-odd ratios, which has the property of constraining the predicted value to lie between 0 and 1 (i.e., the

[27] When student-success outcomes and expenditures are at the institutional level, the various level of expenditure can endogenously determine student-success measures (Webber and Ehrenberg, 2010). For example, universities with a higher level of student-centered expenses will have higher graduation rate. In contrast, higher graduation rate also causes higher spending. As far as this reserve causality is concerned, there is no clear endogeneity even though spending is not exactly exogenous. Therefore, we ignore the any concern of endogeneity.

log-odds ratio of the dependent variable can be mapped to the probability of the event occurring – or on this case a percentage change). In Equation 6, the primary parameter of interest is β_i i.e., *ceteris paribus,* an increase in expenditure by one unit (in our case by a $1,000) increases the log of the odds of being graduated by β unit. Across alternative models, from Model 1 to Model 10, the odd-numbered models use weighted least squares (WLS) whereas the even-numbered models use ordinary least squares with robust clustered standard errors at the state level (OLS-VCE).[28]

These estimation techniques, WLS and OLS-VCE, are applied to five different model specifications. In Models 1 and 2, Equation 6 is estimated using only the three student-centered expenditures (i.e., INSTR-EXP, ACAD-EXP, and STUDENT-EXP) and the indicator variable for the type of research institution (R1). Additional covariates are added as we modify or extend the specification. For Models 3 and 4, we add RES-EXP in addition to student-centered expenditures included in Models 1 and 2. In Models 5 and 6, instead of using INSTR-EXP, we use FAC-SALARY as a proxy for INSTR-EXP[29] along with the student characteristics (ACT-MATH25, PELL% [which performed better than the income variable], and STEM %). Models 7 and 8 adds

---

[28] For an unbiased estimation, ordinary least squares (OLS) regression assumes that the error is independent and identically distributed, i.e., the standard deviation of the error term should be constant (homoscedasticity), and the errors are independent. However, in our data, we observe heteroscedasticity. For example, larger universities may have larger graduation rate, etc. To address this problem, we use two estimation techniques: (i) OLS with robust clustered standard errors at the state level (OLS-VCE) and 2) weighted least squares (WLS).

In even-numbered models, we use OLS-VCE. The robust standard error relaxes the assumption that the errors are identically distributed, while a clustered standard error at the state relaxes the assumption that the error terms are independent but correlated at the state level.

In odd-numbered models, weighted least squares (WLS) technique is used to address heteroscedasticity by transforming the error into a new distribution with constant variance. WLS allows each data point to have the proper amount of influence over coefficient estimations. Thus, we use total undergraduate population as a weight, i.e., larger institute will have higher weight and the smaller institute will have lower weights.

Often both methods, OLS-VCE and WLS, are presented as an alternative approach. Using two methods, WLS and OLS-VCE, is to address the bias-variance trade-off. OLS-VCE are unbiased but inefficient estimators, whereas, weighted least square allows the estimates that have the smallest standard error (Nascimento et al., 2010).

[29] The correlation coefficient between FAC-SALARY and INSTR-EXP is 0.8. In fact, FAC-SALARY takes a large portion of INSTR-EXP. Table A1 in the Appendix provides a correlation matrix of explanatory variables.

institutional characteristics (FEMALE%, WHITE%, HISPANIC% and ASIAN %) to previous models (i.e., Models 5 and 6). Finally, Models 9 and 10 use the complete model with the covariates (i.e., demographic characteristics, student characteristics and institutional characteristics) along with the core student-centered expenditure variables.

Table 8 presents estimates of the log-odds ratio of the retention rate (RETENT) for our entire sample. The models without any controls, Models 1 and 2, show a positive and significant effect of the expenditure categories on the log-odds of retention rate. An increase in INSTR-EXP by a $1000 per FTE, on average, increases the log-odds of retention by 0.0133 (or increases institution's retention rate by 0.5033 percentage points). Although ACAD-EXP and STUDENT-EXP are consistently significant and positive in all the specifications, adding additional covariates in subsequent models fades the influence of INSTR-EXP on retention rate.[30] However, for Models 5 to 8, where we replaced INSTR-EXP with FAC-SALARY, the effect of FAC-SALARY on the retention rate is positive and significant, i.e., increase in the weighted average salary by $1000 per month for full-time, non-medical, instructional staff increases the retention rate by by 0.52 to 0.53 percentage points (or the log-odds of retention by 0.0833 to 0.107). Besides the expenditure variables of interest, other covariates concerning student characteristics and institutional characteristics have expected effects. For example, RES-EXP does not improve the retention rate rather has a negative effect. Student characteristics like PELL% and ACT-MATH25 have the anticipated signs, i.e., increase in the percentage of students receiving Pell grants decreases the retention rate, and higher ACT-MATH25 has a positive impact. Finally, all

[30] Correlation of the regressors may cause the loss in statistical significance. It is intuitive that the core expenditures are correlated each other (See Table 1A). For example, universities that spend a large sum of money on instructional expenses also expend more on the student services. INSTR-EXP is highly correlated with ACT-MATH25. This problem of multicollinearity causes instability in the coefficient estimates. Econometrically, as long as the Variance Inflation Factor (VIF) is below 10, correlated can be used.

the models consistently predict UNM retention rate to be above 80 percent but below 90 percent when the actual UNM retention rate for the AY 2014-15 is 80 percent. The model with the largest R^2, Model 8, predicts retention rate to be 83 percent. This indicates that actual retention rate is not far off from what model predicts it to be and is statistically insignificant.

Table 8: Model Estimation Results: Log odds - Logits of Retention Rate, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.0133***	0.00814**	0.00123	0.00347					0.000720	0.00298
	(0.00343)	(0.00344)	(0.00302)	(0.00406)					(0.00300)	(0.00412)
ACAD-EXP	0.0189***	0.0124***	0.00948**	0.0107***	0.00690	0.00906***	0.00753*	0.00946***	0.00954**	0.0110***
	(0.00653)	(0.00310)	(0.00451)	(0.00277)	(0.00426)	(0.00257)	(0.00412)	(0.00232)	(0.00442)	(0.00266)
STUDENT-EXP	0.0854***	0.106***	0.0324**	0.0387**	0.0154	0.0251	0.0135	0.0180	0.0317**	0.0360**
	(0.0224)	(0.0170)	(0.0155)	(0.0161)	(0.0141)	(0.0160)	(0.0140)	(0.0158)	(0.0153)	(0.0158)
R1	0.664***	0.623***	0.341***	0.385***	0.261***	0.301***	0.289***	0.324***	0.347***	0.396***
	(0.0788)	(0.105)	(0.0630)	(0.0685)	(0.0642)	(0.0605)	(0.0643)	(0.0627)	(0.0649)	(0.0635)
RES-EXP			-0.00153	-0.00683*	-0.00240	-0.00698**	-0.00463*	-0.00777**	-0.00367	-0.00813*
			(0.00326)	(0.00369)	(0.00247)	(0.00293)	(0.00253)	(0.00329)	(0.00331)	(0.00418)
ACT-MATH25			0.141***	0.124***	0.119***	0.105***	0.114***	0.0978***	0.129***	0.111***
			(0.0133)	(0.0195)	(0.0137)	(0.0196)	(0.0144)	(0.0172)	(0.0148)	(0.0197)
PELL%			-0.00400	-0.00554	-0.00590**	-0.00684	-0.00695	-0.00932	-0.00885*	-0.0118*
			(0.00306)	(0.00554)	(0.00298)	(0.00509)	(0.00439)	(0.00617)	(0.00453)	(0.00644)
STEM%			0.000590	0.00161	-0.0000203	0.000637	0.00690**	0.00783**	0.00670*	0.00837*
			(0.00242)	(0.00249)	(0.00222)	(0.00236)	(0.00324)	(0.00370)	(0.00347)	(0.00424)
FAC-SALARY					0.0833***	0.0902***	0.0902***	0.107***		
					(0.0214)	(0.0258)	(0.0230)	(0.0262)		
FEMALE%							0.0162***	0.0164**	0.0151**	0.0152*
							(0.00589)	(0.00753)	(0.00614)	(0.00822)
WHITE%							-0.00127	-0.00363	-0.00161	-0.00400
							(0.00282)	(0.00421)	(0.00299)	(0.00402)
HISPANIC%							-0.00155	-0.00257	-0.000138	-0.000254
							(0.00310)	(0.00347)	(0.00323)	(0.00386)
ASIAN%							-0.00423	-0.0102	0.00203	-0.00323
							(0.00498)	(0.00680)	(0.00493)	(0.00726)
CONSTANT	1.103***	1.232***	-1.511***	-1.145**	-1.648***	-1.412***	-2.445***	-2.032**	-1.910***	-1.325
	(0.0669)	(0.0876)	(0.312)	(0.481)	(0.300)	(0.461)	(0.658)	(0.893)	(0.665)	(0.830)
R^2	0.587	0.619	0.830	0.850	0.844	0.861	0.853	0.873	0.839	0.860
N	216	216	196	196	196	196	196	196	196	196
Predicted (UNM)	0.8889	0.8924	0.8272	0.8309	0.8187	0.8218	0.8218	0.8281	0.8307	0.8421
Actual (UNM)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table 9 presents estimates of the log-odds logit models for the four-year graduation rate (GR-4YR). As expected, all expenditure categories are significant and positively related to the four-year graduation rate. As in retention rate, the effect of INSTR-EXP fades as we add more control variables. Despite the statistically insignificant effect of the INSTR-EXP, ACAD-EXP and STUDENT-EXP are consistently significant - meaning increasing (decreasing) academic support and student services like counseling, etc. increases (decreases) the probability of students graduating in four years. For example, in Model 8, *ceteris paribus*, increasing $1000 in ACAD-EXP increases the GR-4YR by 0.76 percentage points. These results are consistent with earlier findings by Webber and Ehrenberg (2010). Again, the RES-EXP variable is insignificant with a negative estimated coefficient meaning that the research expenses per FTE do not impact the graduation rate (against the concern that a research university may detract from undergraduate education). Finally, the preferred model, Model 8, predicts UNM GR-4YR to be 27 percent. Comparing this to current four-year graduation rate, UNM performs slightly higher (at 29%) than the predictive value, considering OIA-UNM data. [The GR-4YR is lower by 12 percentage points with the provisional IPEDS data.]

The influence of student-centered expenditure on the six-year graduation rate (GR-6YR), as in GR-4YR, is positive and statistically significant in most of the specifications presented in Table 10. As in Table 9, the covariates like ACT-MATH25 or PELL% or FAC-SALARY show the expected signs and significance. Model 8, which has the highest R-squared measure capturing 89 percent of the variability, estimates that $1000 increase in ACAD-EXP per FTE increases GR-6YR by 0.50 percentage points, *ceteris paribus*. This model predicts the UNM six-year graduation rate to be at 55 percent when the actual graduation rate was 47 percent in 2015.

Thus, given current student-centered expenditure levels, the predicted and actual GR-6YR have a difference of 8 percentage points.[31]

[31] Again, the GR-6YR, according to OIA, is 44. Please refer to Figure 1 to see the trends in graduation rates using the data from IPEDS and OIA at UNM.

Table 9: Model Estimation Results: Log odds - Logits of Four-Year Graduation Rate, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.0204***	0.00793**	0.00615	0.00169					0.00575	0.00201
	(0.00485)	(0.00369)	(0.00415)	(0.00380)					(0.00402)	(0.00382)
ACAD-EXP	0.0287***	0.0270***	0.0163**	0.0158***	0.0110*	0.0142***	0.0125**	0.0161***	0.0167**	0.0176***
	(0.00987)	(0.00446)	(0.00678)	(0.00355)	(0.00652)	(0.00346)	(0.00609)	(0.00344)	(0.00646)	(0.00346)
STUDENT-EXP	0.0849**	0.116***	0.0109	0.0125	-0.00761	-0.0176	-0.00616	-0.0195	0.0124	0.0117
	(0.0333)	(0.0396)	(0.0226)	(0.0161)	(0.0207)	(0.0167)	(0.0199)	(0.0124)	(0.0217)	(0.0151)
R1	0.731***	0.818***	0.227**	0.210*	0.109	0.0687	0.164*	0.0879	0.251***	0.198**
	(0.110)	(0.165)	(0.0875)	(0.124)	(0.0884)	(0.102)	(0.0859)	(0.0789)	(0.0872)	(0.0897)
RES-EXP			-0.00453	0.000157	-0.00258	-0.00240	-0.00820**	-0.00719**	-0.0101**	-0.00620
			(0.00478)	(0.00332)	(0.00379)	(0.00268)	(0.00371)	(0.00303)	(0.00473)	(0.00394)
ACT-MATH25			0.195***	0.195***	0.166***	0.159***	0.163***	0.149***	0.179***	0.172***
			(0.0183)	(0.0242)	(0.0189)	(0.0253)	(0.0191)	(0.0255)	(0.0193)	(0.0272)
PELL%			-0.0175***	-0.0201***	-0.0201***	-0.0221***	-0.0183***	-0.0215**	-0.0214***	-0.0255**
			(0.00414)	(0.00691)	(0.00404)	(0.00633)	(0.00585)	(0.0101)	(0.00603)	(0.0100)
STEM%			-0.0176***	-0.0196***	-0.0194***	-0.0203***	-0.00410	-0.00378	-0.00387	-0.00383
			(0.00356)	(0.00397)	(0.00330)	(0.00364)	(0.00450)	(0.00508)	(0.00482)	(0.00566)
FAC-SALARY					0.126***	0.143***	0.132***	0.158***		
					(0.0296)	(0.0367)	(0.0310)	(0.0408)		
FEMALE%							0.0381***	0.0404***	0.0356***	0.0379***
							(0.00795)	(0.00825)	(0.00826)	(0.00929)
WHITE%							0.00445	0.00287	0.00352	0.00186
							(0.00394)	(0.00654)	(0.00416)	(0.00683)
HISPANIC%							-0.00113	-0.00210	0.000649	0.00102
							(0.00413)	(0.00552)	(0.00431)	(0.00625)
ASIAN%							0.00326	0.00201	0.0116*	0.0119
							(0.00668)	(0.0125)	(0.00664)	(0.0121)
CONSTANT	-1.312***	-1.131***	-4.104***	-3.862***	-4.386***	-4.208***	-7.002***	-6.761***	-6.051***	-5.683***
	(0.0984)	(0.135)	(0.426)	(0.591)	(0.406)	(0.546)	(0.873)	(1.303)	(0.875)	(1.328)
R^2	0.507	0.529	0.794	0.825	0.810	0.843	0.833	0.865	0.817	0.846
N	216	216	196	196	196	196	196	196	196	196
Predicted (UNM)	0.4598	0.4972	0.2902	0.3050	0.2737	0.2838	0.2628	0.2669	0.2802	0.2969
Actual (UNM)	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table 10: Model Estimation Results: Log odds - Logits of Six-Year Graduation Rate, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.0153***	0.00463	0.00469	0.00214					0.00534	0.00256
	(0.00375)	(0.00505)	(0.00330)	(0.00313)					(0.00327)	(0.00332)
ACAD-EXP	0.0271***	0.0207***	0.0177***	0.0165***	0.0126***	0.0148***	0.0136***	0.0158***	0.0182***	0.0176***
	(0.00742)	(0.00325)	(0.00530)	(0.00349)	(0.00469)	(0.00362)	(0.00459)	(0.00348)	(0.00522)	(0.00358)
STUDENT-EXP	0.103***	0.137***	0.0308*	0.0437***	0.00570	0.0135	0.00986	0.0115	0.0343*	0.0447***
	(0.0253)	(0.0242)	(0.0178)	(0.0157)	(0.0153)	(0.0123)	(0.0152)	(0.0125)	(0.0176)	(0.0165)
R1	0.690***	0.738***	0.296***	0.340***	0.162**	0.195**	0.195***	0.217***	0.295***	0.336***
	(0.0888)	(0.143)	(0.0711)	(0.0967)	(0.0687)	(0.0738)	(0.0677)	(0.0670)	(0.0723)	(0.0794)
RES-EXP			-0.00442	-0.00699**	-0.00419	-0.00941***	-0.00720**	-0.0109***	-0.00826**	-0.0100**
			(0.00375)	(0.00283)	(0.00272)	(0.00331)	(0.00280)	(0.00401)	(0.00383)	(0.00403)
ACT-MATH25			0.160***	0.155***	0.125***	0.119***	0.131***	0.125***	0.152***	0.150***
			(0.0149)	(0.0217)	(0.0147)	(0.0211)	(0.0152)	(0.0194)	(0.0162)	(0.0228)
PELL%			-0.0100***	-0.0118*	-0.0131***	-0.0139***	-0.00641	-0.00778	-0.00976*	-0.0121
			(0.00342)	(0.00596)	(0.00320)	(0.00493)	(0.00463)	(0.00679)	(0.00502)	(0.00725)
STEM%			-0.00517*	-0.00638**	-0.00689***	-0.00723***	0.00194	0.00121	0.00227	0.00125
			(0.00282)	(0.00249)	(0.00243)	(0.00227)	(0.00349)	(0.00365)	(0.00396)	(0.00428)
FAC-SALARY					0.142***	0.148***	0.154***	0.172***		
					(0.0227)	(0.0282)	(0.0242)	(0.0323)		
FEMALE%							0.0223***	0.0215***	0.0199***	0.0188**
							(0.00625)	(0.00655)	(0.00685)	(0.00773)
WHITE%							0.00778**	0.00434	0.00731**	0.00331
							(0.00305)	(0.00384)	(0.00341)	(0.00413)
HISPANIC%							0.00131	-0.000238	0.00374	0.00321
							(0.00327)	(0.00381)	(0.00358)	(0.00469)
ASIAN%							0.00385	-0.00485	0.0144***	0.00599
							(0.00526)	(0.00909)	(0.00550)	(0.00912)
CONSTANT	-0.147*	-0.00560	-2.790***	-2.578***	-3.070***	-2.945***	-5.383***	-5.020***	-4.379***	-3.849***
	(0.0758)	(0.116)	(0.350)	(0.523)	(0.320)	(0.482)	(0.694)	(0.829)	(0.732)	(0.839)
R^2	0.601	0.623	0.832	0.857	0.861	0.882	0.872	0.891	0.843	0.863
N	217	217	197	197	197	197	197	197	197	197
Predicted (UNM)	.7150	.7324	.5776	.5861	.5543	.5603	.5377	.5542	.5626	.5938
Actual (UNM)	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

6.3.2 Early-Career Salary

Using the reduced form of Equation 5, in the following linear model, we estimate the effect of expenditure categories on early-career median salary, while controlling for institutional, students and state characteristics.

$$(7) \qquad Log\ (EC\text{-}SAL) = \alpha\ + \beta_1 INSTR\text{-}EXP_i + \beta_3 ACAD\text{-}EXP_i + \beta_4 STUDENT\text{-}EXP_i + \beta_5 RES\text{-}EXP_i + \Phi Y_i + \Omega Z_i + \Upsilon S_j + \epsilon_i$$

Where $Log\ (EC\text{-}SAL)$ is the log of early-career median salary, the explanatory variables are the same as in the retention and graduation rate models, with the addition of state characteristics S_j . Here the log transformation of EC-SAL reduces the extreme variations in the data (i.e., distributions are better behaved) and curtails the effects of outliers. From Model 1 to Model 10, the odd-numbered models use weighted least squares (WLS) whereas even-numbered models use ordinary least squares with robust clustered standard errors at the state level (OLS-VCE). We exploit the same five specifications used in graduation and retention rate models in addition to state characteristics.

In Table 11, we estimated the effect of separate student-centered expenditures on log of early-career median salary (EC-SAL), while controlling for student and institutional characteristics. First, while the estimated coefficient for INSTR-EXP is positive, it is always statistically insignificant. However, when alternatively using the variable FAC-SALARY, the largest slice of instructional expenditures, the estimated coefficient is always positive and significant in all the specifications where it is included. Better paid faculty produce better paid early career earners graduating from large research universities.

Further, the variable STUDENT-EXP also demonstrates a positive and significant effect on earnings, which may be due to the fact that holistic student-service support activities ranging

from career counseling, to student health services to resume building, etc. lead to higher successes in the labor market.

The effects of all other covariates are as expected, universities with a higher STEM% have the higher early-career median salary; increasing FEMALE%, on average, decreases the salary as woman continue to earn considerably less than their male counterparts. Not so much as a puzzle but rising the PELL% decreases earning which is statistically significant throughout all specifications. Finally, the predicted early-career median salary ranges from $45,000 to $50,000 while the actual value for UNM graduates is $40,700. Table 12 and Table 13 are extensions of Table 11, i.e., where we attempt to control for state-level economies that students graduate into using LABOR-MKT-RANK and STEM-MKT-RANK respectively (i.e., state characteristics).[32] While Table 12 and Table 13 show similar effects of core student-centered expenditures on the log of early career salary as seen in Table 11, we find that increasing the LABOR-MKT-RANK or STEM-MKT-RANK (lower is better) decreases the log of early-career median salary. Finally, the predicted values using the best fitting model, Model 8, predicts UNM values to be 45,000, which is about 11 percent less than the actual value.

[32] Econometrically, a natural concern would be the use of state characteristics when standard errors are clustered at the state level. Clustered standard errors means that errors are correlated or unobserved components in outcomes for units within clusters are correlated. Therefore, it causes no problem while controlling for state characteristics.

Table 11: Model Estimation Results: Log of Early Career Median Salary, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.00291***	0.00330***	0.000229	-0.0000530					0.0000271	-0.000163
	(0.000646)	(0.000933)	(0.000465)	(0.000428)					(0.000465)	(0.000353)
ACAD-EXP	0.00288**	0.000414	0.000728	0.000236	0.000243	0.000114	0.000125	-0.0000412	0.000453	0.0000189
	(0.00134)	(0.00144)	(0.000731)	(0.000568)	(0.000689)	(0.000617)	(0.000695)	(0.000630)	(0.000741)	(0.000593)
STUDENT-EXP	0.00908**	0.0110	0.00745***	0.00934***	0.00391*	0.00549**	0.00334	0.00495**	0.00637**	0.00865***
	(0.00454)	(0.00716)	(0.00249)	(0.00214)	(0.00226)	(0.00206)	(0.00230)	(0.00230)	(0.00250)	(0.00206)
R1	0.0298**	-0.00473	0.0102	0.00942	-0.00507	-0.00661	-0.00875	-0.00718	-0.000588	0.00400
	(0.0150)	(0.0200)	(0.0102)	(0.0107)	(0.0102)	(0.0108)	(0.0102)	(0.0108)	(0.0103)	(0.0110)
RES-EXP			0.000228	0.000524	0.0000993	0.0000929	0.000385	0.000388	0.000545	0.000704
			(0.000520)	(0.000384)	(0.000400)	(0.000269)	(0.000424)	(0.000378)	(0.000544)	(0.000476)
ACT-MATH25			0.00739***	0.00566**	0.00316	0.00146	0.00200	0.000536	0.00414*	0.00302
			(0.00215)	(0.00270)	(0.00218)	(0.00263)	(0.00228)	(0.00293)	(0.00230)	(0.00313)
PELL%			-0.00143***	-0.00160**	-0.00175***	-0.00182***	-0.00264***	-0.00262***	-0.00308***	-0.00304***
			(0.000495)	(0.000632)	(0.000474)	(0.000549)	(0.000696)	(0.000914)	(0.000713)	(0.000885)
STEM%			0.00427***	0.00403***	0.00416***	0.00399***	0.00322***	0.00306***	0.00314***	0.00298***
			(0.000393)	(0.000366)	(0.000358)	(0.000336)	(0.000526)	(0.000568)	(0.000562)	(0.000630)
FAC-SALARY					0.0159***	0.0158***	0.0136***	0.0149***		
					(0.00336)	(0.00442)	(0.00364)	(0.00485)		
FEMALE%							-0.00238**	-0.00248**	-0.00262***	-0.00275**
							(0.000940)	(0.00102)	(0.000974)	(0.00110)
WHITE%							-0.00109**	-0.000996	-0.00126***	-0.00113*
							(0.000459)	(0.000694)	(0.000484)	(0.000662)
HISPANIC%							-0.000728	-0.000485	-0.000621	-0.000215
							(0.000491)	(0.000628)	(0.000509)	(0.000663)
ASIAN%							0.0000112	-0.000697	0.000977	0.000210
							(0.000791)	(0.00119)	(0.000781)	(0.00110)
CONSTANT	10.71***	10.75***	10.55***	10.60***	10.52***	10.56***	10.81***	10.83***	10.91***	10.94***
	(0.0141)	(0.0229)	(0.0505)	(0.0630)	(0.0474)	(0.0584)	(0.104)	(0.112)	(0.104)	(0.114)
R^2	0.397	0.465	0.799	0.874	0.821	0.886	0.827	0.892	0.810	0.883
N	197	197	197	197	197	197	197	197	197	197
Predicted (UNM)	48771.48	49195.73	46021.24	46084.14	45541.42	45564.14	45198.95	45610.92	45509.46	46257.8
Actual (UNM)	40700	40700	40700	40700	40700	40700	40700	40700	40700	40700

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table 12: Model Estimation Results: Log of Early Career Median Salary, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.00291***	0.00330***	0.000394	-0.0000038					0.000162	-0.000120
	(0.000646)	(0.000933)	(0.000459)	(0.000449)					(0.000460)	(0.000372)
ACAD-EXP	0.00288**	0.000414	0.000733	0.000273	0.000257	0.000138	0.000155	-0.000017	0.000488	0.0000568
	(0.00134)	(0.00144)	(0.000734)	(0.000626)	(0.000694)	(0.000650)	(0.000694)	(0.000659)	(0.000733)	(0.000635)
STUDENT-EXP	0.00908**	0.0110	0.00650***	0.00917***	0.00399*	0.00566**	0.00342	0.00508**	0.00587**	0.00860***
	(0.00454)	(0.00716)	(0.00248)	(0.00216)	(0.00225)	(0.00215)	(0.00228)	(0.00237)	(0.00247)	(0.00208)
R1	0.0298**	-0.00473	0.00868	0.00864	-0.00415	-0.00613	-0.00725	-0.00657	0.000477	0.00427
	(0.0150)	(0.0200)	(0.00989)	(0.0105)	(0.0100)	(0.0106)	(0.0101)	(0.0108)	(0.0101)	(0.0111)
RES-EXP			0.000140	0.000461	0.000150	0.0000954	0.000436	0.000404	0.000506	0.000690
			(0.000520)	(0.000398)	(0.000403)	(0.000276)	(0.000423)	(0.000384)	(0.000537)	(0.000477)
ACT-MATH25			0.00658***	0.00539*	0.00324	0.00157	0.00250	0.000854	0.00444**	0.00329
			(0.00209)	(0.00292)	(0.00214)	(0.00263)	(0.00225)	(0.00272)	(0.00225)	(0.00294)
PELL%			-0.00165***	-0.00164***	-0.00187***	-0.00183***	-0.00244***	-0.00249***	-0.00278***	-0.0029***
			(0.000478)	(0.000593)	(0.000466)	(0.000538)	(0.000691)	(0.000897)	(0.000708)	(0.000853)
STEM%			0.00424***	0.00399***	0.00412***	0.00396***	0.00322***	0.00302***	0.00317***	0.00295***
			(0.000391)	(0.000382)	(0.000358)	(0.000343)	(0.000521)	(0.000563)	(0.000553)	(0.000628)
LABOR-MKT-RANK			-0.00114***	-0.000664	-0.00083***	-0.000419	-0.00076**	-0.000386	-0.00091***	-0.000499
			(0.000309)	(0.000483)	(0.000303)	(0.000475)	(0.000308)	(0.000495)	(0.000317)	(0.000501)
FAC-SALARY					0.0139***	0.0149***	0.0125***	0.0145***		
					(0.00339)	(0.00457)	(0.00362)	(0.00488)		
FEMALE%							-0.00229**	-0.00249**	-0.00247**	-0.00274**
							(0.000929)	(0.00102)	(0.000957)	(0.00111)
WHITE%							-0.00097**	-0.000935	-0.00108**	-0.00104
							(0.000458)	(0.000671)	(0.000481)	(0.000622)
HISPANIC%							-0.000786	-0.000542	-0.000673	-0.000297
							(0.000485)	(0.000576)	(0.000499)	(0.000607)
ASIAN%							-0.000181	-0.000772	0.000639	0.0000792
							(0.000786)	(0.00113)	(0.000777)	(0.00103)
CONSTANT	10.71***	10.75***	10.60***	10.62***	10.56***	10.58***	10.81***	10.83***	10.90***	10.93***
	(0.0141)	(0.0229)	(0.0506)	(0.0738)	(0.0486)	(0.0707)	(0.103)	(0.106)	(0.102)	(0.107)
R^2	0.397	0.465	0.806	0.877	0.824	0.888	0.831	0.893	0.817	0.884
N	197	197	197	197	197	197	197	197	197	197
Predicted (UNM)	48771.48	49195.73	45421.84	45731.66	45166.46	45373.65	44767.34	45333.38	44998.23	45868.41
Actual (UNM)	40700	40700	40700	40700	40700	40700	40700	40700	40700	40700

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS - Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table 13: Model Estimation Results: Log of Early Career Median Salary, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.00291***	0.00330***	0.000307	-0.0000224					0.000107	-0.000131
	(0.000646)	(0.000933)	(0.000462)	(0.000422)					(0.000463)	(0.000350)
ACAD-EXP	0.00288**	0.000414	0.000804	0.000278	0.000306	0.000138	0.000189	-0.0000235	0.000535	0.0000556
	(0.00134)	(0.00144)	(0.000737)	(0.000625)	(0.000697)	(0.000649)	(0.000701)	(0.000656)	(0.000741)	(0.000638)
STUDENT-EXP	0.00908**	0.0110	0.00731***	0.00948***	0.00431*	0.00574**	0.00379	0.00514**	0.00647**	0.00881***
	(0.00454)	(0.00716)	(0.00249)	(0.00217)	(0.00228)	(0.00222)	(0.00232)	(0.00247)	(0.00249)	(0.00212)
R1	0.0298**	-0.00473	0.0101	0.00887	-0.00358	-0.00630	-0.00754	-0.00696	0.000235	0.00393
	(0.0150)	(0.0200)	(0.00998)	(0.0105)	(0.0101)	(0.0106)	(0.0101)	(0.0109)	(0.0102)	(0.0109)
RES-EXP			0.000183	0.000477	0.000133	0.0000922	0.000418	0.000392	0.000522	0.000684
			(0.000522)	(0.000375)	(0.000404)	(0.000273)	(0.000426)	(0.000385)	(0.000543)	(0.000469)
ACT-MATH25			0.00616***	0.00505*	0.00280	0.00129	0.00194	0.000551	0.00375*	0.00292
			(0.00214)	(0.00295)	(0.00217)	(0.00275)	(0.00226)	(0.00290)	(0.00227)	(0.00310)
PELL%			-0.00175***	-0.00176***	-0.00194***	-0.00190***	-0.00267***	-0.00262***	-0.00306***	-0.00301***
			(0.000491)	(0.000612)	(0.000475)	(0.000542)	(0.000692)	(0.000910)	(0.000704)	(0.000879)
STEM%			0.00433***	0.00404***	0.00420***	0.00400***	0.00325***	0.00306***	0.00321***	0.00299***
			(0.000393)	(0.000376)	(0.000360)	(0.000344)	(0.000526)	(0.000570)	(0.000559)	(0.000629)
STEM-MKT-RANK			-0.000990***	-0.000524	-0.000670**	-0.000292	-0.000547*	-0.000188	-0.000766**	-0.000351
			(0.000325)	(0.000447)	(0.000318)	(0.000438)	(0.000327)	(0.000438)	(0.000335)	(0.000428)
FAC-SALARY					0.0144***	0.0152***	0.0125***	0.0146***		
					(0.00342)	(0.00464)	(0.00367)	(0.00499)		
FEMALE%							-0.00234**	-0.00247**	-0.00254***	-0.00272**
							(0.000937)	(0.00102)	(0.000964)	(0.00110)
WHITE%							-0.000931**	-0.000942	-0.00100**	-0.00102
							(0.000470)	(0.000696)	(0.000494)	(0.000630)
HISPANIC%							-0.000564	-0.000436	-0.000396	-0.000131
							(0.000499)	(0.000628)	(0.000513)	(0.000651)
ASIAN%							0.0000515	-0.000698	0.000924	0.000173
							(0.000787)	(0.00117)	(0.000773)	(0.00110)
CONSTANT	10.71***	10.75***	10.60***	10.62***	10.56***	10.58***	10.82***	10.83***	10.91***	10.93***
	(0.0141)	(0.0229)	(0.0522)	(0.0715)	(0.0502)	(0.0704)	(0.103)	(0.108)	(0.103)	(0.108)
R^2	0.397	0.465	0.803	0.876	0.822	0.887	0.828	0.892	0.814	0.883
N	197	197	197	197	197	197	197	197	197	197
Predicted (UNM)	48771.48	49195.73	44618.51	45302.43	44643.96	45150.96	44562.5	45379.88	44586.86	45796.46
Actual (UNM)	40700	40700	40700	40700	40700	40700	40700	40700	40700	40700

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

6.3.3 Summary of Significant Marginal Effects

To help synthesize some of the extensive econometric modeling from Tables 8-11, Table 14 provides a summary of some marginal effects, representing the instantaneous rate of change on the dependent variable produced by a unit change in an independent variable, *ceteris paribus*. While doing so, we only present the covariates that are statistically significant using the best-fitted model for each outcome measure.

In column 1, we use the specification from the Table 8 and Model 8 to compute the marginal effects for the retention rate, RETENT. We find that the log-odds of retention rate by 0.50 percentage point if academic support expenditures, ACAD-EXP, were to increase by increases by $1000. The most influential factor, that is statistically significant and positive, is the average faculty salary variable, FAC-SALARY. Our estimation shows that an increase by $1000 in the level of FAC-SALARY variable increases the retention rate by 0.54 percentage points.

Continuing with column 1 in Table 14, notably, we also find the probability of retention, RETENT, decreases as expenditures on research, RES-EXP, increases. This result is consistent with prior findings in Webber and Ehrenberg (2010).

Column 2 provides the marginal effects of log-odds of the four-year graduation rate using Model 8 in Table 9. The variables ACAD-EXP and FAC-SALARY are shown to have a positive and significant impact on the GR-4YR.

Column 3 presents the results for the six-year graduation rate (Table 10 and Model 8). The signs are as expected; the ACAD-EXP is positively and significantly related to GR-6YR, i.e., $1000 increase in ACAD-EXP increases the six-year graduation rate by 0.50 percentage point; the faculty salary measure, FAC-SALARY is statistically significant.

Finally, Column 4 provides the result for EC-SAL. Two student-centered expenditure measures, FAC-SALARY and STUDENT-EXP are statistically significant and positive. PELL% and FEMALE% have significant but inverse relationships with EC-SAL.

Table 14: Significant Marginal Effects, Selected Models

	RETENT Model 8 Table 8	GR-4YR Model 8 Table 9	GR-6YR Model 8 Table 10	EC-SAL Model 8 Table 11
FAC-SALARY	0.107***	0.158***	0.172***	0.0149***
	(0.0262)	(0.0408)	(0.0323)	(0.00497)
ACAD-EXP	0.00946***	0.0161***	0.0158***	
	(0.00232)	(0.00344)	(0.00348)	
STUDENT-EXP				0.00526**
				(0.00241)
RES-EXP	-0.00777**	-0.00719**	-0.0109***	
	(0.00329)	(0.00303)	(0.00401)	
ACT-MATH25	0.0978***	0.149***	0.125***	
	(0.0172)	(0.0255)	(0.0194)	
PELL%		-0.0215**		-0.00257***
		(0.0101)		(0.000884)
STEM%	0.00783**			0.00315***
	(0.00370)			(0.000641)
FEMALE%	0.0164**	0.0404***	0.0215***	-0.00235**
	(0.00753)	(0.00825)	(0.00655)	(0.00112)
R1	0.324***		0.217***	
	(0.0627)		(0.0670)	
N	196	196	197	197

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Some of the important conclusions from Table 14 are: (i) the estimated coefficient on FAC-SALARY variable, the primary cost component of instructional expenses, is significant and positive in every student-success outcome measure; (ii) further, the marginal impact of this average faculty salary variable is significantly larger, at the 0.01 level, than that of ACAD-EXP or STUDENT-EXP measures (for F-test results see Table A8); (ii) in all cases, two or more student-centered expenditure measures are significant and positive in determining student-

success outcomes. The level of expenditures on educational-related services clearly matters for student outcomes.

6.3.4 Models that Aggregate Student-Centered Expenditures

As discussed above and presented in Tables 8 to 13, we show that in various combinations of disaggregated student-centered expenditure measures – INSTR-EXP (or FAC-SAL), ACAD-EXP, and STUDENT-EXP – are statistically significant positive determinants of student-success outcomes as measured in terms of four-year and six-year graduation rates, retention rate, and early-career median salary. We turn now to examining the results from a similar set of models, but with an aggregated measure of student-centered expenditures, which is more consistent with how we frame the expenditure side of our annual value proposition measure. Further, this will facilitate comparison for how UNM is performing relative to statistical expectations.

In Tables 15 to 17, we explore how an aggregate measure of student-centered expenses (SC-EXP), the sum of INSTR-EXP, ACAD-EXP, and STUDENT-EXP, influences student-success outcomes by employing identical specifications as in the graduation rates or retention rate models. The idea behind this approach, i.e., using SC-EXP, is to provide a more aggregated perspective on how expenditures can enhance the student outcomes, consistent with the proxy benefit measure we presented in our value proposition (Equation 1). In addition, doing so allows us to conveniently include quadratic of the student-centered expenditure, $SC\text{-}EXP^2$, to explore any non-linear relationship, as in diminishing marginal returns to SC-EXP.

Table 15 presents the effect of SC-EXP on log-odds of the retention rate (RETENT), while controlling for other factors. All the models consistently show a significant and positive impact of SC-EXP on retention rate, while the quadratic of student-expenditure ($SC\text{-}EXP^2$) is

negative – meaning that the increasing expenses have diminishing returns. However, SC-EXP^2 is not statistically significant in most models. We observe similar trends on estimated effect of SC-EXP on the four-year graduation rate (Table 16) and the six-year graduation rate (Table 17); however, SC-EXP^2 is consistently significant throughout each specification. These models estimate that a $1000 increase in SC-EXP per FTE increases RETENT by 0.50 to 0.51 percentage points; increases GR-4YR by 0.51 to 0.52 percentage points; and increases GR-6YR by 0.51 to 0.52 percentage points (Table 15, Model 6). Similarly, the predicted UNM four-year graduation rate is 29 percent (Table 16, Model 6) and the predicted UNM six-year graduation rate is 59 percent (Table 17, Model 6).

Table 15: Model Estimation Results: Log odds - Logits of Retention Rate, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE
SC-EXP	0.0478***	0.0538***	0.00927*	0.0185**	0.00547	0.0149**
	(0.00528)	(0.00984)	(0.00488)	(0.00728)	(0.00522)	(0.00692)
SC-EXP^2	-0.000218***	-0.000269***	-0.0000218	-0.0000630	0.00000238	-0.0000412
	(0.0000409)	(0.0000809)	(0.0000320)	(0.0000556)	(0.0000335)	(0.0000525)
R1	0.532***	0.448***	0.310***	0.328***	0.317***	0.342***
	(0.0752)	(0.102)	(0.0624)	(0.0615)	(0.0644)	(0.0582)
RES-EXP			-0.00295	-0.00875**	-0.00496	-0.00978**
			(0.00324)	(0.00411)	(0.00332)	(0.00478)
ACT-MATH25			0.141***	0.120***	0.132***	0.110***
			(0.0140)	(0.0200)	(0.0150)	(0.0196)
PELL%			-0.00395	-0.00490	-0.00936**	-0.0112
			(0.00307)	(0.00558)	(0.00466)	(0.00690)
STEM%			0.000666	0.00187	0.00634*	0.00737*
			(0.00247)	(0.00242)	(0.00353)	(0.00439)
FEMALE%					0.0145**	0.0127
					(0.00627)	(0.00888)
WHITE%					-0.00185	-0.00400
					(0.00306)	(0.00391)
HISPANIC%					0.000104	0.000169
					(0.00329)	(0.00393)
ASIAN%					0.00198	-0.00389
					(0.00504)	(0.00741)
CONSTANT	0.762***	0.734***	-1.530***	-1.191**	-1.868***	-1.257
	(0.0965)	(0.150)	(0.312)	(0.458)	(0.672)	(0.825)
R^2	0.621	0.665	0.825	0.848	0.833	0.855
N	216	216	196	196	196	196
Predicted (UNM)	0.8801	0.8768	0.8275	0.8282	0.8325	0.8418
Actual (UNM)	0.8	0.8	0.8	0.8	0.8	0.8

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS - VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table 16: Model Estimation Results: Log odds - Logits of four-year graduation rate, weighted by size of total enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE
SC-EXP	0.0719***	0.0754***	0.0285***	0.0278***	0.0245***	0.0242***
	(0.00714)	(0.00918)	(0.00642)	(0.00696)	(0.00691)	(0.00638)
SC-EXP-^{2}	-0.000373***	-0.000400***	-0.000146***	-0.000143***	-0.000112**	-0.00011***
	(0.0000570)	(0.0000770)	(0.0000439)	(0.0000387)	(0.0000460)	(0.0000363)
R1	0.565***	0.526***	0.214**	0.135	0.246***	0.126
	(0.100)	(0.141)	(0.0832)	(0.108)	(0.0843)	(0.0825)
RES-EXP			-0.00477	-0.000548	-0.0101**	-0.00642
			(0.00467)	(0.00299)	(0.00472)	(0.00399)
ACT-MATH25			0.174***	0.168***	0.168***	0.157***
			(0.0181)	(0.0254)	(0.0187)	(0.0282)
PELL%			-0.0168***	-0.0204***	-0.0191***	-0.0236**
			(0.00392)	(0.00654)	(0.00600)	(0.00939)
STEM%			-0.0169***	-0.0184***	-0.00441	-0.00519
			(0.00350)	(0.00377)	(0.00478)	(0.00550)
FEMALE%					0.0320***	0.0331***
					(0.00816)	(0.00969)
WHITE%					0.00465	0.00344
					(0.00415)	(0.00645)
HISPANIC%					0.00269	0.00234
					(0.00423)	(0.00649)
ASIAN%					0.00825	0.0111
					(0.00659)	(0.0127)
CONSTANT	-1.898***	-1.899***	-3.990***	-3.639***	-6.006***	-5.504***
	(0.131)	(0.159)	(0.405)	(0.546)	(0.849)	(1.245)
R^2	0.583	0.598	0.804	0.830	0.820	0.845
N	216	216	196	196	196	196
Predicted (UNM)	0.4275	0.4298	0.2931	0.2961	0.2940	0.2931
Actual (UNM)	0.15	0.15	0.15	0.15	0.15	0.15

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS - VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table 17: Model Estimation Results: Log odds - Logits of Six-Year Graduation Rate, Weighted by Size of Total Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE
SC-EXP	0.0628***	0.0678***	0.0241***	0.0274***	0.0237***	0.0274***
	(0.00575)	(0.0106)	(0.00539)	(0.00759)	(0.00579)	(0.00853)
SC-EXP^2	-0.000306***	-0.000357***	-0.000102***	-0.000115**	-0.0000908**	-0.000110*
	(0.0000455)	(0.0000912)	(0.0000360)	(0.0000503)	(0.0000380)	(0.0000555)
R1	0.529***	0.465***	0.259***	0.246***	0.266***	0.241***
	(0.0810)	(0.121)	(0.0692)	(0.0866)	(0.0708)	(0.0759)
RES-EXP			-0.00550	-0.00913***	-0.00905**	-0.0115**
			(0.00370)	(0.00337)	(0.00385)	(0.00466)
ACT-MATH25			0.147***	0.141***	0.146***	0.141***
			(0.0153)	(0.0216)	(0.0161)	(0.0220)
PELL%			-0.00994***	-0.0115*	-0.00788	-0.0101
			(0.00336)	(0.00608)	(0.00508)	(0.00817)
STEM%			-0.00459	-0.00579**	0.00197	-0.000345
			(0.00282)	(0.00227)	(0.00398)	(0.00439)
FEMALE%					0.0173**	0.0139
					(0.00689)	(0.00872)
WHITE%					0.00856**	0.00423
					(0.00344)	(0.00430)
HISPANIC%					0.00551	0.00439
					(0.00359)	(0.00493)
ASIAN%					0.0123**	0.00486
					(0.00555)	(0.00952)
CONSTANT	-0.628***	-0.655***	-2.712***	-2.521***	-4.420***	-3.727***
	(0.105)	(0.168)	(0.343)	(0.500)	(0.727)	(0.840)
R^2	0.654	0.675	0.833	0.854	0.842	0.858
N	217	217	197	197	197	197
Predicted (UNM)	0.6932	0.6880	0.5788	0.5772	0.5747	0.5916
Actual (UNM)	0.47	0.47	0.47	0.47	0.47	0.47

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS- Weighted least squares. OLS - VCE -Ordinary least squares with robust clustered standard errors at the state level.

7 Discussion

A primary objective of this research is to investigate and articulate the undergraduate value proposition (VP) at UNM. Focusing on the transactional perspective (rather than, say the transformational side of attending college), our analysis suggests UNM offers an exceptional value proposition. The prior econometric analysis has focused on demonstrating that the benefit proxies (i.e., SC-EXP, and its dis-aggregated measures) in our proffered value proposition are statistically significantly, and positively related to key student-success outcome measures. We do this using production function approach and a national, cross-sectional sample of R1 and R2 research universities. Below we explore a number of pertinent questions that emanate from the prior analysis.

7.1 How does UNM Perform Relative to Predictions?

Besides establishing positive relationships between the student-centered expenditures and student-success outcomes, we are also interested in understanding how UNM performs given student and institutional characteristics. As discussed earlier, evidence suggests that these characteristics are important factors for student success. For example, student characteristics for UNM, such as college preparedness (e.g., as measured by ACT-MATH25) and socioeconomic status (e.g., measured by PELL%), are skewed towards negatively affecting aggregate rates of student success. Since our focus is on UNM, the relationship between expenses and outcomes alone is inadequate to convey an answer to a broader question we would like to explore, i.e., using the best fitting econometric model, how does UNM perform compared to the sample universities? Or how would other universities expect to fare given UNM characteristics?

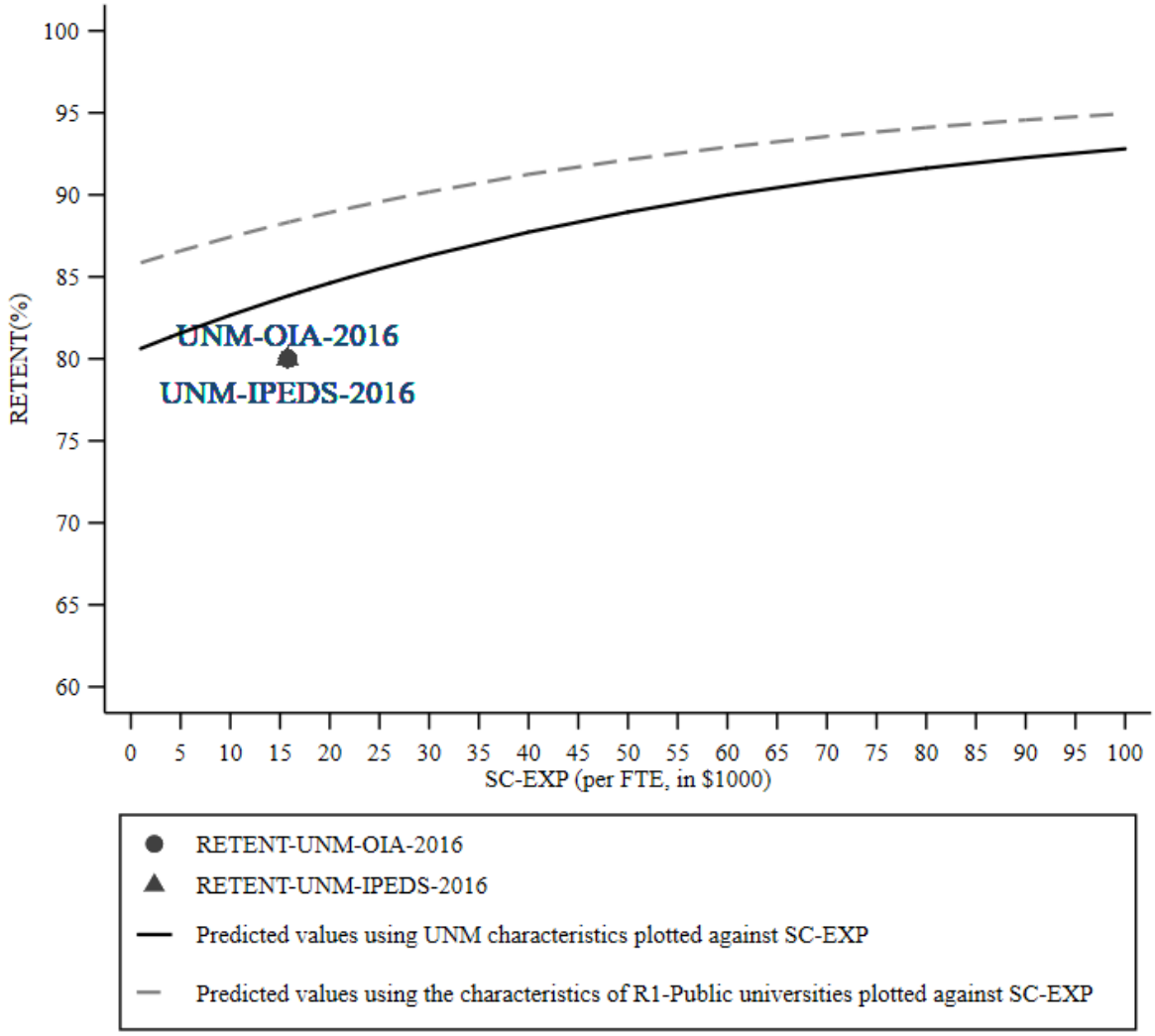
We explore these questions, as presented in Figures 11, 12 and 13, for retention, four-year graduation and six-year graduation, respectively. In each case, using the best-fitting estimated

regression model coefficients, predicted outcome values are calculated using UNM characteristic-levels and then plotted against varying student-centered expenditure (SC-EXP) levels. This is the predicted relationship between an outcome measure and SC-EXP levels, given observed UNM levels for all other variables – it is what we predict to occur for UNM, and is represented by the solid line. For reference to the sub-sample that is most comparable to UNM, the dashed line shows the predicted values of an outcome and SC-EXP levels, given the mean characteristics of the R1-Public sample. As shown in all three figures (11, 12 and 13) UNM characteristics generally yields lower student-success outcomes than the mean characteristics of the R1-Public sample. [33] For example, besides institutional inputs, UNM has, on average, a higher percentage of students receiving Pell Grants and lower scores on ACT-MATH25, which are significant determinants of student outcomes (Table 14).

Assuming no significant changes in student characteristics, we evaluate how UNM is doing relative to predictions. If the current values for a UNM outcome measure (e.g., retention rate or graduation rates at UNM) is statistically significantly lower (or higher) than the solid line, then UNM is under-performing (over-performing) according to our estimation models. Similarly, the vertical distance from a point to a line represents the magnitude, i.e., further away from the predicted line (bigger vertical distance) mean that the performance of an institution on an outcome measure is better or worse depending on the side of the line.

[33] In Appendix Table A9, we present the equivalency test statistics for the predicted mean with UNM characteristics and predicted mean with R1 + Public characteristics. For all three outcomes variables, the predicted mean with UNM characteristics is smaller and statistically significant.

Figure 11: Actual Retention Rate as of August 2015, and Student-Centered Expenses (per FTE) for Fiscal Year 2015 for UNM, with Predicted Values using the Characteristics of R1 and Public Universities, and the Predicted Values for R1 and R2 Universities with UNM Characteristics

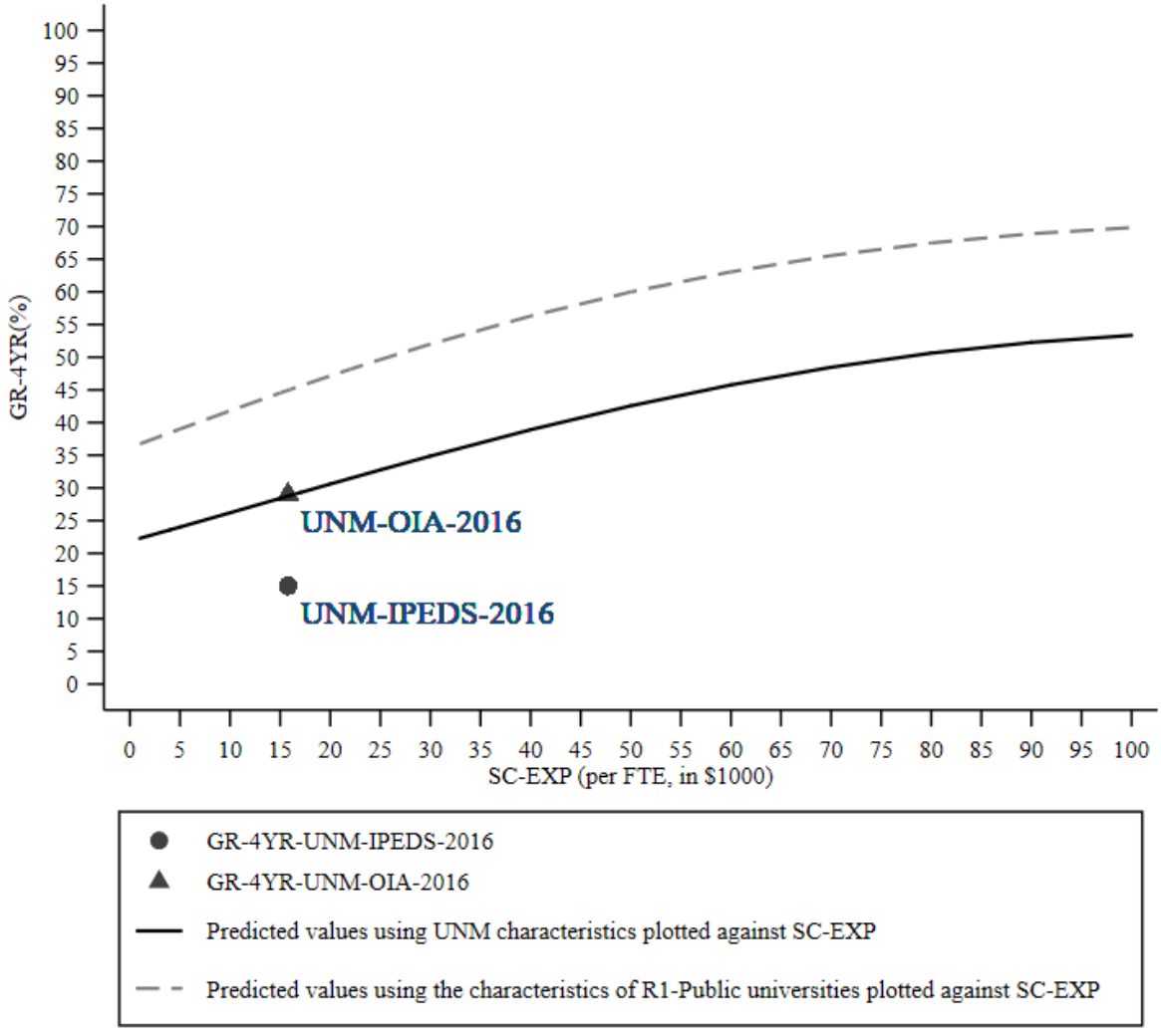


Note: Predicted values are estimated from Model 6,Table 14.
Source: IPEDS and selected databases.

In Figure 11, predicted values for the retention rate (RETENT) using Model 6, Table 14 are plotted against different levels of aggregate student-centered expenditures (SC-EXP). The dashed line is higher than the solid line – meaning that the mean characteristics of R1-Public have a higher expected retention rate than the UNM characteristics. However, the vertical distance decreases with increasing SC-EXP. Visibly the 2016 value for retention rate is very

close to the solid line; however, it is further away from the dashed line. The UNM-IPEDS current retention rate is lower than the predicted value for an R1-Public university with UNM's characteristics. This difference is statistically insignificant.

Figure 12: Actual Four-Year Graduation Rate as of August 2015, and Student-Centered Expenses (per FTE) for Fiscal Year 2015 for UNM, with Predicted Values using the Characteristics of R1 and Public Universities, and the Predicted Values for R1 and R2 Universities with UNM Characteristics

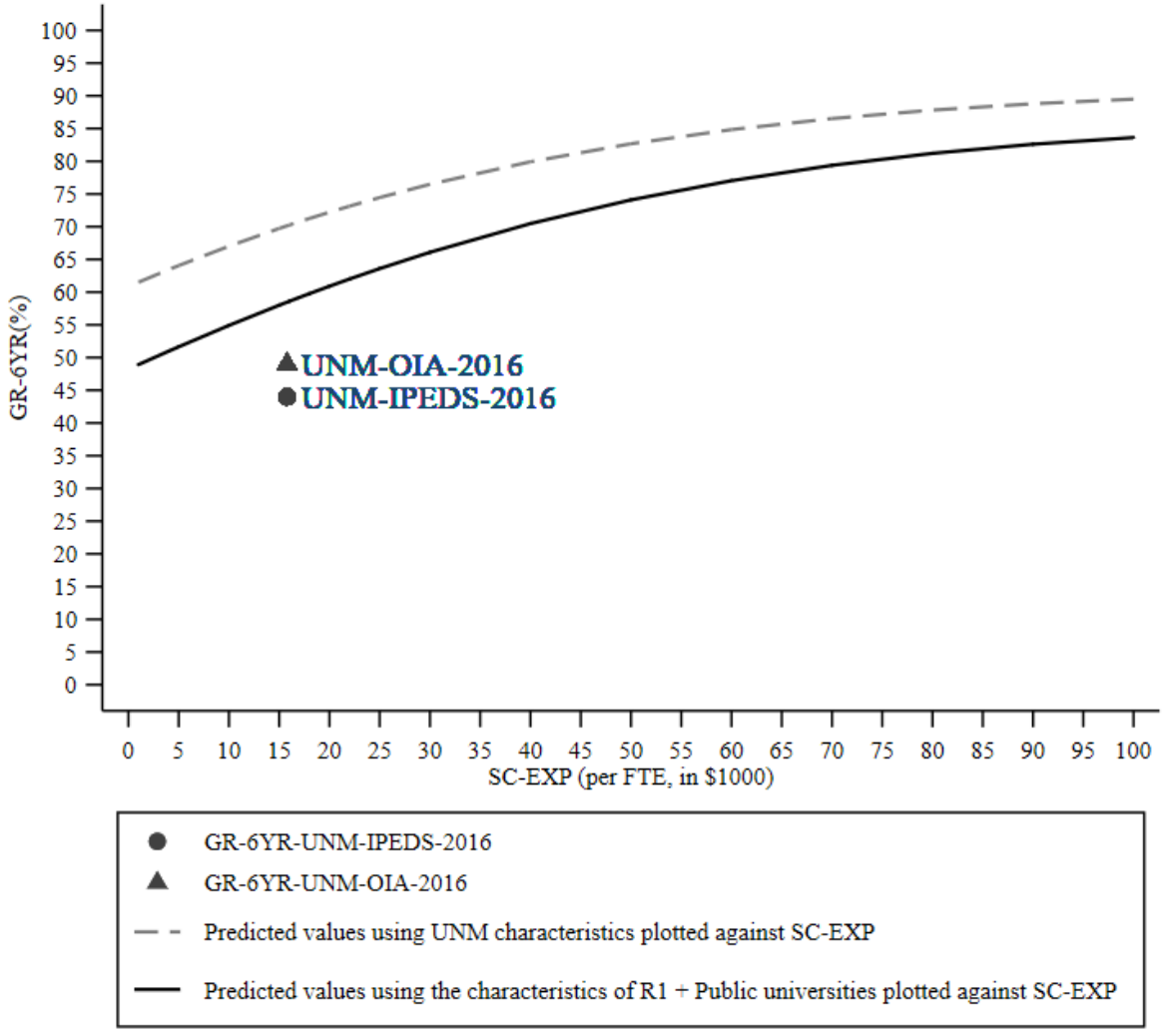


Note: Predicted values are estimated from Model 6,Table 15.
Source: IPEDS and selected databases.

In Figure 12, predicted values for the four-year graduation rate (GR-4YR) using Model 8, Table 9 are plotted against different levels of aggregate student-centered expenditures (SC-EXP).

Although not a statistically significant difference, results indicate that for the 2016 value for four-year graduation rate, obtained from UNM Office of Institutional Analytics (OIA) is 0.25 percentage points higher than the graduation rate predicted by the solid line. With the recent large improvement in GR-4YR, UNM is now meeting our modeling prediction (for an R1-Public university given UNM characteristics).

Figure 13: Actual Six-Year Graduation Rate as of August 2015, and Student-Centered Expenses (per FTE) for Fiscal Year 2015 for UNM, with Predicted Values using the Characteristics of R1 and Public Universities, and the Predicted Values for R1 and R2 Universities with UNM Characteristics



Note: Predicted values are estimated from Model 6,Table 16.
Source: IPEDS and selected databases.

In Figure 13, predicted values for the six-year graduation rate (GR-6YR) using Model 8, Table 10 are plotted against different levels of aggregate student-centered expenditures (SC-EXP). Results indicate that for the 2016 value for six-year graduation rate, obtained from UNM Office of Institutional Analytics (OIA), is 10 percentage points (or 20 percent) lower than the predicted graduation rate (given UNM characteristics). This difference is statistically significantly lower.

7.2 What Would It Cost to Make Additional Student Outcome Improvements?

A natural UNM policy question to be asked from our empirical analysis is: *what would it likely cost to make additional student outcome improvements?* The difficult challenge is that it can be costly to move up and along the "graduation curve" (in Figures 12 and 13) by spending more on student-centered expenditure categories, SC-EXP per FTE (where SC-EXP = INSTR-EXP + ACAD-EXP + STUDENT-EXP) due to diminishing marginal return.

It can be thought of this way, if we start from an inefficient point (e.g., 15% four-year graduation rate), and then over 5 or 6 years we correct this inefficiency to move from below the prediction curve up to where we should be with largely the same expenditure level, then that is not costly (i.e., it just primarily involves improved allocation of resources). But, once we are allocating reasonably efficiently and we are on the curve (i.e., hitting our predicted GR-4YR at around 29%) and want to move along it, say going from 29 percent GR-4YR to 31 percent (two percentage point gain or 6.89% improvement), then much of the low hanging fruit has been grabbed, and it now becomes costly to move up and along curve. You are either going to have to spend more, or you are going to have to figure out some kind shifting of cost curves. An example might be in capturing new insights on student learning and technologies.

To help provide some context, we can make a comparison to one of our HED-approved Peer Institutions: UC-Riverside (R1 Carnegie Classification). They have a large PELL% (52%) students, similar FTE size (21,524 UG + GRAD-POP), a bit of enhanced administrative cost efficiency relative to UNM, but are much more selective in student access than we are with ACT-MATH25 (=23 versus 20 for UNM). They have a 2015 SC-EXP of $19,026 per FTE, and report a GR-4YR of 41 percent in 2015 compared to the UNM 2015 SC-EXP of $15,770 per FTE, and GR-4YR of 29 percent (UNM-OIA). What the econometric model for all R1+R2 universities shows is that we might have to spend something more than they do to make a large/significant jump, given our student access profile. And every $1000 SC-EXP increment is: $1000 * 18,500 UG FTE = $18.5 million (or about $22.5 million if you applied to full FTE). We use the fitted model to estimate what level of SC-EXP per FTE would be needed to increase our GR-4YR (model 6 in Table 15), *ceteris paribus*. The estimation is presented in Table 18.

Table 18: Student-Centered Expenditure, per FTE Needed to Increase Four-Year Graduation Rate for UNM Main Campus using Model 6, Table 15

GR-4YR	SC-EXP in $1000, constant 2017 dollar	Increment in SC-EXP from current level (GR-4YR [29%] and 2015 SC-EXP [16.34])
29 (current)	16.34	0
31	18.31	1.97
33	21.60	5.26
35	24.71	8.37
37	27.67	11.34
40	31.90	15.56

From the estimates above, and assuming this required annual SC-EXP increment ($1,970) is applied to 18,500 FTE undergraduate students, then moving up the GR-4YR once we are on the predicted curve becomes quite costly. For example, a 2-percentage point increment (or 6.89% improvement) would require increasing our SC-EXP from $16,340 per FTE to $18,310 per FTE, for a total investment of $36.5 million (i.e., some combination of increased state subsidy and

tuition increase, in real terms). This value is large, but can be put into perspective by comparing to lost real dollars to the UNM Main Campus Academic Affairs combined revenue from state I&G support and pooled tuition. From AY 2007-08 to the projected AY 2018-19 budget, these lost real dollars are roughly $30 million, when indexed against the Higher Education Price Index (HEPI).

7.3 How Does Value Proposition Connect to Value of UNM Degree and ROI?

With an outstanding undergraduate value proposition, and improving four-year graduation rate, there appears to be a strong case for students and their families to make the investment in a UNM education, with the concomitant responsibility of UNM to make efficient use of available resources in promoting student success. If state support continues to decline in real terms, and an increasing percentage of costs are borne by students and their families, then we can expect to see increased borrowing by UNM students. Generally, this borrowing makes sense as long as the expected return on investment (ROI) is strong relative strong to other opportunities. So, another natural question is how this value proposition connects to evidence on the value of a UNM degree?

At a national level for the US, Avery and Turner (2012), using the 2009 Current Population Survey, calculate that average annual earning gap for college graduates and high-school graduates entering the workforce starts at $7000, and then steadily grows up to age 42 before leveling off. [34] Avery and Turner (2012) document the trends in present discounted value

[34] There are non-completion risks that have to be considered in both ROI and student debt discussions. We focus here on the binary attainment cases (i.e., high school diploma versus bachelor's degree), but generally intermediate levels of college attainment (e.g., two-year degrees, some college attainment, etc.) represent intermediate net monetary rewards, relative to expected earnings with a high school diploma. The profile of these rewards is such that there are typically strong returns to graduating with a bachelor's degree. That is, completion matters. But it is not the case that there are no net rewards to lower levels of educational attainment. Likewise, for

of a bachelor's degree versus high school completion (only), and show that the gap has been growing significantly (although estimates vary depending on assumptions, for example, type of degree completion, time to graduation, choice of occupations, undergraduate major, etc.). This, return on investment (ROI) to graduating from college, can be expressed as either an annual percentage return rate, or a discounted net present value measure, after accounting for the full costs of attendance (including opportunity costs of lost wages while in college). While results vary greatly by major (see Webber, 2018) and require a number of assumptions (e.g., discount rate, years of work, labor force participation, etc.), averaged across all majors, college graduates approximately make $1.2 million in earnings net of tuition at age 64 as opposed to $780,000 for the high school graduates in net present value terms with a 3 percent yearly discount rate. Broadly, this difference is robust to adjustments for self-selection effects, which control for characteristics of likely college attendance (Avery and Turner, 2012). Further, over the last three decades, the lifetime earnings premium from college degree attainment has on average generally been growing "markedly" for both men and women, i.e., in 2008 constant dollars, $300,000 for men and $380,000 for women (Avery and Turner, 2012). While sometimes questioned in media reports, etc., perhaps more than ever, earning a college degree is worth it (Abel and Dietz, 2014; Archibald and Feldman, 2017; Avery and Turner, 2012; and Bowen and McPherson, 2016).

Given the strong undergraduate value proposition offered to UNM students, it is not surprising that the accumulated evidence on the ROI for UNM student is also strong. For example, in one recent analysis, at the state level, Josuweit (2017) ranked NM second highest nationally for states where having a college degree pays off the most. According to the NCES

---

lower levels of educational attainment, average student debt loads are typically much lower (Schanzenbach et al., 2017) .

(2017a), the nationwide median earnings for individuals with only a high school diploma is $30,500. But in New Mexico, the average salary for those without a college degree is well below that number; high school graduates make just $25,747. In contrast, college graduates earn an average salary of $43,257 per year, a difference of over $17,000

We can also be more specific to UNM graduates. Based on national surveys of graduates, *Payscale* regularly calculates fairly restrictive, limited 20 year ROIs for different universities and colleges (PayScale, 2017). For UNM, the calculated (2017) 20-year net ROI for in-state undergraduate students with financial aid (98% of students) and who lived on campus is: $308,000 (an annual 9.3% net ROI rate), averaged across all disciplines. This 20-year ROI for UNM is compares favorably with national averages on the 20-year ROI for all Bachelor's degree recipients, which is equal to approximately $300,000 (Abel and Deitz, 2014).

7.4 With Strong Value Proposition and ROI, Is Enhanced State Investment Justified?

Conducting a full benefit-cost analysis for the state investment in UNM is beyond the objectives of this analysis with its limited focus on the annual undergraduate value proposition. We hope that this investigation spurs additional research, such as a full benefit-cost analysis. But, we can entertain at least a back of the envelope exploration, with our limited focus on degree-production for UNM Main Campus Academic Affairs,. As noted earlier, this 20-year ROI is a net present value. We can try to compare the state's investment in annually generating these net present values as captured by each cohort of graduating students, against the state's annual UNM Main Campus I&G investment in education-related expenditures used to generate the outcomes. That is, we can compare the annual state subsidy (I&G) to UNM's Main Campus Academic Affairs against the aggregate net present value they are expected to capture (annual number of graduates times the expected NPV for each individual graduate). Thus, we can make an annual

flow comparison, but the key point behind this NPV is that individual graduates keep reaping net economics benefits for many years.

UNM IPEDS-listed graduates for 2015-16 include 3,830 Bachelor's degrees, 1,179 Master's degrees and 200 Doctoral degrees. The state subsidy, main campus I&G, received by Academic Affairs in 2015-16 was $191,264,000. (This was cut to $175,823,200 for 2017-18, and then is projected to be $181,793 in 2018-19). Conservatively assuming graduate students (n= 1179+200=1379) receive an NPV 20-year ROI at least as great as the 3,830 undergraduates, then with a 20-year ROI of $308,000 per graduate (times 5209 graduates in 2015-16) the state is generating a NPV of approximately $1.604 billion for a $191.26 million annual investment in Academic Affairs.[35] This would be an approximate **8 to 1** annual benefit cost ratio on this state investment. From just this 20-year NPV, there appears to be a positive *prima facie* argument for increased state support to UNM Main Campus Academic Affairs; however, there are of course competing demands for limited state funding dollars (e.g., including early childhood education, which has typically demonstrated large benefit cost ratios in various economic studies).

To emphasize, this back-of-the-envelope benefit cost calculation, is meant to be illustrative. It is not an analysis of the full economic impacts (direct, indirect and induced) of

[35] The higher earnings attached to a bachelor's degree generate fiscal impacts to government (e.g., higher tax revenues, and lower public program costs elsewhere (e.g., health, welfare, reduced crime etc.[see Trostel, 2007]). Thus, more narrowly, in fiscal terms as long as the state annually captures roughly an eighth (12.5 percent) of these monetary benefits from the aggregate of annual cohorts of college graduates, then it is fiscally neutral to the state. This appears highly plausible. For example, Trostel (2007) investigates the lifetime combined government (federal and state) fiscal impacts from public subsidy of a college degree, relative to a high school diploma, and finds a net return ratio of roughly 7 to 1 at a national level (and discusses considerable variation in an analysis of different states in New England); however, the bulk of this supports tends to be in state subsidy, whereas, the majority of the fiscal impacts are at the federal level. Trostel's analysis is only for direct effects, and does not account for any indirect or induced effects.

UNM aggregate expenditures on the state economy.[36] Moreover, the simplified benefit cost calculation does not account for: (i) any net present value to college attendance from those student who leave UNM annually without graduating or leave and graduate elsewhere; (ii) any benefits from UNM Main Campus research attributable to state subsidy (i.e., the fraction of research output, not supported by federal external grants); (iii) and any other cultural or community benefits generated by state subsidy support to UNM Main Campus. Conversely, if the state subsidizes the education of UNM Bachelor's degree recipients and those graduates have a negative net migration rate for workers (e.g., 25-45 years old), as has been the recent trend in NM, then this would lower this benefit cost ratio.

[36] For a relatively recent economic impact analysis for UNM on the NM state economy, see Bhandari (2011). Bhandari's (2011) input-output analysis indicated that UNM (Main Campus including HSC and Medical Group, and the Branch Campuses) accounted for roughly $1.8 billion in expenditures and over 25,000 jobs in 2010. With a large slice of UNM expenditures supported by out-of-state sources the total economic impact (direct, indirect and induced) in 2010 from these out-of-state revenues amounted to over $1.1 billion in output (with a calculated output multiplier of 1.83).

8 Conclusions

In this investigation, we have attempted to "shift the conversation" (e.g., Barnds, 2012), and broaden the focus from simple college affordability to the larger question of what the average undergraduate UNM Main Campus student can expect to get spent on them in education-related services, and the kinds of outcomes they can expect to receive. To be clear, with current tuition and fees, the UNM Main Campus remains a *very* low cost college option, especially relative to its HED-selected peer institutions and other large public research universities. Yet, relative to other public-sector HE options in NM, UNM is typically more expensive. But, rather than focusing only on the cost of education (affordability), we think it is more crucial for UNM to focus on the various value propositions it offers (Massy, 2016), and that this will especially be the case going forward if current trends continue, and UNM incrementally becomes more tuition-dependent for financial sustainability (e.g., see Archibald and Feldman, 2017).

Expressed as the difference between what they can expect to get spent on them (average annual student-centered expenditures per FTE), and what the average full-time undergraduate actually pays in tuition and fees, ***UNM represents an exceptional undergraduate value proposition***. This annual difference was $14,500 in 2016-17, and in constant 2017 dollars it ranged from approximately, $13,500 to $15,500 over the prior decade, despite significant fiscal challenges at UNM.

Viewed as a ratio, annual student-centered expenditures (the sum of instructional, academic support, and student support) per FTE to annual out-of-pocket costs for tuition and mandatory fees for the average full-time, degree-seeking undergraduate remained more than 10/1 in 2016-17; this ratio eroded slightly in 2017-18 with changes to the NM Legislative Lottery

Scholarship, but may now be partially recovered with changing scholarship payouts in 2018-19. This strong ratio is driven by several factors: (i) NM state support for higher education to UNM has declined in real terms over the last decade, but remains strong relative to other states; (ii) the NM Legislative Lottery Scholarship continues to contribute to a very low net price for many UNM students; and (iii) internally, despite some high-profile concerns (e.g., financial management in UNM Athletics [see LFC, 2017]), UNM Main Campus has done a good job of protecting and directing spending into key student-centered expenditure categories, and keeping administrative expenditures in check, relative to industry benchmarks.

Our own explorations of other universities (e.g., using IPEDS data, finance and net tuition information, with all its potential flaws) makes clear that anything above a 5/1 ratio remains extremely uncommon both within the state, and nationally, where ratios much closer to 3/1, 2/1 or even nearing 1/1 are more common. To help place in context, student-centered expenditures at UNM are approximately 86 percent of the national average for four-year public institutions (The College Board, 2017d), 72 percent for large research universities (Carnegie classifications R1 and R2), and 91 percent of the average for our NM Higher Education Department peer universities; further, when comparing with the national average of out-of-pocket tuition and fees, the average, full-time UNM undergraduate pays 39 percent of the national average for *all* four-year public colleges and universities (The College Board, 2017a). Finally, this strong undergraduate value proposition at UNM is connected to evidence that the average 20-year return on investment (ROI) to a UNM degree is at or above the national average, and that levels of student debt and percent of students with debt are both below national averages.

Confirming prior research (e.g., Webber and Ehrenberg, 2010), our econometric analysis demonstrates significantly positive relationships between various (aggregated and disaggregated) student-centered expenditure variables and various student success outcome measures. Faculty salaries, which remain significantly lower for UNM relative to their HED peer comparisons or other faculty compensation comparisons (see recent UNM Provost's Office studies),[37] are shown to always be a statistically significant, positive determinant, and of relatively large marginal impact, across all student-success outcome measures. Further, for various outcomes measures, academic support and student support expenditures are also shown to be positive and statistically significant determinants. The level of expenditures on education-related services clearly matters for student outcomes. To help situate, UNM significantly trails its R1-Public universities comparisons on these expenditure levels, but is higher and often much higher than all other in-state schools.

While for some measures of student-success outcomes UNM appears to be slightly under-performing, internal UNM OIA data show significant recent improvement in the key measure of four-year graduation rate (often an outcome of emphasis by the NM HED [LFC.2017]). If we take this internal data on four-year graduation rate, then it almost exactly matches the expectation of our best-fitting econometric model for an R1-Public research university matching UNM's characteristics. That is, given the recent improvements in the four-year graduation rate, when controlling for student and institutional characteristics, UNM's performance exactly meets statistical expectations. The implication is that UNM is making cost-

[37] These studies can be accessed at https://provost.unm.edu/initiatives/faculty-compensation-studies-and-policies.html

effective use of resources in producing four-year graduation outcomes for students, families and other stakeholders.

On the other hand, given that our four-year graduation rate is now close to the predicted level, the modeling results also imply that making additional progress on this student success outcome will likely to be difficult without a significant increase in student-centered expenditures. From our econometric analysis, we are not sanguine that there is considerable further room for internal reallocation in UNM Main Campus Academic Affairs to improve the four-year graduation rate above 30 percent and towards the national average for R1+R2 universities (47 percent). The magnitude of incremental annual expenditure to get, say, five percent improvements in outcome measures would clearly be in several tens of millions of dollars. These are not the levels of new monies that have typically been available. However, they are not out of line with the lost real dollar annual revenues experienced at UNM Main Campus Academic Affairs over last decade as tuition increases have not fully kept pace with net losses in real state support over last decade plus.

Like all public universities, UNM faces the difficult challenge of balancing cost, access and quality (the "iron triangle" of higher education). Such discussions of tradeoffs illustrate both challenges and opportunities for the provision of undergraduate education at UNM. The challenge is to continue to provide affordable access to a broad cross section of NM society, without eroding quality, and also while sustaining and enhance student success outcomes. While there have been some high-profile concerns (e.g., financial management in UNM Athletics [see LFC, 2017]), our conclusion is that UNM Main Campus has been doing a relatively good job of efficiently using resources, and protecting student-centered expenditures over a difficult financial decade (2006-2017) where proportional cost-shifting onto students and their families has

certainly occurred. But the key opportunity we see for UNM is to articulate the exceptional undergraduate value proposition that UNM continues to provide. This includes not only to prospective students and their families but also to the external stakeholders who may have concerns or doubt about the values created by UNM.

Depending on the NM state legislature and public willingness to support higher education, the future decade may continue to show increasing cost shifting onto students and families. UNM should be prepared for this possibility. We believe that an economic case for increased state support is justified; but, this is especially so if any new state support can be more directly targeted to SC-EXP categories. Likewise, this same focus on targeting should also be continuously pursued internally at UNM with new tuition revenues (and see LFC, 2017), [38] and the benchmarking of general administrative and auxiliary costs (e.g., ACTA, 2017).

Quite literally, we assert that the exceptional undergraduate value proposition offered by UNM may be perhaps the best economic investment opportunity that many NM residents will ever be presented with. Our concern is that inordinate focus on affordability, or largely misplaced concerns about student debt, will discourage rather than encourage many prospective students and families from accessing this exceptional value proposition, and within reasonable

[38] Of note, in terms of affecting how new tuition revenues are allocated, there are various pricing and budgeting strategies that can help keep administrative costs in check (e.g., bypassing implicit taxation in a centralized budgeting model for general administration and auxiliary enterprise support [e.g., Athletics] or to subsidize research), while more directly targeting student tuition revenues into SC-EXP categories. As increasingly employed by some large research universities, broad use of significant differential tuition and program charges can act as quasi-efficiency measures to better connect resources to educational activities (Fehtke and Policano, 2012). These can be justified either in terms of differences in marginal cost of program delivery, or marginal utility (marginal willingness to pay based on variation in expected earnings [e.g., see Webber, 2018]).

limits (e.g., say, kept below national averages, and perhaps connected to expected earnings by field or major) to help them wisely borrow if necessary to finance this investment.

We close with a number of caveats and suggestions that we hope spur additional investigations:

First, most basically and importantly, our offered value proposition is an <u>average annual difference measure</u> for a full-time, degree seeking student. On the expenditure side (SC-EXP) of our value proposition, it is likely to vary greatly across different groups (e.g., by major, college or school, and upper and lower division). For any individual student, it will vary by their year of attendance, and college/major they choose.[39] Likewise on the net price (NET-PRICE) side of our equation, it is also likely to vary greatly.[40] We don't want to obscure this point, but rather see it as the next important "shifting of the conversation." ***How the value proposition varies across groups is exactly the type of questions that should now be fully explored internally by UNM***.

---

[39] As with most large research universities (see Fethke and Policano, 2012; Massy, 2016; Archibald and Feldman, 2017), "cross subsidies" across colleges and school are highly prevalent on the UNM Main Campus; they are likely even more so at UNM than other large public research universities given the incremental base budgeting model, the very limited use of price differentiation in any form, and the historical heavy reliance on state public subsidies (SHEEO, 2017). To wit, by our calculations the ratio of UNM Main Campus Academic Affairs I&G allocations per SCH generated varies across colleges and schools by 3.4 to 1 (or 1.7 to 1 excluding the Law School, which only generates graduate credit hours). This excludes consideration of differential tuition, which only widens the observed variation (since largest college, Arts and Sciences, has low I&G allocation per SCH generated, and with a several small exceptions does not have access to differential tuition or program charges). This ratio blends all undergraduate and graduate SCH generation, but UNM has very modest differences in undergraduate and graduate tuition and fee rates. This ratio is also far larger than college and school differences in tuition and fee rates, given very limited usage and modest increments in differential tuition. All this supports the argument that it is likely there is large variation in our proffered undergraduate value proposition, which we believe merits thorough investigation.

[40] Preliminary internal analysis at UNM indicates that projected net tuition paid by undergraduates for 2018-19 will vary by broad income groups (e.g., roughly $200 annually for over 5,500 students from households with less than $30,000 annual income; roughly $1,4000 annually for over 5,900 students from households with greater than $30,000 but less than $100,000 annual income; approximately, annually $2,300 annually for over 3,000 students from households with greater than $100,000 annual income; and approximately $2,500 annually for over 5,500 students from households with no needs analysis. (See UNM Board of Regents' meeting minutes, April 17, 2018.) Thus, the value proposition is strong across all groups (e.g., with a net difference of greater than $10,000), but particularly so for low income households.

Doing so will help inform numerous campus budgeting and financing debates that are often done without full information. Examples include how resources are centrally allocated across colleges and schools, and the use of various price differentiation strategies, such as upper division premiums, and tuition differentials. We think such investigations are merited at UNM on a variety of grounds, including efficiency, transparency and meeting student concerns (especially under a more tuition-dependent setting). Moreover, we think such investigations would help reveal current vulnerabilities for UNM Main Campus in the highly-competitive higher education marketplace (e.g., where an excellent undergraduate value proposition overall may pale against particular dimensions, such as unbundled components of the highly-transferrable general education core credits from in-state competitors (see LFC, 2017)).

Second, with our focus on the UNM Main Campus undergraduate value proposition, we are not trying to dismiss concerns about affordability at UNM. Going forward, questions about affordability for access to the NM flagship university should rightfully be asked, and we encourage further exploration that builds on the considerable efforts already undertaken at UNM to ensure broad access. But, if trends toward cost-shifting continue, then detailed investigation is warranted that focuses on the *distribution* of affordability measures across our student population, especially among students from low-income families (e.g., possibly against the suggested Lumina Foundation (2015) criteria). Our point has been that the public debate and discussion shouldn't end with affordability, but must be extended to the value proposition (e.g., Barnds, 2012).

Third, UNM raised its four-year graduation rate from 15 percent in 2011-12 to 29 percent in 2016-17. If this proves to be sustained (and further translates into expected gains in the six-year graduation rate), then this remarkable leap shows something is right, and it happened within

deeply difficult financial circumstances. It will be critical to be reflective and take a deep internal look at what strategies and tools guided the four-year graduation rate to a new high. It is easy to be anecdotal in surface explanations, and harder isolate actual causes. Broadly, we have seen here that student-centered expenditures were largely protected,[41] and institutional support costs kept in check relative to benchmarks, but an examination appears to be merited at much more dis-aggregated expenditure level than investigated in this study.

Finally, like any large research university, UNM Main Campus Academic Affairs produces multiple outputs, which extend beyond the undergraduate value proposition to include a research value proposition, a graduate student value proposition (closely connected to research), and a community engagement value proposition (see Massy, 2016). These value propositions only grow when we extend to consideration and recognition of inter-connections with the UNM Branch Campuses and UNM Health Sciences Center (HSC). We have chosen here to focus on just one, but believe that all these value propositions we offer to NM and its citizens are worthy of investigation, as UNM positions itself in a highly competitive higher education marketplace.

[41] Of note, there was even a noticeable spike in 2011, which may have been driven by a short-term experiment with UNM Extended University revenue-sharing to colleges and schools.

Bibliography

Abel, J. R., & Deitz, R. (2014). The Value of a College Degree. Retrieved June 24, 2018, from http://libertystreeteconomics.newyorkfed.org/2014/09/the-value-of-a-college-degree.html

American Academy of Arts & Sciences. (2015a). *Public Research Universities: Changes in State Funding*. Cambridge, MA: American Academy of Arts & Sciences. Retrieved from https://www.amacad.org/multimedia/pdfs/publications/researchpapersmonographs/PublicResearchUniv_ChangesInStateFunding.pdf

American Academy of Arts & Sciences. (2015b). *Public Research Universities: Recommitting to Lincoln's Vision: An Educational Compact for the 21st Century*. Cambridge, MA: American Academy of Arts & Sciences. Retrieved from https://www.amacad.org/multimedia/pdfs/publications/researchpapersmonographs/PublicResearchUniv_Recommendations.pdf

American Academy of Arts & Sciences. (2015c). *Public Research Universities: Serving the Public Good*. Cambridge, MA: American Academy of Arts & Sciences. Retrieved from https://www.amacad.org/multimedia/pdfs/publications/researchpapersmonographs/PublicResearchUniv_PublicGood.pdf

American Academy of Arts & Sciences. (2015d). *Public Research Universities: Understanding the Financial Model*. Cambridge, MA: American Academy of Arts & Sciences. Retrieved from https://www.amacad.org/multimedia/pdfs/publications/researchpapersmonographs/PublicResearchUniv_FinancialModel.pdf

American Council of Trustees and Alumni [ACTA]. (2017). *How Much is Too Much? Controlling Administrative Costs through Effective Oversight*. American Council of Trustees and Alumni. Retrieved from https://www.goacta.org/images/download/controlling-administrative-costs.pdf

Archibald, R. and D. Feldman. (2017). *The Road Ahead for America's Colleges and Universities*. Oxford University Press.

Association of Governing Boards of Universities and Colleges. (2014). *Consequential Boards: Adding Value Where It Matters Most*. Retrieved from https://www.agb.org/reports/2014/consequential-boards-adding-value-where-it-matters-most

Avery, C. and S. Turner. (2012). "Student Loans: Do College Students Borrow Too Much – Or Not Enough? *Journal of Economic Perspectives.* 26(1):165-192. http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.26.1.165

Barnds, W. K. (2012). Your Institution's Value Proposition: Affordability or Employability? Retrieved April 11, 2018, from https://www.academicimpressions.com/your-institutions-

value-proposition-affordability-or-employability/

Bettinger, E. P., Evans, B. J., & Pope, D. G. (2013). Improving College Performance and Retention the Easy Way: Unpacking the ACT Exam. *American Economic Journal: Economic Policy*, *5*(2), 26–52. https://doi.org/10.1257/pol.5.2.26

Bhandari, D., (2011). The Economic Impact of the University of New Mexico on the State of New Mexico. Bureau of Business and Economic Research, UNM. Retrieved July 6, 2018 from http://digitalrepository.unm.edu/cgi/viewcontent.cgi?article=1066&context=bber

Blagg, K., Chingos, M. M., & Lee, V. (2017). *The Price of Room and Board: Understanding Trends in On-Campus Living Charges* (p. 45). Urban Institute.

Bourbon, J. (2013). The Rules of Attraction: Enrolling Students in (and for) the 21st Century. Retrieved from https://www.agb.org/trusteeship/2013/9/rules-attraction-enrolling-students-and-21st-century

Bowen, W., and M. McPherson (2016). *Lesson Plan: An Agenda for Change in American Higher Education.* Princeton University Press.

Bradshaw, W. G. (2013). Responding to the Commoditization of Higher Education: Higher Education's Value Proposition. Retrieved April 9, 2018, from http://www.presidentialperspectives.org/pdf/2013/2013-Chapter-4-Higher-Educations-Value-Proposition-Bradshaw.pdf

Carlson, S. (2013). How to Assess the Real Payoff of a College Degree. *The Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/Is-ROI-the-Right-Way-to-Judge/138665

Carnevale, A., Jayasundera, T., Repnikov, D., & Gulish, A. (2015). *State Online College Job Market: Ranking the States*. Georgetown University Center on Education and the Workforce. Retrieved from https://eric.ed.gov/?id=ED558165

Chetty, R., Friedman, J. N., Saez, E., Turner, N., & Yagan, D. (2017). *Mobility Report Cards: The Role of Colleges in Intergenerational Mobility* (No. w23618). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w23618.ack

Commonfund Institute. (2016). *Commonfund Higher Education Price Index*. Retrieved from https://www.issuelab.org/resources/27494/27494.pdf

DeRuy, E. (2015). At Universities, More Students Are Working Full-Time. *The Atlantic*. Retrieved from https://www.theatlantic.com/politics/archive/2015/10/at-universities-more-students-are-working-full-time/433245/

Desrochers, D. M., Lenihan, C. M., & Wellman, J. V. (2010). *Trends in College Spending 1998-2008*. Washington, DC: Delta Cost Project. Retrieved from

https://deltacostproject.org/sites/default/files/products/Trends-in-College-Spending-98-08.pdf

Diem, C. (2012). The college textbook bubble and how the "open educational resources" movement is going up against the textbook cartel. Retrieved April 9, 2018, from http://www.aei.org/publication/the-college-textbook-bubble-and-how-the-open-educational-resources-movement-is-going-up-against-the-textbook-cartel/

Dills, A. K., & Rotthoff, K. W. (2013). Price-Increasing Competition: Evidence from Higher Education.

Dranove, D., & Marciano, S. (2005). *Kellogg on Strategy: Concepts, Tools, and Frameworks for Practitioners*. John Wiley & Sons. Retrieved from https://www.scholars.northwestern.edu/en/publications/kellogg-on-strategy-concepts-tools-and-frameworks-for-practitione

Dynarski, S. (2014). An Economist's Perspective on Student Loans in the United States. Economic Studies Working Paper Series, Brookings Institute. Retrieved July 5, 2018 from: https://www.brookings.edu/wp-content/uploads/2016/06/economist_perspective_student_loans_dynarski.pdf

Education Advisory Board. (2014). *Optimizing Institutional Budget Models: Strategic Lesson for Aligning Incentives and Improving Financial Performance*. The Advisory Board Company. Retrieved from https://www.cwu.edu/provost/sites/cts.cwu.edu.provost/files/EAB%20Optimizing%20Institutional%20Budget%20Models.pdf

Ehrenberg, R. G. (2012). American Higher Education in Transition. *Journal of Economic Perspectives*, *26*(1), 193–216. https://doi.org/10.1257/jep.26.1.193

Erwin, Christopher & Binder, Melissa (2018). Does Broad-Based Merit Aid Improve College Completion? Evidence from New Mexico's Lottery Scholarship. *Education Finance and Policy (forthcoming)*

Fethke, G., and A. Policano. (2012). Public No More.A New Path to Excellence for America's Public Universities. Stanford University Press.

Fillmore, I. (2016). *Price Discrimination and Public Policy in the U.S. College Market. Employment Research Newsletter. Volume 23, Number 2*. W.

Gilpin, G. A., Saunders, J., & Stoddard, C. (2015). Why has for-profit colleges' share of higher education expanded so rapidly? Estimating the responsiveness to labor market changes. *Economics of Education Review*, *45*, 53–63. https://doi.org/10.1016/j.econedurev.2014.11.004

Hattan, A. S., Feder, J., Naik, A., Murphy, K., Vithlani, K., & Rigaud, G. (2010). *Advancing*

Education for Sustainability: Teaching the Concepts of Sustainable Building to All Students. Second School: Education For Sustainability. Retrieved from https://www.centerforgreenschools.org/sites/default/files/resource-files/Advancing%20Ed%20for%20Sust_Strategy%20Paper_Final.pdf

Hebel, S. (2014). From Public Good to Private Good. *The Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/From-Public-Good-to-Private/145061

Immerwahr, J., Johnson, J., & Gasbarra, P. (2008). *The Iron Triangle: College Presidents Talk about Costs, Access, and Quality. National Center Report #08-2*. National Center for Public Policy and Higher Education. Retrieved from https://eric.ed.gov/?id=ED503203

Johnston, J. (1987). *Econometric Methods* (Third Edition). New York: McGraw-Hill.

Josuweit, A. (2017). 5 States Where a Bachelor's Degree Pays Off The Most. Retrieved June 24, 2018, from https://www.forbes.com/sites/andrewjosuweit/2017/08/06/5-states-where-a-bachelors-degree-pays-off-the-most/

Kingwell, M. (2013). A university education is more valuable than any "outcome." Retrieved from https://www.theglobeandmail.com/opinion/education-is-the-serious-business-of-being-a-person/article14050671/

Lardaro, Leonard. (1993). *Applied Econometrics*. New York, NY: HarperCollins College Publishers

Lumina Foundation. (2015). *A Benchmark for Making College Affordable*. Indianapolis, IN. Retrieved from https://www.luminafoundation.org/files/resources/affordability-benchmark-1.pdf

National Academies of Sciences, Engineering, and Medicine. (2016). *Quality in the undergraduate experience: What is it? How is it measured? Who decides? Summary of a workshop*. National Academies Press.

New Mexico Legislative Finance Committee [LFC]. (2017). *Program Evaluation: Higher Education Cost Drivers and Cost Savings*. Report #17-02. Program Evaluation Unit. Retrieved June 25, 2018 from https://www.nmlegis.gov/Entity/LFC/Documents/Program_Evaluation_Reports/Program%20Evaluation%20Higher%20Education%20Cost%20Drivers%20and%20Cost%20Savings.pdf

Martin, R. E., & Hill, C. (2014). *Baumol and Bowen Cost Effects in Research Universities* (SSRN Scholarly Paper No. ID 2153122). Rochester, NY: Social Science Research Network. Retrieved from https://papers.ssrn.com/abstract=2153122

Massy, W. F. (2016). *Reengineering the University: How to Be Mission Centered, Market Smart, and Margin Conscious*. JHU Press.

McMahon, W. W. (2009). *Higher learning, greater good: The private and social benefits of higher education*. JHU Press.

Nascimento, R. S., Froes, R. E., e Silva, N. O., Naveira, R. L., Mendes, D. B., Neto, W. B., & Silva, J. B. B. (2010). Comparison between ordinary least squares regression and weighted least squares regression in the calibration of metals present in human milk determined by ICP-OES. *Talanta*, *80*(3), 1102-1109

National Conference of State Legislatures. (2015). Performance-Based Funding for Higher Education. Retrieved April 9, 2018, from http://www.ncsl.org/research/education/performance-funding.aspx

PayScale, Inc. (2016.). *PayScale's 2016-2017 College Salary Report*. PayScale's 2016-2017 College Salary Report: PayScale, Inc. Retrieved from https://www.payscale.com/college-salary-report

PayScale Inc. (2018). Best Value Colleges. Retrieved June 20, 2018, from https://www.payscale.com/college-roi/

Pike, G. R., Kuh, G. D., McCormick, A. C., Ethington, C. A., & Smart, J. C. (2011). If and when money matters: The relationships among educational expenditures, student engagement and students' learning outcomes. *Research in Higher Education*, *52*(1), 81-106.

Pope, D. G. (2017). How Colleges Can Admit Better Students. *The New York Times*. Retrieved from https://www.nytimes.com/2017/03/18/opinion/sunday/how-colleges-can-admit-better-students.html

Redden, E. (2015). The University of China at Illinois. Retrieved April 8, 2018, from https://www.insidehighered.com/news/2015/01/07/u-illinois-growth-number-chinese-students-has-been-dramatic

Schanzenberg, D., Bauer, L., & Breitweiser, A. (2017). Eight Economic Facts on Higher Education. Brookings Institute. Retrieved July 6, 2018 from https://www.brookings.edu/research/eight-economic-facts-on-higher-education/

Schwartz, M. (2011). Making Sense of Tuition Prices and College Costs. Retrieved April 11, 2018, from https://www.agb.org/trusteeship/2011/julyaugust/making-sense-of-tuition-prices-and-college-costs

Shapiro, D., Dundar, A., Huie, F., Wakhungu, P., Yuan, X., Nathan, A., & Hwang, Y., A. (2017). *A National View of Student Attainment Rates by Race and Ethnicity – Fall 2010 Cohort (Signature Report No. 12b)*. Herndon, VA: National Student Clearinghouse Research Center. Retrieved from https://nscresearchcenter.org/wp-content/uploads/Signature12-RaceEthnicity.pdf

Soliday, J., & Mann, R. (2013). *Surviving to Thriving: A Planning Framework for Leaders of Private Colleges & Universities*. Credo.

State Higher Education Executive Officers [SHEEO]. (2017). *State Higher Education Finance, FY 2016 Report*. Retrieved June 25, 2018 from http://sheeo.org/sites/default/files/SHEEO_SHEF_2016_Report.pdf

Stata Corp. (2015). Stata Statistical Software: Release 14 (Version 14). College Station, TX: StataCorp LLC.

Sullivan, D. F. (2010). The Hidden Costs of Low Four-Year Graduation Rates. Retrieved April 9, 2018, from https://www.aacu.org/publications-research/periodicals/hidden-costs-low-four-year-graduation-rates

The College Board. (2009). *ACT and SAT® Concordance Tables. Research Notes. RN-40*. College Board. Retrieved from https://eric.ed.gov/?id=ED562594

The College Board. (2017a). Net Price for Trends in College Pricing - Trends in Higher Education. Retrieved April 9, 2018, from https://trends.collegeboard.org/college-pricing/figures-tables/net-price

The College Board. (2017b). Average Cumulative Debt Levels in 2016 Dollars: Bachelor's Degree Recipients at Four-Year Institutions, 2000-01 to 2015-16 - Trends in Higher Education. Retrieved June 20, 2018, from https://trends.collegeboard.org/student-aid/figures-tables/cumulative-debt-bachelor-degree-recipients-four-year-institutions-over-time

The College Board. (2017c). *Trends in Student Aid* (p. 32). Retrieved from https://trends.collegeboard.org

The College Board. (2017d). Net Tuition Revenues, Subsidies, and Education Expenditures per Student at Public Institutions over Time - Trends in Higher Education - The College Board. Retrieved June 22, 2018, from https://trends.collegeboard.org/college-pricing/figures-tables/net-tuition-revenues-subsidies-and-education-expenditures-student-public-institutions-over

The Institute for College Access & Success. (2017). *Project on Student Debt*. Retrieved from https://ticas.org/sites/default/files/pub_files/classof2016.pdf

Trostel, J. (2007). *The Fiscal Impacts of Higher Education Attainment*. Retrieved July 07, 2018 from: http//www.bos.frb.org/economic.neppc/index.htm

U.S. Bureau of Labor Statistics. (2016). U-3 and U-6 unemployment by state, 2015: The Economics Daily: U.S. Bureau of Labor Statistics. Retrieved April 8, 2018, from https://www.bls.gov/opub/ted/2016/u-3-and-u-6-unemployment-by-state-2015.htm

U.S. Department of Education, Federal Student Aid. (2018). *Data Center: Official Cohort Default Rate for Schools*. Retrieved June 28, 2018, from https://www2.ed.gov/offices/OSFAP/defaultmanagement/cdr.html

U.S. Department of Education, National Center for Education Statistics [NCES]. (2015). Postsecondary attainment: Differences by socioeconomic status. The Condition of Education, 1–7. Retrieved March 22, 2018, from https://nces.ed.gov/programs/coe/pdf/coe_tva.pdf

U.S. Department of Education, National Center for Education Statistics [NCES]. (2016). *IPEDS: Integrated Postsecondary Education Data System*. *Use the Data*. [Data files and dictionaries]. Retrieved from http://nces.ed.gov/ipeds/datacenter/DataFiles.aspx

U.S. Department of Education, National Center for Education Statistics [NCES]. (2017a). Fast Facts: Income of young adults. Retrieved June 24, 2018, from https://nces.ed.gov/fastfacts/display.asp?id=77

U.S. Department of Education, National Center for Education Statistics [NCES]. (2017b). *IPEDS Finance Data FASB and GASB - What's the Difference? A Guide for Data Users.* Retrieved June 29, 2018, from https://nces.ed.gov/ipeds/report-your-data/data-tip-sheet-distinguishing-finance-standards-fasb-gasb

Urban Institute. (2018). Debt in America: An Interactive Map. Retrieved June 20, 2018, from http://urbn.is/2AnVzHa

Webber, D. (2018). Projected Lifetime Earnings by Major. Retrieved July 5, 2018 from: http://www.doug-webber.com/expected_all.pdf

Webber, D. A., & Ehrenberg, R. G. (2010). Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education? *Economics of Education Review*, *29*(6), 947–958. https://doi.org/10.1016/j.econedurev.2010.04.006

Whitt, R. (2018). UNM gets higher Lottery Scholarship funding than expected. Retrieved June 20, 2018, from https://news.unm.edu/news/unm-gets-higher-lottery-scholarship-funding-than-expected

Wolla, S. A. (2014). The Rising Cost of College: Tuition, Financial Aid, and Price Discrimination. Retrieved April 8, 2018, from https://www.stlouisfed.org/education/page-one-economics-classroom-edition/the-rising-cost-of-college-tuition-financial-aid-and-price-discrimination

Appendix

Table A1: Correlation Matrix of Explanatory Variables

	INSTR-EXP	ACAD-EXP	STUDENT-EXP	RES-EXP	INST-SUP-EXP	PUBLIC-EXP	OTHER-EXP	SC-EXP	ADMIN/INSTR+COST-RATIO	ACT-MATH25	ACT-COMP25	PELL%	STEM%	HH-INC	R1	PUBLIC	FAC-SALARY	FAC-STUDENT-RATIO	UG-POP	GRAD-POP	LABOR-MKT-RANK	STEM-MKT-RANK	UE-RATE	FEMALE%	WHITE%	HISPANIC%	ASIAN%	BLACK%	NAT-AMER%
INSTR-EXP	1																												
ACAD-EXP	0.6	1																											
STUDENT-EXP	0.7	0.7	1																										
RES-EXP	0.8	0.6	0.5	1																									
INST-SUP-EXP	0.8	0.7	0.7	0.8	1																								
PUBLIC-EXP	0.0	0.0	-0.1	0.0	-0.1	1																							
OTHER-EXP	0.2	0.1	0.1	0.2	0.2	0.1	1																						
SC-EXP	1.0	0.7	0.8	0.8	0.8	0.0	0.2	1																					
ADMIN/INSTR+COST-RATIO	0.0	0.0	0.1	0.1	0.4	-0.1	0.0	0.0	1																				
ACT-MATH25	0.7	0.6	0.6	0.6	0.7	-0.1	0.1	0.7	0.1	1																			
ACT-COMP25	0.7	0.6	0.6	0.6	0.7	-0.1	0.1	0.7	0.2	1.0	1																		
PELL%	-0.4	-0.4	-0.4	-0.4	-0.4	0.0	0.0	-0.5	0.0	-0.7	-0.7	1																	
STEM%	0.3	0.3	0.3	0.5	0.4	-0.1	0.0	0.4	0.2	0.6	0.5	-0.3	1																
HH-INC	0.6	0.6	0.7	0.5	0.6	-0.1	0.1	0.7	0.0	0.8	0.8	-0.7	0.2	1															
R1	0.4	0.2	0.2	0.3	0.3	0.2	0.2	0.3	-0.2	0.5	0.5	-0.3	0.1	0.3	1														
PUBLIC	-0.6	-0.5	-0.6	-0.4	-0.7	0.2	-0.1	-0.6	-0.4	-0.7	-0.7	0.5	-0.3	-0.6	-0.1	1													
FAC-SALARY	0.8	0.6	0.7	0.7	0.7	-0.1	0.2	0.8	0.1	0.8	0.8	-0.5	0.5	0.7	0.5	-0.6	1												
FAC-STUDENT-RATIO	-0.7	-0.6	-0.6	-0.5	-0.7	0.0	-0.1	-0.7	-0.3	-0.7	-0.7	0.6	-0.4	-0.7	-0.2	0.8	-0.6	1											
UG-POP	-0.4	-0.3	-0.4	-0.3	-0.4	0.2	0.1	-0.4	-0.4	-0.3	-0.3	0.3	-0.3	-0.3	0.3	0.5	-0.2	0.6											
GRAD-POP	0.2	0.1	0.0	0.2	0.1	0.1	0.2	0.2	-0.2	0.3	0.3	-0.1	-0.1	0.2	0.5	-0.1	0.3	-0.1	0.4	1									
LABOR-MKT-RANK	-0.1	-0.1	-0.2	-0.2	-0.2	0.3	0.0	-0.1	0.0	-0.2	-0.2	0.1	-0.2	-0.2	-0.1	0.2	-0.3	0.1	0.0	-0.1	1								
STEM-MKT-RANK	-0.1	0.0	-0.1	-0.1	-0.2	0.3	0.0	-0.1	-0.2	-0.2	-0.1	0.0	-0.1	-0.1	-0.1	0.2	-0.2	0.1	0.0	-0.1	0.7	1							
UE-RATE	0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.0	0.1	-0.1	0.2	-0.1	-0.1	0.1	0.0	-0.1	1						
FEMALE%	-0.1	-0.1	-0.1	-0.2	-0.1	0.0	0.0	-0.1	-0.1	-0.3	-0.3	0.3	-0.8	-0.1	0.0	0.0	-0.2	0.1	0.2	0.2	0.1	0.0	0.1	1					
WHITE%	-0.3	-0.2	-0.3	-0.3	-0.3	0.2	-0.2	-0.3	-0.1	-0.2	-0.2	-0.4	-0.2	0.0	-0.2	0.2	-0.4	0.1	0.0	-0.2	0.3	0.3	-0.4	-0.1	1				
HISPANIC%	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	-0.1	-0.1	-0.1	0.4	0.0	-0.2	0.1	0.1	0.1	0.2	0.2	0.1	-0.2	0.0	0.1	0.1	-0.6	1			
ASIAN%	0.5	0.4	0.4	0.5	0.4	-0.1	0.2	0.5	-0.1	0.5	0.5	-0.1	0.4	0.3	0.4	-0.2	0.7	-0.3	-0.1	0.2	-0.3	-0.3	0.2	-0.1	-0.7	0.2	1		
BLACK%	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	0.3	-0.3	-0.3	0.5	-0.2	-0.3	-0.2	0.1	-0.3	0.1	-0.1	-0.1	0.1	-0.2	0.3	0.4	-0.3	-0.1	-0.2	1	
NAT-AMER%	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.0	-0.1	-0.1	-0.3	-0.2	0.1	-0.1	-0.2	-0.2	0.2	-0.2	0.1	0.0	-0.1	0.1	0.2	-0.1	0.1	0.1	0.1	-0.2	0.0	1

Table A2: One Sample Student's *t*-test for Key Variables

Variable	R1+R2 Mean SD	R1-Public Mean SD	UNM	R1+R2 & UNM Difference *t*-stat	R1-Public & UNM Difference *t*-stat
GR-6YR	68.51	71.19	47	21.51***	24.19***
	(17.24)	(12.66)		18.38	17.09
GR-4YR	47.02	47.52	15	32.02***	32.52***
	(23.36)	(16.69)		20.14	17.43
RETENT	86.09	87.95	80	6.09***	7.95***
	(8.38)	(6.15)		10.71	11.55
EC-SAL	51014.21	49748.75	40700	10314.21***	9048.75***
	(6896.81)	(4575.28)		20.99	17.69
INSTR-EXP	18.70	14.68	12	6.32***	2.30***
	(17.57)	(6.01)		5.30	3.42
ACD-EXP	5.56	4.43	2	3.41***	2.28***
	(7.13)	(2.40)		7.05	8.49
STUDENT-EXP	2.90	1.93	1	1.65***	0.68***
	(2.59)	(0.97)		9.38	6.23
RES-EXP	10.35	9.56	8	2.27**	1.48**
	(14.87)	(6.21)		2.24	2.13
INST-SUP-EXP	5.35	3.35	3	2.51***	0.51***
	(5.50)	(1.48)		6.72	3.07
PUBLIC-EXP	2.06	3.27	16	-13.98***	-12.78***
	(2.85)	(3.91)		-72.30	-29.22
OTHER-EXP	1.87	2.02	4	-2.20***	-2.05***
	(2.93)	(1.26)		-11.05	-14.58
SC-EXP	27.16	21.03	16	11.38***	5.25***
	(23.74)	(8.35)		7.06	5.63
ADMIN/INSTR+C	0.22	0.18	0.196	0.03***	-0.01**
OST RATIO	(0.10)	(0.06)		4.02	-2.16
ACT-MATH25	23.45	23.40	20	3.45***	3.40***
	(4.08)	(2.78)		12.48	10.92
ACT-COMP25	23.85	23.61	20	3.85***	3.61***
	(3.97)	(2.49)		13.82	12.55
PELL%	27.87	28.54	40	-12.13***	-11.46***
	(12.54)	(10.07)		-14.26	-10.18
STEM%	25.54	23.84	17	8.54***	6.84***
	(15.85)	(9.67)		7.56	6.32
HH-INC	108.81	102.41	74	34.91***	28.51***
	(31.81)	(17.27)		16.16	14.76
FEMALE%	51.29	50.57	55	-3.96***	-4.69***
	(7.59)	(4.77)		-7.69	-8.79
WHITE%	55.89	56.75	36	20.30***	21.16***
	(19.43)	(18.07)		15.39	10.47
HISPANIC%	11.01	11.98	45	-33.62***	-32.65***
	(11.82)	(10.71)		-41.91	-27.26
ASIAN%	8.62	10.72	3	5.57***	7.67***
	(8.51)	(10.06)		9.64	6.82
BLACK%	9.40	7.10	3	6.80***	4.51***
	(13.67)	(6.05)		7.33	6.67
NAT-AMER%	0.55	0.40	6	-5.59***	-5.75***
	(1.53)	(0.81)		-54.02	-63.84
FAC-SALARY	10.40	10.50	9	1.49***	1.59***
	(2.35)	(1.48)		9.38	9.60
FAC-STUDENT-	15.92	18.23	19	-3.08***	-0.77**
RATIO	(4.74)	(3.23)		-9.57	-2.14

* p < 0.10, ** p < 0.05, *** p < 0.01

Table A3: NM Public Colleges and Universities, Ranked by Administrative Cost Ratio (ACTA, 2017)

Institution (Carnegie Classification)	**ADMIN/INSTR+ COST RATIO FY 2015**	**UG FTE Enrollment, 15-16, for benchmark**	**ACTA Bench-mark Ratio***	**Difference (Actual – Benchmark)**
NMSU-Main (Doct. Univ., Higher Res. Act.)	2147/(10229+1903)=**.1770**	11,069	0.19	**-0.013**
San Juan College (Assoc. Coll.: Mixed Transfer/Career & Technical-Mixed Traditional/Nontraditional)	1666/(7391+1173)=**.1945**	4813		
UNM-Main (Doct. Univ. Highest Res. Act.)	2843/(12376+2150)=**.1957**	18,982	0.19	**+0.0057**
NMSU Dona Ana (Assoc. Coll.: High Transfer-Mixed Traditional/Nontraditional)	1179/(5105+910)=**.1960**	4970		
ENMU-Main (Masters Coll.&Univ.: Medium Programs)	2079/(7025+1587)=**.24141**	3383	0.24	**+0.0014**
NMSU Carlsbad (Assoc. Coll.: HTHN)	2078/(7520+1087)=**.24143**	954		
WNMU (Masters Coll.&Univ.: Medium Programs)	2233/(7884+1021)=**.2508**	1787	0.28	**-0.0292**
NMSU Alamagordo (Assoc. Coll.: HTHN)	2296/(7443+1627)=**.2531**	969		
UNM-Valencia (Assoc. Coll. :HTHN)	1492/(4900+933)=**.2558**	1241	--	--
UNM-Gallup (Assoc. Coll.: Mixed Transfer/Career & Technical-High Traditional)	1914/(5923+1485)=**.2584**	1,643	--	--
CNM (Assoc. Coll.: Mixed Transfer/Career & Technical-Mixed Traditional/Nontraditional	1483/(4522+1183)=**.2599**	16,513	--	--
SFCC (Assoc. Coll.: Mixed Transfer/Career & Technical-High Nontraditional)	2418/(7886+1284)=**.2746**	2694		
NMSU Grants (Assoc. Coll.: Mixed Transfer/Career & Technical-High Nontraditional)	2523/(5698+3287)=**.2808**	428		
Clovis CC (Associate's Colleges: HCTHN)	1681/(5066+731)=**.2903**	1613		
NM Highlands (Masters Coll.&Univ.: Larger Programs)	2516/(7371+1058)=**.2985**	1782	0.24	**+0.0585**
Mesalands CC (Associate's Colleges: HCTHN)	2697/(7245+1625)=**.3041**	433		
NMJC (Assoc. Coll.: HTHN)	3053/(6998+1580)=**.3559**	1813	--	--
ENMU Roswell (Assoc. Coll.: HCTHN)	2479/(6456+428)=**.36**	1716		
UNM-Los Alamos (Assoc. Coll.: HTHN)	2090/(4197+1563)=**.3628**	451	--	--
Luna CC (Assoc. Coll.: Mixed Transfer/Career & Technical-High Nontraditional)	4176/(8585+1937)=**.3969**	759		
ENMU Ruidoso (Assoc. Coll.: HCTHN)	2876/(5314+1272)=**.4367**	326		
NM Tech (Master's Coll. & Univ.: Small Programs)	5151/(9914+1098)=**.4678**	1535	0.34	**+.1278**
UNM-Taos (Assoc. Coll.: HTHN)	2565/(4244+645)=**.5240**	823	--	--
NNMC (Bacc./Assoc. Coll.: Mixed Bacc./Assoc.)	7124/(9981+1615)=**.6143**	848	--	--

Notes: HTHN= High Transfer-High Nontraditional; HCTHN= High Career & Technical-High Nontraditional;

Table A4: Model Estimation Results: Log odds - Logits of Retention Rate, Weighted by Size of Total FTE Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.0130***	0.00865**	0.00127	0.00441					0.000694	0.00411
	(0.00341)	(0.00358)	(0.00299)	(0.00437)					(0.00298)	(0.00455)
ACAD-EXP	0.0185***	0.0128***	0.00945**	0.0112***	0.00695	0.00912***	0.00752*	0.00950***	0.00950**	0.0116***
	(0.00643)	(0.00320)	(0.00441)	(0.00290)	(0.00422)	(0.00257)	(0.00413)	(0.00239)	(0.00440)	(0.00289)
STUDENT-EXP	0.0861***	0.108***	0.0336**	0.0376**	0.0159	0.0240	0.0134	0.0178	0.0319**	0.0357**
	(0.0221)	(0.0183)	(0.0153)	(0.0167)	(0.0140)	(0.0166)	(0.0140)	(0.0160)	(0.0152)	(0.0164)
R1	0.664***	0.627***	0.342***	0.394***	0.261***	0.305***	0.288***	0.325***	0.348***	0.402***
	(0.0792)	(0.102)	(0.0630)	(0.0703)	(0.0642)	(0.0615)	(0.0643)	(0.0648)	(0.0650)	(0.0679)
RES-EXP			-0.00173	-0.00749*	-0.00249	-0.00705**	-0.00462*	-0.00775**	-0.00372	-0.00883*
			(0.00320)	(0.00391)	(0.00245)	(0.00303)	(0.00253)	(0.00336)	(0.00330)	(0.00451)
ACT-MATH25			0.140***	0.123***	0.118***	0.103***	0.114***	0.0998***	0.128***	0.113***
			(0.0133)	(0.0195)	(0.0137)	(0.0199)	(0.0144)	(0.0181)	(0.0147)	(0.0203)
PELL%			-0.00420	-0.00514	-0.00599**	-0.00660	-0.00691	-0.00720	-0.00904**	-0.00952
			(0.00307)	(0.00538)	(0.00299)	(0.00496)	(0.00439)	(0.00664)	(0.00453)	(0.00698)
STEM%			0.000632	0.00202	-0.000005	0.000818	0.00688**	0.00682*	0.00682*	0.00740*
			(0.00238)	(0.00253)	(0.00221)	(0.00241)	(0.00324)	(0.00384)	(0.00347)	(0.00435)
FAC-SALARY					0.0836***	0.0965***	0.0902***	0.115***		
					(0.0214)	(0.0280)	(0.0230)	(0.0293)		
FEMALE%							0.0161***	0.0140*	0.0154**	0.0122
							(0.00589)	(0.00756)	(0.00615)	(0.00831)
WHITE%							-0.00125	-0.00190	-0.00165	-0.00229
							(0.00283)	(0.00488)	(0.00299)	(0.00476)
HISPANIC%							-0.00153	-0.00173	-0.000221	0.000550
							(0.00310)	(0.00379)	(0.00324)	(0.00405)
ASIAN%							-0.00424	-0.00871	0.00221	-0.00113
							(0.00498)	(0.00746)	(0.00492)	(0.00825)
CONSTANT	1.115***	1.179***	-1.482***	-1.168**	-1.638***	-1.452***	-2.448***	-2.205**	-1.905***	-1.428*
	(0.0669)	(0.0835)	(0.312)	(0.475)	(0.300)	(0.457)	(0.658)	(0.919)	(0.665)	(0.849)
R^2	0.587	0.614	0.831	0.845	0.845	0.857	0.853	0.865	0.839	0.851
N	216	216	196	196	196	196	196	196	196	196
Predicted (UNM)	0. 8897	0. 8886	0.8271	0. 8296	0. 8186	0. 8202	0. 8218	0. 8248	0. 8305	0. 8387
Actual (UNM)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS - Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table A5: Model Estimation Results: Log odds - Logits of Four-Year Graduation Rate, Weighted by Size of Total FTE Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.0195***	0.00845**	0.00622	0.00330					0.00605	0.00363
	(0.00480)	(0.00406)	(0.00409)	(0.00459)					(0.00395)	(0.00484)
ACAD-EXP	0.0279***	0.0269***	0.0168**	0.0169***	0.0113*	0.0146***	0.0123**	0.0164***	0.0166**	0.0187***
	(0.00974)	(0.00451)	(0.00674)	(0.00377)	(0.00652)	(0.00358)	(0.00613)	(0.00378)	(0.00645)	(0.00394)
STUDENT-EXP	0.0848***	0.123***	0.0126	0.0111	-0.00659	-0.0167	-0.00432	-0.0175	0.0133	0.0126
	(0.0325)	(0.0414)	(0.0224)	(0.0189)	(0.0205)	(0.0188)	(0.0197)	(0.0133)	(0.0214)	(0.0168)
R1	0.763***	0.811***	0.240***	0.239*	0.118	0.0982	0.177**	0.115	0.265***	0.228**
	(0.109)	(0.160)	(0.0878)	(0.125)	(0.0883)	(0.103)	(0.0855)	(0.0853)	(0.0871)	(0.0979)
RES-EXP			-0.00457	-0.00152	-0.00267	-0.00291	-0.00849**	-0.00756**	-0.0106**	-0.00767
			(0.00473)	(0.00414)	(0.00380)	(0.00298)	(0.00375)	(0.00327)	(0.00469)	(0.00482)
ACT-MATH25			0.192***	0.191***	0.160***	0.156***	0.155***	0.153***	0.171***	0.176***
			(0.0179)	(0.0265)	(0.0185)	(0.0281)	(0.0186)	(0.0286)	(0.0187)	(0.0304)
PELL%			-0.0171***	-0.0201***	-0.0202***	-0.0223***	-0.0197***	-0.0187	-0.0226***	-0.0223*
			(0.00414)	(0.00681)	(0.00401)	(0.00640)	(0.00576)	(0.0117)	(0.00594)	(0.0117)
STEM%			-0.0171***	-0.0188***	-0.0188***	-0.0199***	-0.00343	-0.00501	-0.00306	-0.00492
			(0.00354)	(0.00415)	(0.00329)	(0.00376)	(0.00451)	(0.00558)	(0.00480)	(0.00612)
FAC-SALARY					0.131***	0.145***	0.131***	0.163***		
					(0.0291)	(0.0426)	(0.0305)	(0.0463)		
FEMALE%							0.0387***	0.0370***	0.0367***	0.0339***
							(0.00794)	(0.00911)	(0.00825)	(0.0102)
WHITE%							0.00399	0.00513	0.00323	0.00423
							(0.00392)	(0.00804)	(0.00414)	(0.00840)
HISPANIC%							-0.00139	-0.000881	0.000201	0.00218
							(0.00416)	(0.00603)	(0.00434)	(0.00660)
ASIAN%							0.00418	0.00346	0.0129**	0.0140
							(0.00656)	(0.0137)	(0.00650)	(0.0140)
CONSTANT	-1.279***	-1.190***	-4.065***	-3.854***	-4.315***	-4.214***	-6.813***	-6.979***	-5.893***	-5.856***
	(0.0988)	(0.129)	(0.419)	(0.627)	(0.395)	(0.586)	(0.855)	(1.465)	(0.858)	(1.469)
R^2	0.510	0.525	0.791	0.812	0.808	0.830	0.832	0.848	0.817	0.829
N	216	216	196	196	196	196	196	196	196	196
Predicted (UNM)	0.4731	0. 4843	0. 2950	0. 3019	0. 2767	0. 2816	0. 2654	0. 2627	0. 2819	0. 2910
Actual (UNM)	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS - Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table A6: Model Estimation Results: Log odds - Logits of Six-year Graduation Rate, Weighted by Size of Total FTE Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.0150***	0.00566	0.00447	0.00354					0.00539*	0.00393
	(0.00373)	(0.00526)	(0.00327)	(0.00367)					(0.00324)	(0.00393)
ACAD-EXP	0.0267***	0.0213***	0.0175***	0.0175***	0.0125***	0.0151***	0.0134***	0.0160***	0.0179***	0.0184***
	(0.00737)	(0.00345)	(0.00524)	(0.00383)	(0.00471)	(0.00366)	(0.00464)	(0.00356)	(0.00521)	(0.00396)
STUDENT-EXP	0.102***	0.139***	0.0317*	0.0411**	0.00560	0.0125	0.0104	0.0115	0.0344**	0.0436**
	(0.0251)	(0.0257)	(0.0176)	(0.0168)	(0.0153)	(0.0129)	(0.0152)	(0.0121)	(0.0174)	(0.0168)
R1	0.700***	0.737***	0.301***	0.355***	0.163**	0.210***	0.198***	0.227***	0.300***	0.348***
	(0.0889)	(0.140)	(0.0714)	(0.0979)	(0.0688)	(0.0750)	(0.0677)	(0.0706)	(0.0724)	(0.0847)
RES-EXP			-0.00442	-0.00805**	-0.00419	-0.0094***	-0.00734**	-0.0107**	-0.00860**	-0.0108**
			(0.00371)	(0.00329)	(0.00274)	(0.00350)	(0.00283)	(0.00411)	(0.00381)	(0.00435)
ACT-MATH25			0.160***	0.153***	0.124***	0.117***	0.130***	0.127***	0.149***	0.151***
			(0.0149)	(0.0221)	(0.0147)	(0.0222)	(0.0150)	(0.0207)	(0.0160)	(0.0234)
PELL%			-0.0098***	-0.0115*	-0.0131***	-0.0138***	-0.00675	-0.00629	-0.0103**	-0.0101
			(0.00344)	(0.00575)	(0.00319)	(0.00486)	(0.00462)	(0.00744)	(0.00500)	(0.00798)
STEM%			-0.00518*	-0.00563**	-0.00680***	-0.0068***	0.00247	0.000209	0.00304	0.000333
			(0.00279)	(0.00258)	(0.00244)	(0.00235)	(0.00351)	(0.00391)	(0.00396)	(0.00451)
FAC-SALARY					0.143***	0.150***	0.153***	0.175***		
					(0.0227)	(0.0319)	(0.0241)	(0.0355)		
FEMALE%							0.0233***	0.0184**	0.0216***	0.0150*
							(0.00628)	(0.00697)	(0.00689)	(0.00807)
WHITE%							0.00805***	0.00562	0.00768**	0.00469
							(0.00306)	(0.00477)	(0.00341)	(0.00513)
HISPANIC%							0.00144	0.000652	0.00376	0.00394
							(0.00330)	(0.00414)	(0.00363)	(0.00474)
ASIAN%							0.00486	-0.00372	0.0159***	0.00759
							(0.00523)	(0.00943)	(0.00544)	(0.00998)
CONSTANT	-0.130*	-0.0676	-2.788***	-2.596***	-3.064***	-2.974***	-5.407***	-5.075***	-4.430***	-3.875***
	(0.0762)	(0.111)	(0.349)	(0.527)	(0.318)	(0.490)	(0.690)	(0.879)	(0.728)	(0.877)
R^2	0.600	0.618	0.831	0.850	0.860	0.875	0.871	0.883	0.843	0.855
N	217	217	197	197	197	197	197	197	197	197
Predicted (UNM)	0.7195	0.7229	0.5803	0.5821	.5555	0.5569	0.5384	0.5502	0.5628	0.5873
Actual (UNM)	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS - Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table A7: Model Estimation Results: Log of Early Career Median Salary, Weighted by Size of Total FTE Enrollment

	Model 1 WLS	Model 2 OLS-VCE	Model 3 WLS	Model 4 OLS-VCE	Model 5 WLS	Model 6 OLS-VCE	Model 7 WLS	Model 8 OLS-VCE	Model 9 WLS	Model 10 OLS-VCE
INSTR-EXP	0.00250***	0.00314***	0.000237	0.0000147					0.0000261	-0.000088
	(0.000636)	(0.000915)	(0.000463)	(0.000446)					(0.000459)	(0.000378)
ACAD-EXP	0.00261**	0.000492	0.000735	0.000285	0.000250	0.000104	0.000131	-0.0000379	0.000437	0.0000797
	(0.00130)	(0.00142)	(0.000734)	(0.000610)	(0.000690)	(0.000631)	(0.000691)	(0.000651)	(0.000736)	(0.000642)
STUDENT-EXP	0.00922**	0.0123*	0.00731***	0.00968***	0.00385*	0.00572**	0.00325	0.00514**	0.00614**	0.00891***
	(0.00436)	(0.00713)	(0.00249)	(0.00229)	(0.00226)	(0.00215)	(0.00228)	(0.00237)	(0.00247)	(0.00219)
R1	0.0430***	-0.00141	0.0102	0.0103	-0.00506	-0.00638	-0.00896	-0.00684	-0.000935	0.00469
	(0.0151)	(0.0190)	(0.0102)	(0.0114)	(0.0102)	(0.0111)	(0.0102)	(0.0113)	(0.0103)	(0.0117)
RES-EXP			0.000209	0.000484	0.0000899	0.000101	0.000393	0.000386	0.000562	0.000646
			(0.000521)	(0.000411)	(0.000401)	(0.000296)	(0.000422)	(0.000412)	(0.000539)	(0.000515)
ACT-MATH25			0.00759***	0.00491	0.00334	0.000578	0.00228	-0.000550	0.00457**	0.00199
			(0.00214)	(0.00299)	(0.00217)	(0.00293)	(0.00227)	(0.00332)	(0.00228)	(0.00351)
PELL%			-0.00141***	-0.00162**	-0.00175***	-0.00186***	-0.00264***	-0.00274***	-0.00307***	-0.00311***
			(0.000493)	(0.000686)	(0.000473)	(0.000573)	(0.000695)	(0.000906)	(0.000712)	(0.000893)
STEM%			0.00427***	0.00413***	0.00416***	0.00406***	0.00318***	0.00318***	0.00307***	0.00311***
			(0.000394)	(0.000394)	(0.000358)	(0.000356)	(0.000526)	(0.000653)	(0.000562)	(0.000726)
FAC-SALARY					0.0157***	0.0165***	0.0134***	0.0154***		
					(0.00335)	(0.00458)	(0.00362)	(0.00495)		
FEMALE%							-0.00247***	-0.00234**	-0.00276***	-0.00267**
							(0.000944)	(0.00112)	(0.000979)	(0.00121)
WHITE%							-0.00110**	-0.00104	-0.00126***	-0.00116*
							(0.000459)	(0.000668)	(0.000484)	(0.000645)
HISPANIC%							-0.000684	-0.000543	-0.000537	-0.000275
							(0.000496)	(0.000616)	(0.000517)	(0.000647)
ASIAN%							-0.0000409	-0.000687	0.000894	0.000293
							(0.000787)	(0.00120)	(0.000775)	(0.00115)
CONSTANT	10.72***	10.74***	10.54***	10.61***	10.52***	10.57***	10.81***	10.85***	10.91***	10.95***
	(0.0141)	(0.0221)	(0.0501)	(0.0706)	(0.0471)	(0.0647)	(0.104)	(0.110)	(0.104)	(0.115)
R^2	0.381	0.450	0.798	0.863	0.820	0.878	0.827	0.883	0.811	0.873
N	197	197	197	197	197	197	197	197	197	197
Predicted (UNM)	49539.94	48941.4	46013.82	46121.95	45532.78	45594.44	45247.99	45603.13	45605.09	46225.07
Actual (UNM)	40700	40700	40700	40700	40700	40700	40700	40700	40700	40700

Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01; WLS - Weighted least squares. OLS -VCE -Ordinary least squares with robust clustered standard errors at the state level.

Table A8: Restricted F-test for Key Parameters

		RETENT Model 8 Table 8	GR-4YR Model 8 Table 9	GR-6YR Model 8 Table 10	EC-SAL Model 8 Table 11
$\beta^{FAC-SALARY} = \beta^{ACAD-EXP}$	F	13.25	10.28	21.03	
	Prob > F	0.001	0.0023	0.0000	
$\beta^{FAC-SALARY} = \beta^{ACAD-EXP}$	F				2.12
	Prob > F				0.1512

Table A9: Paired *t*-test for the Predicted Values

RETENT						
	Mean	Std. Dev.	Std. Err.	Difference	*t*-stat	*p*-value
Predicted-UNM	86.192	3.869	0.888	-3.879	-17.192	0.000
Predicted- R1 - Public	90.070	2.886	0.662			
GR-4YR						
	Mean	Std. Dev.	Std. Err.	Difference	*t*-stat	*p*-value
Predicted-UNM	35.471	10.308	2.365	-16.387	-82.683	0.000
Predicted- R1 - Public	51.858	10.913	2.504			
GR-6YR						
	Mean	Std. Dev.	Std. Err.	Difference	*t*-stat	*p*-value
Predicted-UNM	65.421	11.295	2.591	-10.073	-19.058	0.000
Predicted- R1 - Public	75.494	9.032	2.072			

Note: Predicted-UNM: Predicted values using UNM characteristics. Predicted values using the characteristics of R1 -Public universities

Figure A1: ADMIN/INSTR+COST RATIO as of Fiscal Year 2015, and UG-POP (Full Time Equivalent) for Academic Year 2014/15 for Public Colleges and Universities in New Mexico

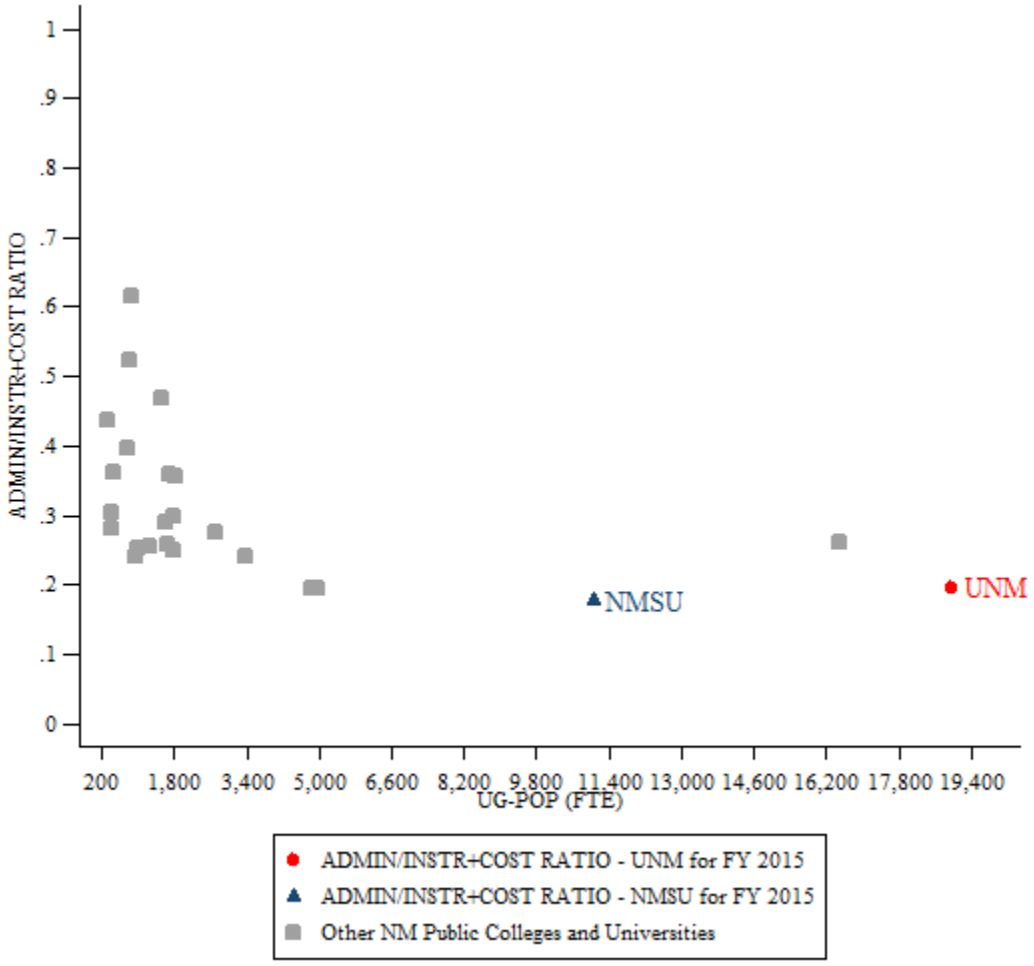
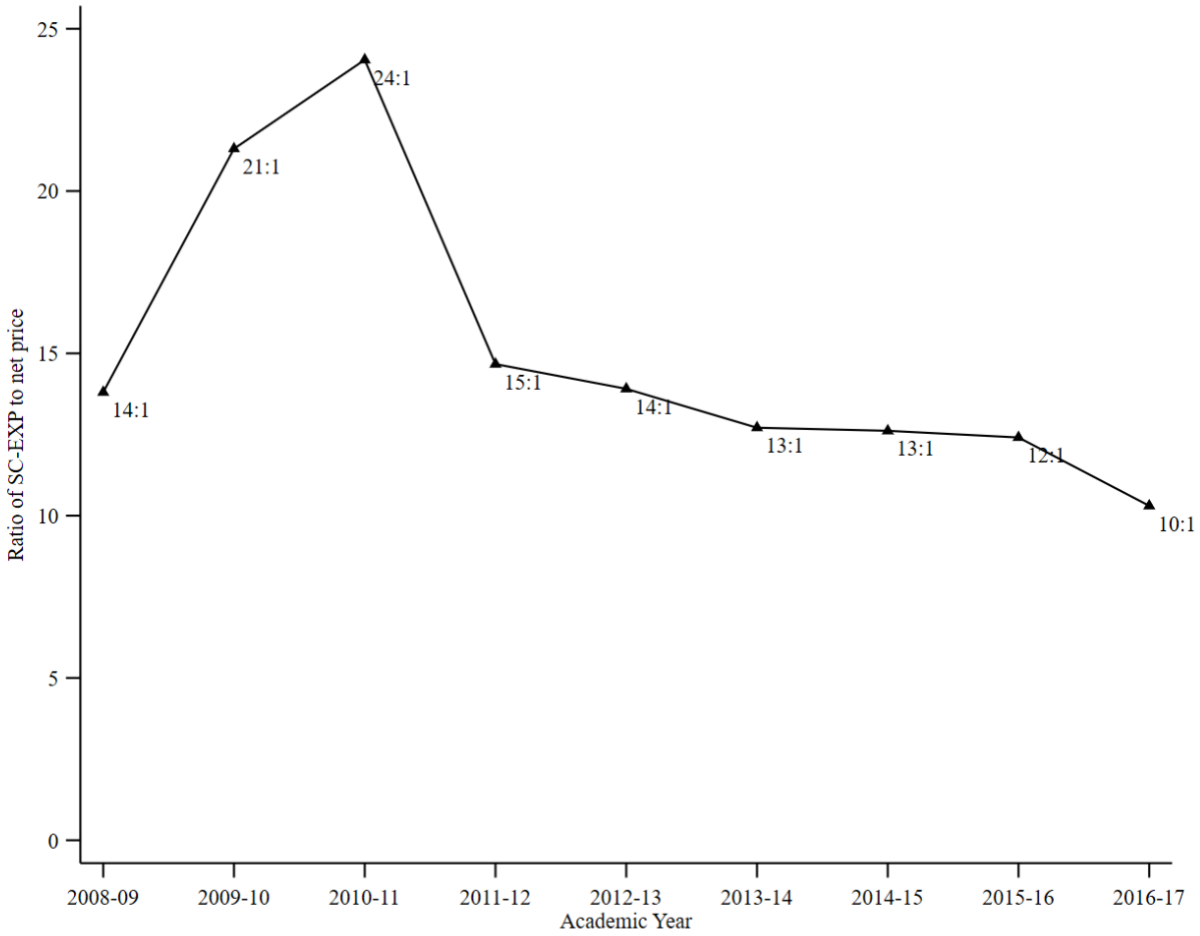


Figure A2: Trends in Ratio of Student Centered Expenses to Average Tuition and Fees Paid by Degree Seeking, Resident Undergraduate at University of New Mexico – Main Campus



Sources: IPEDS and Bursar's Office, University of New Mexico.