

The Honorable Adam Kissel
Deputy Assistant Secretary for Higher Education Programs
U.S. Department of Education
Office of Postsecondary Education
400 Maryland Avenue, SW
Washington, D.C. 20202

December 29, 2017

Dear Mr. Kissel:

Thank you for the invitation to provide consultation for the Graduate Assistance in Areas of National Need (GAANN) program. High-quality graduate education—especially that of future researchers and educators—is crucial to ensure the future scientific discoveries that expand the body of knowledge and to develop a skilled workforce. These things then lead to corresponding social benefits, such as economic growth and an improving quality of life.

This letter offers a general overview of the GAANN program, discusses the economic problem it is intended to address, explores the economic rationale behind subsidizing graduate-degree-granting education, and evaluates the GAANN program from this economic perspective. I conclude by offering alternate solutions that would more directly address ways the government can ensure the availability of a talented workforce and encourage valuable research which otherwise might not be undertaken.

Summary of Findings

I find that research in Nursing, Educational Evaluation/Research/Statistics, and Psychology may meet the minimum economic criteria to warrant government subsidies. The other GAANN subject areas are either likely to experience private market demands for their research, meaning that subsidies are not needed, or are not likely to create the kinds of public benefits that warrant subsidization.

Furthermore, I suggest that the particular mechanism the GAANN program uses to subsidize research should be made more efficient. The current approach funds graduate students' education in the hopes that their future research and teaching will result in knowledge creation that is beneficial to the public, whereas a more focused approach would directly fund such research conducted by established scholars.

Lastly, if policymakers are concerned about ensuring the U.S. labor market has a sufficient population of highly-educated science and engineering workers, there are two straightforward solutions. First, a relatively simple tax code change would allow businesses to directly invest in the education and training of their workers in the same way that they can currently invest in factory machines. This would likely go a long way to solving the much discussed problem of a “skills gap” in the workforce. Second, although China and India possess intimidating numbers of college graduates, many of those graduates are underemployed because of an oversupply of

skilled workers in those labor markets. Allowing additional immigration of this underutilized talent would ensure that the U.S. economy is fully supplied with the innovators who will drive future growth.

Overview

The GAANN program provides around \$30 million annually to fund the education of graduate students pursuing the highest degree available in their course of study.¹ A back-of-the-envelope calculation suggests that it fully subsidizes the stipends of approximately 810 graduate students each year.² 55,006 research doctorate degrees were awarded in 2015 (the most recent year for which data is available), suggesting that GAANN education subsidies were associated with approximately 1.5 percent of the degrees awarded that year.³

Policymakers have expressed concern that the U.S. might fall behind other nations—in particular China and India—in innovation, technological development, and economic growth.⁴ Statistics like those reported by the World Economic Forum, which found that the U.S. had a recent STEM⁵ graduate population of 568,000 in 2016, compared to 4.7 million in China and 2.6 million in India, lend credibility to such fears and may help motivate government spending to support higher education.⁶

¹ The enabling legislation authorizes up to \$35 million in appropriations. The academic subject areas authorized to be awarded GAANN grants are

Area, Ethnic, and Cultural Studies	Mathematics
Biological Sciences/Life Sciences	Nursing
Chemistry	Physics
Computer and Information Sciences	Psychology
Engineering	Educational Evaluation, Research, and Statistics
Foreign Languages	

² Appropriation for the GAANN program was \$29,293,000 in FY2014, FY2015, and FY2016. 119 academic institutions were awarded grants in FY2015 and FY2016, with an approximate average annual award of \$246,100. Subtracting the institutional payment of approximately \$15,200 and dividing the remainder by the maximum stipend of \$34,000 suggests that the education of 6.8 students was funded at the average academic institution (because the institution is responsible for covering at least 25% of the value of the award to the student the actual number of students whose education is subsidized at the average institution is probably around 9). Multiplying the average number of funded students by the number of institutions suggests that the GAANN program fully funds stipends for approximately 810 students each year.

Data source: U.S. Department of Education, <https://www2.ed.gov/programs/gaann/funding.html>.

³ National Center for Science and Engineering Statistics Directorate for Social, Behavioral and Economic Sciences, “2015 Doctorate Recipients from U.S. Universities” (National Science Foundation, June 2017), <https://www.nsf.gov/statistics/2017/nsf17306/static/report/nsf17306.pdf>.

⁴ Neera Tanden and Matt James, “U.S. Education Must Keep up With China’s, India’s Bold Programs,” *US News & World Report*, August 22, 2012, <https://www.usnews.com/opinion/articles/2012/08/22/us-education-must-keep-up-with-chinas-indias-bold-programs>; Sean Cavanagh, “U.S. Education Pressured by International Comparisons - Education Week,” *Quality Counts*, January 12, 2012, <https://www.edweek.org/ew/articles/2012/01/12/16overview.h31.html>.

⁵ Science, Technology, Engineering, and Mathematics

⁶ It’s important to recognize, however, that such concerns fail to acknowledge that lesser-developed countries are still ‘catching up’ to the U.S. in terms of the proportion of the population with an advanced education. For example, despite China’s recent amazing growth in college graduates, less than 2.5% of young adults held a bachelors degree

Economic Rationale for Educational Subsidies

Economic theory suggests that in some unusual situations the normal market mechanisms which incentivize producers to satisfy consumer demands may become distorted. The case of “externalities” is one of these. An externality is a cost or benefit of production/consumption which does not accrue to either the consumer or producer—therefore, it is not incorporated into the price of the good or service because it is “external” to the exchange. This results in a non-optimal amount of the good or service being produced. Pollution from a factory is the classic example of negative (costly) externality, while beekeepers’ honey bees pollinating nearby farmers’ crops in the process of making honey is a positive (beneficial) externality.

Normal market systems may also fail to incentivize producers to create an optimum amount of “public goods.” These are goods and services where it is (1) hard to exclude non-paying consumers from benefiting and (2) where one person’s consumption does not diminish another person’s consumption of the good or service. Common examples of a public goods are national defense or a town’s Fourth of July fireworks display. The biggest hurdle that inhibits private companies’ provision of public goods comes from situations where it’s difficult to exclude non-paying consumers from benefitting from producing the good or service. For example, because it’s hard to charge admission to a fireworks display, there’s little incentive for private companies to produce them. This is also known as the “free-rider problem” and it’s similar to a positive externality, meaning that a sub-optimal amount of the good or service will be produced.⁷

The major difference between these two concepts is that positive externalities are secondary to the specific intent of production and consumption, while the public good is itself the primary focus. It would seem that the true intent of the GAANN program is to subsidize the production of research that is a public good. However, the method used to accomplish this is subsidizing the education of students who might produce this research in the future as part of their career, which is an indirect, externality-related approach.

Policy Solutions to Sub-Optimal Production of Research

While there are many policy solutions which might solve these kinds of market distortions, the simplest—although generally impractical—is a subsidy which is equal to the benefit provided by the positive externality.⁸ In order for the GAANN program’s subsidy of any particular graduate

in 2010, compared to over 30% in the U.S. Niall McCarthy, “The Countries With The Most STEM Graduates,” *Forbes*, February 2, 2017, <https://www.forbes.com/sites/niallmccarthy/2017/02/02/the-countries-with-the-most-stem-graduates-infographic/>; Jackie Kraemer and Jennifer Crow, “Statistic of the Month: Engineering and Science Degree Attainment by Country,” *National Center on Education and the Economy* (blog), May 27, 2014, <http://ncee.org/2014/05/statistic-of-the-month-engineering-and-science-degree-attainment-by-country/>.

⁷ Tyler Cowen, “Public Goods and Externalities,” *The Concise Encyclopedia of Economics* (blog), accessed December 27, 2017, <http://www.econlib.org/library/Enc1/PublicGoodsandExternalities.html>.

⁸ Such subsidies (or fees called “Pigovian taxes” for negative externalities) are mostly regarded by economists as a theoretical solution, offered for illustration of the concept. They often fail as a practical fix to the problem because of subsequent dynamic responses by producers and consumers to the fee or subsidy (among other problems). John Nye, “The Pigou Problem,” SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, August 20, 2008), <https://papers.ssrn.com/abstract=1241542>.

degree to be economically justified, there must be convincing evidence that the “human capital”⁹ produced by the education (and not the recipient’s inherent or self-developed human capital) will create public benefits which are not incorporated into the compensation received by the degree recipient or the profits earned by her employer.¹⁰ The clearest way this could happen is through GAANN-funded graduate education increasing the production of new scientific knowledge which serves to make future production across the economy more efficient (producing more goods and services using fewer resources or producing higher quality goods and services with the same resources).

The clearest real-world example of this sort of economically-justifiable subsidization of academic research is the legislation enabling U.S.’s land-grant universities. The Morrill Land Grant Acts (1862 and 1890), the Hatch Act of 1887, and the Smith-Lever Act of 1914 were premised on the fact that in many cases scientific knowledge—in this case, research that improved crop production—could not be effectively monetized.¹¹ Entrepreneurs who invested in such research would unlikely be able to use it to gain a competitive advantage in serving customers because of the difficulty in excluding competitors from using the knowledge their research investments had discovered. This would reduce the incentive for anyone to invest in developing the knowledge in the first place. The land-grant institutions were a conscious effort to support research that would benefit society in general by increasing food availability and lowering prices. In conjunction with other technological advances that have influenced agricultural production, the knowledge developed and spread by land-grant universities has assisted economic growth: The agricultural sector declined from 41 percent of the workforce in 1900 to less than 2 percent of the workforce in 2000, while total agricultural production has increased by over 600 percent since 1929.¹²

Economic Evaluation of GAANN Program

In order for GAANN program subsidies to be economically justified, it must be shown that they have a similar effect to that of previous agricultural research by filling a gap that normal market forces are unlikely to motivate. Therefore, the graduate fellowships should be in academic areas that are likely to return otherwise-unobtainable public benefits. Importantly, the private benefits of graduate education—whether the education results in a good career for the student or she produces a large amount of value for her employer—should not be considered as part of the decision-making process.

⁹ Human capital is similar to physical capital, such as tools or factory machines. It refers to inherent personal qualities as well as investments in schooling, training, or other kinds of personal development which make a person more productive.

¹⁰ If those benefits were incorporated into the researcher’s salary or her employer’s profits, there would be no need to offer a subsidy to incentivize them.

¹¹ National Research Council, “History and Overview of the Land Grant College System,” in *Colleges of Agriculture at the Land Grant Universities: A Profile* (Washington, D.C.: National Academies Press (US), 1995), <https://doi.org/10.17226/4980>.

¹² Julian M. Alston et al., “A Brief History of U.S. Agriculture,” in *Persistence Pays*, Natural Resource Management and Policy (Springer, New York, NY, 2010), 9–21, https://doi.org/10.1007/978-1-4419-0658-8_2.

However, GAANN program administrators face a difficult problem in deciding which subject areas to fund. This occurs because (1) there is no crystal ball to foretell how subsidizing current graduate students' education will result in public value from the research they may do in the future, and (2) centralized administrators, although knowledgeable and hard-working, do not have access to local information that would better inform their funding decisions. Indeed, it is because of the latter problem that the Department of Education reaches out to educational institutions—who have more localized knowledge of the market for education—to provide feedback on what academic subjects should be designated Areas of National Need.

The Knowledge Problem

Nobel laureate Friedrich Hayek called this issue the “knowledge problem”: that the information needed for rational economic planning—entrepreneurial action that takes advantage of previously unseen opportunities, is nimble at serving customers' changing needs, and minimizes waste—is distributed among individuals in the market.¹³ Importantly, the decentralized approach Hayek recommends is not *against* economic planning, but rather is focused on *who* does the planning. Because the sum of localized knowledge cannot be known by a centralized authority, the best way to maximize value creation throughout the economy is to empower individual economic agents to act on their local knowledge.

Although U.S. policymakers are understandably concerned with imbalance between U.S. and Chinese STEM graduates each year, China also offers sobering lessons on the unintended consequences of centralized planning. A recent example is China's “ghost cities”—major residential and commercial zones which are mostly vacant because of over-building.¹⁴ In some places, never-used residential towers have even been torn down to make room for new development.¹⁵ In 2010 it was reported that China might have as many as 64 million vacant residential units—enough to house 15 percent of the country's 1.3 billion people. But in surprising contrast, there isn't enough housing available where it's really needed. Beijing has some of the highest housing prices in the world and five percent of the city's population lives underground in nuclear fallout shelters because of a lack of affordable housing.¹⁶

But even more relevant to the concerns of the GAANN program is that a substantial proportion of the people living in Beijing's underground slums are members of the “ant tribe”—

¹³ F. A. Hayek, “The Use of Knowledge in Society,” *The American Economic Review* 35, no. 4 (September 1945): 519–30.

¹⁴ Richard Gray, “China's Zombie Factories and Unborn Cities,” *BBC*, February 23, 2017, <http://www.bbc.com/future/story/20170223-chinas-zombie-factories-and-unborn-cities>; Christian Sorace and William Hurst, “China's Phantom Urbanisation and the Pathology of Ghost Cities,” *Journal of Contemporary Asia* 46, no. 2 (April 2, 2016): 304–22, <https://doi.org/10.1080/00472336.2015.1115532>; Gus Lubin and Chandni Rathod, “And Now Presenting: Amazing Satellite Images Of The Ghost Cities Of China,” *Business Insider*, December 14, 2010, <http://www.businessinsider.com/pictures-chinese-ghost-cities-2010-12>.

¹⁵ Jacob Shamsian and Chelsea Pineda, “Watch China Demolish a 27-Story ‘Ghost Building’ in Seconds,” *Business Insider*, November 16, 2015, <http://www.businessinsider.com/unused-27-story-building-in-china-demolished-2015-11>.

¹⁶ Ye Ming, “A Million People Live in These Underground Nuclear Bunkers,” *National Geographic*, February 16, 2017, <https://www.nationalgeographic.com/photography/proof/2017/02/atomic-rooms-beijing-china-housing/>.

underemployed college graduates unable to fulfill their career ambitions.¹⁷ The ant tribe emerged after changes in Chinese education policy in the 1990s led to an abrupt increase in university attendance—over the 5 year period from 1998 through 2003 both undergraduate and postgraduate enrollment more than tripled.¹⁸ When this group of students started graduating the supply of college-educated workers—including large numbers of STEM graduates—far outstripped the demand for such talent, leading to a continuing social crisis where many highly-educated workers are settling for blue-collar jobs.¹⁹ Similarly, India has its own “timepass” generation—large numbers of educated young people listlessly waiting for better employment opportunities.²⁰

While these are sad circumstances for the people involved, U.S. policymakers can take the lesson that increasing the number of students being educated is not always the best policy. Oversupplying the market for highly-educated workers can cause social unrest while wasting government resources at the same time. Furthermore, China and India’s underemployment problem suggests that the U.S. should not feel threatened simply by the fact that other countries have larger numbers of STEM graduates.

The Importance of Feedback Mechanisms

A key problem leading to China’s underemployment problem is the lack of informational feedback to decision makers. The government officials that implemented the increases in university funding may have used the best information they had available in complying with the directives of higher-level authorities who set the policy, but because those decision makers are not the students themselves, they didn’t bear the full cost of making the wrong decision.

One of the foundational principles of economics is that “incentives matter,” meaning that if a person is separated from experiencing the consequences of a decision she will be less invested in making the best decision. For example, if a student were solely responsible for funding her own education she is more likely to closely examine potential future outcomes and pick a different path if there’s a current oversupply in the subject area she’s considering. This is a major reason why enrollment in U.S. law schools has substantially declined since 2010—the market for lawyers is oversupplied and would-be law students are recognizing this.²¹

¹⁷ Ming.

¹⁸ Li Lixu, “China’s Higher Education Reform 1998–2003: A Summary,” *Asia Pacific Education Review* 5, no. 1 (2004): 14–22.

¹⁹ EconMatters, “College Graduates: Too Many In China, Not Enough In America,” *Business Insider*, July 5, 2011, <http://www.businessinsider.com/college-graduates-too-many-in-china-not-enough-in-america-2011-7>.

²⁰ Yojana Sharma, “What Do You Do with Millions of Extra Graduates?,” *BBC News*, July 1, 2014, sec. Business, <http://www.bbc.com/news/business-28062071>; Craig Jeffrey, “Underemployed Graduates, ‘timepass’ and the Threat of a Global Demographic Crisis,” *The Conversation* (blog), January 24, 2014, <http://theconversation.com/underemployed-graduates-timepass-and-the-threat-of-a-global-demographic-crisis-22298>.

²¹ Noam Scheiber, “An Expensive Law Degree, and No Place to Use It,” *The New York Times*, June 17, 2016, sec. Business Day, <https://www.nytimes.com/2016/06/19/business/dealbook/an-expensive-law-degree-and-no-place-to-use-it.html>; Tyler Roberts, “Why Flat Enrollment Is Great News for Law Schools | the National Jurist,” *PreLaw* (blog), January 13, 2017, <http://www.nationaljurist.com/prelaw/why-flat-enrollment-great-news-law-schools>.

Conversely, university officials who are asked to comment on the GAANN program's Areas of National Need do not face the costs of getting their recommendations wrong. Furthermore, they would naturally see this as an opportunity to encourage new or expanded government subsidies for graduate education in their own area of study. This arrangement of incentives would naturally result in a "benefits-only" analytical approach because it is costless for the commenters to propose expansion to the program's funding or suggest the GAANN program dilute its limited funds across new Areas of National Need. As a result, Dept. of Education officials should take any such recommendations with a grain of salt.

Commentary on Areas of National Need

Because the Dept. of Education specifically requested feedback on which academic subjects should be considered Areas of National Need, I offer a brief commentary of each of the currently selected GAANN areas using the economic analytical perspective already discussed. Specifically, the litmus test to determine whether subsidizing graduate student education is warranted revolves around whether the future research produced by those graduate students is likely to benefit the public *in ways that are not currently priced into the value of the education.*

While all research, to a limited degree, may conceivably offer the possibility of such value creation, the relevant question facing GAANN program administrators is which areas offer the *most* return for the investment. Importantly, funding should be concentrated in the most valuable research areas, rather than diluting the effect across many different initiatives. Lastly, the option of not funding *any* proposals should be explicitly considered by GAANN program decision makers.

The three GAANN areas of need that appear most likely to result in future research which creates a public good—and therefore are least likely to be pursued by private companies—are Nursing, Educational Evaluation/Research/Statistics, and Psychology. For example, nursing research may address hospital care issues connected with patient health outcomes, such as hospital-acquired infections. The private market for patient care seems unlikely to aggressively pursue this kind of research because the highly regulated nature of the health care industry limits the ability of health care providers to compete for customers. Similarly, the easy dispersion of new knowledge/limited ability to restrict others from utilizing the research findings makes it difficult for the research to pay for itself.²² In addition, because using such knowledge to give one patient better care doesn't preclude other patients from benefitting from this same knowledge, this kind of nursing research exactly meets the definition of a public good. The inability to capitalize on the full value created by such research would lead to a sub-optimal amount of research being conducted, slowing progress toward higher-quality and lower-cost

²² Indeed, many people would argue that limiting the dissemination of medical knowledge when it could be meaningfully important to people's quality of medical care is morally wrong. However, the analysis offered here approaches the issue from an economic perspective focusing on "positive analysis"—meaning that it offers an unbiased description of likely outcomes based on the rules governing the system of exchange—rather than a "normative analysis" which evaluates the desirability of different outcomes based on value judgments.

health care. The incentive to pursue valuable education- and psychology-related research would seem to face similar problems.

In particular, if a lack of psychology research is contributing to a lack of national understanding regarding why some individuals embark on murderous rampages, such as the recent Las Vegas Strip shooting, and if a lack of trained psychology professionals means that these persons don't have access to mental health resources that might eliminate some of these tragedies, psychology research does indeed seem to be an Area of National Need.²³

The GAANN areas in which research seems likely to be incentivized by the normal profit incentive that is inherently a part of customer-focused markets—meaning that there is little need for public subsidy—are Chemistry, Computer and Information Sciences, Engineering, Mathematics, and Physics. Because there are clear ways in which consumer demand for new products or lower-cost alternatives to existing products would motivate and return dividends for research in these areas, there seems little reason to subsidize them, even if they are associated with economic growth. Indeed, they are drivers of economic growth *because* the market-based incentive to reward relevant research is already present.

Lastly, the GAANN areas in which research seems unlikely to be incentivized by customer demands for new and better products, but which also do not seem likely to generate significant spillovers of public value, are Area, Ethnic, and Cultural Studies; Biological Sciences/Life Sciences; and Foreign Languages.²⁴

Policy Proposals Addressing Education Issues

In general, the best way to encourage innovation, creative destruction,²⁵ and the increasing quality of life that results from economic growth is to empower the people to have the best, localized knowledge so that they can act upon it to satisfy customers in new ways. Where there are public goods that may not be adequately provided by the normal process of market exchange, the best means of solving the problem is to directly address the public goods problem, rather than

²³ Jeffrey A. Daniels et al., “A Qualitative Investigation of Averted School Shooting Rampages,” *The Counseling Psychologist* 38, no. 1 (January 2010): 69–95, <https://doi.org/10.1177/0011000009344774>; John Whibey, “Mass Murder, Shooting Sprees and Rampage Violence: Research Roundup,” *Journalist's Resource* (blog), October 1, 2015, <https://journalistsresource.org/studies/government/criminal-justice/mass-murder-shooting-sprees-and-rampage-violence-research-roundup>; Miguel A. Faria, “Shooting Rampages, Mental Health, and the Sensationalization of Violence,” *Surgical Neurology International* 4 (January 29, 2013), <https://doi.org/10.4103/2152-7806.106578>.

²⁴ Indeed, I find it puzzling that foreign language research is even considered as an Area of National Need.

²⁵ “The opening up of new markets, foreign or domestic, and the organizational development from the craft shop to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one” (Joseph Schumpeter). “Over time, societies that allow creative destruction to operate grow more productive and richer; their citizens see the benefits of new and better products, shorter work weeks, better jobs, and higher living standards.” W. Michael Cox and Richard Alm, “Creative Destruction,” Library of Economics and Liberty, *The Concise Encyclopedia of Economics* (blog), accessed August 30, 2017, <http://www.econlib.org/library/Enc/CreativeDestruction.html>.

indirectly address it as if it were an externality (which appears to be the GAANN program's intent, as directed by Congress).²⁶ In the case of the GAANN program, the appropriate response might be deciding to not fund any graduate fellowships and recommending to Congress that the program be adapted to directly fund research solving the public goods problem now, rather than wait for current students to graduate and possibly conduct such research in their future career.

In regard to concerns that the U.S. labor force faces a shortage of skilled workers, and in particular produces less STEM graduates than other countries, there are two relatively simple solutions. First, federal tax code does not allow a tax deduction for expenses related to training or education that upgrades workers' skills to be able to do a new job. Essentially, this policy treats investments in human capital differently than similar investments in physical capital, such as factory machinery. Ending the unequal treatment facing different business investments would make it easier for companies to invest in their workers and would naturally help solve any shortage in critical skills.²⁷

Secondly, the U.S. should consider reforming its immigration policy to make it easier for highly-trained individuals to offer their skills to the U.S. labor market. If both China and India face surpluses of highly-skilled workers, then it's natural—as well as economically efficient—for other labor markets to put such talent to use. Sociologists report that despite their frustrating situations, the ant tribe and the timepass generation are generally optimistic and believe that if they work hard they can earn access to a better life.²⁸ Furthermore, there's a clear economic growth argument for easing immigration policy in this way—more than 40 percent of Fortune 500 businesses were started by an immigrant.²⁹

Conclusion

Although the DoE is authorized to spend up to \$35 million on GAANN, it should do so with discretion. In particular, it should only fund subject areas which are likely to result in transformational research that will create public benefits which—importantly—are otherwise unlikely to be achieved through normal market-based incentives.

A better overall approach for the GAANN program would be to develop research centers to pursue the specific research which is likely to result in these sorts of public benefits. This approach would use already established scholars rather than gambling on the fact that funding

²⁶ It's important to also note that even in situations where public goods are unlikely to be provided by economic markets, social exchange may create the voluntary institutions to solve the problem. See Elinor Ostrom's Nobel Prize lecture: Elinor Ostrom, "Elinor Ostrom - Prize Lecture: Beyond Markets and States: Polycentric Governance of Complex Economic Systems" (The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel, December 8, 2009), <http://www.tandfonline.com/doi/abs/10.1080/19186444.2010.11658229>.

²⁷ Michael D. Farren, "Bridging The Skills Gap," September 7, 2017, https://www.mercatus.org/system/files/farren_-_testimony_-_bridging_the_skills_gap_-_v2.pdf.

²⁸ Sharma, "What Do You Do with Millions of Extra Graduates?"

²⁹ Matthew Denhart, "America's Advantage: A Handbook on Immigration and Economic Growth" (George W. Bush Institute, October 2017), <http://gwbceneter.imgix.net/Resources/gwbi-americas-advantage-immigration-handbook-2017.pdf>; Daniel Griswold, "Reforming the US Immigration System to Promote Growth," Mercatus Research (Arlington, VA: Mercatus Center at George Mason University, October 2017).

graduate students' education *might* result in the creation of these public benefits in the future. If developing the next generation of scholars in these research areas is still regarded as an important goal, the research centers would provide a more targeted and focused environment to train those future scholars. However, I recognize that this suggestion may be beyond the scope of what the enabling legislation allows.

If policymakers are worried about the potential of the U.S. falling behind other countries due to a lack of highly-educated workers, restrictions on how companies can invest in their employees' skills and who can offer their expertise in the U.S. labor market should be lifted. This would allow American businesses to achieve their fullest potential and create greater economic prosperity.

Thank you for the opportunity to comment on the GAANN program's Areas of National Need.

Gratefully,

Michael Farren, PE, PhD
Research Fellow, Mercatus Center at George Mason University