Ian Hunter Calaway
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Fellowship Search Committee
National Bureau of Economic Research

Dear Committee Member,

I am a current fourth year in the Economics PhD program and NSF Graduate Research Fellow at Stanford University with a long-standing interest in the development and later-in-life outcomes of high-achieving mathematics students. My economics training and unique background make me well positioned to conduct novel and impactful research in this area.

Neither my mother nor my father graduated from college. In fact, the four years my father would have spent in college, he was in prison. As a single parent, my mother worked hard to offer financial stability, but the financial crisis and our family's inexperience with higher education made college seem like an impossibility. Fortunately, my teachers in Iowa pushed me to participate in math competitions like the Mathematical Association of America (MAA) American Mathematics Competition (AMC). Through these, I developed a deep love of math and appreciation for education which led me to Macalester College, the alma mater of my favorite math teacher.

The economist in me often considers the counterfactual: "Where would I be if my teachers had not intervened?" While this is impossible to answer, I doubt I would be pursuing a career in research. That question inspired my 2016 Thomas J. Watson Fellowship project, "Mathematics: Community through Collaboration & Competition." During the fellowship, I travelled extensively for a year working with high-achieving math students, forging connections with math organizations, and helping with math competitions and clubs in Australia, China, Germany, Chile, and Brazil. My own experience and those of the students I observed during my travels both motivate and inform my research proposal.

The research I outline in my attached proposal leverages public data from the AMC. While those data would be sufficient for some of my planned analyses, the MAA has additional data that would greatly aid my research. To this end, I plan to develop a partnership with the MAA AMC program that would give me more data access. From my math experiences, I have connections with the former leaders at the MAA (Karen Saxe, David Bressoud) as well as International Math Olympiad Coach Po-Shen Loh. I know that Glenn Ellison and Ashley Swanson have partnered with the AMC program in the past, so this seems possible.

With this fellowship, I could dedicate more time and resources to the research I outline in my proposal. I am certain that being connected with other young researchers who share my passion would further inspire me. Their thoughts would improve my own research, while ideally leading to fruitful collaborations. My experience in innovation research is limited, so the faculty mentor would be helpful in numerous ways.

I have worked with and been advised by Professor Caroline Hoxby (choxby@stanford.edu) and Professor Isaac Sorkin (sorkin@stanford.edu) while at Stanford University. They can speak more to my background, research interests, and research experience.

Thank you for your consideration.

Sincerely,
Ian Calaway

IAN H. CALAWAY

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EDUCATION

Stanford University 2019 – present
Ph.D. Candidate in Economics
Fields: Public, Labor

Macalester College 2012 – 2016
BA, *magna cum laude*
Majors: Economics, Mathematics

Budapest Semesters in Mathematics Fall 2014

RELEVANT POSITIONS

TA for Marcelo Clerici-Arias, Economic Policy Seminar, Stanford University Spring 2023

TA for Caroline Hoxby, Economics of Education, Stanford University Winter 2023

RA for Isaac Sorkin, Stanford University 2020-2021

RA for Jonathan Gruber, National Bureau of Economic Research 2017-2019

WORK IN PROGRESS

Strength in Numbers: The Allocation and Productivity of High-Achieving Math Students

The Effect of Math Competition Training on Math Ability

Accountability Reforms, Teacher Supply, and Student Achievement

Teacher Supply and Shortages: Evidence from Vacancy and Application Data
(with Michael Bates & Andrew Johnston)

Approval Ballot Triangles (with Andrew Beveridge)

PEER-REVIEW PUBLICATIONS

Beveridge, Andrew, Ian Calaway, Kristen Heysse. "de Finetti Lattices and Magog Triangles"
The Electronic Journal of Combinatorics, (2021): 1-38.

Beveridge, Andrew, Ian Calaway. "The Voter Basis and the Admissibility of Tree Characters"
Order: A Journal on the Theory of Ordered Sets and its Applications, 38.3 (2021): 489-514.

Fellowships & Grants

Graduate Research Fellowship, National Science Foundation ($104,000) 2019–2024

Thomas J. Watson Fellowship, Watson Foundation ($30,000) 2016–2017
Project - *Mathematics: Community through Collaboration & Competition*

Undergrad Researcher, Willamette College NSF REU ($4,000) Summer 2015

Undergrad Researcher, Grand Valley State University NSF REU ($4,000) Summer 2014

Scholarships, Honors, and Awards

Mathemacher Award, German Mathematical Society 2017

Presidential Leadership Award, Macalester College 2016

Phi Beta Kappa, Macalester College 2016

David Meiselman Economics Prize, Macalester College 2016

Wagon Math Competition Prize, Macalester College 2015

Barry Goldwater Scholarship (HM), Goldwater Scholarship & Excellence in Education Program 2015

Hamre Award, Macalester College 2013

Service & Leadership

Labor & Public Workshop Organizer, Stanford Department of Economics 2022 – present

Research Mentor, Spelman-Stanford Economics Partnership 2022 – present

Economics Graduate Student Social Chair, Stanford Department of Economics 2020 – 2021

Research Assistant Social Chair, NBER 2018 – 2019

Research Mentor, MIT Summer Research Program Summer 2018

Student Body President, Macalester College 2015-2016

First Generation Student Organizer, Macalester College 2013-2016

Math Competition Club Founder, Macalester College 2014-2016

Other

Software: Stata, R, Python, MATLAB, LaTeX

Project Proposal: Strength in Numbers

Ian Calaway

I have three primary research questions: (1) **How are high-achieving math students allocated across fields/occupations?** (2) **How do the marginal returns to productivity of math ability vary by research field?** and (3) **Does participation in math competitions lead to growth in math ability?**

To study these questions, I will use data from the Mathematical Association of America's (MAA's) American Mathematics Competitions (AMC) program. I have collected student-level AMC data from 2004 to 2022 for the top 5-10% of scorers on the middle school and high school exams (AMC 8/10/12). These data include 200,000+ observations from the US (78%), China (5.5%), Canada (4%) and various other countries. For each of these, I observe score, first name initial, full last name, grade, and school. I would like to work with AMC to get additional data similar to those used by Ellison & Swanson [1]. I will supplement these data with data from LinkedIn, the Web of Science, and the North Carolina Education Research Data Center.

My first question is motivated by the possibility that the allocation of high-achieving math students across fields/occupations is inefficient. Talented students may make suboptimal field/occupation decisions due to lack of information. High-achieving students from low-income backgrounds appear to make suboptimal/inefficient college choices due to information deficits, so this might be common [2][3]. Such information deficits may explain, in part, why high-achieving math students from certain areas are not reaching their innovation potential [4][5]. The identifying information in the AMC data will allow me to follow high scorers' education and career outcomes (via LinkedIn) and research productivity (via Web of Science). These linked data would allow me to describe how high-achieving math students sort across fields/occupations and help me identify sources of inefficiencies.

My second research question is an extension of Agarwal & Gaule [4]. Their International Math Olympiad sample limits their ability to estimate the relationship between math ability and productivity outside of mathematics research. After linking my much larger AMC sample to data from LinkedIn and the Web of Science, I will be able to estimate this relationship over a wider ability range for a variety of research fields and occupations. Such an analysis will provide information on the relative importance of math ability between fields/occupations. Knowing this would be important to stakeholders wishing to increase knowledge production. For example, if the government were interested in increasing knowledge production in physics and the field demonstrates increasing marginal returns to productivity with respect to math ability, then programs that increase math ability of would-be physicists might accelerate innovation in physics.

My last question is inspired by my desire to find cost-effective, scaleable interventions for improving student math ability and later-in-life productivity. The competitions offered by the AMC are possible candidates. However, estimating the effects of the AMC competitions on math ability is empirically challenging. First, I need a measure of math ability disconnected from the AMC that extends before participation. Second, I need some way to credibly separate teacher effects from competition effects, since good teachers are more likely to facilitate competitions. My plan is to leverage heterogeneity in when/if North Carolina middle and high schools join AMC competitions and implement event studies to estimate their effect on standardized test score growth with rich student, teacher, and school controls using data from the NCERDC. My empirical strategy and data will enable me to test for heterogenous effects by race, gender, and ability.

References

[1] G. Ellison, A. Swanson. Do schools matter for high math achievement? Evidence from the American Mathematics Competitions. *American Economic Review*, 106(6), 1244-1277, 2016. **[2]** C. M. Hoxby, S. Turner. What high-achieving, low-income students know about college. *American Economic Review*, 105(5), 514-517, 2015. **[3]** S. Dynarski, C. Libassi, K. Michelmore, S. Owen. Closing the gap: the effect of reducing complexity and uncertainty in college pricing on the choices of low-income students. *American Economic Review*, 111(6), 1721-1756, 2021. **[4]** R. Agarwal, P. Gaule. Invisible geniuses: could the knowledge frontier advance faster? *American Economic Review: Insights*, 2(4), 409-424, 2020. **[5]** A. Bell, R. Chetty, X. Jaravel, N. Petkova, J. Reenan. Who becomes an innventor in America? The importance of exposure to innovation. *The Quarterly Journal of Economics*, 134(2), 647-713, 2019.