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The Implications of Educational and Methodological Background for the Career SUCCESS of Nobel Laureates: Looking at Major Awards

Ho Fai Chan[1] and Benno Torgler[1,2,3*]

[1]Queensland Behavioural Economics Group (QuBE), School of Economics and Finance, Queensland University of Technology, Australia, [2] EBS Universität für Wirtschaft und Recht, EBS Business School, Germany, and [3]CREMA—Center for Research in Economics, Management and the Arts, Switzerland

ABSTRACT: *Nobel laureates have achieved the highest recognition in academia, reaching the boundaries of human knowledge and understanding. Owing to past research, we have a good understanding of the career patterns behind their performance. Yet, we have only limited understanding of the factors driving their recognition with respect to major institutionalized scientific honours. We therefore look at the award life cycle achievements of the 1901 to 2000 Nobel laureates in physics, chemistry and physiology or medicine. The results show that Nobelists with a theoretical orientation are achieving more awards than laureates with an empirical orientation. Moreover, it seems their educational background shapes their future recognition. Researchers educated in Great Britain and the US tend to generate more awards than other Nobelists although there are career pattern differences. Among those, laureates educated at Cambridge or Harvard are more successful in Chemistry, those from Columbia and Cambridge excel in Physics, while Columbia educated laureates dominate in Physiology or Medicine.*

Keywords: *Nobel Prize, Nobel Laureates, Awards, Recognition, Educational Background, Theory, Empirics, Chemistry, Physics, Physiology or Medicine*

JEL Code: M52, J33, Z13

[*] Corresponding author. Email: benno.torgler@qut.edu.au.

I. INTRODUCTION

Recognition is a key driving force of human nature. Scientists are not exempt from this desire; in fact the academic environment relies on an extensive system of awards (Frey 2006, Chan et al. 2013). As Zuckerman (1996, p. 209) suggests, the prime ethos of science should be to derive gratification from conducting research and contributing new knowledge. However, research by Merton (1973) highlights the frequent conflicts over priority, indicating that even most eminent scientists care about recognition. Awards as an institutional instrument in academia remind scientists to advance knowledge, while providing them with a chance to find "those happy circumstances in which self-interest and moral obligation coincide and fuse" (Merton 1973, p. 293). Recognition can be an end in itself, but also an instrument to maintain the option of being engaged in scientific activities and achievements in an environment where monitoring is difficult (Stephan 2012) or where reputation requires constant replenishment (Zuckerman 1996). Scientists care about their peers, searching for their approval and appraise as indicated by Charles Darwin's statement (cited in Merton (1973, p. 293)): "My love of natural science … has been much aided by the ambition to be esteemed by my fellow naturalists".

A growing institutionalization and professionalization of science in the last century has enhanced the discussion regarding how a researcher's educational background shapes his/her future success. Previous studies have found that successful scientists are more likely to be educated in top institutions. For example, Zuckerman (1996) reports evidence on doctoral origins of US Nobel laureates (1901-72). A few large entities drive most of the action[1]: five universities are responsible for more than 55% of all the US laureates with Harvard as the most successful PhD conferring institution (16.2%). Thus, it seems that the early academic start has an influence on how an academic career develops. The environment in which one is educated and trained shapes further success. In addition, we may have a selection effect as talented and capable students are attracted to these places. As Zuckerman (1996) points out: "[T]he clumping of future members of the scientific ultra-elite in elite institutions begins early in the selective educational process" (p. 83). "…few elite universities had

[1] Such a skewed distribution is common in all different academic environments and settings with respect to publication and citation success (see, e.g., Hirsch et al. 1984, Hogan 1986, Cox and Chung 1991, Torgler and Piatti (2013) in the area of economics.

a distinct advantage in getting to observe and assess these talented young scientists during an important formative phase of their careers" (p. 151). She also shows that more than half of the laureates had previously worked either as students, post-doctorates, or junior collaborators under Nobel laureates. Hardly any had studied under an unproductive scientist. She refers to Samuelson who pointed out in his acceptance speech at Stockholm: "I can tell you how to get a Nobel Prize. One condition is to have great teachers" (p. 106) and to Hans Krebs who argued that he owed the Nobel Prize to the "circumstance that I had an outstanding teacher at the critical stage in my scientific career" (pp. 124-125). Zuckerman also stresses that "the lines of elite apprentices to elite masters who had themselves been elite apprentices, and so on indefinitely, often reach far back into the history of science, long before 1900, when Nobel's will inaugurated what now amounts to the International Academy of Sciences" (p. 105). Leading researchers transfer to their youngsters the norms and values for significant research and how to cope with chosen problems (Merton 1968). Interview responses reported by Zuckerman (1996) show that Nobelists profited a lot from seeing their masters operate, perform, think; or more generally observing their method of work, their standards, and the research culture.

A key specialization in academia is whether the researcher is a theorist or an empiricist. It is therefore worth exploring whether such a specialization has an impact on future recognition. There is evidence in economics that empirically oriented research is cited more often that theoretical research (Johnston, Piatti and Torgler 2013). However, with respect to awards and recognition, a tension emerges when discoveries are made: Who should get the recognition? Should it be the theorist who proposed the idea or the theoretical framework or the empiricist who provides the evidence for it?[2] One may raise the criticism that empirics are useless without its theoretical foundation. It is like a setting out for a walk without a compass and a map or no clue where to go. For example, Kuhn (1977) stresses: "To discover quantitative regularity one must normally know what regularity one is seeking and one's instruments must be designed accordingly" (p. 219)[3]. Wilson (1998) argues: "Nothing in science – nothing in life, for that matter – makes sense without theory. It is our nature to put all knowledge into context in order to tell a story, and to re-create the

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[2] Kolbert (2007) nicely points out this problem in an article in The New Yorker, discussing particle physics and the work environment around CERN's Large Hadron Collider.

[3] To better clarify his point: qualitative research which can be theoretical but also empirical is the prerequisite to a successful quantification (p. 213).

world by this means" (p. 56). On the other hand, Nobel laureate Simon (2008) points out: "I think we have been sold a bill of goods with the argument that we must always have a clear-cut theory before we can do empirical work…It is argued that if you don't have a hypothesis you are just counting bricks[4]. But is that a bad thing? If you look down the list of outstanding discoveries in the physical sciences or the biological sciences – look at Nobel awards in those fields – you will note that a considerable number of the prizes are given to people who had the good fortune to experience a surprise" (p. 22). Norrby (2010, pp. 47-58) provides a detailed discussion of serendipitous events that resulted in Nobel Prizes. Creativity enhanced by obsession and inspiration sparked by accidental events of (what Pasteur referred to as) an *esprit preparé* (prepared mind) led to outstanding achievements (p. 47). Experimental research in various disciplines is a good example that the road to scientific knowledge is not a one-way street from scientific law to scientific measurement (as Kuhn (1977) emphasizes when discussing the development of physical science); but rather it is a busy intersection where speaking to theorists and searching for facts is common practice.

In this study we look at the award life cycle achievement of the 1901 to 2000 Nobel laureates in physics, chemistry, and physiology or medicine. Existing studies have looked at the relationship between age and performance/creativity among Nobel Laureates (Stephan and Levin 1993, Jones and Weinberg 2011). However, to our knowledge the academic career and award dynamic has never before been analyzed empirically in detail. In a former study (Chan and Torgler 2013) we explore the number of awards received by a Nobelist before and after obtaining the Nobel Prize. The results indicate a strong increasing rate of awards before the Nobel Prize, reaching the summit in the year of the Nobel Prize followed by a very strong decrease after the Nobel Prize. The current study goes beyond our former work by using a life-cycle approach to explore whether the educational and methodological backgrounds influence a Nobelist's recognition. We observe that theoretically oriented researchers are more successful in generating awards than empiricists. Having received the highest educational attainment from the US and Great Britain also has a strong positive impact on their academic recognition. There is a tendency for Nobelists with

[4] "… the methodological directive, "Go ye forth and measure," may well prove only an invitation to waste time. If doubts about this point remain, they should be quickly resolved by a brief review of the role played by quantitative techniques in the emergence of the various physical sciences" Kuhn (2007, p. 213).

a British education to generate more awards when experiencing their peak award success while researchers educated in the US receive more awards early and late in their career. In addition, we observe that laureates educated in Germany obtain fewer awards and receive recognition later in their academic career. At the institutional level we find that laureates educated at the University of Cambridge and Harvard University generate more recognition than other laureates in Chemistry, while laureates educated in Columbia and Cambridge dominate in Physics. Harvard educated laureates are more recognized than others in Physiology or Medicine.

The remainder of the paper is organized as follows: Section 2 discusses the method, Section 3 reports the results, and Section 4 presents our concluding remarks.

II. METHOD AND DATA

Nobel laureates are an obvious group of eminent scientists to study. By receiving the Nobel Prize, they have all achieved in their lifetime the highest accolade that one can achieve as a scientist: "[I]t appears that the unplanned and tacit contest for prestige among awards is something like the planned and explicit contest of the decathlon in sport, with the Nobel emerging as champion through its high ranking in a variety of attributes making for prestige" (Zuckerman 1996, p. 20). From a quality perspective they can be seen as a homogenous group of scientists who have achieved high quality work in their process of discovery and knowledge generation. We are therefore able to hold quality relatively constant when exploring recognition throughout the career. Similarly, Zuckerman (1996, p. 62) finds that laureates are more productive early in their scientific career, rewarded quickly and in general are able to transform recognition into resources for future work. These common characteristics help to hold other things as equal as possible. Issues related to the previously mentioned selection effect (whereby better students self-select into better institutions) are less relevant when looking only at Nobel laureates. In their youth, Nobelists have a good eye for finding a "master of their craft" (Zuckerman 1996, p. 109). Academia (and in particular Nobel laureates) supplies a "real-world laboratory" for testing how an individuals' training background influences future success. In other labour market settings, such data is noisier and the job profiles, work goals and motivations are less comparable. We are able to measure (via awards) individual career success with very little measurement errors. Obviously, we have heterogeneity across disciplines as well as across the preferences of individuals. Laureates in the area of Physiology or

Medicine have been able to generate more major awards (*n*=1254) than Nobelists in Physics (938) and Chemistry (857). Zuckerman (1996) quotes a Nobel laureate to demonstrate the emotional challenges of awards and how people handle it differently: "[Baker, a pseudonym] was just over seventy when I went to his laboratory. A whole group went to his home and Mrs. Baker showed us all of his medals and there was something she said that made me realize that she was disappointed. It was undoubtedly a reflection of her husband's feelings of disappointment that he had not been recognized by a Nobel award. Driving home with my wife, we got to talking about this and I said, "I am never going to worry or have a goal in mind of any prize, even a Nobel award. I refuse to die disappointed if I don't get it." You put your happiness into the hands of some committee, which can be capricious. You've got to work for the fun of it. Men of equal accomplishment don't get it and then they have to rationalize for the rest of their lives. But don't get me wrong, I'm not sorry I got it" (pp. 209-210). However, incentives and constraints such as the "rule of the academic game" are clearly specified. Such conditions reduce omitted variable biases when conducting an empirical analysis.

In our analysis, we look at a 100-year period focusing on all the 1901 to 2000 Nobel laureates in physics, chemistry and medicine or physiology[5]. We therefore omit economics Nobel laureates. The data is derived from Kurian's (2002) *The Nobel Scientists*: *A Biographical Encyclopedia*, a volume that provides very detailed information of other major institutionalized awards obtained by these Nobel laureates. This Encyclopedia has the advantage of focusing only on very important awards leaving out awards such as honorary doctorates that could be perceived by some Nobelists or researchers as less important. For example, Zuckerman (1996, p. 224) reports how Nobel laureate Francis Crick devised a standardized checklist to deal with the flood of requests that he obtained. Going through the list we can see that he perceived honorary degrees as less important:

> "Dr. Crick thanks you for your letter but regrets that he is unable to accept your kind invitation to:

send an autograph	help you in your project
provide a photograph	read your manuscript

[5] For laureates who received the Nobel Prize twice, we use only the first Nobel Prize award (i.e. Marie Curie (Chemistry 1911), John Bardeen (Physics 1972) and Frederick Sanger (Chemistry 1980)).

cure your disease	deliver a lecture
be interviewed	attend a conference
talk on the radio	act as chairman
appear on TV	become an editor
speak after dinner	write a book
give a testimonial	accept an honorary degree.”

It is important to look at major recognitions, as the number of awards among Nobelists might be driven by the award culture of a country. Some countries have established more academic awards and laureates can profit from such circumstances. Many of the major awards such as the Copley Medal, the Davy Medal, the Lasker Awards, the Enrico Fermi Award, the Franklin Medal, the Hughes Medal, the Max Planck Medal, the Gairdner Foundation International Award, or the Faraday Medal are given to scientists from different countries.

To measure the Nobelists’ educational background we look at the place and the country of their highest educational attainment. This information is also available in Kurian (2012). In cases where researchers have obtained two doctoral degrees we take the institutions where the laureates obtained their more recent degree[6]. Data to proxy a Nobelists’ methodological orientation are derived from Jones and Weinberg (2011). They have determined whether their prize-winning work had an important theoretical or empirical component based on biographical sources[7]. Such a proxy, although not perfect for our longitudinal focus, might be a good reflection of the overall methodological orientation throughout a scientist’s entire career. Our data set indicates that 32.7% of the laureates in Physics are theoretically oriented, while in Chemistry the share is 20.7%. In the case of Physiology or Medicine, the number of laureates in our data set who are classified as theoretically oriented is small (13 out of 172). Thus, when exploring the disciplines independently we only focus on Chemistry and Physics.

[6] For example, Walter Kohn has a PhDs from Harvard (1951) and Toronto (1954). We therefore classify him under Toronto and Canada. Alan G. MacDiarmid is another example with a PhD from University of Wisconsin (1958) and from Cambridge (1961). He is therefore classified under Cambridge and Great Britain.

[7] In 21 cases (out of 525 laureates) they observed a combination of theoretical and empirical work. These were classified under theoretical.

III. RESULTS

1. DESCRIPTIVE ANALYSIS

We first investigate the educational background of the Nobelists, noting the country of their highest education. *Figure 1* shows the relative share of major awards through an academic career. As the number of Nobel Prize winners can vary between fields from year to year, we explore the number of awards per number of Nobel Prize winners within a field (number of awards in a particular year divided by number of laureates in that field based on laureates that are still alive). Moreover, we look at the number of awards relative to the number of Nobelists educated in a country. For example, the blue line (US) shows the number of awards divided by the number of Nobel laureates that obtained their highest education in the US. The figures show a five-year moving average window (smoothing). In *Figure 2* we explore Nobelists who received the award before and after WWII separately. Before WWII, Germans were responsible for a large share of Nobelists (more than one fourth), followed by Great Britain. The US took the lead after the war (Zuckerman 1996). She refers to "Hitler's Gift to American Science" (p. 69), as many eminent scholars left Germany after the Nazi government passed the "Law for the Restoration of the Professional Civil Service" in April 1933 (Waldinger 2012, p. 840). The list of important European researchers who moved to the US included, for example, Albert Einstein, Enrico Fermi, James Franck, Viktor Hess, Peter Debye, Otto Loewi, Otto Meyerhof, and Otto Stern. Nobel laureate Samuelson (2004) also points out: "Hitler gave us even before the war the cream of the continental crop" (p. 51). This provided a boost to the academic and educational system in the US. If we look at the number of major awards in our data set we can see that laureates educated in the US generated in total 1312 awards, followed by Great Britain (562) and Germany (364).

FIGURE 1: AWARDS AND COUNTRIES' EDUCATIONAL BACKGROUND

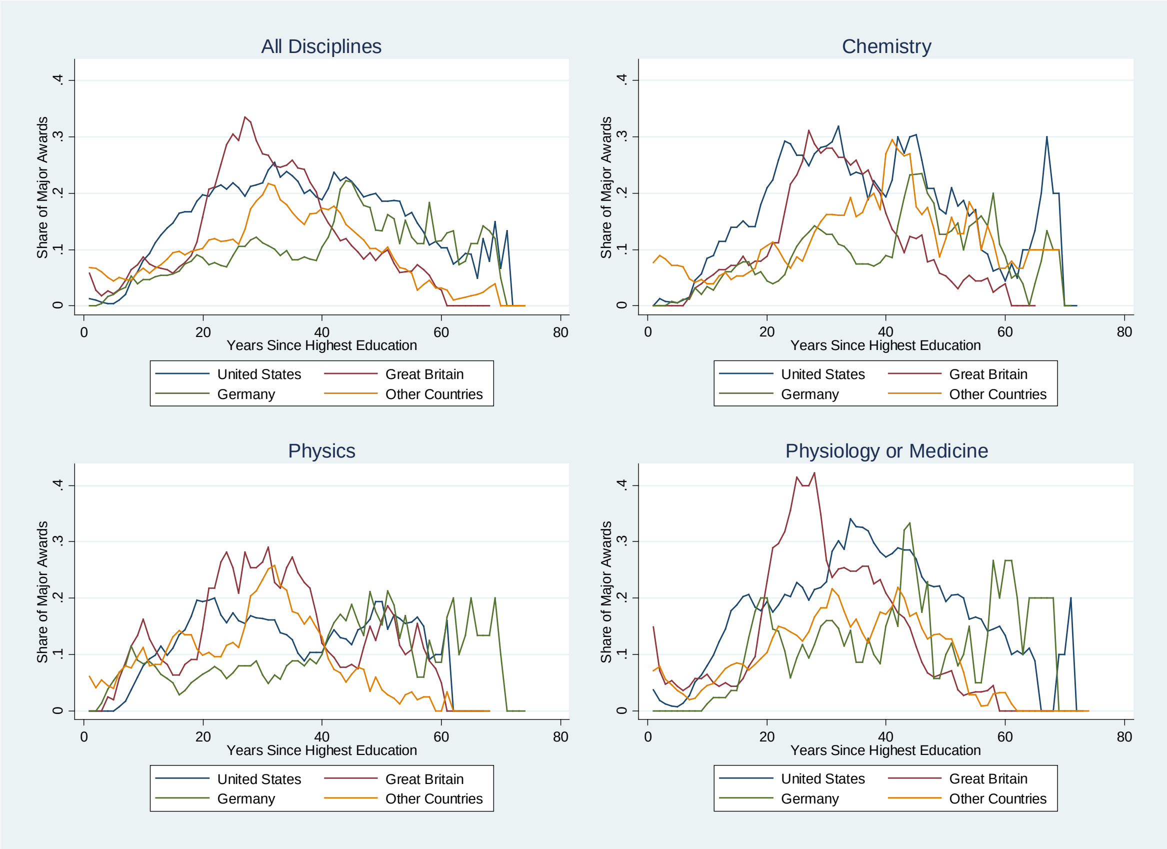
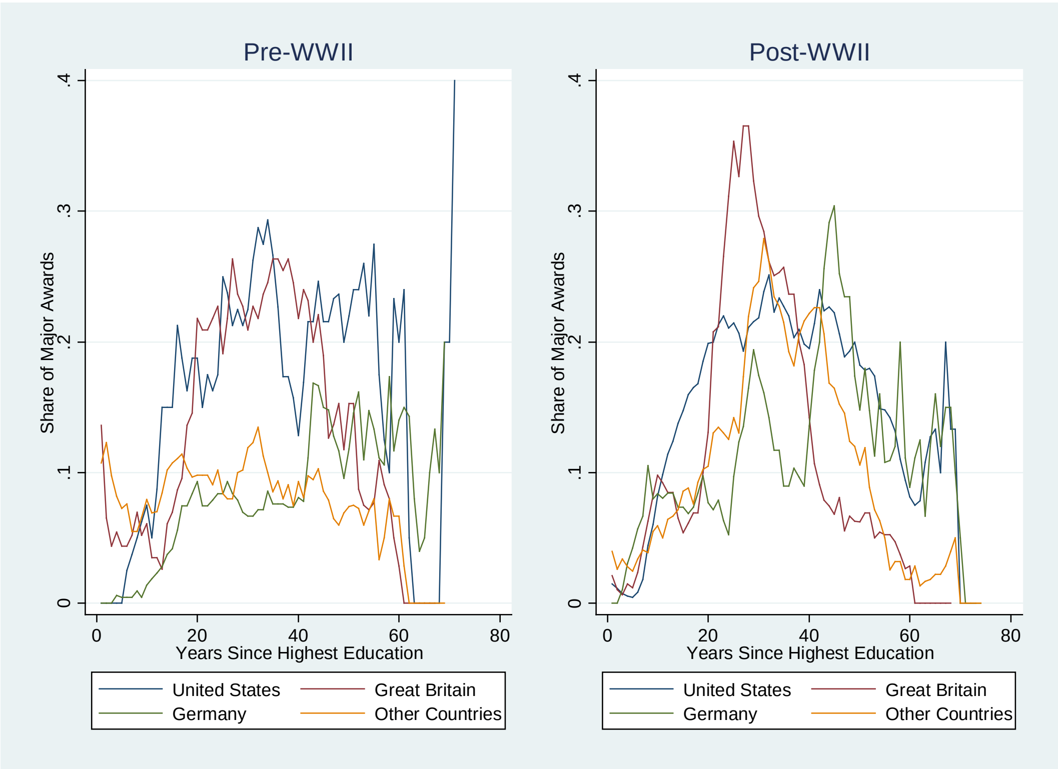


FIGURE 2: NOBEL LAUREATES WHO OBTAINED THE NOBEL PRIZE BEFORE AND AFTER WWII



There is the tendency for Nobelists with a British education to generate more awards when experiencing their peak recognition. On the other hand, researchers educated in the US receive more awards earlier in their career and are recognized later in their career. In addition, we observe that laureates with a German educational background receive their recognition later in their academic career. These results are relatively stable over all the three fields.

TABLE 1: EDUCATIONAL DIFFERENCES

T-Tests on Country of Highest Education			
All	Great Britain	Germany	Other Countries
United States	2.888	4.573	6.737
Great Britain		1.782	2.645
Germany			-0.308
Chemistry	Great Britain	Germany	Other Countries
United States	4.005	4.568	3.018
Great Britain		0.771	-0.625
Germany			-1.793
Physics	Great Britain	Germany	Other Countries
United States	-1.522	0.879	1.491
Great Britain		1.906	2.878
Germany			0.143
Physiology or Medicine	Great Britain	Germany	Other Countries
United States	2.782	3.793	6.408
Great Britain		1.241	2.441
Germany			0.278
Pre-WWII	Great Britain	Germany	Other Countries
United States	1.894	4.780	5.266
Great Britain		2.892	3.950
Germany			0.305
Post-WWII	Great Britain	Germany	Other Countries
United States	2.537	2.669	4.694
Great Britain		0.318	0.602
Germany			0.082

When performing a t-test on the equality of the means using single yearly values rather than moving average values[8] we find that Nobelists educated in the US are more successful in generating major awards than all the other countries. Great Britain only dominates the US with respect to Physics although the difference to the US is not statistically significant. Researchers educated in Great Britain are also more successful than those educated in Germany or the group of other countries. However, for Physiology or Medicine and Chemistry, the difference to Germany is not statistically significant. The difference between Germany and the other countries is mostly not statistically significant. When we explore the pre- and post-World War II period separately, based on the year when the Nobelists actually received their Nobel Prize (see *Figure 2* and *Table 1*), we observe that the differences between US and Great Britain remains statistically significant for both groups while the difference between Great Britain and Germany are no longer statistically significant for those Nobelists who received the Nobel Prize in Post-WWII period.

Next, we look at the institution from which the laureates obtained their highest level of education. To visualize the differences we look at the most successful institutions based on the number of laureates generated, and put all other institutions into another category. Cambridge has produced the largest number of Nobelists (9.81%), followed by Harvard (5.76%) and Columbia (4.05%). Within Great Britain, Cambridge is responsible for having generated 60.5% of all the Nobel laureates. Our data set also shows that Nobelists educated in Cambridge have attracted the largest number of major awards (356), followed by Harvard (211), University of California (172), and Columbia (148).

[8] All the t-tests in this paper are conducted with single yearly values rather than moving averages.

FIGURE 3: INSTITUTIONS AND AWARD SUCCESS

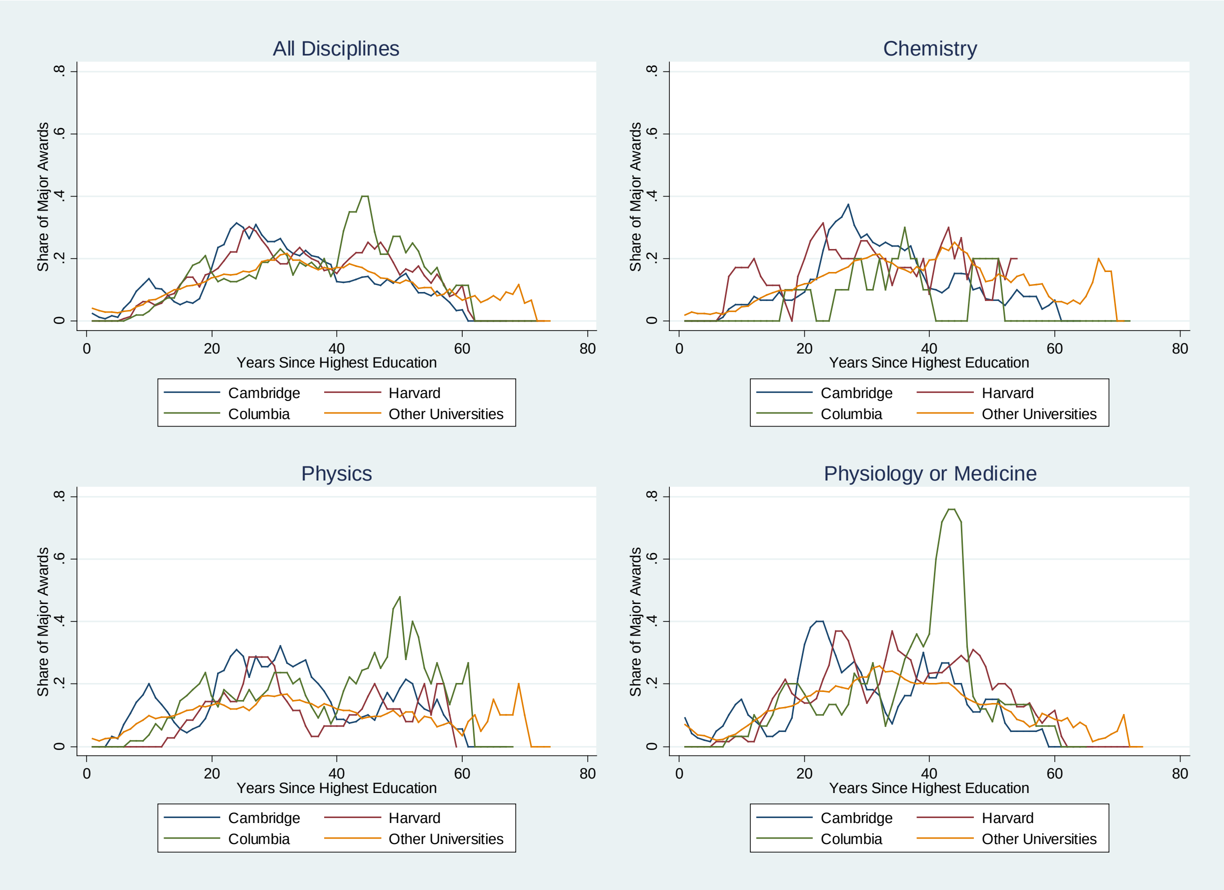


Figure 4: INSTITUTIONS AND AWARD SUCCESS BEFORE AND AFTER WWII

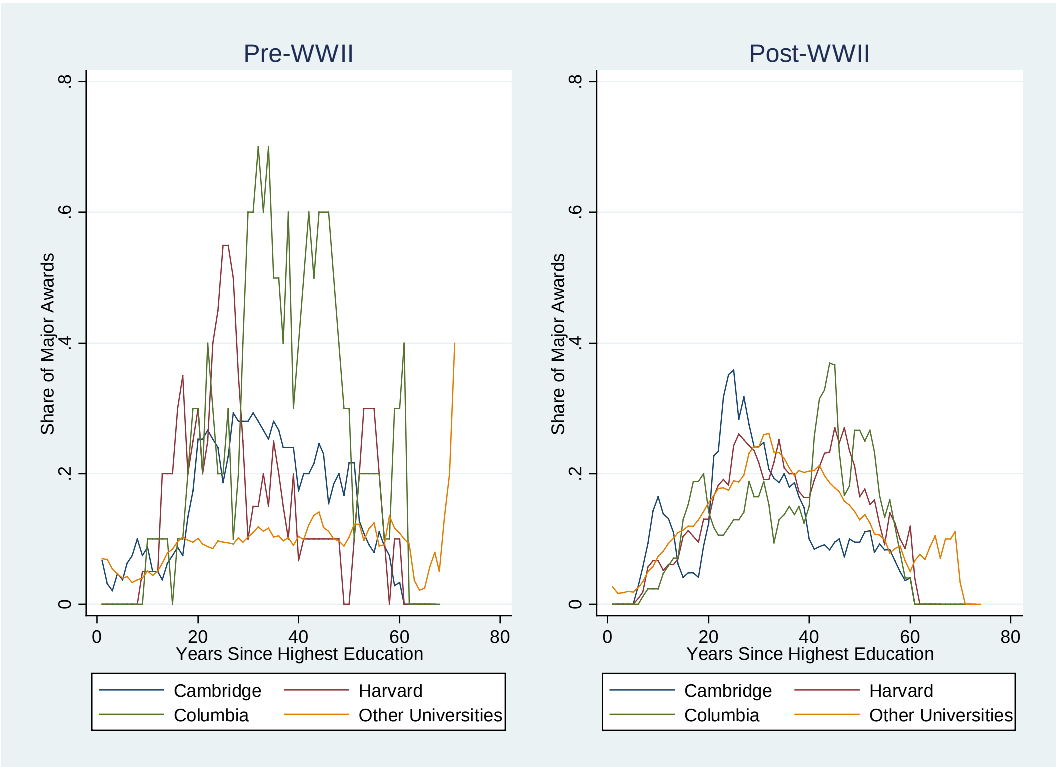
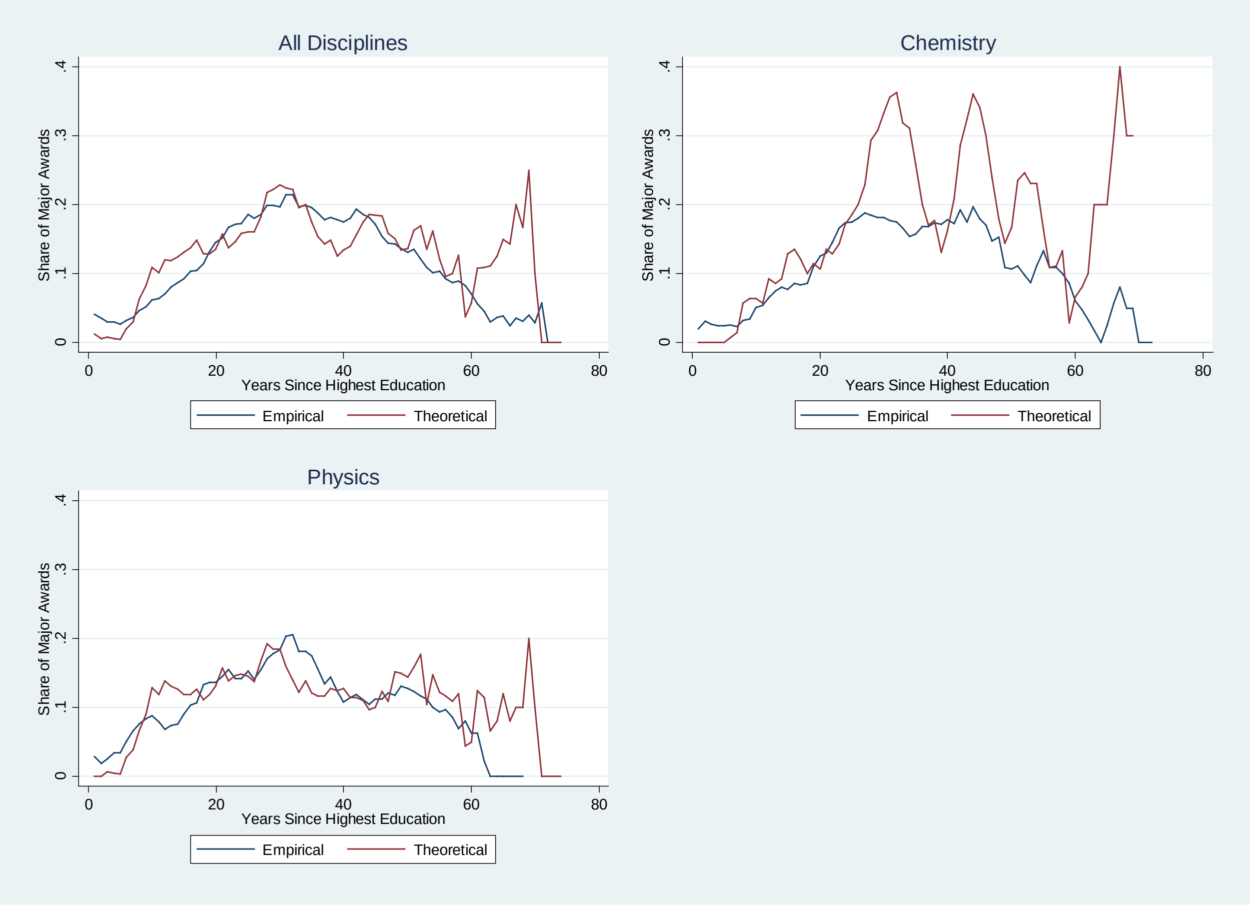


TABLE 2: EDUCATIONAL INSTITUTIONAL DIFFERENCES

T-tests on Top University			
All	Harvard	Columbia	Other Universities
Cambridge	-0.482	-0.798	1.175
Harvard		-0.487	1.277
Columbia			1.559
Chemistry	Harvard	Columbia	Other Universities
Cambridge	-0.493	1.930	-0.512
Harvard		2.139	0.539
Columbia			-2.829
Physics	Harvard	Columbia	Other Universities
Cambridge	3.066	-0.686	2.501
Harvard		-3.377	-0.470
Columbia			2.624
Physiology and Medicine	Harvard	Columbia	Other Universities
Cambridge	-1.175	-0.958	0.416
Harvard		-0.168	1.726
Columbia			1.196
Pre WWII	Harvard	Columbia	Other Universities
Cambridge	-0.285	-2.852	3.554
Harvard		-2.350	2.513
Columbia			4.055
Post WWII	Harvard	Columbia	Other Universities
Cambridge	-0.934	-0.098	-1.135
Harvard		0.646	0.053
Columbia			-0.747

Here we also look at the relative proportion of awards accrued to an institution by dividing the number of awards generated in a particular year by the number of laureates in a particular institution. The results indicate that these three institutions tend to dominate the number of awards obtained throughout the career of a scientist although the difference to the other universities is not statistically significant. Moreover, the difference between the three top places and the group of all the other universities is driven the Nobelists in the pre-WWII period. For Nobelists who obtained the Nobel Prize after WWII the differences between these institutions are no longer statistically significant. When we look at all the fields together the difference between Cambridge, Harvard and Columbia is not statistically significant. However, we observe some heterogeneity between the fields. In the field of Chemistry, Cambridge and Harvard dominate Columbia. In Physics, Columbia and Cambridge dominate Harvard. In Physiology or Medicine, Columbia performs best but the difference between the three institutions is not statistically significant. In Chemistry, there is no statistically significant difference between the other universities and Cambridge or Harvard, while Columbia actually performs worse. For Physics, laureates educated in Cambridge and Columbia perform better than laureates with their highest degree from other universities while the difference between Harvard and the other universities is not statistically significant. Harvard dominates the other institutions in Physiology or Medicine. Pre-WWII, laureates educated in Columbia are more successful than Harvard, Cambridge and the group that covers all other institutions.

FIGURE 5: EMPIRICAL VERSUS THEORETICAL ORIENTATION



In a further step, we explore the difference between theoretically and empirically oriented researchers (see *Figure 5* and *6* and *Table 3*). Overall, having a theoretical orientation leads to more awards throughout the career, particularly during the later stages. A comparison of the fields reveals that theorists are particularly successful in Chemistry, while in Physics the difference is not statistically significant. As mentioned in the methodological section we leave Physiology or Medicine out of the sub-field analysis. For Chemistry, there is no difference between those laureates who received the Nobel Prize before WWII and those after the war. On the other hand, there are differences in Physics. A theoretical rather than empirical orientation has a positive impact on awards among post-WWII Nobelists while the opposite is observed for pre-WWII laureates.

FIGURE 6: PRE- AND POST-AWARD DIFFERENCE BETWEEN SUB-FIELDS

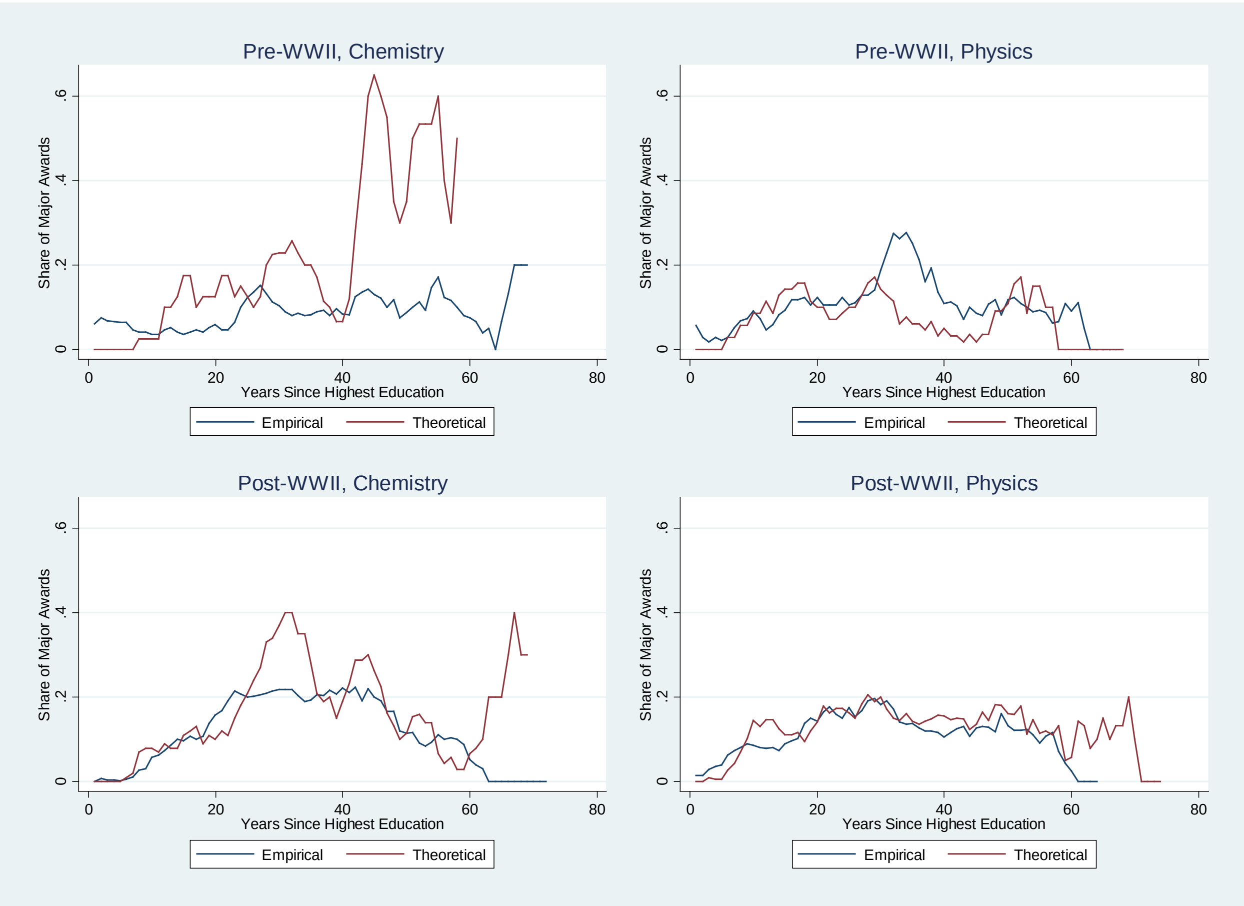


TABLE 3: THEORY VERSUS EMPIRICAL ORIENTATION

T-Test on Empirical versus Theoretical	
All	-1.485
Chemistry	-3.895
Physics	-1.129
Pre-WWII, Chemistry	-1.121
Pre-WWII, Physics	-1.195
Post-WWII, Chemistry	-3.534
Post-WWII, Physics	3.051

2. MULTIVARIATE ANALYSIS

We estimate the effect of our key variables by modelling the award count of Nobel laureate *i* in year *t* (A_{it}) using a random-effects negative binomial regression model:

$$Pr(A_{it} = a_{it}|X_{it}, \delta_i) = \frac{\Gamma(\lambda_{it} + a_{it})}{\Gamma(\lambda_{it})\Gamma(a_{it} + 1)} \left(\frac{1}{1+\delta_i}\right)^{\lambda_{it}} \left(\frac{\delta_i}{1+\delta_i}\right)^{a_{it}}$$

where $\Gamma(\cdot)$ denotes the gamma integral, $\lambda_{it} = exp(X_{it}\beta)$, X_{it} is a vector of individual-specific characteristics, and δ_i is the dispersion parameter that varies randomly across individuals with $1/(1+\delta_i) \sim Beta(r,s)$. Unlike the Poisson regression model, this model is designed to explicitly handle over-dispersion, which has been tested for and is a feature of our data[9]. As independent variables we include a dummy for being theoretically oriented (*Theoretical Orientation*), dummies for educational background based on the highest educational attainment (*Great Britain*, *US*, *Germany*, and *Other Countries* (reference group)), a quadratic time trend (*Years since Highest Educational Degree*, *Years since Highest Educational Degree^2*), a dummy for the *Post Nobel Prize Period* based on our former results (Chan and Torgler 2013), dummies for the field where a scientist obtained the Nobel Prize (*Chemistry*, *Physics*, *Physiology* or *Medicine* (reference group)), and a dummy for those laureates who obtained the Nobel Prize after WWII (*Post WWII*).

[9] For a discussion on the test see Cameron and Trivedi (2009, p.561).

TABLE 4: THE IMPACT OF EDUCATIONAL AND METHODOLOGICAL BACKGROUND ON AWARDS USING RANDOM EFFECTS NEGATIVE BINOMIAL MODEL

Dependent Variable: Number of Major Awards Independent Variables	Died NB (1)	All (2)	Died NB (3)	All (4)	Without NB Died (5)	Without NB All (6)
Theory versus Empiricism						
Theoretical Orientation	**0.244*** **	**0.135** **	**0.252** **	**0.156***	**0.253** **	**0.183***
	(3.210)	(1.986)	(2.497)	(1.663)	(2.374)	(1.870)
	0.030	*0.017*	*0.035*	*0.025*	*0.028*	*0.022*
Educational Background						
Great Britain	**0.326*** **	**0.189** **	**0.386*** **	**0.275** **	**0.393*** **	**0.254** **
	(3.589)	(2.253)	(3.295)	(2.432)	(3.189)	(2.175)
	0.040	*0.024*	*0.054*	*0.043*	*0.043*	*0.030*
US	**0.417*** **	**0.274*** **	**0.396*** **	**0.300*** **	**0.442*** **	**0.295*** **
	(5.212)	(4.042)	(3.752)	(3.199)	(3.981)	(3.049)
	0.051	*0.035*	*0.055*	*0.047*	*0.048*	*0.035*
Germany	**-0.176***	**-0.226** **	**-0.371*** **	**-0.305** **	**-0.388*** **	**-0.377*** **
	(-1.839)	(-2.544)	(-3.023)	(-2.547)	(-2.946)	(-3.006)
	-0.022	*-0.029*	*-0.052*	*-0.048*	*-0.042*	*-0.045*
Other Countries	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Time Element						
Years Since Highest Educational Degree			**0.162*** **	**0.160*** **	**0.140*** **	**0.139*** **
			(21.867)	(25.521)	(18.175)	(21.380)
			0.023	*0.025*	*0.015*	*0.017*
Years Since Highest Educational Degree^2			**-0.002*** **	**-0.002*** **	**-0.002*** **	**-0.002*** **
			(-17.304)	(-19.080)	(-15.652)	(-17.350)
			0.000	*0.000*	*0.000*	*0.000*
Field						
Chemistry			**0.181***	**0.073**	**0.161**	**0.061**
			(1.765)	(0.773)	(1.489)	(0.621)
			0.025	*0.012*	*0.017*	*0.007*
Physics			**0.088**	**0.050**	**0.045**	**-0.022**
			(0.878)	(0.545)	(0.423)	(-0.236)
			0.012	*0.008*	*0.005*	*-0.003*
Physiology or Medicine			Ref.	Ref.	Ref.	Ref.
Period						
Post Nobel Prize Period			**-1.391*** **	**-1.685*** **	**-0.743*** **	**-1.056*** **
			(-17.254)	(-23.682)	(-9.210)	(-14.985)
			-0.194	*-0.265*	*-0.081*	*-0.126*
Post World War II			**-0.209** **	**-0.125**	**-0.033**	**0.012**
			(-2.365)	(-1.434)	(-0.359)	(0.136)
			-0.029	*-0.020*	*-0.004*	*0.001*
N	17959	23404	17959	23404	17959	23404
Prob.>chi^2	0.000	0.000	0.000	0.000	0.000	0.000

Notes: NP=Nobel Prize. Coefficients in bold, z-statistics in parentheses and marginal effects in italics. The symbols *, **, *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. Number of Nobelist=465 in total and 340 for those who have already died (specification (1), (3) and (5).

In *Table 4* we present the first two specifications including only our main variables. In specification (1) we restrict the sample to laureates that have already died. In the next two specifications we report the full set of control variables (see (3) and (4)). In the final two specifications we exclude the Nobel Prize in the dependent variable (specification (5) and (6)).

In line with results from the descriptive section, the regression results strongly suggest that theoretically oriented laureates are receiving more awards than empiricists: the coefficient on *Theoretical Orientation* is statistically significant. The estimated marginal effect of *Theoretical Orientation* on the number of awards indicates that theoretically oriented Nobelists receive on average between 0.017 and 0.035 more awards per year than empirically oriented Nobelists. When looking at those Nobelists who have died we observe that the period between finishing their highest education and their death is on average 53 years. Thus, taking specification (3) as an example, this would mean that theoretically oriented laureates generate on average 1.86 more major awards those with empirical orientation, an effect that cannot be ignored. It should be noted that on average these Nobel laureates generate 6.85 major awards in their career.

Being educated in Great Britain and the US also increased the number of awards, while Nobelists with a German educational background generate fewer awards than laureates educated in other countries (reference group).

With respect to *Years Since Highest Educational Degree,* we see a non-linear relation (increasing at a decreasing rate) as represented in the previous figures. Field differences do not, ceteris paribus, matter. However, as reported by Chan and Torgler (2013), we observe that after researchers receive the Nobel Prize they attract significantly fewer awards. There is the trend that researchers who became laureates after WWII generate fewer awards. However, in most of the specifications the coefficient is not statistically significant.

In *Table 5* we explore the educational background of the Nobelists, focusing on the institution rather than the country and using the same specification structures reported in *Table 4* specifications (3) to (6). The results show that laureates educated in Cambridge perform best. With an average post educational period of 53 years, they are able to obtain 3.07 more major awards than the laureates who obtained their highest education from the universities in the reference group (specification 3B).

Changing the reference group we also find that the differences between Cambridge, Harvard, and Columbia are not statistically significant.

TABLE 5: INSTITUTIONAL EDUCATIONAL BACKGROUND AND AWARD SUCCESS

	(3B)	(4B)	(5B)	(6B)
University of Cambridge	**0.410*** ***	**0.339*** ***	**0.353*** ***	**0.437*** ***
	(3.185)	(2.708)	(2.728)	(3.218)
	0.058	*0.055*	*0.043*	*0.048*
Harvard University	**0.243**	**0.084**	**0.146**	**0.336***
	(1.318)	(0.534)	(0.903)	(1.730)
	0.035	*0.014*	*0.018*	*0.037*
Columbia University	**0.177**	**0.027**	**0.091**	**0.290**
	(0.873)	(0.146)	(0.481)	(1.356)
	0.025	*0.004*	*0.011*	*0.032*
N	17989	23434	23434	17989

Notes: Regression specifications based on the former table, exchanging the countries' educational background with the institutional background. All the other universities are in the reference group. Coefficients in bold, z-statistics in parentheses and marginal effects in italics. The symbols *, **, *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

IV. CONCLUSIONS

Receiving a major academic award is a signal to the recipients that they have contributed to the advancement of knowledge and to the academic empire. Awards have emerged as a symbol of prestige and scientific standing. In an environment where accomplishment is not easy to measure, awards represent success. Awards also enhance access to resources that can be used to cement and promote research quality (Merton 1968, Zuckerman 1996). The number of scientists has increased significantly and so has the number of awards (Merton 1969, Stephan 2012). It is therefore valuable to explore how the educational and methodological backgrounds shape researchers' future recognition. Looking only at Nobel laureates allows us to hold individual research quality relatively constant when exploring recognition throughout a researchers' career. However, we take advantage of the fact that their level of recognition differs throughout their careers.

The skills and knowledge generated as students can have long-lasting career implications. We observe that laureates with a theoretical orientation are able to acquire more awards than empirically oriented Nobelists. On average a Nobelist who has already died generates 6.85 major awards throughout his/her life. The average period of life after finishing the highest educational achievement is 53 years. Throughout this period, a theoretically oriented laureate is able to generate on average around 1.86 more awards than the empirically oriented laureate. Having received the highest level of educational attainment from the US and Great Britain is beneficial for academic recognition. Cambridge, for example, with its argumentative tradition and its open door policy has stimulated scientific excellence (Erren 2008). Zuckerman (1996) refers to the Cavendish Laboratory at the University of Cambridge as a good example of an intensive interaction between elite masters and excellent apprentices. As our results indicate, Cambridge performs quite well in the area of Physics where the Cavendish Laboratory is active. Eminent researchers provide a "bright ambiance" (a laureate's statement provided in Merton 1968, p. 159). Strong interactions and exchanges with leading researchers in a creative environment enhance human or intellectual capital. Being educated in a top place provides a good foundation for acquiring more of what is required for future success and therefore in achieving recognition.

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