

**Separating the Roles of Church and State in the
Ascendancy of American Higher Education, 1900-1914**

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I. Introduction

The growth of government has been one of the most profound changes in the U.S. economy over the last century. In 1902, for example, expenditures at all levels of government amounted to 7.5 percent of GDP, but had grown to 37.4 percent by 2007.¹ While the appropriate scope and size of government is still a vexing question facing voters, as evidenced by the on-going health care debate, citizens generally accept the government's provision of certain goods and services when allocation by private, market means fails. In the cases of public goods, positive externalities, or incomplete markets, citizen support their government's provision of certain goods and services, though certainly disagreements about the proper levels persist. While citizens and politicians may support the government's role in bolstering the consumption of various goods and services that previously were consumed below some perceived social optimum, how effective is such public provision? If such goods and services were being consumed privately, then government provision may crowd-out – perhaps fully – this private activity as consumers move to allocate their incomes to other utility-enhancing goods and services.² Along a different dimension, crowd-out may occur based on the nature of government funding of the public expenditures. For example, federal grants-in-aid to states may encourage states to shift their prior budgets for a newly-funded program to other purposes, thus leaving the overall level of funding for the program unchanged.³

Economists have devoted increasing attention to the empirical nuances of measuring the extent of this crowd-out, attempting to control for the oftentimes endogenous nature of private and public provision.⁴ Russell Roberts (1984), for example, models the relationship between

private and public charity and argues that in equilibrium there should be a one-for-one crowd-out (see also Warr (1982) and Bergstrom, Blume, and Varian (1986)). He then goes on to suggest that the enormous increase in public relief during the Great Depression and the dramatic reduction in private relief during this period lend support for the model.⁵ Yet, as Gruber and Hungerman (2007) note, the Great Depression caused government expenditures to soar at the same time that people were challenged to provide to private charities (in their study, churches). Therefore, it was not necessarily the enhanced public relief expenditures of the New Deal that caused people to reduce their charitable giving, but it may have been the Depression itself. Gruber and Hungerman adopt an IV approach to establish the causal role of New Deal spending and find that church spending fell by 30 percent as a result of the public relief and can explain nearly all of the observed decline in charitable church giving during the Depression. In a modern context Hungerman (2005) uses landmark changes in the eligibility requirements for welfare in 1996 as an instrument for government welfare spending and estimates church charity crowd-out on the order of 20-38 cents for each public dollar.

While much of the crowd-out literature has focused on outcome measures, such as changes in precautionary saving, private insurance coverage, or charitable giving, recent work has begun to consider the dynamics of the crowd-out effect.⁶ For example, Andreoni and Payne (2003) consider how non-profit managers themselves respond to the changing incentives brought on by increased or decreased public funding. Based on their study the overall crowd-out effect should not be attributed completely to a change in donors' behavior because the non-profits themselves diminish their fundraising efforts when the government is more generous. In another recent study, Gruber and Hungerman (2008) show that religious activity is crowded-out by the repeal of so-called blue laws that restrict prohibit retail activity on Sunday. Thus, public policies

that alter people's opportunity costs to engage in religious activity can have significant effects on participation and, hence, donations. In other words, religiosity and, consequently, charitable giving does not happen in isolation, it comes from individuals' choices that weigh secular alternatives.⁷

This paper seeks to contribute to the growing empirical literature examining the channels through which public expenditures affect private activity. Our study makes use of a unique dataset on individual colleges and universities at the turn of the twentieth century to test whether expansions in publicly-provided higher education impacted the nonsectarian and religious private sectors. We look to a specific time in the history of higher education – 1900 to 1914 – when religious higher-education dominated, when the public sector was expanding, and when it was not clear that higher education would come to be overwhelmingly dominated by public institutions as they are today. In 1900, for example, 45 percent of collegiate students were enrolled in colleges and universities that were controlled by a religious entity, 24 percent went to nonsectarian private institutions, and 31 percent of the students went to public institutions. By contrast, in 2007, 17 percent of today's college students attend religious institutions, 15 percent attend private, not-for-profit colleges and universities, and the super-majority of 68 percent attends public institutions. To what extent can we attribute the dramatic drop in religious control of higher education to the expansion of the public sector? Or is the change a manifestation of Americans' shift toward secular activities? While this paper does not promise to answer this overarching question, our focus on a critical time in the development of American higher education should help to shed light on the market dynamics of the relationships between public universities and their private nonsectarian and religious counterparts.

The paper focuses on a relatively narrow timeframe because it allows us to examine the period surrounding the so-called Nelson Amendment of 1907 that enhanced federal land grant funding of public universities. Beginning in 1908 each state's federal land-grant funding was increased by \$5,000, and then increased by the same amount for the following four years. After five years, then, each state's land-grant appropriation was enhanced by \$25,000. Each state received the same amount, regardless of population, which translated into significant variation in the amounts of new funding that each state received on a per-capita basis. Thus, the nature of the expanded grant program provides a source of exogenous variation that enables us to identify the impact of enhanced public support for higher education on the private nonsectarian and religious sectors.

II. Higher Education at the Turn of the Twentieth Century

Higher education 100 years ago looked much different than it does today. As noted above, religious institutions dominated the market at the turn of the twentieth century, as they enrolled 45 percent of collegiate students, yet they enroll only 17 percent today. Public institutions were clearly important at this time, as they enrolled 31 percent of collegiate students, though their overall size has grown dramatically since then. Today, 68 percent of students attend colleges and universities considered public. While public institutions might not have dominated the market at the turn of the twentieth century, the national statistic masks the variety of market settings across the U.S. Table 1 shows the number of students, the college-going rate as a percentage of 18-to-21 year olds in the state, and the distribution of market shares across the three sectors of higher education – public, private nonsectarian, and religious – across states, Census regions, and the U.S. in 1900. In many states, primarily in the West and Delaware, the

public university was the only institution of higher learning within the state. But these institutions were generally quite small and enrolled a less-than-average fraction of the 18-to-21 year olds within the state (see Table 1). For example, in 1900 the University of Arizona enrolled 53 undergraduate students and they represented 0.6 percent of the state's 18-to-21 year old population. The national college-attendance rate across the U.S. at this time was 1.26 percent.⁸ The one exceptional case was Nevada, which had completely public higher education in 1900, enrolled 176 students, representing a stunning 5.8 percent of the state's 18-to-21 year olds.

The New England and Middle Atlantic states were notable for their relatively small public sectors, falling well below the national average, though New England ranked high in terms of 18-to-21 years olds attending college and the Middle Atlantic at about the national rate. Disproportionately, students in the northeastern states attended nonsectarian private colleges and universities, although religious college attendance was an important option. Southern states (South Atlantic, East South Central, and West South Central Census regions), by contrast, had much smaller proportions of their young adults attending college, and more than half of those who did attend predominantly went to religious institutions. These states had roughly an average share of public attendance and below-average nonsectarian attendance. Midwestern states (West North and South Central Census regions) had an average college-going rate, again with half of the students attending religious institutions. The nonsectarian sector was very small in the Midwest and the public sector enrolled between 39 and 45 percent of the students. Finally, the college attendance rate was relatively high in the western states (Mountain and Pacific Census regions), with more than half of the students attending public institutions, yet a relatively small percentage attended religious colleges. Attendance at private nonsectarian institutions followed the national average.

Goldin and Katz (1999) argue that around 1890 higher education began to undergo fundamental changes that would come to transform the industry over the following century: institutions expanded in size, especially those in the public sector; universities expanded their scope of operation, encompassing specialized departments and professional schools; and religious institutions began their absolute decline and nonsectarian institutions began their relative (compared to publics) decline. While Goldin and Katz talk about higher education's "formative years" as those between 1890 to 1940, the fundamental trends they highlight are readily apparent during the narrower period we consider here, 1900 to 1914.

Figures 1 and 2 provide evidence on two objective measures: collegiate faculty and students. Panel A of each figure shows the number of faculty devoted to collegiate instruction (Figure 1) or collegiate students (Figure 2) across the three sectors; Panel B shows the relative shares of students and faculty in each sector. There were 1,750 faculty at public institutions in 1900 and this number grew significantly to about 6,800 in 1914. The nonsectarian, private sector grew dramatically as well, rising from about 2,000 to 5,700 faculty. The religious institutions experienced an absolute decline in faculty over this period, from roughly 3,800 to 3,500, after reaching a maximum of almost 4,700 in 1903. In terms of where faculty worked in relative terms, the shift away from religious institutions was profound. The share of all faculty employed in religious colleges fell from about 50 percent to 22 percent between 1900 and 1914. The public sector share increased from 23 to 42 percent and the nonsectarian privates increased their market share from 27 to 36 percent.

The student enrollment data show the same stark trends for this short time period. College students in public institutions numbered just over 20 thousand in 1900 and expanded to 70.5 thousand by 1914. Enrollment at private nonsectarians grew from about 18 thousand to 57

thousand. Total religious college enrollment barely changed during the period, from 33.6 thousand to 36.2 thousand. In relative terms, the early years of the twentieth century saw students' rapid shift away from religiously-oriented college instruction. Religious institutions enrolled about 45 percent of all collegiate students in 1900, which fell to 22 percent by 1914. Public institutions increased their shares from 31 to 43 percent of the students, while nonsectarians increased their share from 24 to 35 percent.

Goldin and Katz (1999) offer two explanations for the relative growth of the public sector during this time. First, the demand for more scientifically- and practically-oriented curricula, as opposed to classical curricula, favored the public institutions. "Those that had access to research funds, were initially large and diverse, were non-sectarian, and had reputation and a long purse were in the best position to prosper from the changes" (p. 49). They go on to argue that public institutions were the ones that were able to leverage their research enterprises to benefit their teaching missions across a broad spectrum of curricula, which meant that "Small liberal arts colleges, independent professional schools, and sectarian institutions were at a competitive disadvantage." Second, Goldin and Katz further argue that the secondary school movement that flourished from 1910 to 1940 produced an abundant source of student inputs for higher education in the expanding pool of high school graduates who happened to have lower incomes than their earlier college-going predecessors.

Secondary school expansion is a phenomenon that came somewhat later than the period we consider in this paper, but comparing the three different higher-education sectors in terms of resource capacity, which Goldin and Katz note as an important criterion for future success, is important to put our analysis below into some perspective. In Figure 3a-c we graph estimated kernel densities for the three sectors for three variables (all in per student terms): endowment

income, building and land value, and equipment. All of the distributions are estimated using 1900 to 1905 data and in all cases Kolmogorov-Smirnov tests reject the hypothesis that the data for two sectors (in pair-wise comparisons) are drawn from the same distribution. In terms of annual endowment income and reported building and land values, the distributions indicate the relative wealth of nonsectarian institutions, but the overlap between the public and sectarian sectors is somewhat surprising. The graph showing equipment per student shows more clearly that the public and nonsectarian sectors were engaged in a different type of instruction relative to their sectarian counterparts. At least on this latter measure, the densities suggest that the religious sector was clearly lagging behind in terms of equipping their institutions with the equipment and apparatus to take advantage of the increasing demand for scientific and practical training. But as the other figures demonstrate, some sectarian institutions were clearly competitive with their public counterparts, at least on a per student basis, in terms of their ability to tap endowment funds. Thus, while sectarian institutions were clearly smaller than their counterparts and potentially engaged in a different type of educational mission, how did they respond to the expansive growth in public higher education? Did they maintain the status quo in the face of fundamental changes that were sweeping higher education, or did they adapt to competitive pressures?

The Expansion of the Federal Land-Grant

Disentangling the causal role that the expanding public sector played in the overall secularization of higher education in the U.S. is complicated by the fact that unobservable socioeconomic or religious changes across the U.S. may have contributed to the observed trends. Fortunately, as noted above, in 1907 the Nelson Amendment expanded federal land-grant

funding to the states. Each state was provided the same grant amount, regardless of population, so the per capita amounts were highly variable across the U.S. We use this exogenous federal shock to state-level public higher education funding as a source of variation to identify the response from religious and nonsectarian institutions.

The Morrill Act of 1862 granted each state 30,000 acres for each senator and representative in Congress. The land grants were designed to provide for:

the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life. (7 U.S.C. § 304)

Because of the states' apparent financial difficulty in maintaining support for their new so-called land grant institutions, the Second Morrill Act of 1890 provided each state with a \$15,000 appropriation in that year, with an annual increase of \$1,000 for 10 more years. By 1900, then, the states' nominal budgets for their land grant institutions would have increased by \$25,000 relative to the 1890 baseline. Again, in 1907, the federal government further enhanced land grant funding. Known as the Nelson Amendment, the new law appropriated each state an additional \$5,000 in 1908, with marginal annual increases of \$5,000 more over the next four years. Thus, by 1912 each state received an additional \$25,000 – on top of the \$25,000 from the Second Morrill Act – to support the operation and maintenance of their land grant institutions.⁹

The timing of the supplemental land grant appropriations is illustrated in Figure 4.

There are three points worth emphasizing with regard to the 1890 and 1907 enhancements to the original Morrill Act. First, the money was fungible. As Florence (1938, 293) notes, “the land-grant colleges were permitted to use the funds appropriated by the Acts for instruction not only in basic courses in agriculture, mechanic arts, and home economics but also in courses intended as preparation for teaching those courses.” In other words, the land grant institutions had considerable flexibility in how they could allocate their new funding. Second, the appropriations from the Acts were clearly important, though certainly more important for some states than others. Focusing on the 1907 Nelson Amendment, the \$25,000 that was ultimately appropriated to each state by 1912 represented 5.4 percent of all public expenditures across the U.S. in 1907. Figure 5 shows the distribution across all states. In 32 states the Nelson appropriation enhanced the public universities’ budgets by over 5 percent, and in many cases where the institutions were fairly small to begin with, the percentage increase was substantial. Third, given the flat nature of the grants, not all states benefitted equally. Of course, states with smaller populations (which did not receive as much land under the 1862 Morrill Act because they had fewer representatives in the House of Representatives) disproportionately gained. Figure 6 shows the per capita distribution of the Nelson Amendment appropriation based on the number of 18-to-21 years olds in each state in 1900. Clearly, sparsely populated western states benefitted on a per capita basis, with Nevada receiving a stunning \$8.23 per college-age resident. While the Nelson appropriation, from a national perspective, increased higher education funding by 20 cents for each 18-to-21 year old American (or, roughly \$3.16 per 18-to-21 year old who graduated from high school), there was a wide variation in each state’s treatment.¹⁰ It is this exogenous source of variation in public funding for higher education that took effect in 1908 that we exploit to identify the spillover effects in the sectarian and non-sectarian private sectors.

We are confident that examining this seemingly short time period from 1900 to 1914 is one of the most important to consider in the history of higher education. As the Figures 1 and 2 show, nearly half of the public sector's overall growth from 1900 to 2007 occurred in the first 14 years of the twentieth century. Similarly, the religious sector's relative decline was nearly complete by 1914. The sector's faculty and student shares were essentially cut in half (student share fell from 47 to 22 percent) during the 14-year period we consider in this period, and it would take another 93 years for the share to drop another five percentage points.

III. Data and Empirical Strategy

Data

The primary data that we use to estimate the impact of expanded public higher-education funding are drawn from the under-used U.S. Commissioner of Education annual reports. Beginning in 1870 the Commissioner of Education published survey-based information on each higher education institution. By the mid-1880s, the data provide not only the name of the institution, its location, and control authority (state/city, non-sectarian, or specific religious affiliation), number of students (preparatory, collegiate, and graduate), and faculty (preparatory and collegiate), but also a rich set of financial and capital statistics. Data are reported on income from federal and state governments, tuition, endowment, benefactions, and other sources, as well as the respective values of land and buildings, scientific equipment, endowment, and the library. In addition, the number of volumes within the library is reported.

Table 3 provides summary statistics of student, faculty, income, and capital measures aggregated to the state level in 1903. We report the summary statistics by institution control-type and then stratify the states based on whether their public expenditures were below- or

above-median. Because the number of states represented in each panel is not uniform (i.e., not all states had non-sectarian or sectarian institutions), it would be misleading to compare statistics across the panels. Instead, the statistics should be compared across columns (i.e., below- versus above-median public spending).

As shown in Panel A, public institutions in above-median states were quite different from their counterparts in states that had relatively less public funding. Not surprisingly, relatively greater public spending meant larger student bodies and faculties, but the means indicate that the larger public institution invested heavily in scientific equipment and in physical plant. Whereas the above-median states enrolled 2.9 times as many students in public institutions as below-median states and 3.8 times as many faculty, they had 5.6 times the level of scientific equipment on their campuses and 4.0 times the land and buildings. The above-median states also had greater levels of endowment resources (2.2 times as much as below-median states), so this cursory glance at private giving does not seem to suggest a large degree of crowded-out. Interestingly, the tuition that both sets of institutions charged was statistically indistinguishable.

Comparisons between columns (2) and (3) in Panels B and C are encouraging in the sense that both religious and non-sectarian institutions in below- and above-median states had similar characteristics from a statistical perspective. We cannot reject the hypothesis that the means of any of the variables are statistically different from one another. We will provide additional evidence of this point in the next section, but this overview of the data does not indicate that non-sectarian and religious institutions were behaving differently prior to the expansion of public funding initiated by the 1907 Nelson Amendment. Moreover, the similar means across the two sets of states might even be interpreted as evidence that public spending did not crowd out private activity.

Finally, Panel D shows that the level of public expenditures on higher education was correlated with certain socioeconomic characteristics. Among states with greater primary and secondary school enrollment and greater literacy, the more likely the state would be spending more for higher education. States with relatively greater black populations were inclined to spend less. Further, greater religious affiliation tended to be (weakly) correlated with less public spending. Since there are likely other correlated unobservable determinants of higher education spending across sectors, our empirical strategy relies on finding an exogenous source of variation that enables us to identify the causal impact that public spending had on other sectors. We argue that the 1907 Nelson Amendment provides such exogenous variation because individual states received vastly different amounts of money per college-eligible student simply because they all received the same nominal amount regardless of the state's population.

Methodology

Our empirical approach uses the variation in the size of federal government intervention across states to estimate the causal effect of government expansion on the behavior of religious and non-sectarian colleges and universities. Consider a very simple model of the effect of public expenditures on the operation of private universities,

$$Y_i = \beta \text{Gov}_i + \varepsilon_i, \tag{1}$$

where Y_i is the size of a private institution in terms of, for example, students or faculty, Gov_i is the amount of government spending, and ε_i is the error term. Institutions in our analysis are indexed by the subscript i . The coefficient (β) describes the relationship between private sector university size and the extent of government intervention. If there is a significant crowd-out response, then we would expect that as government spending increases the private university sector would decline (i.e. $\beta < 0$).

A central challenge in estimating the casual effect of expansions in the public sector on private sector activity, as represented in equation (1), is that many determinants of Y_i are unobserved. More importantly, government activity does not occur at random. The size of the government sector is likely to be correlated with unobserved determinants of the size of the private sector. For example, if the social return to education is high in an area, voters will likely push for higher levels of government spending on higher education. However, as social returns to education are likely correlated with private returns, more students would attend private colleges anyway. In this case we would obtain an estimate of β which is biased upwards, perhaps significantly. Alternatively, voters may push for higher levels of government spending on higher education in response to poor performance by private, incumbent institutions. As students are also less likely to attend poorly performing colleges and universities, less students would attend private colleges anyway. In this case we would obtain an estimate of β which is biased downwards. In any case, the endogenous nature of government spending is likely to bias estimates of β in a simple cross-sectional OLS regression.

To address these potentially important sources of bias, we utilize variation in the size of the government sector in a state that is plausibly exogenous to the performance of private institutions in that state. As noted above, the flat nature of federal spending on education in the Nelson Amendment provides an important source of exogenous variation in the level of spending per college-eligible student in each state. Our central identifying assumption is that changes in federal spending per college-eligible student arising from differences in population across states are unrelated to changes in unobserved determinants of university performance.

Formally, we estimate the equation,

$$Y_{it} = \beta_1(P_i \times LG_{it}) + \beta_2(R_i \times LG_{it}) + \beta_3(NS_i \times LG_{it}) + \beta_4(P_i \times \gamma_t) + \beta_5(R_i \times \gamma_t) +$$

$$\beta_6(NS_i \times \gamma_t) + \delta_i + u_{it}, \quad (2).$$

P_i is an indicator variable for publically-controlled institutions, R_i is an indicator variables for religiously-controlled institution, NS_i is an indicator variable for non-sectarian institution, LG_{it} is the total federal land grant expenditure per college-eligible student, γ_t is a set of year fixed effects, δ_i is a set of institution fixed effects, and u_{it} is the error term. Our central parameters of interest are β_1 , β_2 , and β_3 . If federal government spending causes a reduction in private sector activity (crowd-out) we expect to estimate negative coefficients for β_2 and β_3 . Conversely, if federal government spending causes an increase in private sector activity (crowd-in) we would estimate positive coefficients for β_2 and β_3 . Fitting equation (2) forms the heart of our analysis.

A couple of estimation details are worth noting. First, as we include institution and year-by-institution type fixed effects in the model, we control for both time-invariant characteristics of each institution and national trends by university control type in the outcomes we study. The identification of our parameter of interest does not use either source of variation. Second, our policy change of interest occurs at the state level and institutions within the same state likely had similar unobservable determinants of the key outcomes, so we cluster the standard errors at the state level.

Our central identification assumption is that absent the passage of the Nelson amendment, institutions in states with large and small levels of Nelson Amendment spending per college-eligible student would have had similar trends in outcomes. While we cannot test this assumption directly, we can probe its validity by examining whether institutions in these different states follow similar pre-Nelson trends. It would be cause for concern for example if student enrollment in institutions where the Nelson Amendment resulted in a large shock to

federal spending was already increasing before the Amendment passed. To examine this issue we estimate the model,

$$Y_{it} = \beta_1(P_i \times LNelson_i \times \gamma_t) + \beta_2(R_i \times LNelson_i \times \gamma_t) + \beta_3(NS_i \times LNelson_i \times \gamma_t) + \beta_4(P_i \times \gamma_t) + \beta_5(R_i \times \gamma_t) + \beta_6(NS_i \times \gamma_t) + \delta_i + u_{it}, \quad (3),$$

where $LNelson_i$ is an indicator variable for institutions located in states with a above-median change in Nelson expenditure per college-eligible student. Equation (3) allows us to examine whether institutions in states with relatively large and small Nelson Amendment appropriations per college-eligible student were indeed following similar trends before the Nelson Amendment became law. If the timing of the Nelson Amendment shock across institutions was correlated with trends in relevant outcomes, then we should observe that β_1, β_2 , and β_3 for the years before 1908 already reflect their post-Nelson trends. If we find this to be the case, then it would undermine our identification strategy and indicate that the Nelson Amendment timing and structure was likely endogenously related to trends in the higher-education marketplace.

IV. Empirical Results

In this section we discuss the results of estimating two versions of equation (2). One version includes region specific year effects, while the second does not. We discuss the results for each outcome variable in turn.

Students. We report the results of our student outcome specifications in Table 4. Panel A of the table reports the results for our three key coefficients of interest: 1890 and 1907 federal land grant supplemental appropriations interacted with the three institutional control types. In column (1) we present the results without the census region specific year effects, in column (2) the

regression model includes region specific year fixed effects. Panel B of the table reports the mean number of collegiate students per college-eligible student in a state for each institution type in our sample. We report a separate baseline level of student enrollment per college-eligible student for each control type to provide context for the magnitude of each coefficient estimate.

In column (1) of Table 4 we see that federal land grant income increases student enrollment at all three types of colleges. However, when we include region-specific year fixed effects the effect for religious colleges becomes statistically insignificant. The magnitudes of the estimates are quite large when compared to the respective baselines. Over the 1907 to 1912 period the maximum Nelson Amendment increased federal spending per eligible student by \$3.55 for the average state. Thus, the coefficients in column (2) of Table 4 represent increases of 11% and 31% of baseline for public and non-sectarian institutions, respectively. These magnitudes suggest that the crowding-in response for the non-sectarian universities was indeed quite large.

While the coefficients reflect large public expansion and crowding-in responses when compared to baseline student college-going rates, they suggest also that the Nelson Amendment played a relatively modest role in the overall college-going trends over this time period. From 1903 to 1914, the fraction of college-eligible students attending public colleges rose from 14.9 to 32.1, a change of over 110%. The change in the fraction of college-eligible students going to non-sectarian universities was equally dramatic. It increased from 7.15 to 17.9 from 1903 to 1914, an increase of over 130%. Compared to these very large secular trends, the Nelson Amendment accounted for only 4.7% of the increase at public colleges and 8.5% of the increase at non-sectarian colleges. Given the significant technological changes at this time, and the likely

large increase in returns to skill, the relative lack of importance of government policy in explaining the observed trends is less surprising.

Figures 7 and 8 provide a visual depiction of the results in Table 4, and also probe the validity of our key identifying assumption. Recall that our identifying assumption is that the amount of additional federal funding that land grant colleges received per college-eligible student under the 1907 Nelson Amendment is exogenous to university outcomes in that state. Our identifying assumption may be threatened if colleges in states with large Nelson shocks were already experiencing significant increases in student enrollment before the legislation passed in 1907. To examine this possibility we plot the differential between above- and below-median Nelson states, by institution control type. For our identifying assumption to remain plausible we expect to see that outcomes in above- and below-median states had a similar pre-Nelson amendment trajectory.

The credibility of our research design is validated in Figure 7, which shows that the Nelson differential for public universities does not emerge until after 1907. This finding indicates that student enrollment at public universities in states that received relatively large levels of land grant funds per eligible student were not previously on different (especially increasing) trends. The analysis lends further credence that our estimation strategy is identifying the effect of government spending on institutions' behavior. In Figure 8 we examine a similar above/below-median Nelson trends for non-sectarian and religious institutions. Again we find little evidence that differential land grant allocations per college-eligible student predicted trends in attendance at religious or non-sectarian colleges prior to the Nelson Amendment.

Faculty. We report the results of our faculty outcome specifications in Table 5. Again, Panel A presents the regression coefficient estimates and Panel B shows the baseline levels of faculty per college-eligible students, by institution types.

In column (1) of Table 5, we see that federal land grant income increases faculty numbers at all three types of universities. However, when we include region-specific year fixed effects, the estimated coefficient for religious institutions becomes statistically insignificant. The magnitudes of the estimates are quite large when compared to the baseline. As noted above, full Nelson Amendment funding increased federal appropriations per college-eligible student by \$3.55 in the average state from 1907 to 1912. Thus, the coefficients in column (2) of Table 5 represent increases of 10% and 21% of baseline for public and non-sectarian universities, respectively. These magnitudes suggest that the crowd-in response for the non-sectarian universities was indeed quite large.

As before, Figures 9 and 10 provide a visual depiction of the results in Table 5, and also probe the validity of our key identifying assumption. Crucially for the credibility of our research design, Figure 9 shows the Nelson differential for public universities does not emerge until after 1907. As was the case with the student enrollment trends, before the Nelson Amendment, faculty was not increasing disproportionately in states that subsequently received larger levels of land grant funds per college-eligible student. In Figure 8 we examine a similar above/below-median Nelson comparison for non-sectarian and religious institutions. Again, we find little evidence that differential relative allocations predicted pre-treatment trends in faculty numbers teaching at religious and non-sectarian institutions.

Pricing and Fundraising. We next examine two additional potential responses to enhanced public funding for higher education: pricing and fundraising. One possible explanation for the results above is that public and non-sectarian institutions were in the same student market. For the public colleges to enroll students who would not have otherwise gone to college without the enhanced Nelson public funding, perhaps their response was to lower tuition. As non-sectarians were in the same market for students, perhaps the increased competition forced them to lower tuition as well. While we do not think that colleges and universities compete primarily on price, the fact that we would expect these types of responses among for-profit firms makes them useful to examine.

In Table 6 we present the results where we examine tuition per enrolled student as the outcome.¹¹ Interestingly, we find no evidence of a statistically significant college pricing effect for any type of college. Next we examine whether college donors responded to the increase in government intervention in the university marketplace. It is likely that donors value the specific aspects of education embodied in certain institutions and were concerned that students would substitute away from the type of education the donors valued in response to increasing public provision of education. We test for a response along this margin in Table 7.¹² The results in Table 7 demonstrate that donors indeed responded to increased government intervention. This response is particularly true for religious colleges. The response compared to the baseline level is more than four times larger for religious universities than for either public or non-sectarian colleges.

Capital Inputs. Finally, we examine whether increased government funding induced institutions to invest in additional capital stock. We consider two measures of capital stock:

scientific equipment and buildings and land. Scientific equipment provides a useful measure of the scientific intensity of instruction at an institution. As demand for this new type of education is a key reason for expanding government intervention under the land grant acts, we regard responses along this dimension to be important. We also examine whether there was a response in investment in land and buildings to understand whether capacity in general responded to government intervention.

The results in column (1) of Table 8 reveal that the largest response to increased government intervention in terms of equipment investment was for religious colleges. This finding suggests that religious colleges became increasingly aware of the public competition that shifted curricula away from classical studies in favor of scientific and practical studies. These results, however, are not robust to the inclusion of region specific time trends as reported in column (2) of Table 8.

The results in column (1) of Table 9 reveal that the largest response to increased government intervention in terms of land and building investment is also for religious colleges. However, the magnitude of the response for religious colleges (compared to baseline) is larger for equipment investment than for land and building investment. Religious colleges apparently were increasing their scientific intensity more than their overall capital intensity. The land and building results are also not robust the inclusion of region specific time trends in column (2) of Table 9.

V. Concluding Remarks

A cursory look at the trends in higher education from the early twentieth century might lead one to think that the public sector's rapid expansion contributed to the religious sector's

relative decline. At the start of the twentieth century almost half of collegiate students attended a sectarian college or university and within 14 years that share had declined to 22 percent.

Previous research on the expansion of public funding of social services and its significant impact on religious activity (e.g., Gruber and Hungerman 2007) suggests that the relationships between the changes in public and private higher education outcomes was not mere coincidence.

Our goal in this paper is to use the expansion of the federal land grant program to determine the causal effect of increased public funding of higher education on their sectarian and non-sectarian counterparts. The nature of the 1907 Nelson Amendment (and the 1890 Second Morrill Act) provides an exogenous source of variation given that each state received the same amount of money and they all had very different population sizes. On a per eligible student basis, relatively small states receive large appropriations while heavily populated states received little.

We were unable to find evidence of crowd-out, and in fact the results suggest that crowd-in might be the more appropriate interpretation of the results. For both the student and faculty outcomes, increased federal spending led to an expansion of public universities, which is certainly expected, and we also found that non-sectarian and religious institutions grew as well, though the religious results were not statistically robust. Our results suggest that the Nelson Amendment accounted for 4.7% of the increase in student enrollment at public colleges and 8.5% of the increase at non-sectarian colleges from 1903 to 1914. Thus, the federal government played a relatively small role in the changes in college attendance that swept the country in the early twentieth century. But it does not seem to be the case that the expansion of public institutions came at the expense of their private counterparts.

Our results provide insight into the nature of the competitive pressure that public-sector growth exerted on private institutions. Public and private institutions do not appear to have competed on price (tuition), as the Nelson Amendment had no statistical effect on the tuition revenue per enrolled student in any sector. We found very strong responses in donations to all sectors as a result of the federal land-grant expansion, though the greatest response was the increase in endowment income generated by religious institutions. To some extent this increase in benefactions contributed to increased investment in scientific apparatus and in building and land, although this result is sensitive to the empirical specification we use (i.e., the inclusion of census region by year fixed effects).

Publicly funded universities led the way in terms of offering curricula that met the demands of an evolving American economy. At the instigation of the public sector, the focus of higher education turned away from classical and religious studies toward scientific and engineering studies that met the needs of an industrializing economy. Our results suggest that private non-sectarian and religious institutions did not sit idly by as this transformation in higher education was occurring. They adjusted too, and in the case of the non-sectarian sector, it seems the response was aggressive.

The secularization of higher education that occurred during the early twentieth century does not appear to have been a direct result of the expansion of the public sector, but more likely the result of students' and society's demand for a modern college education. Based on market share alone, religious-based colleges had been successful in meeting the needs of students who sought training in Latin, Greek, or philosophy, but demand shifted during the course of the early twentieth century. There is some evidence that religious institutions tried to respond by increasing faculty, fundraising, investment in scientific equipment, and physical plant, but their

response was not great enough to keep up with the rapid changes underfoot at public and non-sectarian institutions. While religious institutions lost significant market share from 1900 to 1914 (47 to 22 percent), today they enroll 17 percent of college students. Our results offer some insights into how these institutions were able to maintain roughly the same market share for almost a century. The simple answer is that they adapted their supply to a fundamentally altered demand.

ENDNOTES

¹ *Historical Statistics of the United States*, Series Ca10 and Ea15-17 and *2009 Statistical Abstract of the United States*, Table 1315.

² Peltzman (1973) argues that the in-kind nature of public higher education, depending on students' and parents' preferences, could lead to an overall reduction in higher education consumption than would otherwise be the case with private consumption. For a study using individual-level data that corroborates the Peltzman hypothesis, see Ganderton (1992).

³ Whether crowd-out effect or flypaper effect of federal grants dominates becomes an empirical question, which necessitates an empirical model that accounts for the endogenous nature of federal and lower-level spending. See, for instance, Hines and Thaler (1995) and Knight (2002).

⁴ For a recent survey of this literature, see Payne (2009).

⁵ Gruber and Hungerman (2007, 1047) criticize Roberts's interpretation of the data on the grounds that prior to 1933 large amounts of private relief monies were in fact originated in the public sector, but managed by private charities. New Deal policy dictated that public funds be managed by public agencies, so Roberts reports a mechanical crowd-out.

⁶ As examples of studies that test for private crowd-out based on various outcome measures, see the various studies examining saving behavior: Feldstein (1974 and 1982) and Leimer and Lesnoy (1982) on Social Security, Kantor and Fishback (1996) on workers' compensation, Gruber and Yelowitz (1999) on public health insurance, and Engen and Gruber (2001) on unemployment insurance. See Cutler and Gruber (1996) and Gruber and Simon (2008) for studies of private health insurance crowd-out from Medicaid expansion, and Brown and Finkelstein (2008) on Medicaid's crowd-out of private long-term care insurance coverage. Further, studies focusing on donation crowd-out within the non-profit sector include, for

example, Kingma (1989; public radio), Payne (1998; non-profits offering social services), Borgonovi (2006; theater), and Dokko (2009; arts organizations).

⁷ For an introduction to the economics of religion, see Iannaccone (1998).

⁸ A comparable figure in 1995 would be 39 percent. Estimated calculated from the *Historical Statistics of the United States*, series Aa129-130 and Bc523.

⁹ This brief history of land grant funding is drawn from Covert (1938).

¹⁰ In 1900 only 6.4 percent of 17 year olds graduated from high school. See Snyder (1993, 55).

¹¹ We do not have specific data on tuition, per se, but instead on the institution's reported tuition income. We divide the tuition by the number of students to estimate an institution's level of tuition.

¹² Ideally, we would have access to reliable data on donations to each institution. However, as such data do not exist we use data on endowment income. To the extent that differences in changes in endowment income across institutions are due to new donations, this measure will capture the effect of interest.

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Table 1

Higher Education Attendance Across Sectors, 1900

State	Number of collegiate students attending all colleges & univs.	Pct. attending relative to 18- 21 year olds	Public pct.	Nonsectarian Pct.	Religious pct.
AL	656	0.42	30.64	0.00	69.36
AR	604	0.54	48.18	0.00	51.82
AZ	53	0.60	100.00	0.00	0.00
CA	3,699	3.49	48.31	33.33	18.36
CO	882	2.33	35.83	44.78	19.39
CT	2,253	3.41	3.55	20.15	76.30
DE	102	0.72	100.00	0.00	0.00
FL	153	0.34	33.99	11.76	54.25
GA	1,318	0.70	31.18	9.86	58.95
IA	2,653	1.51	24.43	0.72	74.86
ID	106	0.92	100.00	0.00	0.00
IL	5,838	1.59	22.05	9.08	68.88
IN	2,592	1.33	33.22	4.05	62.73
KS	1,712	1.44	43.28	0.00	56.72
KY	1,083	0.62	28.25	6.09	65.65
LA	921	0.81	25.08	38.65	36.26
MA	4,472	2.16	3.96	76.63	19.41
MD	1,112	1.18	8.45	29.95	61.60
ME	1,044	2.11	30.17	0.00	69.83
MI	2,450	1.34	62.57	0.00	37.43
MN	2,056	1.55	60.80	0.00	39.20
MO	2,758	1.11	41.99	15.30	42.71
MS	538	0.40	38.29	0.00	61.71
MT	68	0.41	100.00	0.00	0.00
NC	1,441	0.90	23.94	0.00	76.06
ND	103	0.43	66.99	0.00	33.01
NE	1,598	1.88	67.02	0.00	32.98
NH	762	2.61	15.22	82.81	1.97
NJ	1,406	1.02	0.00	74.89	25.11
NM	14	0.10	100.00	0.00	0.00
NV	176	5.80	100.00	0.00	0.00
NY	6,669	1.24	15.47	67.37	17.15
OH	5,341	1.67	34.23	20.16	45.61
OK	75	0.12	56.00	0.00	44.00
OR	377	1.21	27.85	0.00	72.15
PA	6,926	1.44	24.03	27.27	48.70
RI	819	2.49	4.40	0.00	95.60
SC	855	0.72	26.55	0.00	73.45
SD	191	0.63	48.17	0.00	51.83
TN	2,486	1.44	14.44	37.73	47.83

TX	1,436	0.56	36.63	0.00	63.37
UT	90	0.41	90.00	0.00	10.00
VA	1,561	1.01	45.61	8.39	46.00
VT	480	2.00	57.92	42.08	0.00
WA	489	1.35	67.28	3.48	29.24
WI	2,533	1.62	71.06	14.05	14.88
WV
WY	68	0.94	100.00	0.00	0.00
<i>Census Regions:</i>					
New England	9,830	2.41	10.19	47.96	41.85
Middle Atlantic	15,001	1.30	17.97	49.56	32.46
South Atlantic	6,566	0.77	29.59	9.32	61.09
East North Central	18,754	1.54	38.97	11.03	50.00
East South Central	4,763	0.74	22.51	21.08	56.41
West North Central	11,071	1.36	45.42	3.98	50.59
West South Central	3,036	0.56	35.90	11.73	52.37
Mountain	1,457	1.21	60.54	27.11	12.35
Pacific	4,565	2.64	48.65	27.38	23.96
United States	75,043	1.26	30.97	24.35	44.67

Notes & Sources: The number of students refers to collegiate students enrolled in a baccalaureate program. U.S. Commissioner of Education (1901) and *Historical Statistics of the United States*, State Populations, Series Aa2244-6550. Following Goldin and Katz (1999, 41), the number of 18 to 21-year olds was estimated as 0.4 times the number of 15 to 24-year olds, which were reported by the Census.

Table 2

Top Ten Public, Nonsectarian, and Religious Institutions in 1900, by Collegiate-Student Enrollment

Institution	Enrollment in 1900	Enrollment in 1914	Percent Growth
Public:			
University of Wisconsin	1,800	3,989	122%
University of California	1,787	4,683	162
University of Michigan	1,533	4,069	165
University of Minnesota	1,250	2,809	125
University of Illinois	1,114	3,501	214
University of Nebraska	1,071	2,484	132
College of the City of New York	1,032	1,401	36
Ohio State University	1,022	3,414	234
Indiana University	861	1,511	75
University of Missouri	804	2,445	204
Nonsectarian, Private:			
Harvard University	2,424	2,359	-2.7
Cornell University ^b	1,584	4,194	165
Leland Stanford Junior University	1,217	1,453	19
Princeton University	1,053	1,423	35
University of Pennsylvania	968	2,839	193
Columbia University	956	1,769	85
Syracuse University	710	2,403	238
Dartmouth College	631	1,299	106
University of Nashville	603	Ceased operation 1909	n/a
New York University	537	3,381	529
Religious:			
University of Chicago (Baptist; switched nonsectarian in 1911)	1,801	5,446	202
Yale University (Congregational; switched nonsectarian in 1904)	1,719	2,465	43
Brown University (Baptist)	783	881	13
Northwestern University (Methodist Episcopal)	572	1,209	111

Ohio Wesleyan University (Methodist Episcopal)	539	927	72
Boston University (Methodist Episcopal)	452	1,157	156
University of Notre Dame (Roman Catholic)	408	555	36
Cornell College (Methodist Episcopal)	362	373	3
DePauw University (Methodist Episcopal)	332	710	114
Lafayette College (Presbyterian)	305	269	-12

^a Data drawn from 1913 Annual Report.

^b Cornell University, or parts thereof, was the land-grant university within New York at this time. To offer some perspective, 5.8 percent of Cornell's total revenue came from the federal and state governments in 1900, and 12.4 percent in 1914.

Source: U.S. Commissioner of Education, *Annual Report* (various years).

Table 3
Aggregate Summary Statistics of Institutions in 1903

All variables, except tuition, are scaled by the number of college-eligible students in the institution's state; dollar values are expressed in 1900 \$	Public Expenditures Per College- Eligible Student:			(3) – (2) t-stat (4)
	All States	Below median	Above median	
	(1)	(2)	(3)	
<i>Panel A. Public-Controlled Institutions</i>				
Student (collegiate) enrollment (x 100)	14.93 (16.53)	7.211 (4.523)	20.87 (19.80)	3.02
Faculty (x 100)	1.816 (1.739)	0.701 (0.384)	2.674 (1.890)	4.59
Federal government income	17.40 (32.59)	3.517 (2.945)	28.08 (40.40)	2.71
State government income	31.22 (26.09)	12.150 (6.413)	45.89 (26.06)	5.65
Endowment income	5.489 (7.046)	3.314 (2.923)	7.163 (8.728)	1.89
Value of Scientific Equipment	48.77 (65.44)	13.19 (8.779)	73.81 (76.03)	3.45
Value of land & buildings	173.8 (175.0)	64.88 (41.87)	257.7 (192.4)	4.39
Tuition income per enrolled student	33.37 (25.48)	33.18 (23.11)	33.53 (27.70)	0.04
<i>Panel B. Religious-Controlled Institutions</i>				
Student (collegiate) enrollment (x 100)	12.40 (11.74)	10.97 (11.92)	14.15 (11.61)	0.85
Faculty (x 100)	1.443 (1.173)	1.156 (1.220)	1.791 (1.041)	1.74
Endowment income	8.831 (16.22)	8.912 (18.15)	8.732 (14.03)	-0.03
Value of Scientific Equipment	13.57 (14.30)	12.03 (14.83)	15.26 (13.88)	0.71
Value of land & buildings	196.2 (183.3)	164.8 (136.5)	234.6 (226.3)	1.20
Tuition income per enrolled student	72.70 (36.03)	73.60 (43.71)	71.55 (24.07)	-0.18
<i>Panel C. Nonsectarian-Controlled Institutions</i>				
Student (collegiate) enrollment (x 100)	7.145 (7.144)	8.322 (8.020)	5.567 (6.067)	-0.77
Faculty (x 100)	0.807	0.831	0.779	-0.13

	(0.807)	(0.913)	(0.713)	
Endowment income	16.17	13.00	20.14	0.61
	(24.18)	(18.35)	(30.90)	
Value of Scientific Equipment	18.50	18.67	18.13	-0.04
	(27.87)	(32.63)	(15.29)	
Value of land & buildings	135.5	140.88	128.7	-0.18
	(140.9)	(170.9)	(102.6)	
Tuition income per enrolled student	72.23	78.18	64.80	-0.85
	(32.81)	(38.51)	(24.37)	

Panel D. State Characteristics

Church Attendance Per Capita	0.352	0.374	0.3305	-1.78
	(0.086)	(0.080)	(0.0893)	
Primary and Secondary School Enrollment Rate	0.727	0.6763	0.7789	2.76
	(0.139)	(0.1610)	(0.0866)	
Population Illiterate (%)	10.60	14.26	6.802	-2.86
	(9.787)	(10.80)	(6.980)	
Population Urban (%)	31.40	33.06	29.68	-0.54
	(21.71)	(27.33)	(14.06)	
Population Black (%)	10.81	19.00	2.272	-3.92
	(17.01)	(20.31)	(4.916)	

^a College-eligible students corresponds to the number of 18-to-21 year olds in the states multiplied by the national high school graduation rate in 1900 (6.4 percent).

Table 4
The Impact of Federal Government Expenditure on Student Enrollment, By University Control Type

Dependent variable = Collegiate Student Enrollment Per College-Eligible Student

	(1)	(2)
<i>Panel A: Regression Results</i>		
Public x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.28*** (0.10)	0.23** (0.10)
Religious x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.16*** (0.05)	0.11 (0.11)
Non-Sectarian x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.30*** (0.06)	0.26*** (0.08)
Region x Year Fixed Effects	No	Yes
R^2	0.94	0.95
N	5261	
<i>Panel B: Baseline Collegiate Student Enrollment Per College-Eligible Student</i>		
	Mean [standard deviation]	
Public:	7.27 [7.17]	
Religious:	1.38 [3.37]	
Non-Sectarian:	2.92 [4.44]	

Source: Data are from U.S. Commissioner of Education, *Annual Report* (1903-1914).

Notes: College-eligible students corresponds to the number of 18-to-21 year olds in the states multiplied by the national high school graduation rate in 1900 (6.4 percent). The estimates presented are for alternative versions of equation (2). The unit of observation is at the institution-year level. Panel A reports the coefficient estimates in the main entries of columns (1) - (2) and the standard errors of the coefficient clustered at the state level are in parentheses. Panel B reports the mean and standard deviation of the outcome variable in the 1903 cross-section, by university control type.

* indicates significantly different from zero at the 10% level of significance;

** indicates significantly different from zero at the 5% level of significance;

*** indicates significantly different from zero at 1% level of significance.

Table 5
The Impact of Federal Government Expenditure on Number of Faculty, By University Control Type

Dependent variable = Number of Faculty Per College-Eligible Student

	(1)	(2)
<i>Panel A: Regression Results</i>		
Public x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.04*** (0.01)	0.03** (0.02)
Religious x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.02*** (0.01)	0.02 (0.01)
Non-Sectarian x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.02*** (0.01)	0.02** (0.01)
Region x Year Fixed Effects	No	Yes
R^2	0.94	0.94
N	5420	
<i>Panel B: Baseline Number of Faculty Per College-eligible Student</i>		
	Mean [standard deviation]	
Public:	0.88 [0.81]	
Religious:	0.16 [0.31]	
Non-Sectarian:	0.33 [0.49]	

Nores & Sources: See Table 4.

* indicates significantly different from zero at the 10% level of significance;

** indicates significantly different from zero at the 5% level of significance;

*** indicates significantly different from zero at 1% level of significance.

Table 6
The Impact of Federal Government Expenditure on Annual Tuition Charged, By University Control Type

Dependent variable = University Tuition Income Per Enrolled Collegiate Student, Student Composition Adjusted

	(1)	(2)
<i>Panel A: Regression Results</i>		
Public x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	-0.13 (0.13)	0.02 (0.17)
Religious x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.34 (0.66)	0.54 (0.66)
Non-Sectarian x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.65 (0.80)	0.75 (0.72)
Region x Year Fixed Effects	No	Yes
R^2	0.76	0.76
N	4120	
<i>Panel B: Baseline Tuition Income Per Enrolled Student</i>		
	Mean [standard deviation]	
Public:	36.90 [35.26]	
Religious:	73.80 [50.63]	
Non-Sectarian:	86.94 [62.27]	

Notes & Sources: See Table 4.

* indicates significantly different from zero at the 10% level of significance;

** indicates significantly different from zero at the 5% level of significance;

*** indicates significantly different from zero at 1% level of significance.

Table 7
The Impact of Federal Government Expenditure on Endowment Income, By University Control Type

Dependent variable = University Endowment Income Per College-Eligible Student

	(1)	(2)
<i>Panel A: Regression Results</i>		
Public x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.17* (0.09)	0.21* (0.11)
Religious x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.21** (0.10)	0.31** (0.12)
Non-Sectarian x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.18** (0.09)	0.25** (0.11)
Region x Year Fixed Effects	No	Yes
R^2	0.86	0.87
N	3653	
<i>Panel B: Baseline Endowment Income Per College-eligible Student</i>		
	Mean [standard deviation]	
Public:	3.88 [5.51]	
Religious:	1.43 [4.88]	
Non-Sectarian:	5.62 [9.09]	

Notes & Sources: See Table 4.

* indicates significantly different from zero at the 10% level of significance;

** indicates significantly different from zero at the 5% level of significance;

*** indicates significantly different from zero at 1% level of significance.

Table 8
The Impact of Federal Government Expenditure on the Value of Scientific Equipment, By
University Control Type

Dependent variable = Value of Scientific Equipment Per College-Eligible Student

	(1)	(2)
<i>Panel A: Regression Results</i>		
Public x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	1.35*** (0.42)	0.74 (0.47)
Religious x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	0.66*** (0.24)	-0.25 (0.64)
Non-Sectarian x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	1.14*** (0.37)	0.59 (0.38)
Region x Year Fixed Effects	No	Yes
R^2	0.88	0.89
N	2368	
<i>Panel B: Baseline Value of Scientific Equipment Per College-eligible Student</i>		
	Mean [standard deviation]	
Public:	21.75 [25.47]	
Religious:	1.87 [5.05]	
Non-Sectarian:	9.69 [19.18]	

Notes & Sources: See Table 4.

* indicates significantly different from zero at the 10% level of significance;

** indicates significantly different from zero at the 5% level of significance;

*** indicates significantly different from zero at 1% level of significance.

Table 9
The Impact of Federal Government Expenditure on the Value of Land and Buildings, By
University Control Type

Dependent variable = Value of Land and Buildings Per College-Eligible Student

	(1)	(2)
<i>Panel A: Regression Results</i>		
Public x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	3.54** (1.35)	2.12 (1.34)
Religious x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	2.06*** (0.66)	0.47 (2.29)
Non-Sectarian x 1890 Morrill and 1907 Nelson Act Income Per College-Eligible Student	2.32*** (0.71)	0.90 (1.56)
Region x Year Fixed Effects	No	Yes
R^2	0.92	0.93
N	3427	
<i>Panel B: Baseline Value of Land and Buildings Per College-eligible Student</i>		
	Mean [standard deviation]	
Public:	87.71 [97.66]	
Religious:	21.35 [47.54]	
Non-Sectarian:	56.69 [83.53]	

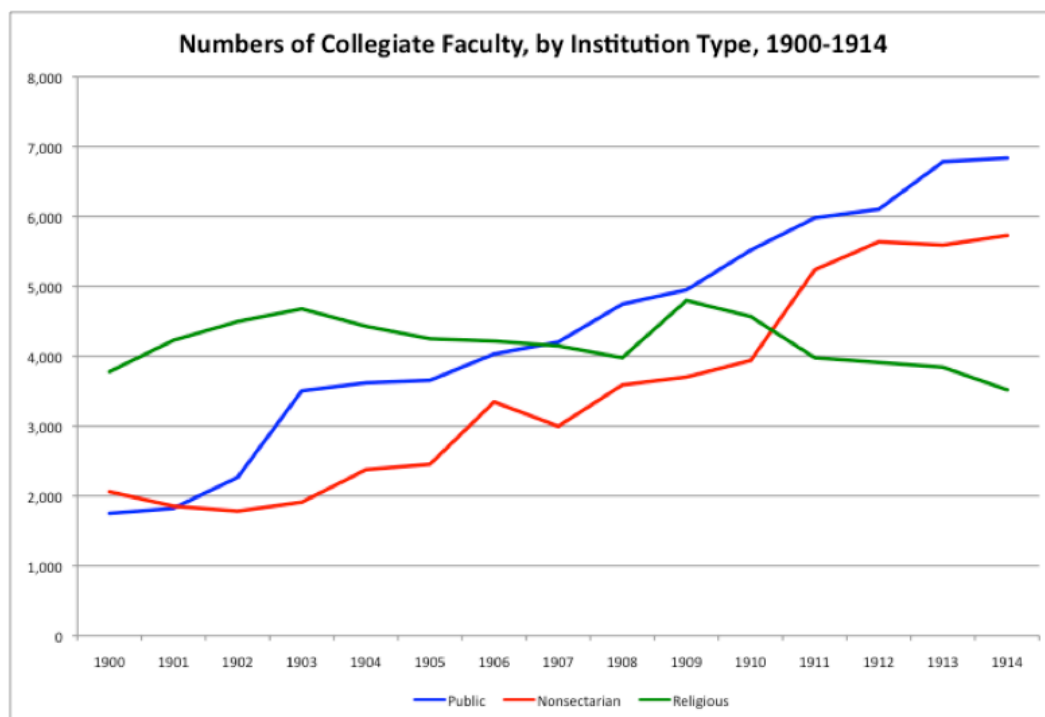
Notes & Sources: See Table 4.

* indicates significantly different from zero at the 10% level of significance;

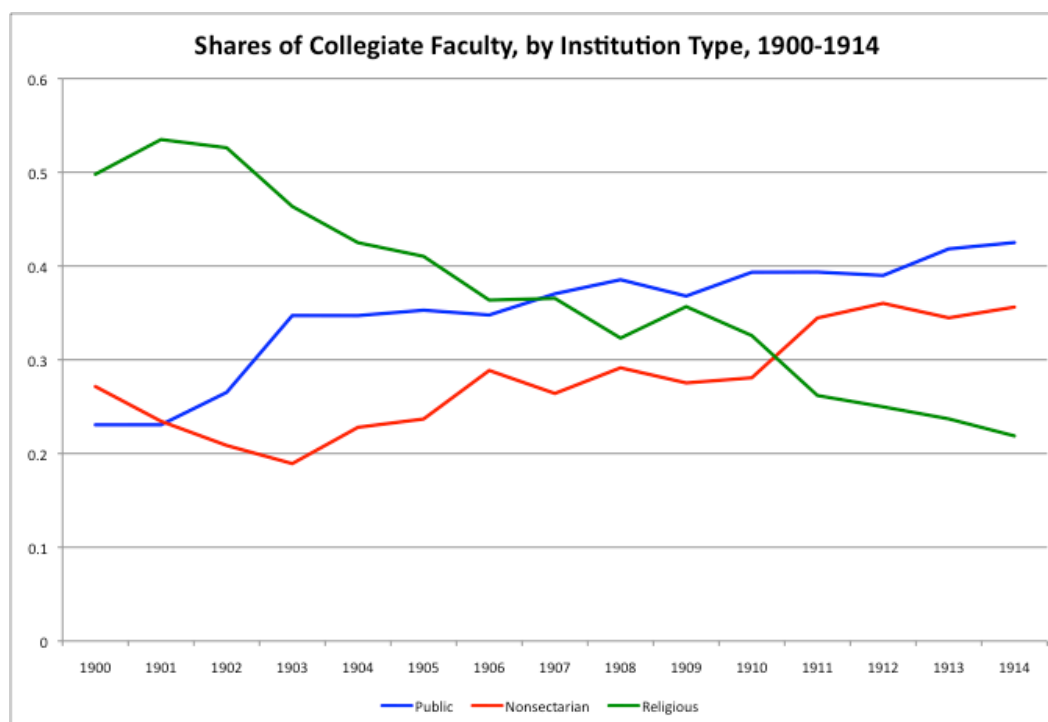
** indicates significantly different from zero at the 5% level of significance;

*** indicates significantly different from zero at 1% level of significance.

Figure 1
Panel A

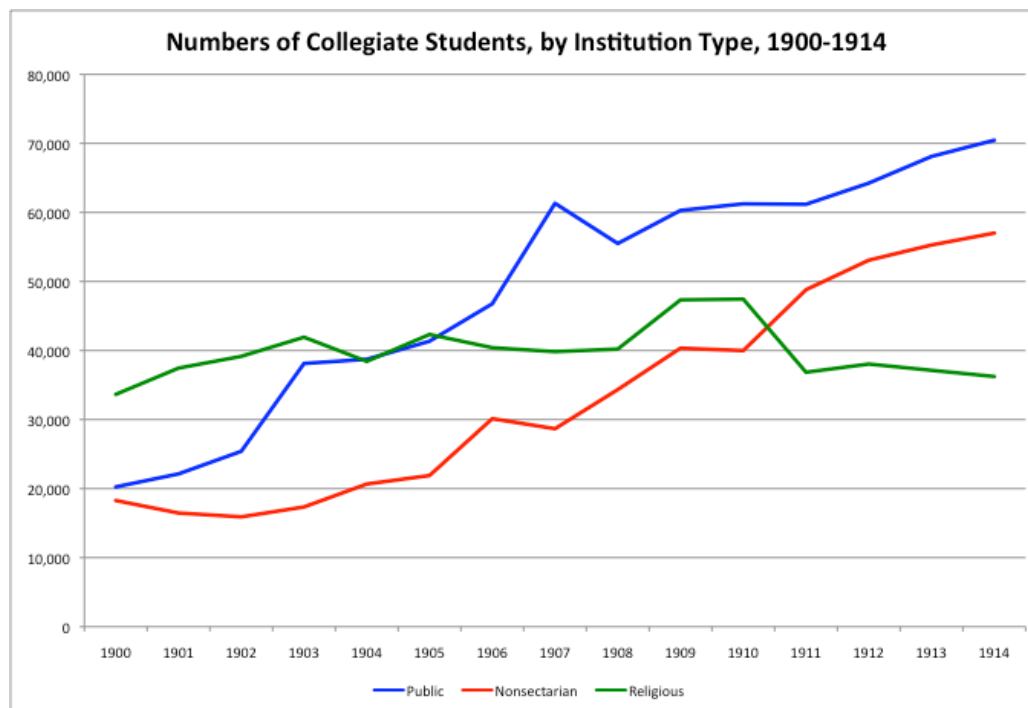


Panel B

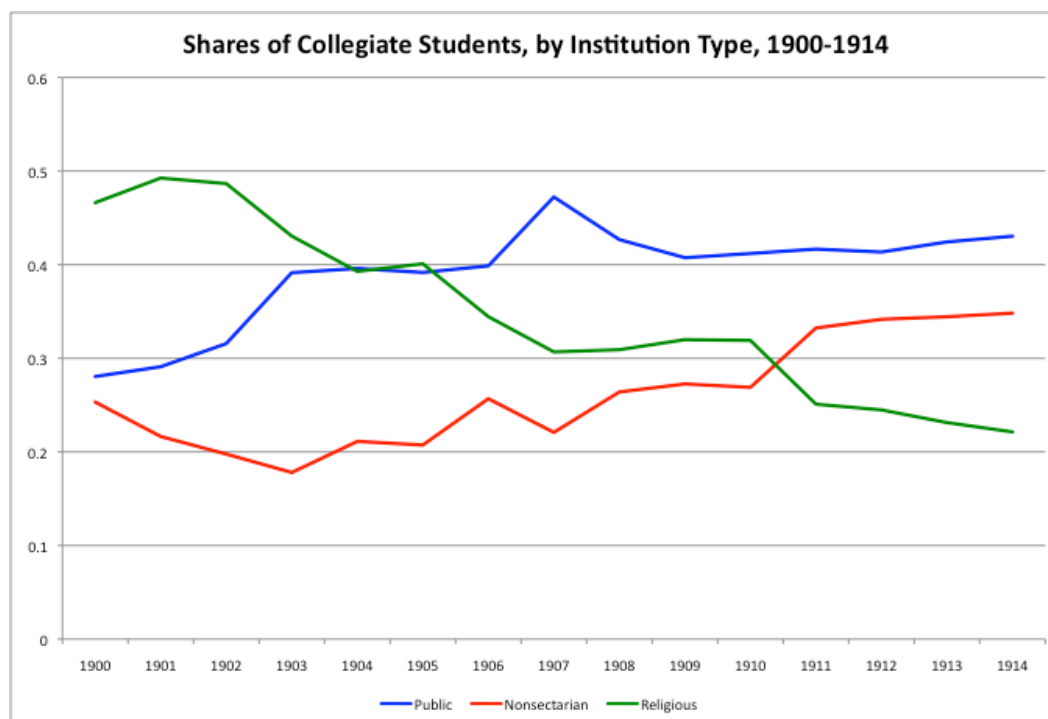


Source: U.S. Commissioner of Education, *Annual Report* (various years).

Figure 2
Panel A

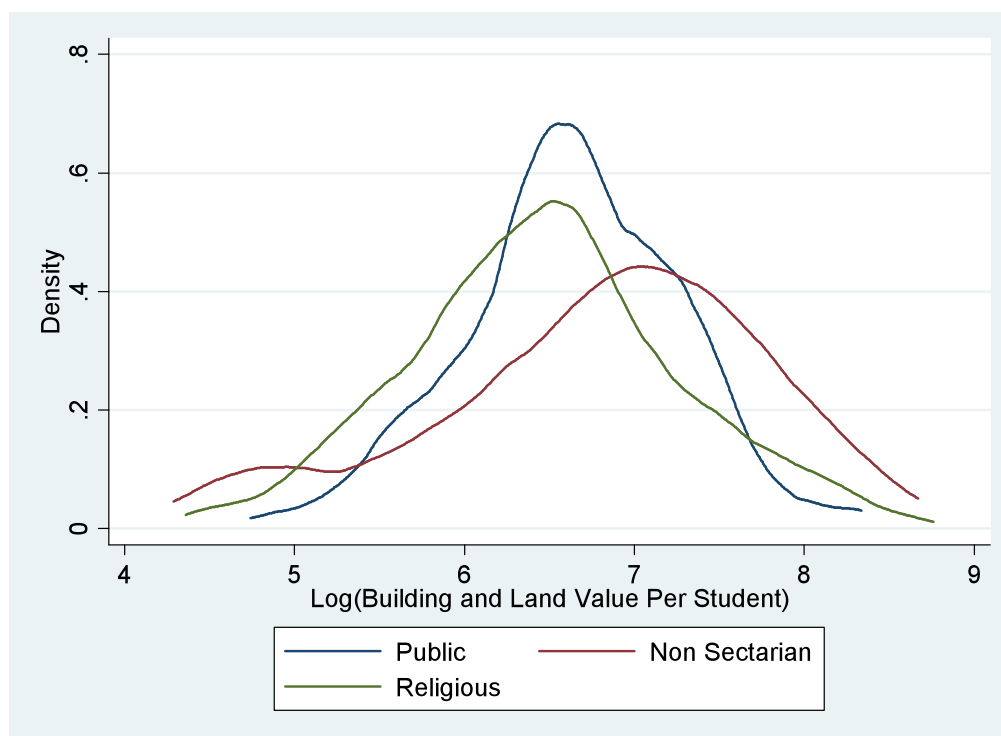
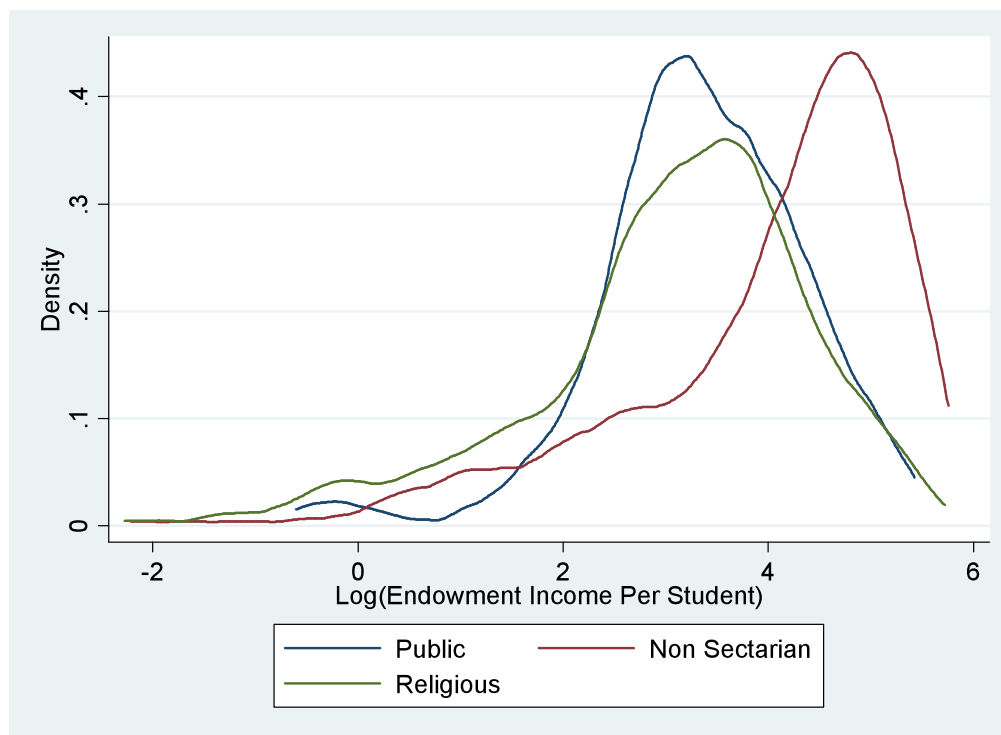


Panel B



Source: U.S. Commissioner of Education, *Annual Report* (various years).

Figure 3a-c



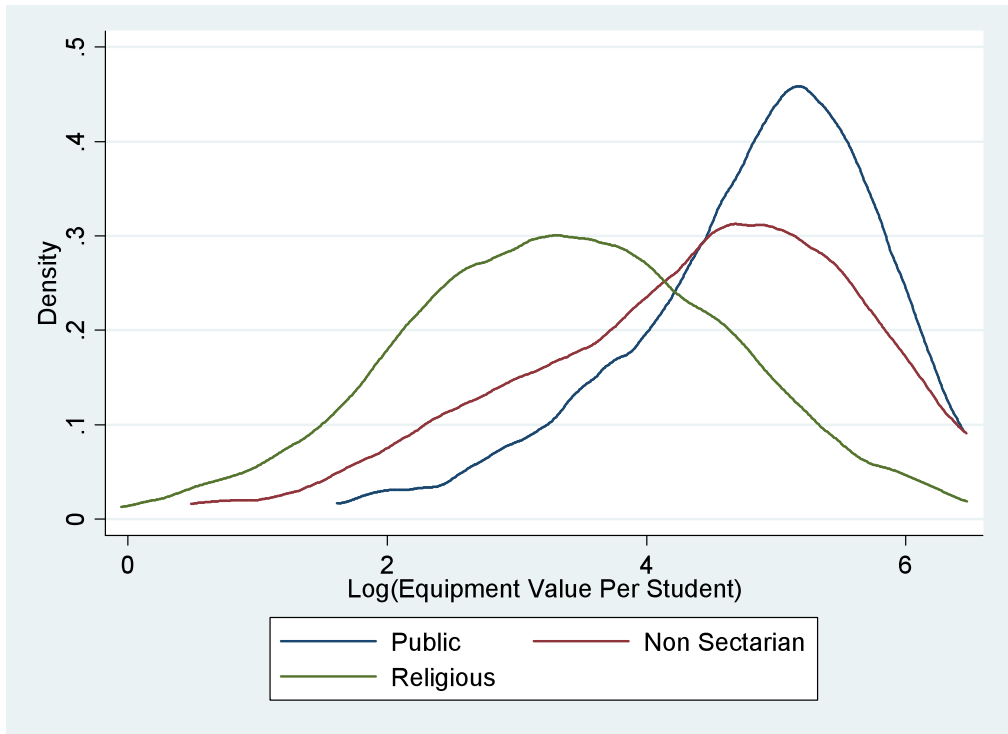


Figure 4

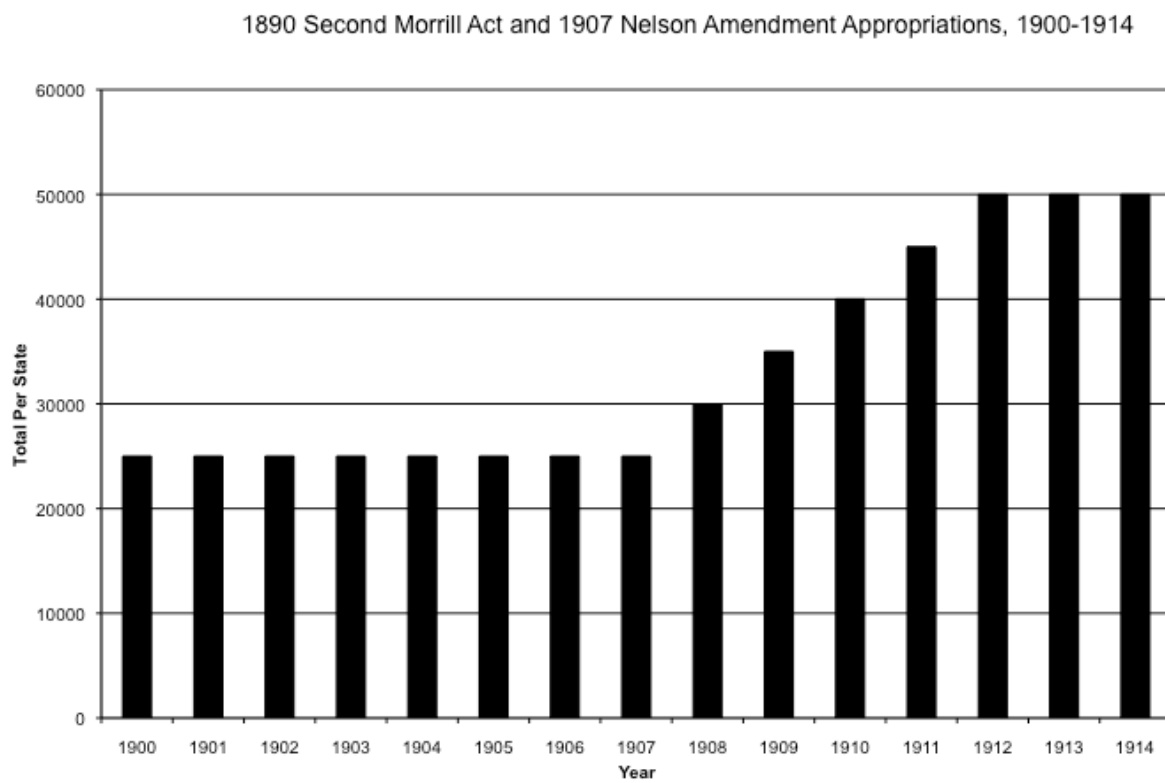
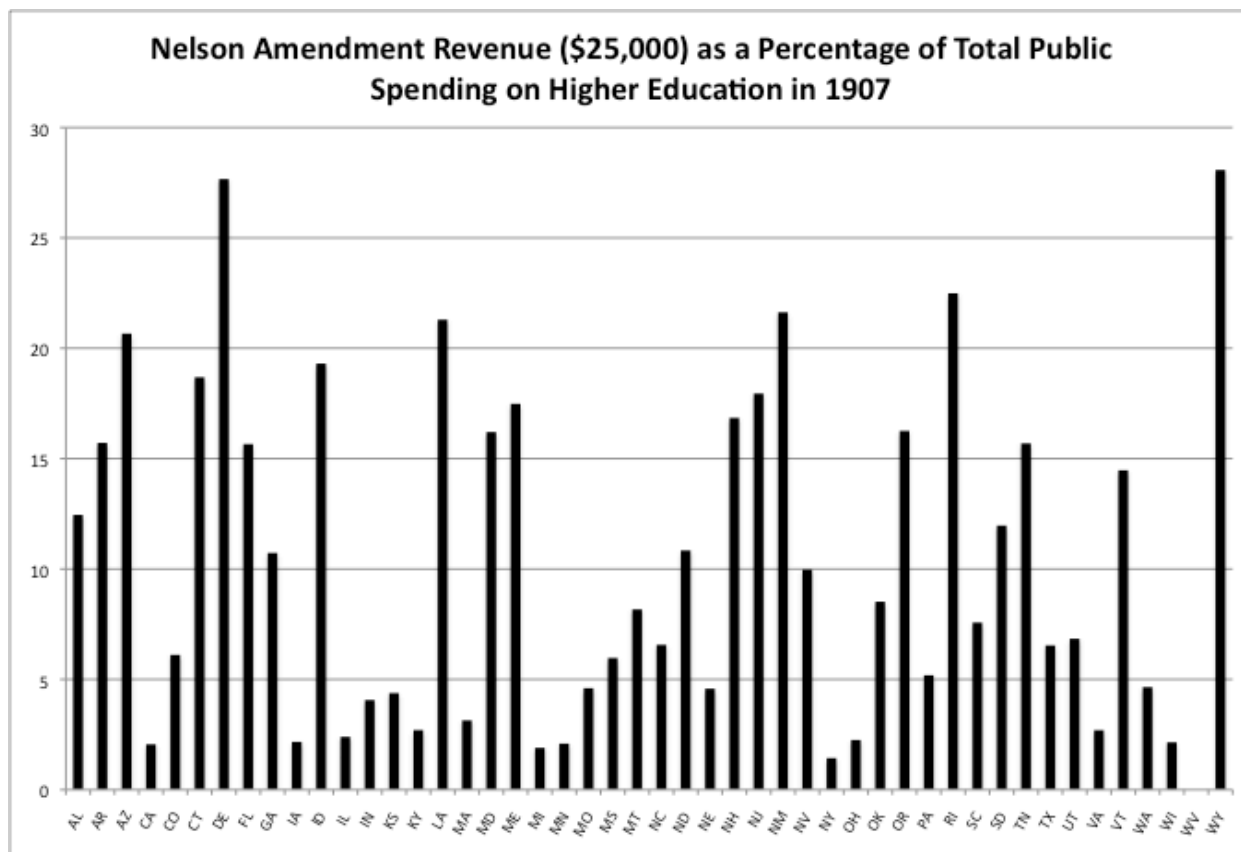
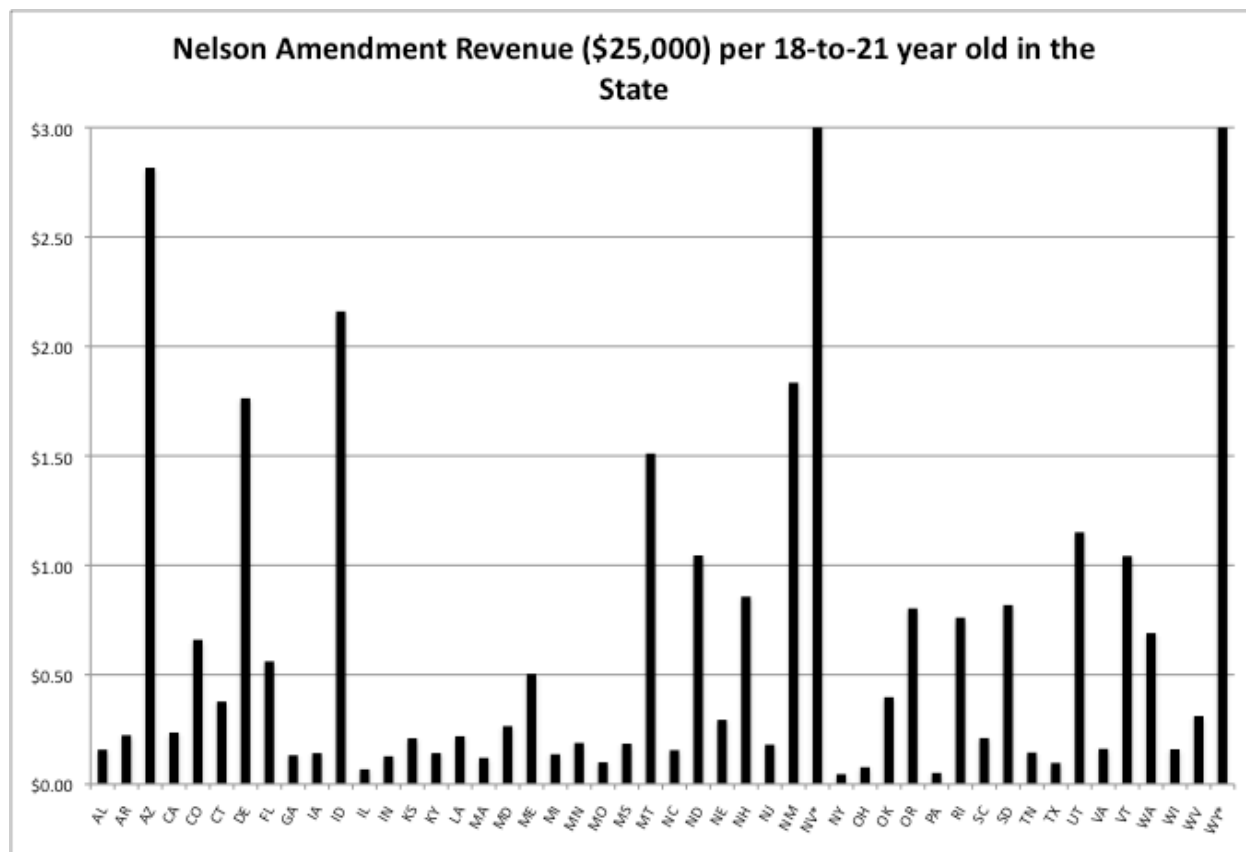


Figure 5



Source: U.S. Commissioner of Education, *Annual Report* (various years).

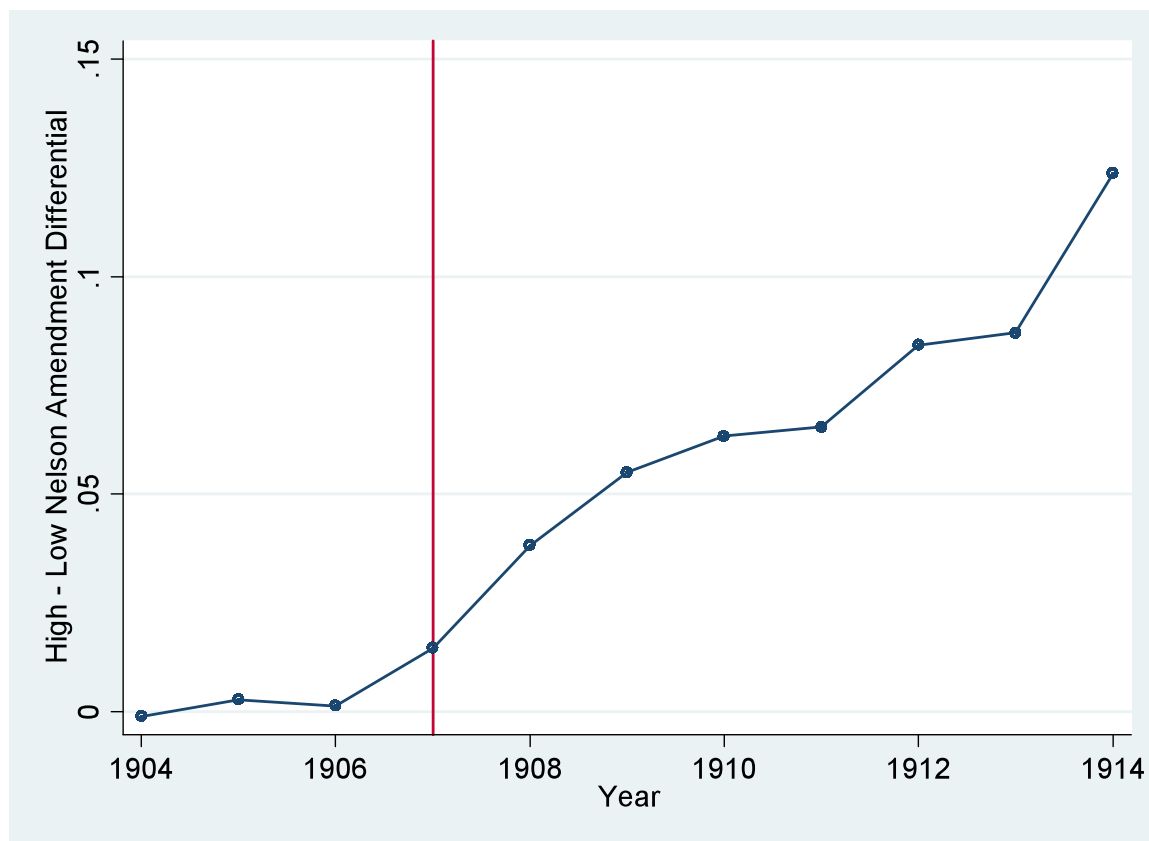
Figure 6



* The Nevada figure is \$8.23 and Wyoming is \$3.45.

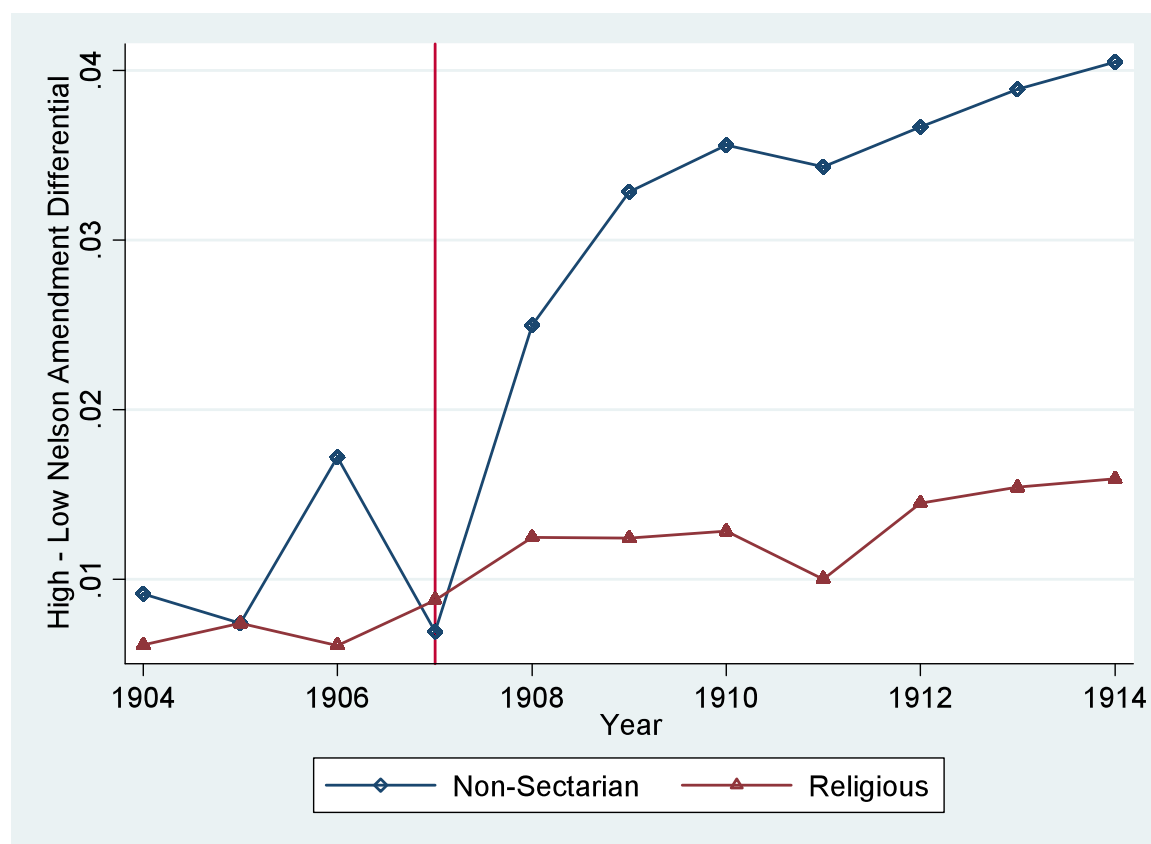
Source: U.S. Commissioner of Education, *Annual Report* (various years). *Historical Statistics of the United States*, State Populations, Series Aa2244-6550. Following Goldin and Katz (1999, 41), the number of 18 to 21-year olds was estimated as 0.4 times the number of 15 to 24-year olds, which were reported by the Census.

Figure 7
Trends in Public University Student Enrollment, Per College-Eligible Student, by 1907 Nelson Amendment Shock Size



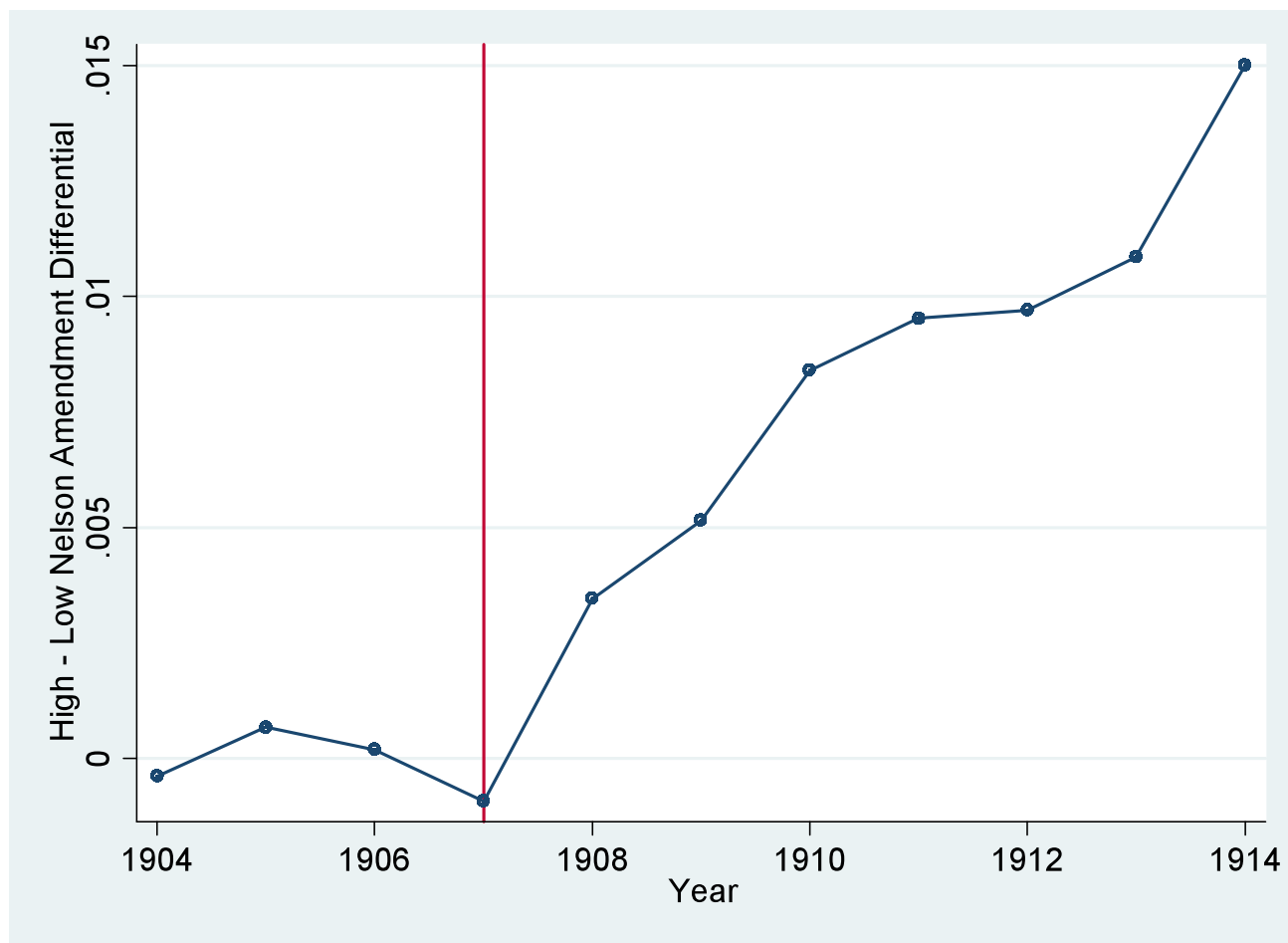
Notes: The estimates presented are the coefficient estimates for the Public university - high Nelson amendment state interaction by year, from estimating equation (1) in the text. The unit of observation is at the institution-year level.

Figure 8
Trends in Private University Student Enrollment, Per College-Eligible Students, by 1907 Nelson Amendment Shock Size



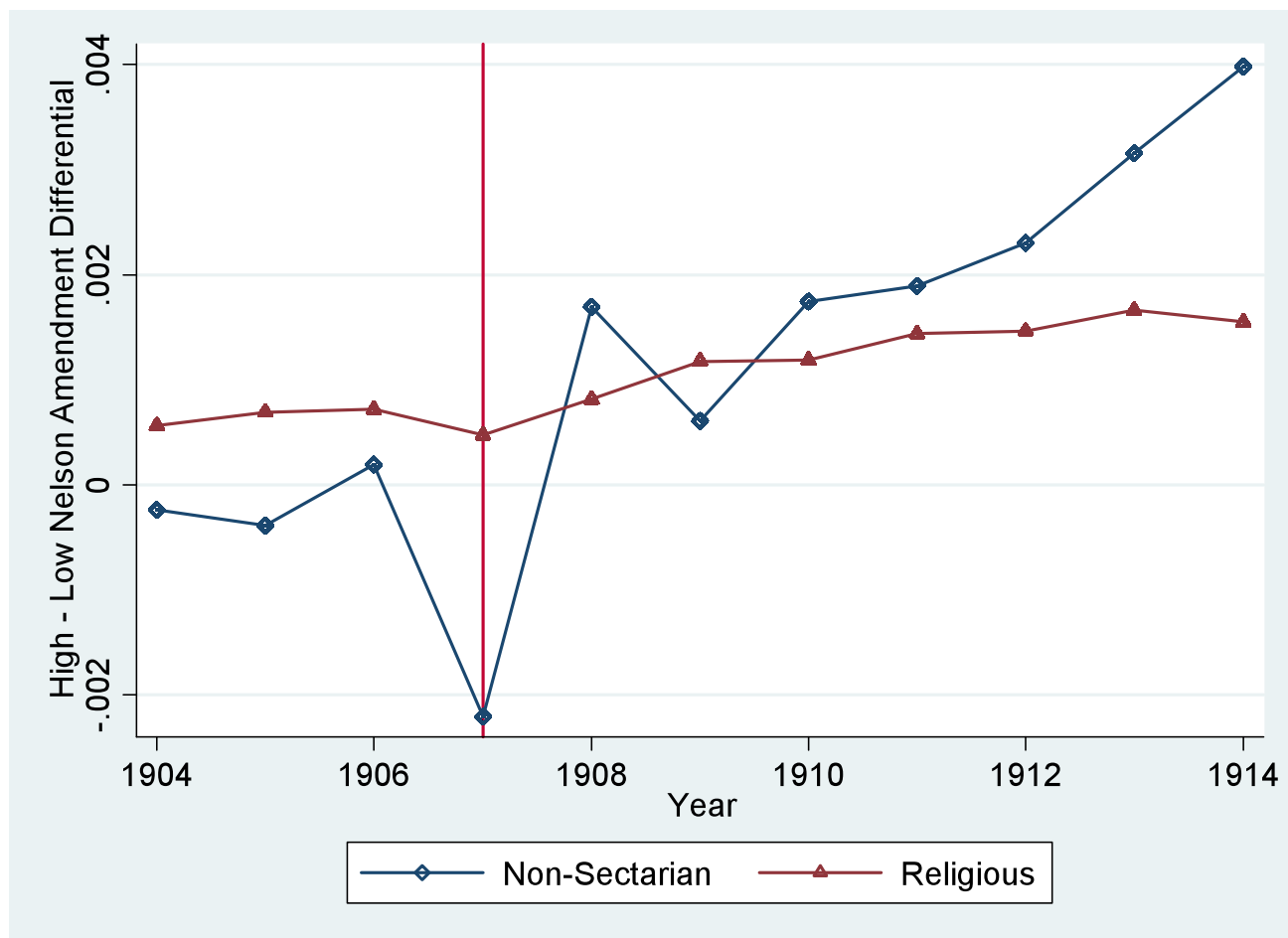
Notes: The estimates presented are the coefficient estimates for the Religious or Non-Sectarian university - high Nelson amendment state interaction by year, from estimating equation (1) in the text. The unit of observation is at the institution-year level.

Figure 9
Trends in Public University Faculty, Per College-Eligible Student, by 1907 Nelson Amendment Shock Size



Notes: The estimates presented are the coefficient estimates for the Public university - high Nelson amendment state interaction by year, from estimating equation (1) in the text. The unit of observation is at the institution-year level.

Figure 10
Trends in Private University Faculty, Per College-Eligible Students, by 1907 Nelson Amendment Shock Size



Notes: The estimates presented are the coefficient estimates for the Religious or Non-sectarian university - high Nelson amendment state interaction by year, from estimating equation (1) in the text. The unit of observation is at the institution-year level.