

Attitudinal Trends in Alternative Postsecondary Learning

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Traditional postsecondary learning in the United States consists in obtaining a four-year degree and is associated with increased earnings and employment. These benefits come at substantial cost. Scholars and the public increasingly express concern about a student debt crisis and question the return to increased educational expenditure. Alternative education allows many kinds of individuals to obtain superior outcomes at an accelerated pace and reduced cost. Key bottlenecks to socialization of alternative education include limited public awareness, limited learner favorability, and limited employer favorability. This paper explores a novel data set of 1190 observations on over 100 variables to understand the state of public and employer attitudes on alternative credentials, favorability changes over time, and actionable strategies to solve for constraints to normalization. Results indicate that favorability is high but declining. Decline may reverse over time. Normalizing alternative education through employers and parents of students is seen as efficacious relative to appealing directly to prospective postsecondary students. Education consumers are advised to use a both-not-either approach, and pursue accredited education using alternative pathways to reduce cost and accelerate completion. Some policy considerations are discussed.

KEYWORDS: Education economics, alternative education, debt crisis, signaling

JEL CODES: D12, I21, I22, I24, I25, I26

Section 1 - Introduction

The concept of a student debt crisis has found durable academic and media coverage. In 1999, Roots called the student loan debt crisis a lesson in unintended consequences¹. He identified the issue as attributable in large part to the Guaranteed Student Loan Program of 1965.

It was neither a new lesson at that time, nor a lesson finally learned at that time. Hansendn and Rhodes discuss the student debt crisis in 1988². Van Dusen published a genuinely prescient paper, *The Coming Crisis in Student Aid*, in February 1979³. Forbes noted in 2019⁴ that “Student loan debt in 2019 is the highest ever...There are more than 44 million borrowers who collectively owe \$1.5 trillion in student loan debt in the U.S. alone.”

Recent work has called into question both the social return and the individual return to spending on education⁵. Alternatives to the status quo in education present the opportunity for significant economic benefit. From 1989 to 2012, the average cost of a year of undergraduate education in the US rose 79%⁶. Over the same period, per pupil public expenditure for K-12 students increased 27%⁷. This indicates that postsecondary education presents a particularly valuable area of exploration.

From 1989 to 2012, K-12 student expenditure increased significantly and the cost of a year of undergraduate education grew nearly three times more quickly, but the adjusted average starting salary of a college graduate decreased. In real terms, the average starting salary of a college graduate decreased about 9%⁸. Additional temporal sampling from 1960 to 2015 indicates that the longer trend for education is modestly positive, with a real increase of about 6% over that period. It’s worth noting that the highest paying years for the degree were observed around 1970 in real terms, and salaries after the Great Recession have remained lower than the early 2000s.

Because the price of college is rising several times faster than the rate at which the salary of new graduates is increasing, the traditional degree is becoming a dynamically worse financial investment, and current research shows it is already a relatively poor choice compared to investing in a standard fund from the social point of view, although it is clearly lucrative from the individual perspective. Caplan estimates the private average annual return to attempting a year of college is about 4.9% in Chapter 5 of *The Case Against Education*. In Chapter 6 he calculates the social return to college at less than 2%.

¹ <https://heinonline.org/HOL/LandingPage?handle=hein.journals/swulr29&div=22&id=&page=&t=1556581085>

² <https://www.sciencedirect.com/science/article/abs/pii/0272775788900751>

³ <https://eric.ed.gov/?id=EJ198251>

⁴ <https://www.forbes.com/sites/zackfriedman/2019/02/25/student-loan-debt-statistics-2019/#5a7501b9133f>

⁵ A recommended example: Caplan, Bryan. *The case against education: Why the education system is a waste of time and money*. Princeton University Press, 2018.

⁶ This represents a price increase from \$11,862 to \$21,222 in constant 2016 dollars. This price includes tuition and fees and room and board rates charged for full-time students in degree-granting postsecondary institutions. https://nces.ed.gov/programs/digest/d17/tables/dt17_330.10.asp

⁷ This represents an increase from \$8,654 to \$11,011 in constant 2014 dollars. https://nces.ed.gov/programs/digest/d15/tables/dt15_236.15.asp

⁸ From 1989 to 2012, a decrease of \$4,385 from \$49,487 to \$45,102 in constant 2016 dollars is observed. $(4385/49487) = .089$. From 1960 to 2012 an increase from \$47,442 to \$50,219 is observed. <https://www.naceweb.org/job-market/compensation/salary-trends-through-salary-survey-a-historical-perspective-on-starting-salaries-for-new-college-graduates/>

Annualized 20 year returns on an S&P index, in contrast, typically return between 4 and 9%⁹. It's worth noting that Caplan uses 2011-2012 in-state tuition and fees at public four-year universities when calculating return. From the 2011-2012 school year to the 2018-2019 school year, the relevant cost figure increased from 8,244 in 2011 dollars to 10,230 in 2018 dollars¹⁰. This represents a real cost increase of about 11% from 9,203 to 10,230 in 2018 dollars, after accounting for a cumulative rate of inflation of about 11.6% from 2011 to 2018¹¹.

It's also worth noting that this return on investment assumes no expenditure for residence. Ostensibly the student will be living at home. In practice, this greatly reduces the number of actual universities available for a learner to choose from, and this may force a student to choose a more expensive school. Many schools have an on-campus residency requirement, and many other schools will be too far to commute for most learners. Learning exclusively online from a provider which has no on-campus residency requirement remains an option, but this can safely be considered a non-traditional practice. In 2015, less than 15% of students were exclusively distance learners¹², although the number is trending up over time.

Mattern and Wyatt note that college students live an average distance of 268 miles from home and a median of 94 miles. This indicates that most students don't live at home, and as a result housing costs should be included in both the average and median analysis of college price. Baum and Ma give the \$8,244 tuition and fees figure used by Caplan, and they also provide a room and board figure of \$8,887 for the 2011-2012 academic year. Abodo reports that median rent in 2018 for a 1/1 was about \$1,010 per month¹³, and this works out to about \$803 in 2011 dollars¹⁴. At 9 months per year, it would have been a more affordable \$7,227 for the typical student to live in a 1/1 apartment than to consume university room and board.

Consider that the modal degree is a Business degree, and the average salary for a business degree graduate is about \$54,000¹⁵. A common, in-demand occupation for someone holding a business degree is a business analyst role. Business analysts earn about \$67,000 per year, and there many reputable bootcamp-style alternative learning programs for this occupation¹⁶. Many of these bootcamps are online and take less than 6 months to complete and cost less than half of the \$7,227 price of housing alone. Online learning is not equally suited to all individuals. Minnesota State has a short quiz which helps individuals identify if online learning is a good fit¹⁷.

⁹ <https://www.forbes.com/sites/robisbitts2/2018/11/19/the-sp-500s-long-term-return-is-mediocre-really/#48014c625b1e>

¹⁰ <https://trends.collegeboard.org/college-pricing/figures-tables/2018-19-state-tuition-and-fees-public-four-year-institutions-state-and-five-year-percentage>

¹¹ Cumulative inflation according to <https://www.usinflationcalculator.com/>

¹² <https://nces.ed.gov/fastfacts/display.asp?id=80>

¹³ <https://www.abodo.com/blog/2018-annual-rent-report/>

¹⁴ Calculated from rent-specific inflation, not general inflation figures, using <http://www.in2013dollars.com/Rent-of-primary-residence/price-inflation/2011-to-2018?amount=803>

¹⁵ <https://www.forbes.com/sites/susanadams/2013/04/15/college-degrees-with-the-highest-starting-salaries-3/#4a5c692f629b>

¹⁶ <https://www.cio.com/article/3270932/10-boot-camps-for-business-analysts.html>

¹⁷ <https://careerwise.minnstate.edu/education/onlinequiz.html>

While traditional education is a decent investment, once we ignore typical housing costs, alternative education is a strictly better investment. This is because an individual can utilize alternative education to obtain a traditional credential for a lower price at an accelerated rate, and employers pay based on credentialing. The meaning of alternative education for the purposes of this paper is detailed in section 2, but one example of an alternative pathway to a traditional degree would be to leverage credit by examination. Almost any degree program can be partially fulfilled through credit by examination. In section 2.4 the price of credit by examination is calculated as about 15% of the traditional way to obtain credit in the average case.

In addition to generalized cost reductions from alternative pathways, alternative credentialing programs sometimes allow learners to obtain better salary or employment for even less than 15% of the price of a traditional degree, and often over a much shorter time. In other cases, alternative education may be more expensive but desirable even so. General Assembly is an example of an Information Technology industry bootcamp. They teach business, marketing, and design courses in addition to the typical programming courses offered at similar programs. General Assembly costs \$14,950 for its priciest full-time, immersive course, but students can finance in creative ways like \$0 upfront with an income sharing agreement, where a student doesn't need to pay until employed full-time¹⁸. The immersive lasts about 3 months. 88% of GA students found full-time work within 90 days of graduation, and 99% found full-time work within 180 days¹⁹. This is in notable contrast to the traditional degree, where 54% of the class of 2015 had found a standard, full-time job 6 months after graduation²⁰.

Bootcamps can sometimes be used as a college substitute, but they can also be used after college graduation to differentiate a job candidate from competitors, or to switch careers or brush up on recent changes mid-career. Finally, many traditional universities now offer through prior learning assessments or credit by portfolio, so that bootcamps can result in college credit even without officially partnering with a university²¹.

Traditional education might still be an optimal consumption choice if students demand higher education as leisure, but survey data indicates that this is not the case. Among a mix of prospective and first year college students from ages 16-40²², Rachel Fishman finds that the top three reasons to go to college are improved employment, making more money, and getting a good job. Over 90% of respondents affirmed at least one of these reasons.

In *A New U*, Craig documents several faster and cheaper alternatives to college²³. Craig establishes that many of these alternative education solutions are quickly growing in both supply and demand, but it is not obvious whether the programs Craig discusses are representative of the broader ecosystem of alternative learning. Prior to Craig's writing, Bryan Caplan argues for the signaling model of postsecondary credential value²⁴. On Caplan's view, the consumer of alternative credentials faces a

¹⁸ <https://generalassemb.ly/education/software-engineering-immersive/washington-dc>

¹⁹ <https://studentloanhero.com/featured/general-assembly-review-career-development/>

²⁰ <https://www.insidehighered.com/news/2016/06/07/where-was-class-2015-six-months-after-graduation>

²¹ <https://www.acenet.edu/news-room/Pages/Adult-Learners-Guide-to-PLA.aspx>

²² Rachel Fishman, "College Decisions Survey: Deciding to Go to College," New America Foundation, May 28, 2015, <https://www.newamerica.org/education-policy/edcentral/collegedecisions>

²³ <https://www.amazon.com/New-Faster-Cheaper-Alternatives-College/dp/1946885479>

²⁴ Caplan, Bryan. *The case against education: Why the education system is a waste of time and money*. Princeton University Press, 2018.

signal composition problem which threatens the value of the credential. Traditional credentials may do a better job of signaling things like work ethic and conformity.

Alternative education, however, may endow real skills at a better rate than traditional education. Caplan estimates, for example, that the value of vocational education benefits is 40% signaling, in contrast with 80% signaling for the usual college education²⁵. If employers can obtain better-skilled workers for lower cost, they would be expected to have some willingness to give on conformity. In addition, as alternative credentials become more widely accepted, any stigma or nonconformity costs from pursuing alternative education is expected to diminish. Additionally, prior research has yet to establish magnitudes and dynamic trends on those magnitudes for many of these important effects.

This paper explores a novel attitudinal data set on alternative credentials²⁶. This paper tests the thesis that employers will favor alternative credentials as a mechanism to identify suitable entry level employment. As a secondary interest, changes over time to the relation of interest are investigated. The structure of included survey data allows for exploration of several other interesting tertiary relations.

The first section describes the organization of the paper, the motivation, and the main thesis. The second section gives theoretical and historical context. The third section presents findings. The fourth section describes applications or use cases for findings.

Section 2.1 - Introduction to the Theory of Alternative Education

This second section is broken into six subsections. The first subsection gives an overview of the subsequent five sections.

Because alternative education is characterized as the negation of traditional education, the second subsection begins by conceptualizing tradition. Section 2.3 moves from theoretical conceptualization of tradition into a brief inventory of actual American history, including legislation relevant to the topic of interest. The description of traditional credentials toward the end of the third section flows naturally into a discussion on alternative credentials in the fourth section. The three subtypes of alternative education are detailed throughout the fourth section. The subtypes include alternative credentials, alternative pathways, and alternative pedagogies.

Section 2.5 synthesizes these subtypes into a discussion of alternative education and alternativeness in a general way. The fifth subsection also discusses minor results from outside of the main data set which help concretize the concept of alternativeness intended throughout the paper.

To further clarify the intuition of the thesis, Subsection 2.6 describes a game-theoretic model of dynamic norms.

Section 2.2 - Traditions Conceptualized

²⁵ Chapter 8, *The Case Against Education*

²⁶ The data used in this survey are publicly accessible at <https://github.com/Vandivier/research-dissertation-case-for-alt-ed/tree/master/papers/alt-ed-survey/190201-feb-survey-monkey/data>

Throughout the paper, the variable of interest will be referred to in a few ways. The variable of interest is most concisely described as entry-level suitability. More completely, the variable of interest is favorability on the use of alternative credentials to qualify an entry-level candidate who is applying for a career position. Technically, and most completely, the variable of interest is a response between 1 and 10 to the question, “For many professions, alternative credentials can qualify a person for an entry-level position.” A response of 10 represents a strong agreement.

Alternative credentials fit into the broader research area on alternative education. Alternative education is defined as all education other than traditional education. Alternative education decomposes into three subtopics including alternative credentials, alternative pathways, and alternative pedagogy. Each of these alternative entities is defined by the negation of their traditional counterpart.

In service of an effective description of alternative credentials, traditions are described in this subsection. Traditions can be concisely described as intertemporal social norms. As such, traditions exist in socio-temporal space. The maximum socio-temporal space that such a tradition could occupy would be from the dawn of humankind until today, and among all humans. Tradition can be viewed on a spectrum, where some processes are relatively traditional, and the modal process among a group of comparable processes is the strictly defined traditional process, implied when the singular traditional process is referred to.

Section 2.3 - Actual Traditions: A History of Accreditation and Student Lending in the United States

From the vantage point just established, postsecondary accreditation is a peculiar and infant approach to learning and education. Private accrediting agencies began forming in the 1880s in the United States, and private accreditation had become a well-established element of the higher education landscape by the 1930s²⁷. The G.I. Bill was signed into law in 1944²⁸, and provisions of the bill boosted consumption of higher education through subsidy to military service members. The number of degrees awarded by US colleges and universities more than doubled between 1940 and 1950. The increased demand for education stimulated the formation of many new colleges, and some of these were perceived to be “of dubious quality.”²⁹ The G.I. Bill was reauthorized in 1952, but this time the educational benefits it included were restricted in availability to those students enrolling at an accredited institution, and the U.S. Commissioner of Education began publishing a list of federally recognized accredited institutions.

Over time, federal recognition criteria became more elaborate. The 1992 Amendments to the Higher Education Act is a notable act in this regard. Federal lending began in a military-oriented fashion with the National Defense Education Act of 1958, but lending was expanded to the general population with the 1965 Higher Education Act and subsequent legislation³⁰. As earlier noted, Roots and other scholars identify this legislative trend as essentially causal to our present student debt crisis.

This brief history indicates that federal postsecondary accreditation is not only new as a human institution, but also new within the much more limited context of United States history. It’s true that

²⁷ <http://www.acics.org/accreditation/content.aspx?id=2258>

²⁸ <https://www.ourdocuments.gov/doc.php?flash=false&doc=76>

²⁹ <https://www.chea.org/recognition-accreditation-organizations>

³⁰ <https://www.luminafoundation.org/looking-back-to-move-forward-1>

market-driven accreditation has existed since the 1880s, and therefore may be considered a traditional process in United States education, but it is not true that the federal accreditation process which exists today has been around through most of American history. In this sense, federal accreditation is both causal in our present debt crisis and decidedly nontraditional.

The point of this exercise is both to familiarize the reader with a bit of relevant history, and to initiate conceptualization of traditional education as a special case of alternative education, rather than something altogether different. The traditional education of today was itself an alternative form of education at some point in time, and it remains a minority approach to education within a variety of nontrivial timeframes.

Caplan rightly argues that part of the signal of a traditional degree is to signal conformity, but throughout most of history it would be the nonconformist who possesses the thing we now call a traditional degree. Given this prior information, it becomes more plausible that society might one day return to such a situation. Obtaining a federally accredited undergraduate degree is a rather new practice, although we call it a tradition, and it has always been dubiously socially beneficial.

Traditional education is loosely synonymous with accredited education in the United States, but there are important technical differences. Accredited credentials in the context of the US include the high school diploma, the accredited undergraduate degree, and accredited graduate education. While graduate education is accredited, it is also excluded from the concept of traditional education. While tradition indicates a normal activity, graduate education is unusual. About 9% of U.S. adults had a graduate degree in 2000, and about 13% had such a degree as of 2018³¹.

In fact, it's not technically traditional to get a college degree. Technically speaking, the American tradition is to enroll in college degree and never graduate. The history of factors leading to higher enrollment in higher education in the United States, was previously discussed, but it's an important historical watermark to notice that 51% of Americans immediately enrolled in college after high school completion beginning in 1975³². Between 1975 and 2011, the immediate college enrollment rate increased from 51 percent to 68 percent. Immediate transition to college plateaued after the turn of the century. The immediate college enrollment rates for 4-year and for 2-year colleges in 2016 were not measurably different from 2000³³.

Enrolling in college has been a tradition since 1975, but obtaining a degree never was a tradition in the same way. The fact that the trend on immediate enrollment has slowed from a positive trend into a plateau, which has now remained stably flat for more than a decade, casts doubt on the plausibility of a move back to a positive trend. For the foreseeable future, the expected trend on immediate enrollment is between flat and the possibility of a small decline.

In 2016, the percentage of students enrolling in college in the fall immediately following high school completion was 69.8%³⁴, but in 2016 the percentage of the adult population with a bachelor's degree or

³¹ <https://www.census.gov/library/stories/2019/02/number-of-people-with-masters-and-phd-degrees-double-since-2000.html>

³² https://nces.ed.gov/programs/coe/pdf/Indicator_CPA/coe_cpa_2013_01.pdf

³³ <https://nces.ed.gov/fastfacts/display.asp?id=51>

³⁴ <https://nces.ed.gov/fastfacts/display.asp?id=372>

higher was 33.4%³⁵ for “the first time in decades of data.” To reiterate the point, the strictly modal pattern of educational attainment would be for an American student to obtain a diploma, enroll in an accredited undergraduate degree program, and never obtain an undergraduate degree.

Section 2.4 - Three Subtypes of Alternative Education

While the final paragraph of the above section describes the strictly modal pattern of educational attainment in the modern United States, the pattern of enrollment plus noncompletion does not describe the state of being desired by those who enroll. The desired situation would be college graduation. As all ideas are antecedent to action, the desire to complete college is identified as more traditional than the actualization of college completion. The nuanced difference between a desire and its actualization is lost when speaking loosely, and as a result the actual four-year degree is loosely identified as a traditional credential.

Alternative education is a general term which includes alternative credentials, alternative pathways, and alternative pedagogies. Each of these alternative entities is characterized by the negation of a traditional counterpart.

Traditional pedagogy is the lecture format. K-12 education and higher education have both typically utilized this teaching method during and outside of the post-1975 period of interest, despite wide knowledge on the ineffectiveness of this approach. In 2014, for example, a meta-analysis of 225 studies found that undergraduate students in classes with traditional lectures are 1.5 times more likely to fail than students in classes that use active learning methods³⁶.

A pathway is a series of actions culminating in the attainment of education or a credential. The traditional pathway always culminates in the traditional credential, but alternative pathways may also culminate in the traditional credential. For example, a student may obtain significant college credit or even complete an entire degree program through credit by examination. This competency-based pathway is importantly different compared to the traditional pathway based on the credit hour.

While it's common for students to self-study in preparation for credit by examination, it's also common for students to attend preparatory classes or even obtain knowledge for the purposes of testing out of one course by sitting in another traditional course. That situation could occur if a student took a course at one university, changed universities, and the credit would not transfer for the original course. Although their credit did not automatically transfer, the student might be able to test out at the second school. In cases like these, the student may have obtained a traditional credential through education using a traditional lecture-based pedagogy, and yet the pathway was not traditional.

The distinction of pathways might seem like splitting hairs in theory, but in practice alternative pathways like credit by examination, prior learning assessment, credit by portfolio, and similar processes hold immense potential as a time and cost savings mechanism for the student, while holding constant any concerns over lack of an accredited degree. To briefly illustrate, the price of a CLEP test is \$89 in 2019

³⁵ <https://www.census.gov/newsroom/press-releases/2017/cb17-51.html>

³⁶ <https://www.pnas.org/content/111/23/8410>

dollars³⁷, while the average cost per credit hour at an accredited college is \$594 in 2018 dollars³⁸. A CLEP test may substitute for a 4-credit course³⁹. This means credit by examination is approximately 15% of the price of credit by credit hour.

Section 2.5 - Alternative Education Broadly Conceptualized

Alternative education broadly encompasses all forms of formal and informal learning, but such a process space exceeds feasible study in a single paper, and frankly eludes sufficient study after combining many papers across several fields. Instead of studying alternative education holistically, researchers typically identify and studying a special case or particular implementation of alternative education.

One benefit of this approach is that the researcher may identify specific instances of alternative education which are faster, cheaper, or otherwise preferred in some way relative to traditional education, but a weakness of such an approach is that findings appear small, rare, disbursed, and ad hoc. To collect such effects into a strong case against the existing norm, a systematic approach is required which establishes alternativeness as an independent factor which can then be tested for effect.

Alternativeness can be conceptualized ordinally or cardinally. Remember that the three subtypes of alternative education are alternative credentials, alternative pathways, and alternative pedagogies. Within each of these three subtypes, solutions within a given subtype can be identified and ranked according to popularity. After ranking from most popular to n-popularity, an increase in rank number synonymously represents decreasing traditional status and increasing alternativeness.

By directly utilizing the underlying measure of popularity, a cardinal operationalization is achieved. Examples of popularity measures include number of applications, number of enrollments, expenditure toward a program, or survey-based measures of familiarity and favorability with respect to a specific program.

As a brief concretization, a secondary data set is investigated. The College Board, which administers the SAT, recognizes four types of high school in 2014⁴⁰ and other years. These types include public, religiously affiliated, independent, and a group combining other and unknown types of schools. Table 1 shows reported measures of SAT performance by type of high school, augmented with third party data for homeschooled⁴¹. Table 2 shows basic model results for cardinal and ordinal operationalizations, with linear and marginal effects in their expected directions. Low significance is attributable to small sample size. Notice the non-trivial R-square values identified despite the small sample size.

³⁷ <https://clep.collegeboard.org/register>

³⁸ <https://studentloanhero.com/featured/cost-per-credit-hour-study/>

³⁹ Credit may vary and is generally decided by the awarding institution rather than the exam provider. Some CLEP tests are offered at other price points. CLEP tests are a specific product provided by The College Board and other providers may charge different prices. Other exams widely recognized for credit by examination include AP, Cambridge International, DSST, Excelsior College, and TECEP exams.

⁴⁰ <https://secure-media.collegeboard.org/digitalServices/pdf/sat/TotalGroup-2014.pdf>

⁴¹ <https://hslda.org/content/docs/news/2016/201606240.asp>

Other research indicates that charter schools⁴² perform modestly better than public schools when standardizing by SAT score, although nationally representative charter school data could not be found, and gains vary importantly by state and other factors.

Table 1 – SAT Score by School Type

School Type	Test Taker Count	Rank Alternativeness	Total Score	Math	Reading	Writing
Home School	13549	5	1623	521	567	535
Public	1306039	1	1471	501	492	478
Religious	142783	2	1597	537	533	527
Independent	102358	4	1657	580	535	542
Other and Unknown	121215	3	1521	558	479	484

Table 2 – Models of SAT Score by Alternativeness

	Rank 1 b/se	Rank 2 b/se	Count 1 b/se	Count 2 b/se
rank1	36.400 (18.25)	82.686 (110.58)		
rank2		-7.714 (18.08)		
count1			-0.000 (0.00)	-0.000 (0.00)
count2				0.000 (0.00)
constant	1464.600*** (60.51)	1410.600* (145.10)	1610.331*** (30.38)	1635.664** (72.77)
R-sqr	0.570	0.606	0.598	0.627

* p<0.05, ** p<0.01, *** p<0.001

Section 2.6 - A Game-Theoretic Model of Dynamic Norms

It's expected and intuitive that rank alternativeness would have a positive linear and negative marginal effect. Traditions are a kind of durable norm or institution. It's a foundational lesson of New Institutional Economics that norms, institutions, and other classes of informal rules are self-sustaining and socially valued⁴³. If alternativeness continued to move in a positive direction ad infinitum, this would seem to indicate that traditions are perfectly opposed to maximal social value. That would be a jarring result which would fly in the face of much of mainline economics. Instead, the observed positive linear and

⁴² Di Carlo, Matthew. "The Evidence on Charter Schools and Test Scores. Policy Brief." *Albert Shanker Institute* (2011).

⁴³ Dequech, David. "Institutions and norms in institutional economics and sociology." *Journal of Economic Issues* 40.2 (2006): 473-481.

negative marginal effects collectively indicate something much more compatible with orthodox economics. The indication is that some of tradition's near neighbors represent an improvement, but continuing into the deeply alternative eventually detracts from value.

Education fits a non-special case of norms models. As a completely standard example, Conley and Neilson use a prisoner's dilemma to demonstrate equilibrium adoption of social norms⁴⁴. Suppose we modify this approach to account for dynamic technical improvement. In the present approach, consider an infinitely repeated prisoner's dilemma where each round adds an additional option to choose $cooperate_N$. $cooperate_N$ pays off $(1 + cooperate_{N-1})$, and in the first round the participants are known to choose $cooperate$, because they have already equilibrated on the $cooperate$ choice as a social norm. For the sake of modelling, also suppose there is a $defect_N$ added in each round as well, and it pays off $(defect_{N-1} - 1)$, although it's immediately obvious that coordination on such defects never obtains.

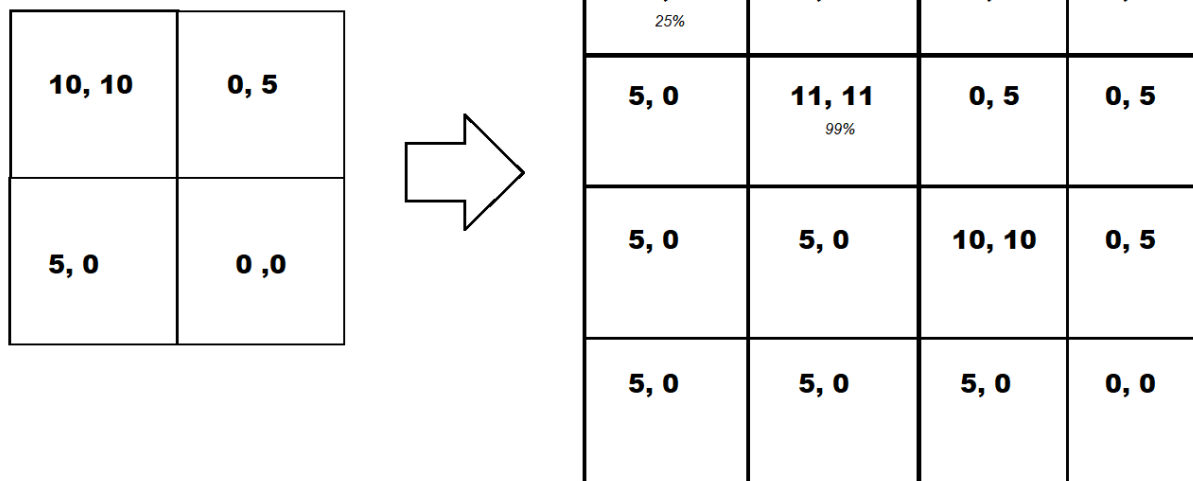
Alternative credentials include both technological improvements, and ostensibly technological degradation, relative to present-day norms, but according to the above game-theoretic representation, it's not expected for society to equilibrate on any of the technologically degraded choices. Instead, it's observed in the model that society will tend to adopt those preferred alternatives as they become available over time.

In a more complex model, suppose that instead of both players gaining certain knowledge of the new $cooperate$ option, each player had some probability of knowledge of the new $cooperate$ option and some level of risk aversion. It's now seen that there is some delay in adoption of the new $cooperate$ choice, and in some rounds one or both players may prefer to remain on the prior $cooperate$ space, but eventually all players tend toward the highest value $cooperate$ choice.

In a third model of highest complexity, suppose that two new $cooperate$ choices are added each round instead of a single choice each round, but players only probabilistically know about the new choices. Figure 1 presents a diagram of this game. The first new $cooperate$ choice is revealed to both players with 99% probability, and the second $cooperate$ choice has a payoff which is larger by one unit, but it is revealed to each player with a probability of 10%. Given standard models of nonlinear risk aversion, players will coordinate on the choice which is revealed with near certainty.

Figure 1 – Modified Iterated Prisoner's Dilemma with Probabilistic Discovery

⁴⁴ Conley, John P., and William Neilson. "Endogenous games and equilibrium adoption of social norms and ethical constraints." *Games and Economic Behavior* 66.2 (2009): 761-774.



Other research echoes this story of dynamic curvilinear adoption of new technology under risk and uncertainty, with or without the game-theoretic explanation in similar or other forms. Marra et al covers this literature well in a paper on adoption of agricultural innovation⁴⁵. Marra emphasizes that agriculture is just one instance of a general learning concern, and the present paper considers itself similarly.

This model clarifies risk aversion as a powerful mechanism for the incremental transition of norms from tradition toward alternatives. I propose that additional unmodeled mechanisms exist in the real world, but that the real-world trend nevertheless moves in the modeled direction. One example of an unmodeled consideration is that when an individual consumes alternative education in the real world, the payoff might be smaller than the traditional payoff.

Section 2.7 - Actual Alternatives: A History of Alternative Education in the United States

Several other papers do a great job of assessing the history of alternative education prior to 2000. One important point in much of this literature is that differing concepts of alternative education are used. Aron⁴⁶ states that the term alternative education, “in its broadest sense covers all educational activities that fall outside the traditional K-12 school system (including home schooling, GED preparation K-12 school system (including home schooling, GED preparation programs, special programs for gifted children, charter schools, etc.), although the term is often used to describe programs serving vulnerable youth who are no longer in traditional schools.” In the same literature, Lange and Sletten are not abnormal in nearly using the term as a synonym for K-12 special education. They collect earlier research on the subject beginning in the 1960s⁴⁷.

⁴⁵ Marra, Michele, David J. Pannell, and Amir Abadi Ghadim. "The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: where are we on the learning curve?." *Agricultural systems* 75.2-3 (2003): 215-234.

⁴⁶ Aron, Laudan Y. "An Overview of Alternative Education." *Urban Institute (NJ1)* (2006).

⁴⁷ Lange, Cheryl M., and Sandra J. Sletten. "Alternative Education: A Brief History and Research Synthesis." For full text: <http://www.nasdse.org/forum.htm>, 2002.

The present paper takes an even broader look at alternative education by considering alternative post-secondary education including professional certifications and a crop of new, non-accredited, digital credentials like the Udacity Nanodegree. By looking at post-secondary education, the present paper unifies the literature on K-12 alternative education with the literature on nontraditional students. One might think nontraditional students exist in the K-12 space, and they do, but the nontraditional student literature focuses on college students in particular. Dill and Henly⁴⁸, operationalize a nontraditional student as “as having multiple roles (e.g., parent, employee, student) and at least 1 year between high school and college.” Taniguchi and Kaufman⁴⁹ define a nontraditional student as, “those who enter four-year colleges or universities as adults, or at age 21 or older.”

A variety of definitions are used for alternative education and nontraditional learning, but many of the solutions are robust across these definitions. The present paper emphasizes postsecondary alternative learning, but many of the technical solutions which are helpful in this space are also helpful elsewhere. Partially or fully online learning, personalized learning, and active learning are examples of alternative pedagogies which improve results across many of these categories.

Harasim gives a good history of online education from the founding of the world wide web in 1992 through the year 2000⁵⁰. Allen and Seaman gave an early look at online education beginning in 2003 and proceeding annually, then they released an informative 10-year review in 2013⁵¹. From these papers we can already see some clear problems and advantages with online learning. Advantages include lower cost and improved learning outcomes from web-assisted or hybrid courses. The effectiveness of online learning grew importantly over the early 2000s. In 2003, 57.2 percent of academic leaders rated learning outcomes from online education as the same or better than face-to-face, while the number rose to 77% in 2012.

Massive Open Online Courses, or MOOCs, are a major topic in the modern digital learning literature. In the Allen and Seaman note that, “Academic leaders remain unconvinced that MOOCs represent a sustainable method for offering online courses, but do believe they provide an important means for institutions to learn about online pedagogy.” The literature on MOOCs is broadly pessimistic about effectiveness. A well-designed study in 2015 found that a majority of MOOCs scored highly on organization of material and low on instructional design⁵².

Universities are shifting to become more like their alternative competitors, but an interesting finding is that their competitors are also shifting to become more university-like, so that traditional educators and disruptive educators both appear to be equilibrating around a hybrid model, and even partnering directly with each other so that online education providers are beginning to offer college credit.

⁴⁸ Dill, Patricia L., and Tracy B. Henley. "Stressors of college: A comparison of traditional and nontraditional students." *The Journal of Psychology* 132.1 (1998): 25-32.

⁴⁹ Taniguchi, Hiromi, and Gayle Kaufman. "Degree completion among nontraditional college students." *Social Science Quarterly* 86.4 (2005): 912-927.

⁵⁰ Harasim, Linda. "Shift happens: Online education as a new paradigm in learning." *The Internet and higher education* 3.1-2 (2000): 41-61.

⁵¹ Allen, I. Elaine, and Jeff Seaman. *Changing course: Ten years of tracking online education in the United States*. Sloan Consortium. PO Box 1238, Newburyport, MA 01950, 2013.

⁵² Margaryan, Anoush, Manuela Bianco, and Allison Littlejohn. "Instructional quality of massive open online courses (MOOCs)." *Computers & Education* 80 (2015): 77-83.

The present paper is focused on suitability of alternative credential. A prototypical example of the type of modern, digital, alternative credential the research is intended to relate to would be the Udacity Nanodegree. This credential is specifically mentioned during survey administration. The survey includes a brief statement on alternative credentials as follows:

Alternative credentials include certificates, documents, and other proof of receiving education, other than traditional credentials. Traditional credentials include a high school diploma or an undergraduate degree from an accredited university. An example of an alternative credential is a Nanodegree from Udacity.

While there is some ongoing discussion in the current literature to the effect that online education is still contentious, the present section shows that online and hybrid learning are in fact a new normal which has been developing for some time. The disruptive education of Clayton Christiansen and Michael Horn has already been incorporated into the typical university⁵³.

While the present paper strongly argues for alternative education, it agrees with scholars like Jeffrey Selingo. Jeff agrees that the bundled service model of the traditional 4-year undergraduate degree is collapsing, but rather than foreseeing a market takeover by nimbler competitors, Jeff is optimistic that universities will be able to adapt. This theme of universities successfully adapting to become like their competitors, rather than being ousted by competitors, is a major theme of the book.

In Robinson⁵⁴ and Selingo⁵⁵ we see traditional providers including four-year universities adapting and innovating by adopting best-of-breed technologies, pedagogies, and program structures piloted by alternative providers. Craig shows that this flow is bidirectional, rather than unidirectional. Craig notes that Udacity's latest innovation is the in-person course⁵⁶. Besomebody Paths are fully offline. The typical course seems to be achieving equilibrium among a range of subtly different, but substantively similar, hybrid modes. Far from being an artifact of overfitting this literature, the elucidated pattern is consistent with multiple stories that none of these authors mention.

An elementary conversation on alternative education consists in contrasting disruptive private education and online learning providers with traditional education. Clayton Christiansen lead development of thought on disruptive innovation⁵⁷ and worked with Michael Horn to bring this analysis to the field of education in 2008 with a book entitled *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*. Notice the change in tense between 2008 and 2011, when Clayton publishes a second book on the subject called *The Innovative University: Changing the DNA of Higher Education from the Inside Out*⁵⁸.

A correct understanding of those in the movement of the disruption of education is not that they are anticipating declining university enrollment any time soon. Southern New Hampshire University and

⁵³ 2008, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*, Clayton M. Christensen, Curtis W. Johnson, and Michael B. Horn

⁵⁴ April 2015, *Creative Schools: The Grassroots Revolution That's Transforming Education*, Ken Robinson

⁵⁵ 2013, *College (Un) Bound*, Jeffrey Selingo

⁵⁶ Sept 2018, *A New U: Faster + Cheaper Alternatives to College*, Ryan Craig

⁵⁷ Bower, Joseph L., and Clayton M. Christensen. "Disruptive technologies: catching the wave." (1995): 43-53.

⁵⁸ 2011, *The Innovative University: Changing the DNA of Higher Education from the Inside Out*, Clayton M. Christensen and Henry J. Eyring

Western Governors University are mentioned as leaders in competency-based education. In one part of Selingo's College (Un)Bound, he mentions Paul LeBlanc. Paul LeBlanc identifies himself as a disrupter in the vein of Christiansen. He considers the online learning revolution old news and competency-based education is the more recent innovation. LeBlanc believes that competency-based education will come from existing institutions, and will exist alongside four-year programs.

In 2011, the same year that Christiansen noticed the present-tense changing of higher education's DNA, Sebastian Thrun manifested the Christiansen of 2008 and ignored the Christiansen of 2011 by relinquishing his tenure at Stanford to found Udacity. Udacity's first courses began taking students in early 2012⁵⁹. Only in 2013 did Udacity begin contributing to changing the university by offering some courses for college credit. In 2014, Udacity entered into its first full-fledged partnership with a university. The same year, Udacity released its first signature alternative credential, the Nanodegree. Excitement filled the air. About that time, as Craig informs us, the evidence on weak outcomes for Udacity's courses and other MOOCs began to cause significant doubt. In 2017, Udacity Connect was launched. This product is a hybrid learning solution which occurs partly in a classroom setting and partly online. Now that the results have started coming in, as earlier mentioned, this approach has shown about a 500% increase in graduation rate.

In 2016, Khan Academy applied for the \$100 million dollar grant by 100&Change in order to create a globally recognized secondary education diploma. 1904 organizations applied for the grant⁶⁰. 1870 proposals are documented in a solution explorer made public by 100&Change⁶¹. 375 proposals are in the education category. When decisions were rendered in 2017, Khan Academy's proposal earned an honorable mention as one of the top ten in the education category, but it did not place among the 8 semi-finalists across categories and did not earn a financial award⁶².

Like Udacity, Khan Academy is an online learning provider which went through a period of immense excitement followed by failure, and also like Udacity, Khan Academy achieved a remarkable success on a different project during the same calendar year as their disenchanting loss. In 2017, Khan Academy released the results of a study they conducted with the College Board. It showed that studying for the SAT using Khan Academy is associated with 115-point average score increase⁶³. Khan Academy also became the official practice partner for AP exams in 2017⁶⁴.

Not only do Udacity and Khan Academy share a Jungian hero typology, they have both evolved from traditional learning competitors to traditional learning allies. Like Coursera, edX, and others, the best-of-breed alternative learning providers of today are not substituting for traditional education providers, they are integrating with them. Likewise, the best-of-breed traditional providers are not rejecting new

⁵⁹ <https://www.khanacademy.org/about/blog/post/163503591115/khan-academy-is-the-official-practice-partner-for>

⁶⁰ <https://blog.udacity.com/2016/04/introducing-udacity-connect-turbocharged-learning.html>

⁶¹ <https://www.playworks.org/news/playworks-is-top-10-education-finalist-in-global-100change-competition/>

⁶² <http://100andchange.foundationcenter.org/dashboard/>

⁶³ <https://www.macfound.org/programs/100change-2017-semifinalists/>

⁶⁴ <https://www.khanacademy.org/about/blog/post/160451329150/studying-for-the-sat-for-20-hours-on-khan-academy>

learning approaches, they are partnering with them, awarding credit to students for alternative learning, and even supplying online education providers with content.

While literature can be found further back that applies in ways increasingly less direct, I consider Christiansen's 2008 piece to be a watermark in the literature. With Udacity's course offerings in early 2012, I observe a bright line in the actualization of modern alternative education provision. With Udacity, Coursera, Khan Academy, and other major online learning providers having been through significant revision in just a few years, I consider 2018 to be a new age of alternative education. Significant changes occurred during 2017, so 2018 will have been the first year in which these changes were available throughout the period.

The general trend is toward integration of traditional and alternative providers, but alternative learning systems are heterogeneous and these heterogeneous solutions are not equal in optimality for consumption by any particular individual, nor at the social level. Portfolios, and digital portfolios in particular, are in demand by employers. Digital portfolios have recently become trendy among universities, while they have been in fashion with alternative providers for some time. Standardized portfolio artifact generation and evaluation is becoming more standardized over time, assisted by certain dedicated evaluation providers.

Apprenticeship programs are making a comeback as a matter of fact, although it is controversial to claim that this is an obvious social good. These programs never truly left Germany, but they have revived from slumber in the UK. Under Trump, the US saw a major step forward for a particular implementation of apprenticeship⁶⁵, but it has been a controversial policy implementation, as discussed in the atemporal findings section. Like apprenticeship, many scholars find themselves supporting evidence-based learning, even while criticizing particular implementations of learning assessment. It is particularly fashionable to criticize standardized examination.

Standardized exams typically have certain question formats, including multiple choice or essay response questions which may be graded according to a rubric. Examples of standardized exams include the SAT, the ACT, the international PISA, and many state-level exams including the Texas STAAR. Standardized exams are generally cost-effective means of generating meaningful signals, but these signals are often systematically imperfect, and those imperfections are the source of much discussion. While portfolios may be costlier to generate and evaluate, they seem to be substantially less controversial in both the literature and when surveying professionals. Portfolios may include a broad range of expression, and the complexity of normalizing these expressions may be one reason for a silence in the academic literature. The best explanation for high professional opinion, on the other hand, may be plain efficacy of skill demonstration by the candidate to a knowledgeable portfolio reviewer.

Section 2.8 - Atemporal Findings in the Academic Literature

A history of alternative education was just given, evidencing an argument about the directional trend of education. Earlier a similar thing was done with traditional education. This section notes some important points on education which seem to hold in a non-trending way.

⁶⁵ <https://en.wikipedia.org/w/index.php?title=Udacity&oldid=853136895>

Intellectually, there is a clean distinction between a disruption camp and a non-disruption camp. In the real world, the leaders in either camp exist much more in the middle of the two than toward the extremes. The leading thinkers and practitioners in favor of the university system acknowledge that universities should continue to innovate, and adopting non-traditional features is practically, and in some sense tautologically, the means to that end. The leading thinkers and practitioners opposed to the legacy system acknowledge that the legacy system is firmly entrenched and will continue to be so for many years, and so the optimal course of action for individuals and for society is for new providers to integrate, cooperate, and coordinate with those legacy systems, instead of attempting to steal consumers in a winner-take-all fashion.

The result is that leading thinkers and practitioners on both sides largely support both alternative education and traditional education. Moreover, leaders on both sides generally agree on which pedagogies, technologies, and so on, provide optimal results in most cases. A cursory glance at the non-book literature demonstrates the difficulty involved in locating a formal paper with citations in excess of the single digits which promotes the traditional lecture mode of class instruction. I could only find one from by Kalogeras in 1976⁶⁶. While the magazines occasionally headline an article which pretends to defend lecture, seldom make an evidence-based case and often essentially concede the point. Consider **In Defense of the Lecture**, a 2014 article from the Chronicle of Higher Education. This article points out specific virtues of lecture, even while conceding "...lecturing as a means of transferring basic factual information is a poor way to teach. I agree..."

The differences in opinion seem rather limited, and they almost universally apply to macroeconomic issues. The closest thing to disagreement on microeconomic choices seems to be threefold:

- 1 Some scholars are aware of interesting programs or technologies which other scholars are not aware of.
- 2 Scholars heterogeneously trust the payoff claims of particular programs of alternative learning.
- 3 Some scholars oppose particular alternative education techniques.

Expanding on the third point above, Eric Hanushek recently stated⁶⁷ "We should not delude ourselves into thinking that Trump's apprenticeship expansion will substitute for our failing K-12 schooling system...Vocationally-trained workers with relatively narrow skills face a harsher labor market with time as the nature of production changes." Along the same lines, a Brookings study to which Hanushek contributed found that excess utilization of an apprenticeship model at the social level could generate a skill gap⁶⁸. Despite Hanushek's particular position on the Trump plan, and perhaps his general opposition to excess utilization of apprenticeship, it is clear that he does not oppose alternative education writ large, and that he does not deny the utility of vocational training for particular individuals.

It is worth mentioning that both of these main microeconomic concerns are being addressed over time by projects like Credential Engine, which seeks to comprehensively catalog non-accredited credentials

⁶⁶ <https://www.jstor.org/stable/41947890>

⁶⁷ https://www.huffingtonpost.com/entry/germany-apprenticeship-america-trump_us_594be9ebe4b0a3a837be16b5

⁶⁸ <https://www.brookings.edu/blog/brown-center-chalkboard/2017/06/28/apprenticeship-programs-in-a-changing-economic-world/>

and standardize their outcome measurement and reporting⁶⁹. An alternative strategy is provided by firms like Degreed, which markets a generalized service to measure any skill⁷⁰. This approach simplifies the measurement trust problem from a need to trust heterogeneous providers to the need to trust a single provider of learning measurement, Degreed.

Many less comprehensive skill measurement providers exist. Pluralsight, for example, is a relatively well known and reputed firm in the IT market. Pluralsight provides a standard measurement service for a specific range of skills⁷¹. This measurement process obtains independent from where the learning or skill development occurred. In this sense, employers can choose to trust a skill measurement provider instead of directly trusting a learning provider. This simplifies the analysis problem for employers, and it also creates an additional incentive for learning providers to provide good content. If many students pass through an alternative learning process, then perform poorly during standard evaluation, the poor performance becomes attributable in part or whole to that alternative learning process.

The main sources of debate seem to be on macroeconomic concerns. These concerns are completely out of my interest, but they are worth noting:

- 1 What is the best course of action for the mean or median student?
- 2 What should be done with public funds for education?
- 3 Should the existing educational requirements for certain professional licenses be reevaluated, or should certain licenses be created or destroyed?

It seems to me that if there is to be any meaning to the labelling of a scholar as in favor of traditional education, it merely means that, with respect to the macroeconomic points mentioned above, the scholar believes at least one of, and possibly all of, the following:

1. The mean or median student should obtain a four-year degree.
2. The growth in public education spending should remain constant, or perhaps grow.
3. At least some professions benefit from licensing, and at least some licenses benefit from requiring accredited education.

Caplan would represent, then, a non-traditional position. Hanushek would represent a moderate position between these extremes, arguing that policymakers should not grow spending, or perhaps cut it non-drastically, but mainly focus on spending in a more intelligent way⁷².

Under this macroeconomic categorization, even the proponent of traditional education need not say a particular student should necessarily obtain a four-year degree, although it would seem to be a null hypothesis. It is this null hypothesizing mechanism which finally allows us to obtain some meaningful distinction at the microeconomic level, whereas breaking scholars into camps according to their attitude on disruption seems like a red herring.

⁶⁹ <https://credentialengine.org/about/>

⁷⁰ <https://degreed.com/skill-certification>

⁷¹ <https://www.pluralsight.com/product/skill-iq>

⁷² <http://hanushek.stanford.edu/publications/saving-schools-why-more-money-not-answer>

Section 3.1 - Methodology and Organization of Findings

Comparable survey questions obtained a maximum of 1190 responses during four administration windows including portions of February 2018, October 2018, February 2019, and May 2019. Appendix 1 details the wording of questions and the answers available. Appendix 2 identifies which factors were included in each administration, notes significant factors by administration, and gives shorthand factor names. In general, significant factors and variables of interest were persisted across administration. Weak factors or tangential curiosities were included only in a subset of administrations.

The survey was created in SurveyMonkey and responses were gathered using SurveyMonkey Paid Audiences, Amazon Mechanical Turk, social media posts, and word of mouth. Responses were grouped according to their origin using a construct in SurveyMonkey which is called a collector. Collector effects were insignificant. This is interesting for two reasons. First, the source populations are known to be systematically different. Perhaps the most notable known systematic difference is that Amazon Mechanical Turk respondents were guaranteed to be U.S. High School graduates. A second reason the insignificance of collector effects is important is that response prices were significantly different. Amazon Mechanical Turk responses were more than 20% cheaper than SurveyMonkey Paid Audience responses on average.

Systematic analysis of the novel data set includes 106 right-hand variables and two left-hand variables. Ad hoc analysis checked another 8 selectively created interaction or similar variables. Variable-level sample sizes range from 240 to 1190. Appendix 3 lists technical variable names in alphabetical order along with summary statistics. Appendix 4 lists variable names in alphabetical order, and summarizes factor strength across models. Factors are generally operationalized into multiple variables. Appendix 4 makes this factor-to-variable mapping clear by identifying the factor short name related to each variable. For example, 9 gender variables were explored. These variables are sometimes complimentary, and in other cases they are directly redundant with another representation of the same construct.

Data exploration began and by investigating arbitrary relations of interest. These ad hoc findings of interest are discussed in section 3.5. The primary variable of interest goes by the variable name *voi* and is referred to in shorthand as entry-level suitability. It is structured as a favorability question on a scale from 1 to 10. See the description of question number 2 in appendix 1 for the wording of the question.

The secondary variable of interest goes by the variable name *ioi* and is referred to in shorthand as the index of interest. This is a 3-factor index which establishes a more general favorability measure of alternative education, whereas entry-level suitability is narrowly focused on the favorability of using alternative credentials in entry-level job application. The index of interest includes the variable of interest, and the two factors are strongly correlated, so general comments on favorability of alternative education should be considered a reference to both. Results for the index of interest were mainly uninteresting, as they were very much in line with an attenuated form of the results for the variable of interest.

Systematic analysis leveraged ordinary least squares regression analysis and identification of four key models for each administration year. The first model is a long model which involves multiple regression of every available right-hand variable. The second model of interest is the weak model which involves regressing all variables with a p-value less than .5. The third model is the adjusted r-squared maximizing

model, and the fourth model, also called the strong model, involves regressing variables which have a p-value less than .1.

Systematic exploration began with the long model and variables were eliminated one at a time by significance until the next model of interest was discovered. The long model is interesting because it shows the maximum explanatory power of the available data set. The weak model is interesting because each variable which survives to this model is more likely than not to have an effect on the left-hand variable. The adjusted r-squared model is interesting because it balances between model complexity and explanatory power in a standard way. The strong model is interesting because it includes factors which have had an effect identified rigorously to a high degree of precision. With the probable exception of the long model, any of these models might be useful in varying applied business scenarios. While the long models seem to have high complexity relative to added value, it is interesting to note that the raw explanatory power of .5635 is greater than .5. This is important because it means the long model explains more of the variation than it fails to explain among the observations it is fit against.

Because the October 2018 administration variables are a superset of the February 2018 variables, a single systematic exploration was conducted concerning the 2018 administration year. Similarly, May 2019 variables are a superset of February 2019, and a single systematic exploration was conducted for 2019 variables. This analysis did not restrict the sample, however, and it turned out exegetically that the 2019 strong model holds for 2018 as well. That is, the most significant factors identified in the 2019 samples were also measured in the 2018 administrations. This is likely a case of statistical endogeneity of significance, however, as these variables may be significantly identified precisely because they were oversampled.

Section 3.2 – Complexity and The Preferred Model

4 of the 8 systematically derived models are reported in Table 3. Long and weak models are not recorded in the table for brevity, but factor strength across all models is reported in Appendix 4, and discussion is given to these models and their weak and super-weak factors when relevant. Adjusted r-squared maximizing models are also called medium models, and the variables in these models is considered to have medium importance.

Overall, the 2019 medium model is preferred. It obtains high raw and adjusted explanatory power while maintaining relatively low complexity. It is not, however, the highest of all adjusted-r squared among the four models. The medium model including 2018-only variables had a higher adjusted r-squared. There are a couple potential reasons for this. First, variables which were included in 2018 and not included in 2019 are likely to contain important effects which would add to adjusted explanatory power. Secondly, there might be additional variation in the newer samples which would cause weaker fit even in the presence of 2018 variables.

Initial investigation at the time of the 2018 survey administrations indicated that stem identification and religiosity were insignificant, so they were removed from later investigation. More recent replication of those results uncovered that those effects were moderately important, and inclusion in future research is recommended for reanalysis.

During 2018 investigation, there was suspect improvement to simplicity when filtering by factor significance from the weak into the medium model. 7 variables were eliminating, leading to nontrivial gain in adjusted r-squared, however the practical complexity of the matter did not significantly reduce because only one survey question could be eliminated in order to implement the medium model instead of the weak model. This is a different perspective on complexity which is an economically important distinction. As a result, a metric called q-complexity was checked for all models. This metric simply measures the number of questions which would be asked during a survey in order to implement a model.

Q-complexity is more directly connected to expenditure when constructing a survey or other data collection system, and it also more accurately assesses the interpretive complexity compared to adjusted r-squared in some cases. A model with 9 regional effects instead of 10 is unimportantly simpler compared to the reduction in complexity achieved when a survey with 9 yes or no questions is administered in comparison to a survey with 10 such questions. Q-complexity detects this nuance while adjusted r-squared is blind to it.

This background is an important reason for selecting the 2019 medium model. The 2018 medium model decreased q-complexity by 1 relative to the 2018 weak model, so practically the weak model is not more expensive to implement, and it may gain substantively in raw explanatory power. In the 2019 case, however, the medium model reduces q-complexity from the 2019 weak model by 4, or 25%, so it achieves an economically important reduction in implementation use and it is also substantively simpler to reason about.

Table 3 – Medium and Strong Models

	voimaxar2018 b	voistr2018 b	voimaxar2019 b	voistr2019 b
issurv~emale	1.091**	0.955**		
isstem	-1.212			
isnotstem	-1.269*			
isindustry1	1.797			
isindustry2	1.424*			
isindustry4	0.960			
isindustry5	1.395*			
isindustry6	1.830**			
isindustry10	1.438**		-0.410	
isindustry11	1.203			
isregion2	0.834	0.895	-1.214**	
isregion3	0.512		-0.838	
isregion6	0.904			
isregion7	-1.533**	-1.531**		
nvoifai1	0.700*	0.776**		
nvoifai2	-0.065*	-0.069**		
nvoifameri~2	0.011*	0.011*		
nvoifconve~3	0.003***	0.003***	-0.007*	-0.005***
nvoifcrypto2	0.009			
nvoifonline2	0.067	0.016*	0.240	0.013***
nvoifonline3	-0.005		-0.012	
nvoifregul~1	1.161	0.110*	0.268***	0.110***
nvoifregul~2	-0.250			
nvoifregul~3	0.016			
nvoifrelig~1	0.120*	0.105*		
csmage1	12.783		-12.882	
csmage2	-4.248	-0.039	4.025	
csmage3	0.426		-0.403	
csmincome1	0.770**	0.192*		
csmincome2	-0.056*		0.046	
cprovider2	0.038		0.146	
ctime3	-0.000		0.000*	
issurv~ymale			2.162*	
ismanager			-0.475	
isunemployed			1.118*	
ismale			-2.458*	-0.422**
isindustry7			-2.514**	
isindustry12			-1.668	
isregion4			-0.729	
isethnicity4			0.870	
isethnicity6			1.682*	
ishighered			0.933	
nvoifai3			0.001	0.000*
nvoifconve~2			0.113**	0.081***
nvoifonline1			-1.358	
csmincome3			-0.004	
cprovider1			-0.572	
ceduc1			0.811	
ceduc2			-0.095	
constant	1105.125	0.106	-12345.347*	3.289***
R-sqr	0.597	0.504	0.526	0.319

* p<0.05, ** p<0.01, *** p<0.001

Section 3.3 - Systematic Exploration of the 2018 Data Set

There were 168 observations in the 2018 long model. Model hardening from the long model to the weak model for 2018 resulted in a reduction from 69 to 39 variables. The 69 variables were associated with 15 questions, and the surviving 39 variables in the weak model were associated with 14 questions. Surprisingly, the only question which was fully filtered out was the question on employment status.

The original hypothesis was that employers would be willing to support alternative credentials. The systematically derived 2018 models indicate that the attitudes of those individuals who make hiring and firing decisions are not significantly different than the general population, but this simply begs a question about whether the general population supports alternative credentials. Appendix 3 answers this question by presenting summary data on all variables. The mean of the variable of interest is about 6.614, which is significantly more favorable than not across the population. Table 4 adds a bit of detail with respect to the specific sample included in the 2018 long and weak models. Individuals within this sample had an average favorability of about 6.351, although this is insignificantly different from average.

Table 4 – Cross Tab VOI by is2018LongModelResponse

is2018sample	Summary of voi		Freq.
	Mean	Std. Dev.	
0	6.6575342	2.557112	1022
1	6.3511905	2.6244814	168
Total	6.6142857	2.5678279	1190

While cross tabulation within this sample seems to hint at weak positive temporal trend, direct interrogation of time variables yields a mixed confirmation. Simple regression of linear time on the variable of interest has a super-weak ($p > .5$) negative effect. A regression of linear and squared time on the variable of interest yields stronger effects on each factor, but the effects are still weak ($.5 > p > .1$). Interestingly, the weak temporal effects are opposite expectation. Linear positive effects with a negative marginal effect would be intuitive, but the observed weak temporal effects are linearly negative and marginally positive. Positive marginal effects are generally considered unsustainable, but this finding may indicate that entry-level suitability resides on the early portion of an s-curve for adoption.

When cubic time is introduced to the right hand, linear time becomes omitted due to collinearity. The p-values of marginal and cubic effects are slightly better than the p-values of the linear and marginal effects in the simpler model, but the marginal effect has a negative value in this model. Theoretically, as time increases arbitrarily the cubic effect would dominate, so that this model also suggests unbounded increasing returns to scale. As earlier mentioned, this is generally considered theoretically unsustainable, and so a more plausible interpretation of this temporally complex model is simply that it is replicating the suggestion that entry-level suitability exists at the early phase of an adoption growth curve, prior to inflection, sometimes called the lag phase.

Based on exploration up to this point, the working answer to the hypothesis is that employers are favorable toward using alternative credentials, but so is everyone else. In addition, there is weak evidence that exponential favorability is down the road, but favorability may decrease in the immediate future and for some time. The date construct used is the number of days since 1960. Time effect coefficients indicate that the total time effect will net positive with central estimates of 80-120 years⁷³. The variety of events which could occur over such a time jeopardize reasonable confidence about the magnitude of these effects, and statistical significance in these effects is low enough that it would be unsurprising for inflection to obtain within 5 years. High variability in temporal estimation underscores the potential value of additional temporal sampling.

Reducing the weak 2018 model into the 2018 adjusted r-squared maximizing model eliminates Christian identification as an important variable. This variable competed with generic religious identification, and linear religiosity survives to this model with a positive effect. Religiosity is typically associated with political conservatism, and conservatism is thought to move with status quo bias⁷⁴. The present article gives mixed confirmation of a positive relation between religiosity and anti-innovation bias, but education appears to be an important exception.

Innovation proxy variables include favorability to artificial intelligence, cryptocurrency, and online education. These variables are cross-correlated with one another with a p-value of less than .001. Religiosity is negatively related only to artificial intelligence, but artificial intelligence is the only variable in this set of three which survives to the strong model. The negative linear correlation between religiosity and artificial intelligence is also more significant and larger in magnitude compared to the relation of religiosity to other innovation proxies.

Conservatism is characterized by high religiosity and high favorability to market-based solutions. Regulatory favorability is positively associated with all proxies of innovation. This amounts to confirmation on the association of market favorability with status quo bias, but it also presents two paradoxes. First, the market is considered an effective tool of innovation⁷⁵, so individuals seeking to maintain the status quo ought to disfavor it rather than favor it. Second, traditional education is regulated education, and alternative credentials are deregulated, so individuals committed to high levels of regulation ought to disfavor alternative credentials. One hypothesized explanation to this apparent paradox is oriented around individual personality. If those on the political left are high in openness, then they might also favor alternative credentials.

Industrial effects are common in weaker models, but fail to survive into the strong model for 2018. The most significant industrial effect was for those who chose other as their industry. The second most significant effect was for information technology. Two regions have significant effects in the strong model. The mid-atlantic region, including much of Washington DC, is associated with a positive effect. The west south central region is associated with a large negative effect. This region consists of Arkansas,

⁷³ The non-cubic model is approximately of the form $-.139t + 3.24(10)^{-6}t^2$, so that we predict a positive trend at a level of 0 when $t = 42,901$, or in about 117.5 years. The cubic model is of the form $-3.26(10)^{-6}t^2 + 1.01(10)^{-10}t^3$. This indicates a break-even date of $t = 32,277$, or in about 88.4 years.

⁷⁴ Eidelman, Scott, and Christian S. Crandall. "Bias in favor of the status quo." *Social and Personality Psychology Compass* 6.3 (2012): 270-281.

⁷⁵ Baumol, William J. *The free-market innovation machine: Analyzing the growth miracle of capitalism*. Princeton university press, 2002.

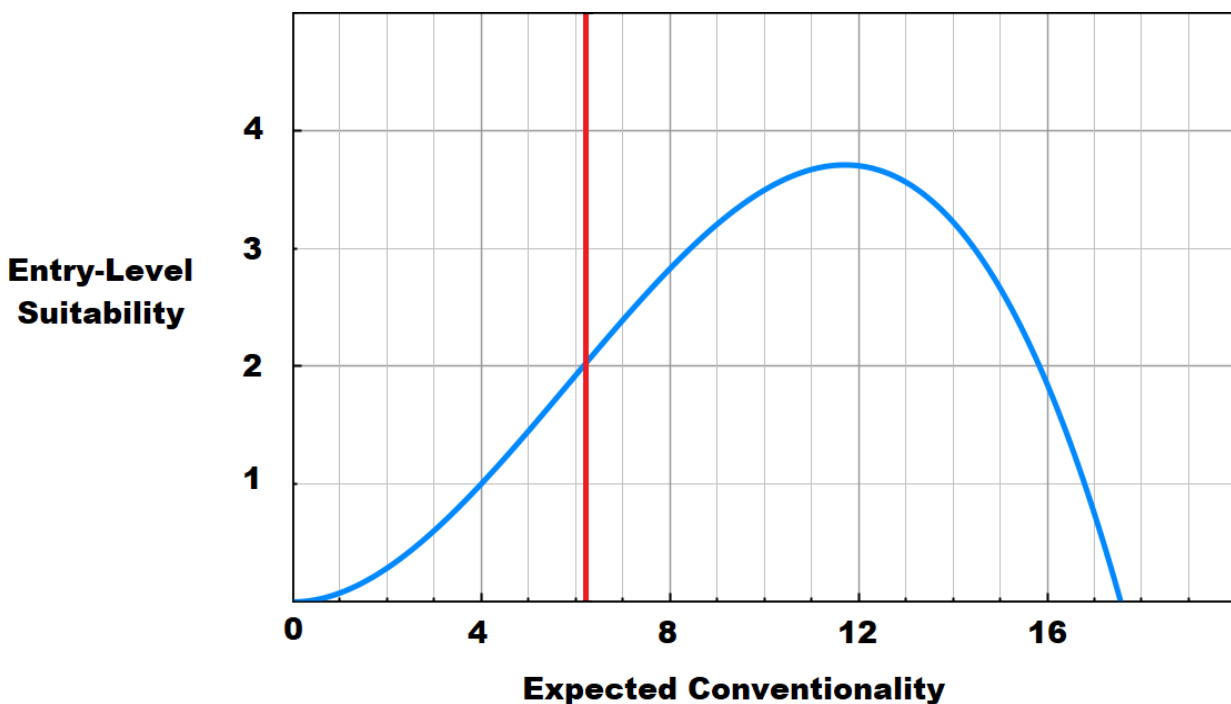
Louisiana, Oklahoma, and Texas⁷⁶. Gender, age, and income were significant. Anti-foreign bias was tested and identified, but it's explanation is not intuitive. Anti-foreign bias is positively correlated with favorability on alternative education.

Section 3.4 - Systematic Exploration of the 2019 Data Set

The 2019 strong model identifies gender, innovation bias, expected conventionalism, online education favorability, and regulatory favorability as the strongest factors. Effects move in their expected directions, except for regulatory favorability which is linearly positive with respect to the entry level suitability. It's interesting that the question about whether alternative credentials will be conventional soon survives into the strong model, because this reinforces two key theoretical stories in the literature.

First, it highlights the importance of education as a norm, which is key to Caplan's criticism of alternative credentials. Second, the surviving positive quadratic and negative cubic effects reinforces the story that alternative credential adoption is progressing through an s-curve. Figure 3 shows that the effect of expected conventionality on entry-level suitability follows an s-curve. This only reinforces our temporal story if time moves with expected conventionality, and indeed with nonlinear conventionality, but it turns out that this is exactly the case. While our earlier simple analysis of time on the variable of interest involved p-values on time variables in the neighborhood of .4, a regression of linear time on nonlinear expected conventionality reveals a positive coefficient with a p-value of .024.

Figure 3 – Effect of Expected Conventionality on Entry-Level Suitability in the 2019 Strong Model



⁷⁶ <https://factfinder.census.gov/help/en/division.htm>

The vertical line in Figure 3 occurs at a value of about 6.1, which is the mean value of expected conventionality in the survey. Notice that this story about s-curve adoption is slightly different than our earlier story. The conventionality-based adoption analysis indicates that alternative credentials are past the lagged phase of adoption and recently past the point of inflection. Extrapolating far into the future seems to indicate an eventual demise to suitability, but this extrapolation is inappropriate for a few reasons. First, the model turns negative around an expected conventionality value of 11, but the maximum value this construct is capable of taking on is 10. At 10, we seem to see a marginal value near zero, which is consistent with the second extrapolation issue. In theory, we have good reason to expect decreasing marginal effects, but we have not identified any reason to expected negative marginal effects. Section 2.6 discusses some of this theory on growth curves, learning curves, and so on.

Finally, the shape of the curve is the result of analytical design. Quadratic and cubic factors were constructed rather than directly measured. These constructs are useful because they offer simple detection of non-linear effects, but not because they are optimal for all analytical purposes. S-curves are prototypically modeled as a sigmoid function, and log-log modelling is also common for learning or experience curves. While individuals are not treated and measured for learning in this paper, the idea is that society as a whole is learning about alternative credentials over time. Log-log regression for time on conventionalism was checked, and indeed it has an even better p-value of .004. Under that model there would be no extrapolative decline in entry-level suitability as a function of arbitrarily, indeed impossibly, large expected conventionality. For practical purposes there is little substantive difference in these approaches with respect to the variables in question. Expected conventionality is not binary, but transformation of this variable is possible to allow logistic regression to model a sigmoid⁷⁷.

Logarithmic analysis obtains higher confidence, but the relation is indirect to the variable of interest. Unfortunately, log-linear and log-log analysis of time directly to the variable of interest is super-weak, so the indirect relation seems to be both our most accurate story and also a relatively complex story to predict on and reason about. The log-linear regression of expected conventionality on the variable of interest is exceedingly significance with a p-value under .001, but it is less explanatory than a multiple regression of linear, quadratic, and cubic expected conventionality on the variable of interest, and in the longer regression all right-hand variables are significant with p-values under .08.

Because the direct relation between the variable of interest and time is insignificant, but each step of an indirect relationship is significant, an indirect model is tested by generating the predicted log of expected conventionality from log time, and the variable of interest is regressed on predicted log expected conventionality. Yet, this relation is also insignificant with a p-value of .811 for the predicted coefficient in the regression.

Still, following the intuition of this indirect relation, nonlinear regressions are explored for significance. Eventually, three interesting models are identified. One strong temporal model was identified and two nonlinear regressions of expected conventionality on the variable of interest. A dynamic model was identified with the form⁷⁸:

⁷⁷ Cox, Nicholas J. "Stata tip 59: Plotting on any transformed scale." *The Stata Journal* 8.1 (2008): 142-145.

⁷⁸ Technically, this regression is executed in STATA with the syntax ``nl exp2: voi ctime1``.

$$f(x) = voi = b_1 * b_2^t$$

This temporal model obtained an r-squared of .8691 and b_2 had a p-value less than .001. The estimate of b_2 was less than 1, indicating exponential decay rather than exponential growth. This is the best fit temporal trend for the observed data, indicating a decreasing nonlinear trend in alternative credential suitability over the sample. Combining insights from 2018 and 2019 trend analysis, the evidence toward a short run reduction in alternative credential favorability is strong, and there is some comparatively weak evidence for a longer run reversal.

Regarding nonlinear regression of conventionality, a two-factor exponential expansion obtains an r-squared of .9029⁷⁹. Let X represent expected conventionality, then two-factor model takes the form⁸⁰:

$$f(x) = voi = b_0^{b_1 x}$$

A three-factor exponential expansion obtains an r-squared of .2621⁸¹. The three-factor model takes the form:

$$f(x) = voi = b_0 + b_1^{b_2 x}$$

The three-factor expansion is interesting because the exponentiated parameter is identified with a t-statistic of 1077.23. This immense t-statistic seems to indicate the parameter is identified with high precision. However, the constant in this model takes the implausible value of about -171, and the exponentiated parameter takes the implausible value of about 175. Remember that the variable of interest is observed between 1 and 10. The two-factor model estimates the exponentiated parameter at about 4. The two-factor model also estimates the exponentiated parameter with a t-statistic of about 33.8, and an associated p-value of about 0. While this lower t-statistic is technically a less strong identification, it is practically unimportant, and the estimated value is plausible.

The positive association between conventionality and entry-level suitability is already firmly established, as is the short run negative association between time and the variable of interest. One interesting note to add is that when expected conventionality is interacted with time, a multiple regression of time, conventionality, and the interacted variable reveals a positive relation between the interacted variable and entry-level suitability. This may point to long run normalization of alternative credentials as a mechanism toward eventual recovery in entry-level suitability.

Employer effects refer to the effect associated with an individual's statement that they influence hiring and firing decisions in their place of work. Employer effects were weak in the 2018 sample, but

⁷⁹ Technically, this regression is executed in STATA with the syntax ``nl (voi = {b0}*(exp({b1}*nvoifconventionalsoon1)))``.

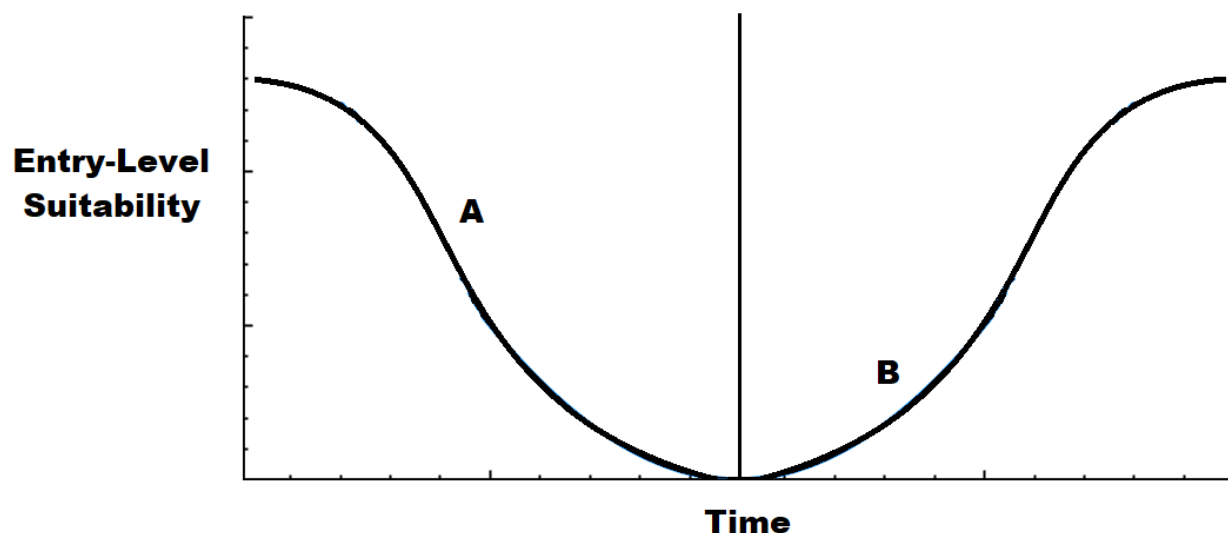
⁸⁰ I recommend the use of KaTeX in constructing mathematical expressions like this. <https://katex.org/>

⁸¹ Technically, this regression is executed in STATA with the syntax ``nl (voi = {b1}+{b2=2}*(exp({b3=0.1}*nvoifconventionalsoon1)))``.

additional sampling across 2018 and 2019 allowed employer effects to survive into the preferred 2019 model. The preferred 2019 model is the model which maximizes adjusted r-squared. Employer effects are negative in that model, with a coefficient of about $-.47$. Employer effects are slightly negative to a lesser extent in a simple regression against the variable of interest, with a coefficient of about $-.1$.

A simple interpretation is that employers are more pessimistic than others on alternative credentials. Another interesting possibility views this effect from a process perspective. From a process perspective, employers are a driver of changes to the labor market, so that population favorability lags employer favorability. It's clear that entry-level suitability will decline in the short term, and this is consistent with employers having a more negative view than average. The interesting finding here is to note that when we interact time with employer status, the employer effects are already reversed from the general population. A regression of four parameters on the variable of interest is depicted in Figure 4, which illustrates a hypothetical reversal in entry-level suitability. The figure is conceptual and not to scale. The population trend is illustrated at A, and employer views are represented at B. At A, time effects are linearly negative and marginally positive. Linear employer-time effects are positive, but marginal employer-time effects are negative. The plausibility of a reversal story is enhanced when noting that interacted manager-time effects are more positive than and significant compared to ordinary time effects.

Figure 4 – Employer-Driven Favorability



Other interesting findings from the 2019 data analysis includes the fact that age group had a more robust effect compared to exact age, which may indicate something like a cohort effect. Prior analysis indicated that regional effects were moderately important. Ethnicity was introduced into the survey in part to distinguish between underlying policy or culture partials of regional effects. Regional effects were significant after the introduction of ethnicity, but ethnic effects were also moderately significant. Future analysis could identify state of residence to partial out policy effects to a greater extent.

Educational attainment obtained an important effect which was more significant than either age or income effects. In addition to level of education, a dummy variable for whether education was at or greater than obtaining a college degree was found to be significant, and it had a positive effect on favorability to alternative education. It seems that individuals who have obtained a traditional degree are more appreciative of alternative education.

Section 3.4 - Other Interesting Results

Previous research found student indifference toward debt⁸² on the part of undergraduate students. The present paper replicates and extends such findings by identifying youth antagonism to alternative credentials. Prior research often measured debt attitudes among college students, but such evidence is susceptible to selection bias because debt-tolerant individuals might have a propensity to consume higher education. In contrast, the present paper identifies generalized youth antagonism to alternative credentials.

A simple regression of exact age on the variable of interest yields a slight negative effect. Age group was more important than exact age, and including age group and exact age simultaneously replicates linear negative association across both variables. These regression results obfuscate a narrative which is readily apparent in Tables 5 and 6, a crosstab of age group on entry level suitability, and a summary of mean response to the variable of interest by age group. Notice that the most positive group is not the youngest group, but the age group actively attending or having just graduated college.

30% of minors gave the lowest possible entry-level suitability response, and only 10% gave the highest response. Minors are the only age group which is unfavorable toward alternative credentials on average, with an average response of 4.6. One age group up, less than 3% of college-aged individuals gave a response of 1, while more than 20% gave a response of 10. Entry-level suitability attenuates downward for age groups 3 and 4, but it is still positive on average. The oldest age group also has the highest proportion of individuals in maximal favor of alternative credentials, with about 1 in 4 giving a response of 10. The oldest age group has a strongly bimodal response, and they are on average less favorable than other groups except minors, but the pessimistic peak among the elderly is still favorable, at a value of 6.

The youngest group is a group of small sample size, and therefore not weighed heavily into the lines of best fit, and they are also the most pessimistic about alternative education. Contrary to the stereotype of the innovative youth against the in-their-ways elderly, the present paper indicates that the youth are less innovative than any other group. In the preferred model, which maximizes adjusted r-squared across all 2018 and 2019 data, we see that educational effects are important, including a dummy variable for having received a college-level or better education. While neither age nor educational attainment survive into the strong model, educational effects are more significant in the preferred model. It seems that having been through the education system is the more explanatory factor, and age is a side-effect, rather than the other way around. The uneducated, including the youth, appear to be less innovative than the elderly.

⁸² <https://www.sciencedirect.com/science/article/abs/pii/S0167487096800146>

This information provides for a better marketing strategy for alternative credentials. Instead of marketing to those about to enter college, market to their parents. Marketing to active college students is also a plausible path, although these students are already invested. Some approaches to alternative education, however, work in concert with traditional education. For example, credit by examination is an affordable, fast-paced alternative pathway toward a traditional degree.

Plausible explanations for elderly favorability include memory of a time before the 1980s when a degree wasn't as essential. These individuals have also often obtained a degree and worked for a substantial amount of time, and they may have noticed only a small attainment of job-related skills from the degree. Younger individuals may have a lack of skin in the game and a longer time horizon for repayment.

Another interesting, if tangential, result is that to the author's knowledge, the present paper is the first to look at the effect of nonbinary gender identification on not only the variable of interest, but other items contained in the survey. Nonbinary gender identification obtained for 16 respondents, and it was motivated for inclusion by a desire to reduce noise in known gender effects, but it turns out to have a significant relation to the variable of interest by itself.

A simple regression of nonbinary gender identification on the variable of interest reveals a coefficient of about -1.3 with a p-value less than .05. Gender nonbinary individuals are also pessimistic about online education, with a coefficient of about -1.1 and a p-value of less than .08 in that simple regression. Gender effects survive into the strong model, but not in the form of the nonbinary identification variable. Substituting nonbinary identification in for other gender variables in the strong model maintains the negative direction of effect, but the magnitude of effect is attenuated to -.48, this time with relatively low significance and a p-value of .374.

A final interesting note is that every factor tested had at least one variable representation that was moderately significant in at least one of the administrations, with two exceptions. Collector effects were utterly insignificant, and Christian identification was weak at best. Ethnicity effects varied by ethnicity. Two were moderately important and none were strong. Hispanics, represented by *isethnicity4*, and also other ethnicities, represented by *isethnicity6*, were the two ethnicity variables present in the preferred model. Both ethnic effects were positive with nontrivial magnitudes of .87 and 1.68. These effects were nearly strong with a maximum p-value of .128 in the preferred model.

Table 5 – Crosstab of Age Group on Entry Level Suitability

voi	cragel					Total
	1	2	3	4	5	
1	3	9	11	13	4	40
2	0	4	11	10	6	31
3	1	7	13	11	5	37
4	0	13	14	20	5	52
5	1	28	31	27	9	96
6	3	27	27	44	14	115
7	1	39	35	29	6	110
8	0	38	45	34	5	122
9	0	16	24	21	4	65
10	1	46	39	36	19	141
Total	10	227	250	245	77	809

Table 6 – Mean VOI by Age Group

cragel	Summary of voi		Freq.
	Mean	Std. Dev.	
1	4.6	3.0258149	10
2	6.9295154	2.404708	227
3	6.624	2.5449028	250
4	6.4040816	2.5454845	245
5	6.3376623	2.872787	77
Total	6.5908529	2.558613	809

Section 4 - Applications

There are several important microeconomic applications of the present research. Key applications include accelerating and reducing cost for traditional education, improving employment and earnings through alternative credentials, individual application during the interview process, individual application in the context of corporate politics, firm application in competitive analysis, and individual application while facing the education consumption decision.

Accelerating and reducing cost for traditional education can be accomplished in several ways. First, identify the average public in-state tuition for four-year public universities in the learner's state of residence. Then, filter possible learning providers to ensure this is the maximum amount paid. Second, utilize online learning providers if the professional education desired support than, and if the learner is comfortable doing so. If the professional education desired involves hand-on experience, like science lab

or medical, pure online solutions may not be ideal. Business, information technology, and liberal arts degrees are largely consumable online. Identify the learner's desired career path and work backwards from that, taking note of relevant certifications, and directly pursuing certification as part of or in lieu of traditional education if possible. Leverage credit by examination and prior learning assessments when possible. Make it a goal to work while going to school and obtain employer reimbursement for college expenses to the maximum available amount.

During the application process, an individual who has received alternative education should bear in mind the preferred model of alternative education favorability. The employment candidate will have opportunities to observe interviewers who will interview on behalf of the employer and contribute to an employment decision. The candidate can strategically communicate their educational history by observing interviewers and roughly calculating their favorability to alternative education.

In the context of corporate politics, an individual may already be employed and may be seeking to garner consensus within the organization for a policy change. An example of a desired policy change might be to eliminate the requirement for a traditional degree from certain job requisitions, or to allow specific alternative credentials to substitute for that requirement in some cases. Many corporations offer thousands of dollars per employee in tuition assistance. A second example of a desired policy change might be to modify tuition assistance to target CLEP testing, so that recipients would be able to more quickly and cheaply obtain college credit, and potentially reduce assistance outlays from the employer. Bearing in mind the preferred model might assist a change advocate in identifying those individuals best predisposed to agreement with the change, facilitating consensus building and execution of that change.

For the two above scenarios, a key rhetorical strategy is to ask a person about whether they are familiar with alternative credentials. If they are not, talk a bit about them. After ensuring the concept is familiar, proceed to ask whether the person thinks these will soon become conventional. This is a key non-observable factor which is extremely explanatory in the model, but when asked in conversation it comes across in a non-technical, comfortable way. Handled properly, this question can be a good ice breaker and help the person asking the question to understand their audience without giving away the views of the person asking the question. The findings in the present paper indicate that people are receptive to alternative credentials even if they aren't familiar with the topic, and that they become more favorable as they learn more⁸³. Outside of formal processes, these positive effects may indicate that conversation around alternative credentials is generally positive, and it might be applicable as ordinary leisure conversation material, which might eventually contribute to wider social acceptance by word of mouth.

Regarding competitive analysis from the firm perspective, particularly in the case of labor competition, firms already know that alternative education is important. People often learn about alternative learning providers through their employer. This is reflected in the findings from the present research in that unemployed status has a highly significant association with lack of knowledge about alternative learning

⁸³ Technically, ``reg voi cprovider1`` indicates that when a person doesn't know of any alternative learning providers, there is still a constant of 6.4 in the simple linear regression, indicating positive favorability to the variable of interest. In addition, `cprovider1` itself has a significant, positive effect, indicating that informing a person about an alternative learning provider is expected to have a positive impact to the variable of interest, which is alternative credential favorability.

providers⁸⁴. While employers are already driving alternative learning adoption, this kind of learning is typically used as a layer of professional learning, upskilling, or continuous education on top of a prior traditional degree.

The competitive trend is the tendency to allow that learning to substitute for the degree. This improvement to the prior human resource process allows access to a larger pool of qualified candidates who tend to accept offers at lower salary. Google was in early on this trend. In 2013, Laszlo Bock, Senior Vice President at Google, was interviewed by Adam Bryant of The New York Times. He stated that Google's data at that time indicated that on the job performance was insignificantly related to GPA or test scores after 2-3 years, and the proportion of people without any college education at Google was increased over time⁸⁵. Years later, in 2018, a well-known salary aggregator called Glassdoor reported on 15 major companies, including Google, which no longer required a degree⁸⁶. Glassdoor stated, "Increasingly, there are many companies offering well-paying jobs to those with non-traditional education or a high-school diploma."

Alternative learning providers are also a key approach to improving workforce diversity⁸⁷. In order to align with other industry-leading firms, drive down labor cost, and improve workforce diversity, the present findings suggest a best practice policy is to marginally reduce traditional educational requirements in as many professional positions as feasible for a given firm.

Facing the education consumption decision includes at least two sub-scenarios. In one scenario the consumer is the student, and in another scenario the consumer is financing a third-party student. Typically, a financier would be a parent paying for their child to receive additional education, but there are many non-parental cases of third-party financing. Employers are a key example of non-parental education financing.

The important takeaway from the findings for individuals facing education consumption choices is that most people are favorable to the idea of alternative education, although we may soon enter a period where that favorability decreases substantially. Even facing lower favorability, though, it may still be worth exploring alternative credentials due to their affordability and rapid ability to attain. Finally, alternative education is broader than alternative credentials, and it's possible to leverage alternative education as a way to accelerate or cheapen the completion of a traditional education.

Learning while employed makes a learner a nontraditional student, but it greatly enhances the return to college. This for at least three reasons. First, because foregone earnings are a major college expense. Second, gaining experience allows the learner to obtain even higher earnings at graduation time. Third, many employers reimburse a significant amount of employee expenses toward college.

This research also informs several potential macroeconomic policy enhancements. Federal lending programs, the G.I. Bill, and similar programs could be redirected, growth-limited, frozen, amended with a sunset provision, or terminated. Licensing regulation entailing formal education could be written to target evidence-based competency in lieu of accredited education. Internship requirements could be

⁸⁴ Technically, `reg cprovider1 isunemployed` identifies a linear effect of unemployed status on learning providers knowledge with a p-value of about 0.000 and a considerable magnitude of -.6.

⁸⁵ <https://www.nytimes.com/2013/06/20/business/in-head-hunting-big-data-may-not-be-such-a-big-deal.html>

⁸⁶ <https://www.glassdoor.com/blog/no-degree-required/>

⁸⁷ <https://www.cio.com/article/3250634/want-a-more-diverse-workforce-hire-bootcamp-graduates.html>

relaxed, or the minimum wage could be reduced. Finally, tax write-offs and tax-privileged investment vehicles targeted at accredited education could be liberalized to allow various forms of alternative education. While the present paper has focused on post-secondary credentials, it finds itself in harmony with a broad literature identifying favorable outcomes for school choice and self-directed learning at all ages.

Appendix 1 - Question Reference

1. Do you contribute to hiring and firing decisions at your company?
 - a. One selection among the following was allowed:
 - i. Yes
 - ii. No
 - iii. Unemployed
2. For many professions, alternative credentials can qualify a person for an entry-level position.
 - a. An integer selection inclusively between 1 and 10.
 - b. Value of 1 labeled “Strongly Disagree”
 - c. Value of 10 labeled “Strongly Agree”
 - d. Other values unlabeled.
 - e. This is the default answer pattern. If some question doesn’t specify the available answers, then the answers available are similar to question #2.
3. It will soon become fairly conventional for high school graduates to obtain alternative credentials instead of going to college.
4. When you add up the pros and cons for online education, it's probably a good thing for society overall
5. When you add up the pros and cons for artificial intelligence, it's probably a good thing for society overall.
6. When you add up the pros and cons for cryptocurrency, it's probably a good thing for society overall.
7. When evaluating an applicant's education, it is important is important to check whether the degree was awarded from a US institution.
8. Have you heard of any of the following online course providers?
 - a. Zero to many selections among the following were allowed:
 - i. Udacity
 - ii. Udemy
 - iii. Coursera
 - iv. Pluralsight
 - v. Lynda.com
 - b. Note: In the May 2019 administration and onward, the choice for Lynda.com was changed to Lynda.com / LinkedIn Learning. This is due to the LinkedIn acquisition of Lynda.com.
9. Do you work in a STEM profession?
 - a. One selection among the following was allowed:
 - i. Yes
 - ii. No
 - iii. Unsure
10. Which of these industries most closely matches your profession?
 - a. One selection among the following was allowed:
 - i. Agriculture
 - ii. Education
 - iii. Energy
 - iv. Finance, Investment, or Accounting

- v. Health
- vi. Information Technology
- vii. Law
- viii. Manufacturing
- ix. Military
- x. Other
- xi. Retail
- xii. Transportation

11. I consider myself religious

12. I consider myself Christian

13. Government regulation helps ensure businesses treat individuals more fairly.

14. Age

- a. Included by SurveyMonkey in 2018.
- b. In 2019 the question was explicitly asked.
- c. In May 2019 and onward, exact age was also asked.
- d. One selection among the following was allowed:
 - i. < 18
 - ii. 18 -29
 - iii. 30-44
 - iv. 45-60
 - v. > 60

15. Gender

- a. Included by SurveyMonkey in 2018.
- b. In 2019 the question was explicitly asked and the value of Other became a choice.
- c. One selection among the following was allowed:
 - i. Male
 - ii. Female

16. Household Income

- a. Included by SurveyMonkey in 2018.
- b. In 2019 the question was explicitly asked.
- c. Measured annually, in nominal USD.
- d. One selection among the following was allowed:
 - i. 0-9,999
 - ii. 10,000-24,999
 - iii. 25,000-49,999
 - iv. 50,000-74,999
 - v. 75,000-99,999
 - vi. 100,000-124,999
 - vii. 125,000-149,999
 - viii. 150,000-174,999
 - ix. 175,000-199,999
 - x. 200,000+
 - xi. Prefer not to answer

17. Region

- a. Included by SurveyMonkey
- b. One selection among the following was allowed:
 - i. New England
 - ii. Middle Atlantic
 - iii. East North Central
 - iv. West North Central
 - v. South Atlantic
 - vi. East South Central
 - vii. West South Central
 - viii. Mountain
 - ix. Pacific

18. Device Type

- a. Included by SurveyMonkey
- b. One selection among the following was allowed:
 - i. iOS Phone / Tablet
 - ii. Android
 - iii. Other Phone / Tablet
 - iv. Windows Desktop
 - v. MacOS Desktop
 - vi. Other

19. What is the highest level of education you have completed?

- a. Did Not Graduate from High School
- b. GED
- c. High School Diploma
- d. Some College
- e. Obtained Undergraduate Degree
- f. Obtained Non-Doctoral Graduate Degree
- g. Obtained a Doctoral Degree

20. Which race/ethnicity best describes you?

- a. American Indian or Alaskan Native
- b. Asian / Pacific Islander
- c. Black or African American
- d. Hispanic
- e. White / Caucasian
- f. Other

Appendix 2 – Questions Per Survey

Question Definition Number*	Short Name(s)	2018, Feb	2018, Oct	2019, Feb	2019, May
1	Employment Status, Employer Effects	X	X	X	X
2	Entry-Level Suitability, Variable of Interest	VOI	VOI	VOI	VOI
3	Expected Conventionality	X	X	X	X
4	Online Education	X	X	X	X
5	Artificial Intelligence, Innovation Bias, Status Quo Bias		X	X	X
6	Cryptocurrency	X	X		
7	US Degree Centrism, Anti-Foreign Bias	X	X		
8	Provider Recognition	X	X	X	X
9	STEM	X	X		
10	Industry	X	X	X	X
11	Religiosity		X		
12	Christian Identification		X		
13	Regulatory Favorability		X	X	X
14	Age	X	X	X	X
15	Gender	X	X	X	X
16	Income	X	X	X	X
17	Region	X	X	X	X
18	Device Type	X	X	X	X
	Time		C	C	C
	Collector			C	C
19	Ethnicity				X
20	Educational Attainment				X

* Question definition number allows cross-reference into Appendix 1 and is not a statement about the presentation order of questions.

C - Response value was determined automatically, rather than by response of the participant.

VOI - Question was present and represents the variable of interest.

X - Question was present for survey. This does not guarantee every respondent answered the question. Particularly, Q14-Q18 were presented as SurveyMonkey included data for paid responses only during 2018. Beginning in 2019, Q14-Q16 were asked of all respondents, but Q17-Q18 remained observed for SurveyMonkey paid responses.

Appendix 3 – Table of Variable Summary Statistics

Variable	N	Mean	SD	P25	Median	P75	Min	Max
ceduc1	406	4.65	1.4	4	5	5	1	8
ceduc2	406	23.55	13.26	16	25	25	1	64
ceduc3	406	127.51	105.17	64	125	125	1	512
cprovider1	1190	1.29	1.2	0	1	2	0	5
cprovider2	1190	3.1	5.22	0	1	4	0	25
cprovider3	1190	9.85	23.71	0	1	8	0	125
crage1	809	3.19	0.99	2	3	4	1	5
crage2	809	11.14	6.52	4	9	16	1	25
crage3	809	41.88	34.91	8	27	64	1	125
crea1	406	39.97	13.72	29	37	50	17	88
crea2	406	1785.07 87800.1	1221.51 90599.3	841	1369	2500 1.25E+0	289	7744 6.81E+0
crea3	406	8	6	24389	50653	5	4913	5
crincome1	773	4.28	2.08	3	4	5	1	10
crincome2	773	22.6	22.54	9	16	25	1	100
crincome3	773	141.9	219.35	27	64	125	1	1000
csmage1	771	3.42	1.08	2	4	4	2	5
csmage2	771	12.88	7.44	4	16	16	4	25
csmage3	771	52.05	41.27	8	64	64	8	125
csmincome1	699	4.06	2.07	3	4	5	1	10
csmincome2	699	20.76	21.24	9	16	25	1	100
csmincome3	699	126.53 21557.7	200.29	27	64	125	1	1000
ctime1	1190	4 4.65E+0	138.76 5.96E+0	21466 4.61E+0	21604 4.67E+0	21677 4.70E+0	21241 4.51E+0	21678 4.70E+0
ctime2	1190	8 1.00E+1	6 1.92E+1	8 9.89E+1	8 1.01E+1	8 1.02E+1	8 9.58E+1	8 1.02E+1
ctime3	1190	3	1	2	3	3	2	3
ioi	1190	19.55	6.13	16	20	24	3	30
iscollector1	1190	0.03	0.18	0	0	0	0	1
iscollector10	1190	0.23	0.42	0	0	0	0	1
iscollector11	1190	0.17	0.37	0	0	0	0	1
iscollector12	1190	0.17	0.38	0	0	0	0	1
iscollector2	1190	0.09	0.28	0	0	0	0	1
iscollector3	1190	0.02	0.13	0	0	0	0	1
iscollector4	1190	0.09	0.28	0	0	0	0	1
iscollector5	1190	0.03	0.16	0	0	0	0	1
iscollector6	1190	0.07	0.26	0	0	0	0	1
iscollector7	1190	0.02	0.13	0	0	0	0	1
iscollector8	1190	0.08	0.28	0	0	0	0	1
iscollector9	1190	0.01	0.09	0	0	0	0	1
isethnicity1	406	0.02	0.13	0	0	0	0	1

isethnicity2	406	0.14	0.34	0	0	0	0	1
isethnicity3	406	0.1	0.3	0	0	0	0	1
isethnicity4	406	0.07	0.26	0	0	0	0	1
isethnicity5	406	0.65	0.48	0	1	1	0	1
isethnicity6	406	0.03	0.17	0	0	0	0	1
isfemale	1190	0.47	0.5	0	0	1	0	1
ishighered	1190	0.84	0.37	1	1	1	0	1
isindustry1	1190	0.02	0.13	0	0	0	0	1
isindustry10	1190	0.25	0.43	0	0	0	0	1
isindustry11	1190	0.09	0.29	0	0	0	0	1
isindustry12	1190	0.03	0.18	0	0	0	0	1
isindustry2	1190	0.12	0.33	0	0	0	0	1
isindustry3	1190	0.02	0.14	0	0	0	0	1
isindustry4	1190	0.08	0.26	0	0	0	0	1
isindustry5	1190	0.12	0.32	0	0	0	0	1
isindustry6	1190	0.18	0.38	0	0	0	0	1
isindustry7	1190	0.03	0.18	0	0	0	0	1
isindustry8	1190	0.05	0.22	0	0	0	0	1
isindustry9	1190	0.01	0.11	0	0	0	0	1
ismale	1190	0.46	0.5	0	0	1	0	1
ismanager	1190	0.37	0.48	0	0	1	0	1
isnotstem	381	0.65	0.48	0	1	1	0	1
isregion1	770	0.06	0.23	0	0	0	0	1
isregion2	770	0.13	0.34	0	0	0	0	1
isregion3	770	0.13	0.33	0	0	0	0	1
isregion4	770	0.07	0.26	0	0	0	0	1
isregion5	770	0.19	0.39	0	0	0	0	1
isregion6	770	0.06	0.24	0	0	0	0	1
isregion7	770	0.09	0.29	0	0	0	0	1
isregion8	770	0.07	0.26	0	0	0	0	1
isregion9	770	0.2	0.4	0	0	0	0	1
isreportedfemale	809	0.48	0.5	0	0	1	0	1
isreportedincomeprefernotdisclosed	809	0.04	0.21	0	0	0	0	1
isreportedmale	809	0.5	0.5	0	1	1	0	1
isreportednonbinary	809	0.02	0.14	0	0	0	0	1
isstem	381	0.23	0.42	0	0	0	0	1
issurveymonkeyfemale	1190	0.36	0.48	0	0	1	0	1
issurveymonkeyincomeprefernotdisclosed	1190	0.06	0.24	0	0	0	0	1
issurveymonkeymale	1190	0.29	0.45	0	0	1	0	1
issurveymonkeyunreportedgender	1190	0.35	0.48	0	0	1	0	1
isunemployed	1190	0.12	0.33	0	0	0	0	1

isunreportedgender	809	0	0	0	0	0	0	0
isunreportedstem	381	0	0	0	0	0	0	0
isunsurestem	381	0.12	0.32	0	0	0	0	1
nvoifai1	1049	5.95	2.53	4	6	8	1	10
nvoifai2	1049	41.79	30.03	16	36	64	1	100
nvoifai3	1049	322.39	313.02	64	216	512	1	1000
nvoifamerican1	381	5.94	2.63	4	6	8	1	10
nvoifamerican2	381	42.22	30.85	16	36	64	1	100
nvoifamerican3	381	329.63	318.86	64	216	512	1	1000
nvoifchristianity1	240	5.15	3.66	1	5	9	1	10
nvoifchristianity2	240	39.79	40.48	1	25	81	1	100
nvoifchristianity3	240	349.15	411.8	1	125	729	1	1000
nvoifconventionalsoon1	1190	6.13	2.6	4	6	8	1	10
nvoifconventionalsoon2	1190	44.26	31.17	16	36	64	1	100
nvoifconventionalsoon3	1190	349.73	328.68	64	216	512	1	1000
nvoifcrypto1	381	4.62	2.6	2	5	6	1	10
nvoifcrypto2	381	28.12	26.91	4	25	36	1	100
nvoifcrypto3	381	197.13	259.62	8	125	216	1	1000
nvoifonline1	1190	6.81	2.49	5	7	9	1	10
nvoifonline2	1190	52.55	31.45	25	49	81	1	100
nvoifonline3	1190	434.07	342.81	125	343	729	1	1000
nvoifregulation1	1049	6.23	2.5	5	6	8	1	10
nvoifregulation2	1049	45.03	29.92	25	36	64	1	100
nvoifregulation3	1049	352.99	314.41	125	216	512	1	1000
nvoifreligion1	240	5.09	3.4	1	5	8	1	10
nvoifreligion2	240	37.38	37.12	1	25	64	1	100
nvoifreligion3	240	312.66	373.82	1	125	512	1	1000
voi	1190	6.61	2.57	5	7	9	1	10

Appendix 4 – Table of Variable Strength

Variable	N	Factor Name	2018 Strength*	2019 Strength*	Preferred
ceduc1	406	Education	N	M	Y
ceduc2	406	Education	N	M	Y
ceduc3	406	Education	N	L	N
cprovider1	1190	Provider Recognition	W	M	Y
cprovider2	1190	Provider Recognition	M	M	Y
cprovider3	1190	Provider Recognition	W	W	N
cage1	809	Age	N	W	N
cage2	809	Age	N	W	N
cage3	809	Age	N	L	N
crea1	406	Age	N	L	N
crea2	406	Age	N	W	N
crea3	406	Age	N	W	N
crincome1	773	Income	N	L	N
crincome2	773	Income	N	W	N
crincome3	773	Income	N	L	N
csmage1	771	Age	M	M	Y
csmage2	771	Age	S	M	Y
csmage3	771	Age	M	M	Y
csmincome1	699	Income	S	W	Y
csmincome2	699	Income	M	M	Y
csmincome3	699	Income	L	M	Y
ctime1	1190	Time	M	L	Y
ctime2	1190	Time	L	L	Y
ctime3	1190	Time	L	M	Y
ioi	1190	VOI	VOI	VOI	VOI
iscollector1	1190	Collector	N	L	N
iscollector10	1190	Collector	N	L	N
iscollector11	1190	Collector	N	L	N
iscollector12	1190	Collector	N	L	N
iscollector2	1190	Collector	N	L	N
iscollector3	1190	Collector	N	L	N
iscollector4	1190	Collector	N	L	N
iscollector5	1190	Collector	N	L	N
iscollector6	1190	Collector	N	L	N
iscollector7	1190	Collector	N	L	N
iscollector8	1190	Collector	N	L	N
iscollector9	1190	Collector	N	L	N
isethnicity1	406	Ethnicity	N	L	N
isethnicity2	406	Ethnicity	N	L	N
isethnicity3	406	Ethnicity	N	L	N

isethnicity4	406	Ethnicity	N	M	Y
isethnicity5	406	Ethnicity	N	W	N
isethnicity6	406	Ethnicity	N	M	Y
isfemale	1190	Gender	L	W	N
ishighered	1190	Education	N	M	Y
isindustry1	1190	Industry	M	W	Y
isindustry10	1190	Industry	M	M	Y
isindustry11	1190	Industry	M	W	Y
isindustry12	1190	Industry	L	M	Y
isindustry2	1190	Industry	M	W	Y
isindustry3	1190	Industry	L	W	N
isindustry4	1190	Industry	M	W	Y
isindustry5	1190	Industry	M	W	Y
isindustry6	1190	Industry	M	W	Y
isindustry7	1190	Industry	L	M	Y
isindustry8	1190	Industry	L	W	N
isindustry9	1190	Industry	L	L	N
ismale	1190	Gender	L	S	N
ismanager	1190	Employment	L	M	Y
isnotstem	381	STEM	M	N	Y
isregion1	770	Region	L	L	N
isregion2	770	Region	S	M	Y
isregion3	770	Region	M	M	Y
isregion4	770	Region	L	M	Y
isregion5	770	Region	L	L	N
isregion6	770	Region	M	L	Y
isregion7	770	Region	S	L	Y
isregion8	770	Region	L	L	N
isregion9	770	Region	L	W	N
isreportedfemale	809	Gender	N	L	N
isreportedincomeprefernotdisclos	809	Gender	N	L	N
isreportedmale	809	Gender	N	W	N
isreportednonbinary	809	Gender	N	L	N
isstem	381	STEM	M	N	Y
issurveymonkeyfemale	1190	Gender	S	L	Y
issurveymonkeyincomeprefernotdis	1190	Income	L	L	N
Issurveymonkeymale	1190	Gender	L	M	Y
issurveymonkeyunreportedgender	1190	Income	L	L	N
isunemployed	1190	Employment	L	M	Y
isunreportedgender	809	Gender	N	L	N
isunreportedstem	381	STEM	L	N	N
isunsurestem	381	STEM	L	N	N
nvoifai1	1049	Artificial Intelligence	S	L	Y

nvoifai2	1049	Artificial Intelligence	S	L	Y
nvoifai3	1049	Artificial Intelligence	L	S	Y
nvoifamerican1	381	US Degree Centrism	L	N	N
nvoifamerican2	381	US Degree Centrism	S	N	Y
nvoifamerican3	381	US Degree Centrism	L	N	N
nvoifchristianity1	240	Christianity	W	N	N
nvoifchristianity2	240	Christianity	W	N	N
nvoifchristianity3	240	Christianity	W	N	N
nvoifconventionalsoon1	1190	Conventionalism	W	L	N
nvoifconventionalsoon2	1190	Conventionalism	W	S	Y
nvoifconventionalsoon3	1190	Conventionalism	S	S	Y
nvoifcrypto1	381	Cryptocurrency	L	N	N
nvoifcrypto2	381	Cryptocurrency	M	N	Y
nvoifcrypto3	381	Cryptocurrency	L	N	N
nvoifonline1	1190	Online Education	L	M	Y
nvoifonline2	1190	Online Education	S	S	Y
nvoifonline3	1190	Online Education	M	M	Y
nvoifregulation1	1049	Regulatory Policy	S	S	Y
nvoifregulation2	1049	Regulatory Policy	M	L	Y
nvoifregulation3	1049	Regulatory Policy	M	L	Y
nvoifreligion1	240	Religiousness	S	N	Y
nvoifreligion2	240	Religiousness	L	N	N
nvoifreligion3	240	Religiousness	L	N	N
voi	1190	VOI	VOI	VOI	VOI

*The letter represents the most significant model the factor survived into. N = Not present in this administration. VOI = included as a variable of interest, and not assessed for explanatory significance. L = Long Model, W = Weak Model, M = Adjuster R-squared Maximizing Model, or Medium Importance, and S = Strong Model. Preferred variables were M or S in exploration of at least one year.